NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

City Climate Convention

KALAMATA

2030 Climate Neutrality Action Plan

KALAMATA

Our mission: go zero!

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Summary

Summary
Kalamata, a city of 80,000 inhabitants, is the largest urban center of Southwestern Greece, where it gathers a large number of economic, cultural and other social activities. It is located in the heart of the Mediterranean, with the effects of climate change evident, where mild winters and cool summers were followed by rapid rainfall, floods, high winds, coastal erosion, prolonged heatwaves and drought. Phenomena that warn and dictate the change of human behavior and the redefinition of our production model. The Municipality of Kalamata has an area of 442.7 Km2 and the city of Kalamata is located in the cove of the Messinian Gulf next to Mount Taygetos, while in the inland of the Municipality there are 34 Communities, in which the inhabitants are mainly engaged in the production of the world-famous Kalamatian olive oil. West and on the outskirts of the city, processing units have been established, utilizing the local products of the Messinian land, promoting olives, oil, wine, drinks and spirits, figs, vinegar, etc., while the position of the tobacco industry KARELIA, an important factor of economic and cultural development of the region, is imposing. The operation since 2010, in western Messinia and 60 Km from the city of Kalamata, of the integrated tourist unit Costa Navarino, the connection of the city with Athens via the A7 motorway, as well as the connection of the airport with more than 30 destinations in Europe, have increased the traffic of the area, resulting in income from tourism increasing satisfactorily every year. At the same time, the concentration in the city of state services, banks, health care units, shops with a strong and international identity, as well as other activities that serve the daily needs of citizens, increases the number of one-day visits. The high mobility to and from the city, on the one hand, improves economic activity, but at the same time creates problems in the operation of the city that affect the quality of life, residents, workers and visitors. In this context, the challenge for Kalamata, with its inclusion in the Network of 100 European cities whose mission is to achieve climate neutrality by 2030, is to implement through partnerships with citizens, the business sector, universities and every level of government, the necessary policies and rules to address the effects of Climate Change. The Municipality of Kalamata, since 2019 with its participation **in the Covenant of Mayors** for Energy and Climate, as well as in the European program **BEACON**, became a sharer of good practices, resulting in the **creation** of the Municipal Energy Community**, while stressing the** need **for a joint effort of all local and regional forces.** In difficult economic conditions for the country, in the municipal budget over the last 5 years, **proposals have** been completed**, implemented** or submitted **for funding**, in the axes of the Built **Environment**, Energy, **Mobility**, Solid Waste Management**, Resilience** and **natural environment, more than** 115 **actions, with a total budget** of more than 122 M€. Projects and interventions with a strong environmental footprint, such as the construction of environmentally friendly transportation infrastructure (pedestrian streets, bicycle paths, sidewalks), as well as the energy upgrade of 15,000 points of municipal lighting, leading to annual

energy savings of 78.5%. A project with a cost of 8.5M financed by private funds and repaid by savings due to reduction of energy costs, over a decade.

At the same time, in the Municipality of Kalamata, the strategies for Sustainable Urban Development **(BAA) and the Operational Program (MasterPlan) of interventions for urban** space, Sustainable Urban Mobility (**SUMP), the Action Plan for Energy** and Climate (SDAEK), the plan for the installation **of Electric Vehicle Charging Stations** in the public space have been prepared and approved by the Municipal Council, the **Marketing Plan** for tourism and the study (**Branding) of the identity and corporate presentation of the city, while today, with the support of the World Bank, the preparation of the strategy for the** promotion of the **coastal front of** the city is in the phase of consultation with the social partners.

Through a process of long consultation, online or in person, in which stakeholders and citizens from all professional classes of the city, members of Universities and Scientific Bodies, entrepreneurs and members of the Public Administration participated, a Strategy was created with basic principles:

1. changing human behavior
2. getting rid of fossil fuels
3. the Digital Transformation of the city

The design of the interventions was guided by the results of the greenhouse gas emissions inventory for the year 2019, the last year where the city operated normally before the Covid-19 pandemic, while the Theory of Change transition model was followed, according to the guidance of the technical assistance team from the NetZeroCities network.

The proposed Climate Contract was co-created in the spirit of portfolios that contain actions that are interrelated both with each other and with actions of other portfolios. Actions corresponding to the following sectors:

1. Built Environment

Where interventions are proposed, infrastructure construction and improvement of the aesthetic and functional image of urban space, so that citizens can move with environmentally friendly means of transport (bicycles, skates, pedestrians, etc.), while entrepreneurs create especially in the tourism sector, creating wealth for all.

2. In Mobility and Transport

Where an environmentally friendly transportation system is promoted, utilizing existing and planned infrastructure, as well as modern digital tools that favor smart transportation. At the same time, the freight transport system is organized and the replacement of internal combustion cars with other electric ones is promoted, while creating the necessary infrastructure.

3. In buildings and facilities

Where interventions were designed to improve the energy efficiency of residences, as well as tertiary sector facilities (hotels, shops, manufacturing units, schools, office and administration buildings, schools, etc.)

4. In Energy

Where clean energy production methods are proposed, utilizing solar potential, liquid waste from the biological treatment of the Municipality of Kalamata, olive waste produced from the processing of the olive fruit, the rich geothermal load of the area, blue hydrogen produced from sea water and the use of energy from the sun. At the same time, the upgrading of the electricity distribution network is promoted, while ways of storing electricity are proposed.

5. Circular Economy and waste

Where promotions are proposed to reduce the production of organic waste, with sorting methods at source, the promotion of home and neighborhood composting, the strengthening of recycling streams, but also the raising of awareness on issues of reuse of raw materials.

6. Industrial Processes and Product Uses (IPPU)

Where certified production of climate-neutral products is proposed, with the replacement of equipment and changes in the steps of production processes, processing units.

7. Agriculture, Forestry and Land Use (AFOLU)

It is proposed to modernize the equipment of pumping stations and means of transport.

The targets set for the reduction of emissions by 2030 are implemented through the following scenarios or transformation pathways (Impact Pathways):

1. Scenario I: Kalamata, city to live in
2. Scenario II: Kalamata, low-emission travel
3. Scenario III: Kalamata, city to produce and create
4. Scenario IV: Kalamata, a city that learns

Scenarios which are analysed in detail in Part B of the Action Plan.

The achievement of such an ambitious venture will be achieved through the mobilization, mobilization and collective action of the actors of an ecosystem described in the plan of commitments and includes:

1. The transition team towards climate neutrality, which has been formed in the Municipality and includes executives of the Municipality, representatives of city bodies and market executives.
2. Networks of Local Government Organizations and State structures at all levels of government.
3. Universities and Research Centers.
4. Companies and private entities.
5. Civil society, with associations, associations, action groups, etc.

At the same time, the Municipality of Kalamata has created a wide framework of partnerships, through which it exchanges good practices necessary to achieve the goal, participating in city networks, such as:

1. ClimaNet Network of the 6 Greek cities and 1 Cypriot city, participating in the Mission of Cities
2. Net Zero Cities
3. Intelligent Cities Challenge
4. Energy Cities
5. CIVITAS

6. Covenant of Mayors for Energy and Climate
7. Major Cities of Europe
8. Network of Greek Municipalities with the distinctive title "**SUSTAINABLE CITY**"

The main guidelines of the interventions are:

1. The creation of the urban environment which, at the same time as the use of new technologies, will favor transportation by environmentally friendly means, in order to reduce the use of fossil fuel passenger cars, improve the quality of life of citizens and protect public health.
2. The utilization of all the wealth-producing energy sources of the city (Sun, Geothermal, Biomass), in order to get rid of fossil fuels and reduce the energy costs of both households and businesses.
3. The city to become an open laboratory, innovating, educating and generating wealth.

The quantitative targets set for the reduction of emissions by 2030 are according to the table below:

N/A	Emissions Sector	2019		2030		Decrease	
		Quantity 2019 (tn CO2)	%	Reduction (tn CO2)	% Decrease	Balance (tn CO2)	
1	Buildings	151.199,70	59,14%	146.945,51	97,19%	4.254,19	
2	Transport	66.736,01	26,10%	66.215,45	99,22%	520,56	
3	Waste	5.246,00	2,05%	3.784,52	72,14%	1.461,48	
4	Industrial Process and Product Use (IPPU)	21.582,93	8,44%	21.270,66	98,55%	312,27	
5	Agriculture, Forestry and Land Use (AFOLU)	10.897,29	4,26%	2.694,42	24,73%	8.202,87	
	Total	**255.661,93**		**240.910,56**	**94,23%**	**14.751,37**	

The residual emissions of **14,751.37** tn CO2 will be addressed through actions related to the increase of green space in urban space, as well as the utilization of residual biomass from livestock farms.

The budget of the actions amounts to **€ 2,040,523,919.75** and will be implemented either by Municipal resources, or by Regional or State or European funding, or by the participation of companies, or finally by citizens' own participation, as described in detail in the investment plan.

Image Catalog

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Abbreviations and acronyms

Abbreviations and acronyms	Definition
Disabled guests	People with Disabilities
RES	Renewable Energy Sources
DEYAK	Municipal Water Supply and Sewerage Company of Kalamata
EU	European Union
NAPCP	National Air Pollution Control Program
EPHO	Light Personal Electric Vehicles
NECP	National Energy and Climate Plan
NSRF	Partnership Agreement for Regional Development
NECSC	Business Plan for the Provision of Common and Public Utility Spaces
CRES	Center for Renewable Energy Sources
KEPE	Centre for Planning and Economic Research
UN	United Nations
PESPKA	Regional Climate Change Adaptation Plan
SSP	Urban Accessibility Plan
SDAEK	Sustainable Energy and Climate Action Plan
SUMP	Sustainable Urban Mobility Plan
SFEO	Electric Vehicle Charging Plan
RIS	Ministry of Environment and Energy
GPS	Global Positioning System
LPG	Liquified Petroleum Gas

1. Introduction

Kalamata's ambition to participate in the evaluation process for the establishment of the network of 100 cities of the EU Mission, with the aim of achieving climate neutrality by 2030, comes as a continuation of the actions with a low environmental footprint undertaken by the Municipality of Kalamata, from 2015 onwards.

The economic crisis of the 2010s in Greece created the need to reduce energy costs, which was done through the project to upgrade municipal lighting, while the great flood in September 2016, along with the prolonged heat waves and drought that appeared in the following years, sensitized citizens to the phenomenon of Climate Change.

The Strategy for Sustainable Urban Development was designed, based on which and in conjunction with the Mobility Strategy (SUMP), an effort was launched to upgrade urban space, with emphasis on car-free mobility, turning roads into pedestrian streets. At the same time, the operation of the new Town Hall, as an energy autonomous building utilizing the rich geothermal load of the area, prompted the drafting of the Energy Strategy (SDAEK), which was the basis for the inventory of CO2 emissions in the Municipality of Kalamata.

Census, the data of which were updated, with reference year 2019, because it was the last year that the city operated normally, before the health crisis. According to which data emerged as the main sources of emissions for the Municipality, buildings (housing and facilities) and transport.

88 % of the city**'s buildings were constructed before 2000, without any provision for thermal insulation at the time, which makes the city's building stock intensely energy-intensive, consuming** about 53% of the **total energy, while the corresponding percentage of buildings emissions is** 59%.

The great growth experienced by Kalamata and the wider region in recent years, has increased the number of visitors to the city, resulting in the use of the car dominating the public space, over pedestrians, creating intense mobility problems, which are reflected in the emission values, which for transport are **about** 26%.

Addressing the problems created by the energy degradation of the building stock and mobility in the city is the dominant strategy of the content of the portfolios of the Action Plan, in which a holistic way of reducing emissions is formulated in a detailed and documented way.

The goals set are ambitious and are the result of the utilization in a scientific and technocratic way, of all the proposals submitted in the long consultation, which was attended by citizens, city bodies, company representatives and academics.

Goals were set, such as: The energy upgrade of the shell and equipment, houses and facilities.

1. Energy production, by utilizing any waste raw material with energy content, such as sewage sludge and olive oil mill waste.
2. The utilization of geothermal load and the production of green hydrogen by electrolysis of seawater.
3. The replacement of thermal energy, heating oil, by electricity, produced by photovoltaic systems, on the roofs of buildings.
4. The creation of an urban environment, friendly to the resident and the visitor, which will inspire transportation with environmentally friendly means and without a car.
5. The integration of digital mobility applications supporting city operations.

6. The promotion of electromobility.
7. Changing the operating procedures of each economic activity in order to achieve economies of scale in energy.
8. The creation of learning structures and processes, in an interactive relationship with the citizen.

With the holistic approach of interventions in which the spirit of innovation is diffused, benefits and opportunities are created for all, with an economic, environmental and social footprint, such as:

1. The reduction of energy costs, in the volatile environment of the energy market.
2. The improvement of the attractiveness of the city, which in recent years has experienced a rapid increase in visitors, creating income for all.
3. The adaptation of the operation of businesses to the new climate and energy data.
4. Kalamata to become a hub of innovation and learning, especially in energy management.
5. The protection of public health.
6. The protection of vulnerable households from the phenomenon of energy poverty.
7. The right to accessibility for everyone everywhere.

During the consultation phase, intense reflection was developed and the difficulties for the implementation of the interventions were highlighted, of which the following stand out:

1. The reluctance of citizens to participate in any innovation, without motivation.
2. The slow legislative framework for the implementation of public procurement.
3. The time-consuming procedures for the approval of the necessary permits.
4. The difficulty of the banking system in financing private projects

In the process of co-creation and elaboration of proposals for the drafting of the action plan, a dynamic of collaborations was developed with Universities, Companies, City Bodies and market professionals, which together with the intellectual capital of the city, as reflected in the strategic plans and people, document the realism and ambition to implement the Climate Contract.

The proposed interventions are ambitious, but present a number of weaknesses in the implementation phase, related:

1. With the lack of technical staff and raw materials, necessary for the energy upgrade of the building stock.
2. The inability of electric vehicle production lines to supply the market with the necessary quantities of vehicles.
3. The inability of the electricity transmission network to promote to consumers the additional quantities of electricity resulting from the replacement of fossil fuels.

Specifically, 77 actions are proposed in 16 portfolios, grouped into 4 scenarios or transformation paths, with a budget of **€ 2,040,373,919.75, leading to** a 94**%** reduction in emissions.

2. Working Process

The **drafting** of the application for inclusion in the Mission of Cities aiming at climate neutrality by 2030, as well as the **formulation** of the content of the Climate Contract, **emerged** through a wide participatory process, led by the Municipality of Kalamata, city **bodies**, academics, **representatives of private** economic operators, but also its members **Civil society**, expressed their views and proposals.

I. Creating a strong mandate

The Municipality **of Kalamata**, for the preparation of the proposal, for inclusion in the network of the Mission of Cities, as well as for the drafting and implementation of the content of the Climate Contract, has **formed** the **Transition Group** for Climate Neutrality, headed by the Mayor Mr. Athanasios Vasilopoulos.

The Transition Team includes executives of the Municipality, **representatives of institutions** and professional **groups of the city, business executives**, **academics** and external partners**. The structure of the group is as follows:**

1. The five-member Coordinating Team, headed by the Mayor.

2. The coordinators at the head of the following axes of intervention:

- Transport – Mobility
- Buildings
- Energy
- Built and natural environment
- Resilience
- Waste and Circular Economy
- Economy – Society

3. The 26 rapporteurs, as heads of the thematic units from each axis.

The transition team initially had **the mission** of implementing open **workshops**, in order to co-shape with the city and civil society actors, the **framework** of policies towards achieving the goal of climate neutrality, the work of which **was supported** by external partners, academics or market executives.

Through this route, a local **ecosystem** was created **per field of intervention**, by political figures, economic operators, professional guilds, but also citizens, who with their continuous participation and the submission of their views **strengthen** the mandate for the **implementation** of the climate contract.

In each thematic unit **, project teams were created**, in which participated the Coordinator, a member of a university institution and an external collaborator with experience in the operation of the market, who **transformed** the political guidelines of the transition team into a proposal text.

The drafting **of the proposals, as well as the** procedures for **their implementation, had and will have the scientific** documentation of the **professors from the collaborating with the Municipality, University laboratories or Research Centers, according to table C-1.1. The** guidance **of University professors in** Mobility, **Energy** Production**, Built Environment and Circular** Economy, has been decisive and in the same spirit there will be **participation** in the implementation of the actions of the climate contract, in order to achieve a reliable process of monitoring and evaluating the results.

At the same time, **by collaborating** with private sector economic operators, the necessary **know-how was** incorporated into the content of the contract **and the necessary** operational **capacity was ensured for the implementation of all planned actions of the climate contract.**

II. Portfolio Co-Design

After 2010, the Municipality of Kalamata**, implementing** strategies that emerged through a participatory process, began to implement ambitious **urban** development **and energy saving** projects . The rearrangement of the central **square** and the extensive **renovations** in the city center, the use of **geothermal** energy for the operation of the **cooling/heating** system of the new Town Hall, as well as the energy **upgrade** of the street lighting network, with self-financing and repayment from energy savings over a decade, are actions with a strong **economic,** environmental **and social** footprint, incorporating **innovative** ideas and certifying Kalamata's ability to implement sustainable development projects.

Today, in the field of urban **development, with participatory processes and the support** of the World Bank, **solutions** are designed **to highlight** the coastal **front of the city, followed by participatory** planning **for interventions in** the eastern **center and Nedontas Park.**

In mobility, **from the construction of soft mobility infrastructure, proposals were designed for** smart **mobility in the city, utilizing** digital **applications and the use of environmentally friendly means of transport, while to reduce CO2 emissions, movement with** low-emission **vehicles** is promoted.

In **the buildings, after the technical interventions in the shell, energy saving solutions are proposed, with the installation** of smart energy **management** and monitoring **systems in real time, while for their energy self-sufficiency solutions are promoted to exploit** the geothermal **and** solar **potential of the area.**

The **transition** away from **fossil** fuels and the **electrification** of society will create the need for **local** energy production from **renewable** sources, such as **photovoltaics,** geothermal**, biomass** from **pruning**, liquid **biological waste** and **hydrogen** from the sea.

Interventions in all emission sectors, where the next step is based on the old, but **incorporates** modern technology and every **innovative** and creative **thinking, with new methods and collaborations, in order to** change **consumption habits of many years.**

The Climate Contract of Kalamata is not a set of projects, but a set of transformation **paths** with **starting and** destination**, horizontally inspired by groups of interventions, whose** portfolios, the **actions of which are related and complement each other, either technically, regulatory, social, financial, etc. For example,** the change **in the consumption pattern is a route** related to **energy**, mobility**, waste and** leading to the reduction of emissions, following a set of **technical,** regulatory **and** economic **interventions.**

In this process, systemic **barriers** are addressed with synergies **at all levels of governance. At** Regional level, with the participation of the Municipality in the **Monitoring Committee of the Operational Program of the Peloponnese Region and at national level, with the participation** of the Municipality of Kalamata in the National Network of Cities **ClimaNet**, with the participation of the six Greek cities of Apostoli, Athens, Thessaloniki, Ioannina, Trikala, Kozani, Kalamata and Limassol from Cyprus. The participations **seek** to resolve all systemic obstacles (regulatory, financial, etc.) to achieve the **goal** of climate neutrality.

III. Action

The Municipality of Kalamata in the last five years, has implemented climate projects, of the order of **120M**, (***Attachment File: Action2016-2021.doc***) and has already received funding from European and National resources, for interventions in the coming years, **over 35M**. Projects that have been integrated into the actions included in the climate contract portfolios. Projects of public interest, which create the **base**, but are **few** compared to the private investments required to achieve the goals.

The proposed interventions require **the** participation **of citizens and investors, who, in order to feel** safe **and** secure**, require support from every level of government.**

IV. Learning-monitoring-evaluation environment

The Transition Team **for the coming years will have the role of** disseminating **to citizens**, the policies **that will be implemented, recording** comments and observations and **evaluating** the results.

The administrative and financial **management** of the actions for the implementation of the Climate Contract will be carried out by a **distinct** administrative structure, which will be integrated into the internal operation organization of the Development Organization of the Municipality of Kalamata, under the name "**SUSTAINABLE CITY".** The Development Organization AEIFOROS POLI has as its mission the support and provision of technical assistance to the Municipality of Kalamata, for the preparation of studies and for the implementation of each development action, so in this context, it will **supervise** the implementation of the Climate Contract.

In order to monitor the progress, the values of **the indicators** described in the Action Plan will **be evaluated** and the interventions will be adjusted **at a time according to the guidelines of the Mission Team. In the full development and familiarization with how to implement the climate contract, integrating and utilizing new digital products, the** goal **is to** monitor be real-time.

In **collaboration** with **innovation bodies** (University or private), the city will be transformed into an open **laboratory** for the production of open data on the environment and city functions, the evaluation of which will contribute both to the **evaluation** of the achievement of the goal and to the **co-benefits** of citizens.

Particular value will be given to the creation and scientific **documentation** of monitoring indicators, related to the **impact** on society and the indirect benefits of citizens, at **economic,** environmental **and** social **level, as described separately in the Technical Fiches of the Climate Contract Actions. Actions planned to be carried out in collaboration with** Universities and **Research** Centers.

At the same time, the implementation of the actions will create learning needs for a large part **of the population,** which will be covered **in each case by the cooperation of the Municipality with the Universities. For example, the training of technicians in the maintenance of electric vehicles, but also of any new technological product, requires new knowledge that should be covered by all levels of education. Also the environmental** Terms for businesses and organizations, require the recording and evaluation of financial data with a green footprint, thus creating the need for green accounting of economic operators.

From the **collaborative** process, the need emerged, in addition to the **targeted information of citizens of various thematic groups and the** creation of **corresponding thematic monitoring groups**, at the stage of implementation of the actions, in **which representatives of the involved bodies will participate, such as in actions** to promote **travel by** mass **means** transport, representatives of public transport operators and TAXIS will participate.

V. Procedure for incorporating the terms of the Climate Contract.

The **monitoring** of the implementation of the climate contract in its entirety will be **done** by a department of the **Development Organization** and is an action of immediate priority, in order to create the right environment **for** informing citizens, developing **partnerships** and attracting **investments** for the implementation of actions.

The expectation is, through the **establishment** of an annual **assessment of the** progress of the implementation of the climate contract, to emerge the possibilities to:

1. The contract should be a **living text** that will record and **evaluate** every factor of the **internal** and **external** environment, in order to accept the necessary **adjustments**.
2. The progress of its implementation and the results should be **open** and **available** to citizens.
3. Be open to any new **collaboration**, inclusive **for anyone. To this end, the Municipality is committed, through the process of monitoring the implementation of actions, to adjust its policies, creating new partnerships or incorporating new processes or products that will improve the result.**

3. Part A – State of play of climate action

Part A "State of Climate Action" outlines the **city'**s **starting point** towards climate neutrality, including commitments and strategies**, of key local** businesses**, and** updates **subsequent sections and outlined orientations** to accelerate actions for climate neutrality. climate.

3.1 Section A-1 Basic greenhouse gas emission inventory

Section A-1 "**Basic Greenhouse Gas Emissions Inventory**" details the city's latest greenhouse gas inventory to determine the emission baseline and determine the emission gap for climate neutrality by 2030 in accordance with the inventory specifications set out in the information package the mission of the cities and the process outlined in the guidelines of the action plan.

A-1.1: Energy end-use by source domain				
Base year	**2019**			
Unit	**MWh/year**			
	Scope 1	**Scope 2**	**Scope 3**	**Total**
Buildings				
Electricity		223.932		**223.932**
Petroleum	103.675			**103.675**
Biomass	33.194			**33.194**
Transport				
Petroleum	111.085			**111.085**
Petrol	149.359			**149.359**
Lpg	1.687			**1.687**
Waste				
(*Type of fuel/energy used*)				
Industrial processes and product use (IPPU)				
Electricity		38.691		**38.691**
Petroleum	1.576			**1.576**
Agriculture, Forestry and Land Use (AFOLU)				
Electricity		3.903		**3.903**
Petroleum	8.171			**8.171**
Lpg	1.933			**1.933**

A-1.2: Applied emission factors						
Primary energy/energy source	**Carbon dioxide (CO_2)**	**Methane (CH_4)**	**Nitric oxide (N_2O)**	**F-gases (hydrofluorocarbons and perfluorocarbons)**	**Sulphur hexafluoride (SF_6)**	**Nitrogen trifluoride (NF_3)**
Buildings						
Private buildings other than residential buildings						
Electrical energy (**t/MWh**)	National: 0.547	CRF: 3.60E-06	CRF: 5.40E-06			
Petroleum (**t/MWh**)	National: 0.266	CRF:	CRF:			
Public buildings						
Electrical energy (**t/MWh**)	National: 0.547	CRF: 3.60E-06	CRF: 5.40E-06			
Petroleum (**t/MWh**)	National: 0.266	CRF: 2.81E-06	CRF: 1.37E-06			
Houses						
Electricity (**t/MWh**)	National: 0.547	CRF: 3.60E-06	CRF: 5.40E-06			
Πετρέλαιο (**t/MWh**)	-	CRF: 0.00108	CRF: 1.44E-05			
Βιομάζα (**t/MWh**)		CRF: 0.00108	CRF: 1.44E-05			
Transport						
Private transfers						
Πετρέλαιο (**t/MWh**)	National: 0.245	CRF: 4.89E-07	CRF: 5.06E-06			
Βενζίνη (**t/MWh**)	National: 0.262	CRF: 7.69E-05	CRF: 5.19E-06			
Υγραέριο ((**t/MWh**)	National: 0.230	CRF: 5.16E-05	CRF: 1.19E-05			
Commercial Transport						
Πετρέλαιο (**t/MWh**)	National: 0.245	CRF: 1.89E-05	CRF: 8.45E-06			
Βενζίνη (**t/MWh**)	National:	CRF:	CRF:			

	0.262	6.71E-05	1.16E-05			
Υγραέριο ((**t/MWh**)	-	-	-			
Public Transport						
Πετρέλαιο (**t/MWh**)	National: 0.245	CRF: 7.13E-06	CRF: 8.38E-06			
Βενζίνη (**t/MWh**)	-	-				
Υγραέριο ((**t/MWh**)	National: 0.230	CRF: 5.16E-05	CRF: 1.19E-06			
Municipal transport						
Πετρέλαιο (**t/MWh**)	National: 0.245	CRF & IPCC: 1.43E-05	CRF & IPCC: 1.20E-05			
Βενζίνη (**t/MWh**)	National: 0.262	CRF: 4.74E-05	CRF: 1.02E-05			
Υγραέριο (**t/MWh**)	National: 0.245	CRF & IPCC: 1.43E-05	CRF & IPCC: 1.20E-05			
Waste						
Waste from pruning (kg/tn)		CRF: 10	CRF: 0.6			
Organics from mixtures (kg/tn)		CRF: 10	CRF: 0.6			
Βιομηχανικές Διεργασίες (Industrial Process and Product Use -IPPU)						
Electricity (**t/MWh**)	National: 0.547	CRF: 3.60E-06	CRF: 5.40E-06			
Πετρέλαιο (**t/MWh**)	National: 0.266	CRF: 2.68E-06	CRF: 6.59E-07			
Agricultural, Forestry and Land Use (AFOLU)						
Livestock farming						
Diesel (t/MWh)	National: 0.266	CRF: 3.24E-05	CRF: 6.62E-05			
Non CO2 (t/animal)		CRF: 0.010	CRF: 3.00E-05			
Georgia						
Electricity (**t/MWh**)	National: 0.547	CRF: 3.60E-06	CRF: 5.40E-06			

Πετρέλαιο (**t/MWh**)	National: 0.266	CRF: 3.24E-05	CRF: 6.62E-05			
Βενζίνη (**t/MWh**)	National: 0.262	CRF: 3.24E-05	CRF: 6.62E-05			

A-1.3: Activity by source sectors			
Base year	**2019**		
Primary energy/ Power source	**Scope 1**	**Scope 2**	**Scope 3**
Buildings			
Private buildings other than residential buildings			
Electricity (**MWh**)		98.782	
Petroleum (**MWh**)	19.697		
Public buildings			
Electricity (**MWh**)		8.536	
Petroleum (**MWh**)	3.118		
Houses			
Electricity (**MWh**)		116.614	
Petroleum (**MWh**)	80.860		
Biomass (**MWh**)	33.194		
Transport			
Private transfers			
Petroleum (**MWh**)	8.111		
Petrol (**MWh**)	107.177		
LPG (**MWh**)	1.687		
Commercial Transport			
Petroleum (**MWh**)	89.870		
Petrol (**MWh**)	42.058		
LPG (**MWh**)			
Public Transport			
Petroleum (**MWh**)	10.572		
Petrol (**MWh**)			
LPG (**MWh**)			

Municipal transport			
Petroleum (**MWh**)	2.532		
Petrol (**MWh**)	124		
LPG (**MWh**)			
Waste			
Waste from pruning (tn)	11.950		
Organics from mixtures (tn)			
Βιομηχανικές Διεργασίες (Industrial Process and Product Use -IPPU)			
Electricity (**MWh**)		38.691	
Petroleum (**MWh**)	1.576		
Agricultural, Forestry and Land Use (AFOLU)			
Livestock farming			
Petroleum (**MWh**)	874		
Non-CO2 emissions (t/animal)			
Georgia			
Electricity (**MWh**)		3.903	
Petroleum (**MWh**)	7.297		
Petrol (**MWh**)	1.933		

A-1.4: Greenhouse Gas Emissions by Sector				
Base year	**2019**			
Unit	**tn CO2/year**			
	Scope 1	**Scope 2**	**Scope 3**	**Total**
Buildings				
Private buildings other than residential buildings				
Electricity (**tn**)		54.033,75		**54.033,75**
Petroleum (**tn**)	5.239,40			**5.239,40**
Public buildings and facilities				
Electricity (**tn**)		4.669,46		**4.669,46**
Petroleum (**tn**)	829,47			**829,47**

Houses				
Electricity (**tn**)		63.787,86		**63.787,86**
Petroleum (**tn**)	21.508,76			**21.508,76**
Biomass (**tn**)	1.131,00			**1.131,00**
Transport				
Private transfers				
Petroleum (**tn**)	1.987,20			1.987,20
Petrol (**tn**)	28.080,37			28.080,37
LPG (**tn**)	388,01			388,01
Commercial Transport				
Petroleum (**tn**)	22.018,15			22.018,15
Petrol (**tn**)	11.019,20			11.019,20
LPG (**tn**)				
Public Transport				
Petroleum (**tn**)	2.590,25			2.590,25
Petrol (**tn**)	0,00			0,00
LPG (**tn**)	0,00			0,00
Municipal transport				
Petroleum (**tn**)	620,34			620,34
Petrol (**tn**)	32,49			32,49
LPG (**tn**)				
Waste				
	5.246			5.246
Βιομηχανικές Διεργασίες (Industrial Process and Product Use -IPPU)				
Electricity (**tn**)		21.163,80		21.163,80
Petroleum (**tn**)	419,13			419,13
Agricultural, Forestry and Land Use (AFOLU)				
Georgia				

Petroleum (**tn**)	214,13			214,13
No CO2 emissions (t/animal)	6.254			6.254
Livestock farming				
Electricity (**tn**)		2.134,94		2.134,94
Petroleum (**tn**)	1.787,77			1.787,77
Petrol (**tn**)	506,45			506,45
TOTAL	**109.872,12**	**145.789,81**	**0,00**	**255.661,93**

A-1.5: Graphics and diagrams

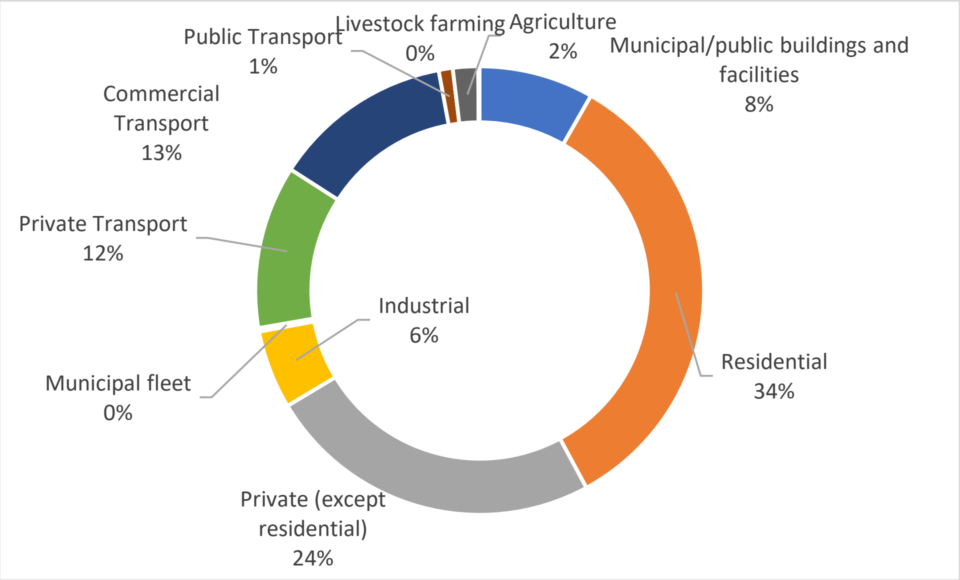


Image 1. Percentage distribution of fuel consumption by sector

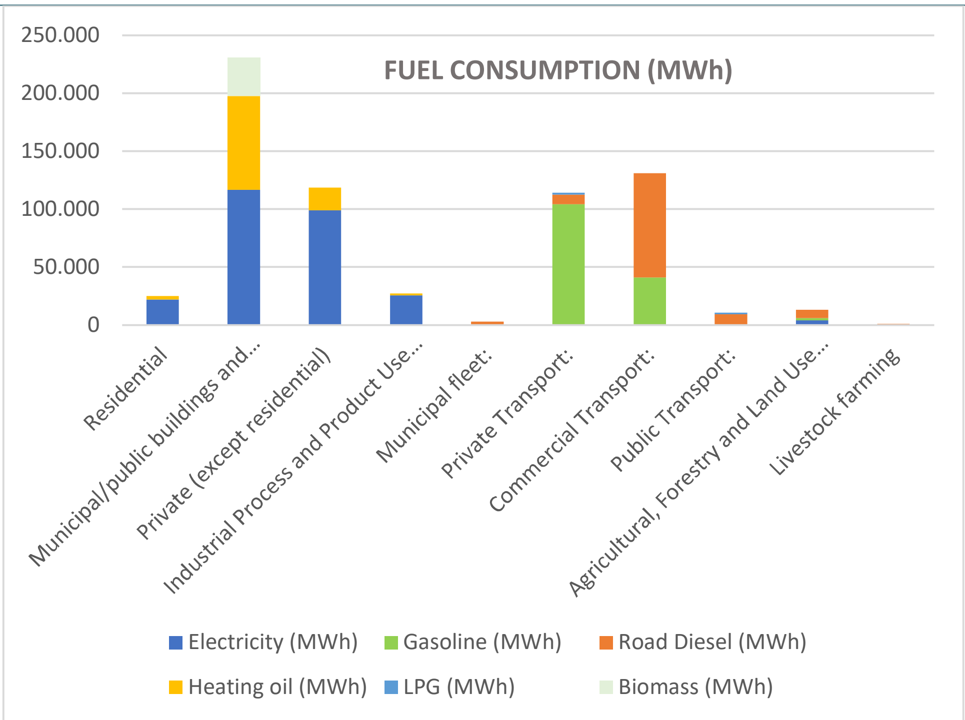


Image 2. Fuel consumption by type and sector

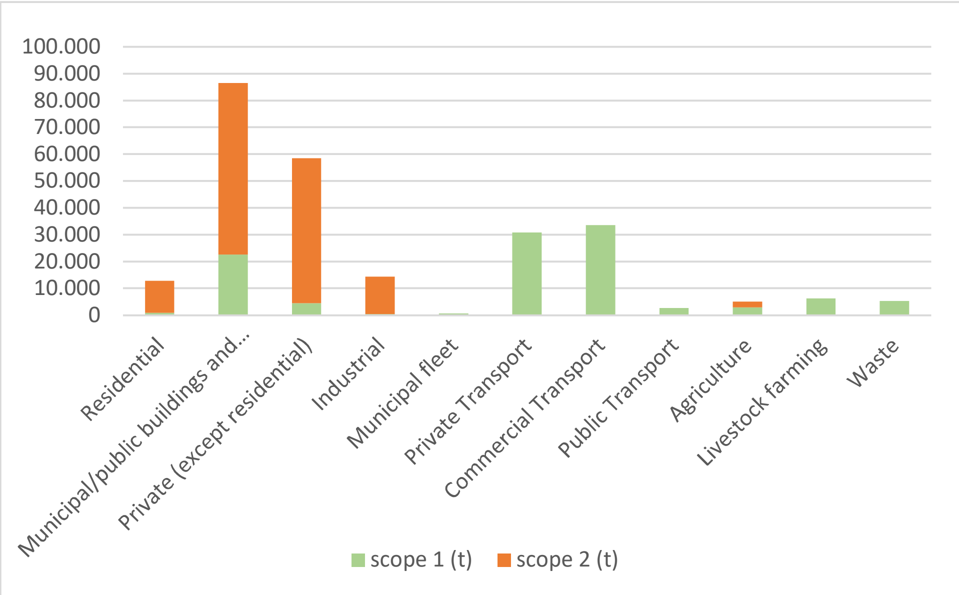


Image 3. CO2-eq emissions (t) by sector and fuel type

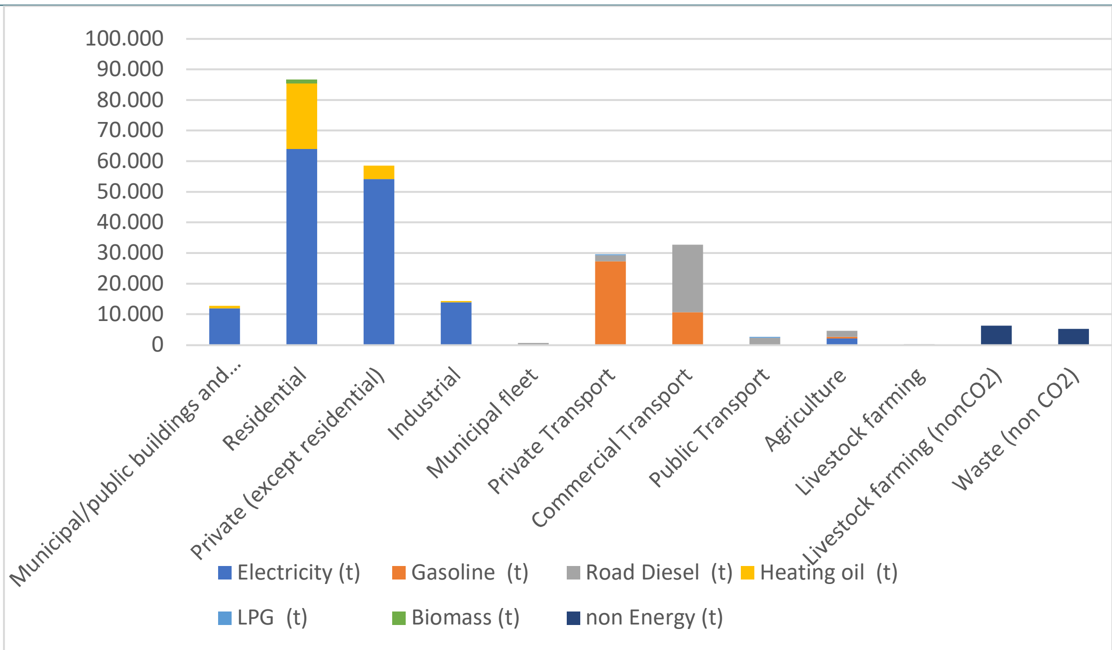


Image 4. CO2-eq (kt) by sector and fuel type

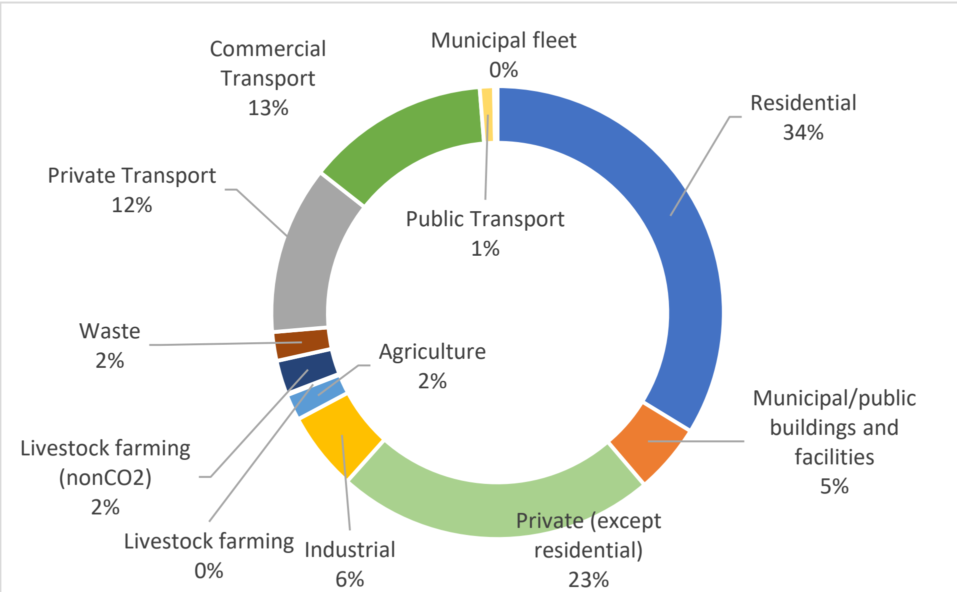


Image 5. Percentage distribution of CO2-eq by sector

More Diagrams are presented in the file entitled "Greenhouse Gas Emission Inventories and Quantification of the Impacts from the Implementation of Measures and Policies in the Municipality of Kalamata", which is presented in the Annexes hereto.

A-1.6: Description and evaluation of the initial greenhouse gas inventory

In the context of this thesis, the greenhouse gas emissions (carbon dioxide, methane and nitrogen dioxide) resulting from all sectors of activity within the boundaries of the Municipality were calculated with reference year 2019. The methodology used to collect the necessary data for the Emission Inventory is based on the methodology applied in the National Inventories, in order to ensure both reliability and compatibility with them. The calculations were therefore made in accordance with the IPCC and UNFCCC guidelines [17].

More specifically, aiming at the creation of the Reference Emissions Balance, energy data were initially collected from reliable sources, as listed below. In cases where it was not possible to provide data at Municipality level, the necessary estimates and assumptions were made, which are different depending on each case, based on the available data. The assumptions made are part of the UNFCCC's good practices for the preparation of inventories.

It is noted that CO2, CH4 and N2O emissions were calculated while F-gases, SF6 and NF3 emissions are not calculated because they do not result from the processes taking place within the boundaries of the Municipality of Kalamata. Any emissions due to the use of air conditioners are assessed as negligible and are not taken into account, since it is not possible to determine the quantities of refrigerants consumed. The aim is to record and record greenhouse gas (GHG) emissions due to fuel/energy consumption within the boundaries of the Municipality. It is noted that the year 2019 was chosen because it is the last year, before the pandemic, with normal operating conditions of the city.

The areas of energy consumption under study are analyzed and divided into the following main categories:

1. Buildings
2. Transport
3. Waste
4. Industrial Processes and Product Use
5. Agriculture

The collection of the required data for the calculation of emissions was done using the following sources:

- Municipality of Kalamata (Services, School Committee, Sports Organization)
- Hellenic Statistical Authority (ELSTAT)
- Hellenic Electricity Distribution Network Operator (HEDNO)
- Agency for Payments and Control of Community Guidance and Guarantee Aid (OPEKEPE)
- Geoinformation Map of the Regulatory Authority for Energy (RAE)
- KTEL Messinia
- National Printing House
- 2006 IPPC Guidelines for National Greenhouse Gas Inventories

- ÌïïôÝëï COPERT (S.A. EMISSION)

As shown in the above Charts, for the reference year 2019, the energy consumed within the boundaries of the Municipality of Kalamata amounts **to 677.21 GWh**. 34% of them came from the Residential Sector, 18% from the Tertiary (professional/commercial/craft) Sector, 19.5% from commercial transport and 17% from private, road transport. The remaining approximately 12% is allocated to energy consumption by industry (~6%), the buildings and facilities of the Municipality (~2%), while the contribution of public transport, agriculture and livestock is much lower.

Given that Private and Commercial Transport constitute the largest part of energy consumption (both sectors **in total 37%),** it is expected that the use of fossil fuels will have a dominant role in the energy mix in the area of the Municipality of Kalamata. Specifically, petroleum products in 2019 accounted for 55% of total energy consumption (22.3% gasoline, 17.4% diesel and 15.5% heating oil). Another important form of energy is electricity, which accounts for 39% of total energy consumption. The remaining 5% concerns forms of energy such as LPG, biomass, etc. (Figure 1).

From the above energy consumptions, summing up the emissions due to waste management, it appears that the total carbon emissions for the reference year amount to 255.66 thousand tons of CO2eq, the distribution of which is illustrated in Figure 3, which presents the CO2-eq emissions from electricity consumption (scope 2) and fossil fuels (scope 1). As shown in Figures 3, As regards Amendments Nos 4 & 5, the sectors which emit the largest quantities of greenhouse gases are the domestic and tertiary sectors, followed by commercial and private transport. However, regarding emissions from the first two sectors, it is expected that, due to the significant penetration of RES in 2030, their emissions will be significantly reduced. Overall, based on the mission target (reducing emissions by a minimum of 80%), emissions *should be reduced by a total of 205 thousand tons of carbon dioxide equivalent by 2030*.

The most important information per sector examined is given below. It is noted that a more detailed analysis is available in the file entitled "Greenhouse Gas Emission Inventories and Quantification of the Impacts from the Implementation of Measures and Policies in the Municipality of Kalamata" which is listed in the Annexes hereto.

1. Buildings

The buildings sector includes (i) municipal buildings, (ii) the domestic sector and (iii) the tertiary sector.

(i) Municipal buildings and facilities

This category includes buildings and facilities that are owned by the Municipality and their management also belongs to it. These include municipal buildings, sports facilities, schools and kindergartens. In addition, the facilities of the Municipality are included, such as street lighting, illumination of other common areas and squares.

(ii) Domestic sector

In the domestic sector, 51% of electricity is consumed, 35% of heating oil, and 14% of biomass (firewood). Regarding CO2-eq emissions. It is reported that 73% concerns emissions due to electricity consumption, while the remaining 26% corresponds to emissions coming mainly from diesel consumption, and to a lesser extent from the use of biomass. It should be noted that CO2 emissions from the combustion of biomass (wood stoves, etc.) were not calculated in the domestic sector because they are considered of biological origin and concern biomass collected sustainably (e.g. it concerns biomass collected from forests according to existing forest management plans or comes from olive pruning). However, for biomass combustion, CH_4 and N_2O emissions were calculated, which were translated into CO_2-eq using the factors 28 tCO_2/tCH_4 and 265 tCO_2/tN_2O, respectively, from the IPCC 5th Fifth Assessment Report (AR5). The total amount of CO_2-eq. It was estimated at 1,131 tonnes (1.3% of total emissions).

(iii) Tertiary sector

The tertiary sector includes all buildings and services managed by private individuals or the state and are not under the jurisdiction of the Municipality. The main object of the Tertiary Sector is trade, services and tourism which owns offices, shops, catering businesses, accommodation, hospitals, etc. In this sector electricity is consumed at a rate of 84% and heating oil at a rate of 16%. In terms of CO_2-eq emissions. 92.5% comes from electricity consumed.

2. Transport

The transport sector is divided into the following subcategories: (i) Municipal fleet, (ii) Public transport, (iii) Private transport and (iv) Freight transport. Especially:

Municipal fleet

The Municipal fleet includes vehicles that serve various activities of the services of the Municipality such as garbage trucks, tankers, fire brigades, etc. Consumption concerns diesel and unleaded petrol. Based on the data collected by the Municipality, it appears that the vehicles of the municipal fleet consume 2,532.31 MWh (ie 95%) diesel and 124.35 MWh (ie 5%) gasoline. Therefore, the total fuel consumption amounts to 2,656.66 MWh. These consumptions concern garbage trucks, bin washers, trucks, tankers, cranes, earthmovers, passenger vehicles as well as sweepers, buses and tractors of the Municipality.

Public transport

This section examines the energy consumption of urban and intercity buses, as well as taxis. Specifically, the kilometers traveled by all buses within the geographical boundaries of the Municipality were calculated using data from the website of the Municipality of Kalamata and the KTEL of the Prefecture of Messinia as well as personal communication with the competent bodies and telephone interviews. The collected data show that 9 bus lines that operate exclusively within the Municipality, 51 intercity lines, with the cities of the Municipality of Kalamata being either the start/end of these routes or intermediate stops to the other neighboring municipalities, as well as 4 lines of municipal transport (intercity routes subsidized by the Municipality). From the above, it follows that the total kilometers traveled within the boundaries of the Municipality by buses amount to approximately **2,166,467**.

Private transfers

Private transport concerns the movement of private individuals by passenger vehicles and motorcycles. From these were deducted the estimated energy consumption for taxis, which, as already mentioned, were included in commercial transport. In the category of private transport, more than 90% of gasoline is consumed, about 7% diesel, and LPG in small quantities.

Freight

Freight transport includes heavy and light goods vehicles. Commercial transport consumes ~32% of gasoline, while the rest of the consumption is diesel.

Summary of the transport sector

Of the sector's total fuel consumption, 58% corresponds to gasoline, 41% to diesel and only 1% to LPG. Commercial transport seems to be the most energy-intensive, consuming almost 50% of total fuel consumption, followed by private transport with a percentage consumption equal to 45%. Public transport accounts for 4% and the municipal fleet for just 1%. Similarly, CO2-eq emissions are distributed. in the subcategories considered.

3. Waste

In addition to greenhouse gas emissions from the activities of the residential, tertiary, municipal sector as well as transport, greenhouse gas emissions, specifically methane and nitrous oxide, are released from the management of municipal solid waste. The organic fraction of municipal waste is composted in ventilated piles.

In 2019, 250 tons of pruning and 11,700 tons of organics were composted from mixed municipal waste, according to data from the Municipality of Kalamata. It is assumed that the entire amount of organic load is composted, according to data from the Municipality.

Organic waste is responsible for methane (CH4) and nitrous oxide (N2O) emissions. The calculations show that a total of 120 tonnes of CH4 and 7 tonnes of N2O are emitted from the waste, corresponding to 5,246 t CO2eq. The conversion of CH4 and N2O to CO2 equivalent was done using the coefficients 28 tCO2/tCH4 and 265 tCO2/tN2O, respectively, from the 5th IPCC Fifth Assessment Report (AR5).

4. Industrial Processes and Product Use

This subcategory includes industrial units within the boundaries of the Municipality, as well as the municipal facilities of the Municipal Water Supply and Sewerage Company and the Water Supply Association. Of the total energy consumption, 95% concerns electricity, while the remaining ~5% corresponds to oil consumption. Total CO2-eq emissions correspond to 21,500 tons, of which 95% comes from electricity consumption.

5. Agriculture

The agricultural sector is divided into two subcategories: (i) Agriculture, (ii) Livestock farming.

i. Agriculture

Greenhouse gas emissions in agriculture come from electricity consumed for the operation of private pumping stations and diesel consumption due to the use of machinery and other equipment. Finally, a quantity of gasoline is consumed in areas of olives that can be oiled. In total, CO2eq emissions from the above correspond to 4,429.16 tons.

ii. Livestock farming

In the Municipality of Kalamata there are livestock units that consume diesel oil for the breeding of sheep, goats, cattle and bees. Therefore, greenhouse gas emissions result from diesel consumption, while it is also reported that livestock farming is associated with CH_4 and N_2O emissions. Methane is produced by enteric fermentation of sheep, goats and cattle and by animal waste management, while nitrous oxide is produced by animal waste management. The largest amount of greenhouse gases comes from animal processes (6,254 tons of CO_2 compared to only 214 tons resulting from oil consumption).

Summary of the agricultural sector, including livestock and agriculture

According to the data collected, the main fuel of the sector is diesel, which accounts for 58% of the total energy consumed of the sector, followed by electricity with 28%, while gasoline consumption amounts to 14% of the total amount of energy consumed. In terms of CO_2-eq emissions. livestock farming is responsible for 66 % of the sector's total emissions.

A-1.7: Emission gaps

The emission gaps, as calculated in detail by the Technical Action Fiches, are distributed by emission category, as in the table below.

SECTOR	Emission category	BALANCE	%
A1	Private buildings other than residential buildings	1.969,29	13,35%
A2	Public buildings and facilities	122,75	0,83%
A3	Houses	2.162,55	14,66%
B1	Private transfers	173,67	1,18%
B2	Commercial Transport	306,10	2,08%
B3	Public Transport	32,43	0,22%
B4	Municipal transport	8,36	0,06%
C	Waste	1.461,48	9,91%
D	Industrial Processes	312,27	2,12%
And	Agriculture	8.202,87	55,61%
		14.751,77	

Table 1. Emission Gaps in the Municipality of Kalamata

In the agricultural sector, with the largest percentage **of 57%,** emissions of 6,254 tn **CO_2 from livestock farms are included and the remaining** 1,948.87 tn **concerns emissions from the use of fuel of agricultural machinery.**

For emissions from animals, no intervention was incorporated into the Climate Contract, while the prospect is that their manure will be exploited by the biogas plant.

Similarly, the reduction of emissions from the use of fuels in the agricultural sector was based only on the change in the calculation factor, from the annual change in the composition of the fuel mix, while in the course of technological developments, it will be possible for the engines of agricultural machinery to be able to run on low-emission biofuels or if there is factory production, to be replaced with electric ones.

In residences, where the gap is **2.162.55 tn** or 14.66%, it mainly concerns the emissions of **1.131 tn**, due to the use of firewood for heating houses. The firewood comes from the pruning of olive trees during the olive harvest period, work carried out by hundreds of residents and at the same time olive growers who live in the Municipality of Kalamata and where the operation of a fire in the house is a matter of lifestyle.

The remaining amount**, 1031.55 tn**, concerns emissions due to the use of fossil fuels that have not been replaced and are used to heat homes. The prospect is to gradually replace uses with lower emission ones, such as heat pumps or the use of biofuels.

Similarly for tertiary sector buildings, the amount of **1,969.29 tn** will be reduced by gradually replacing carbon thermal energy, using other forms of lower emissions.

Finally, in the waste sector, the effort, as outlined in the portfolio of actions, to enhance recycling streams and home composting will further reduce emissions.

3.2 Module A-2 Evaluation of Current Policies and Strategies

Section A-2 **"Current** policies and strategies" presents relevant policies, strategies, initiatives or regulations at local, regional and national level, relevant to the city's transition towards climate neutrality.

A-2.1: List of relevant policies, strategies and regulations

Application level	**EUROPEAN AND INTERNATIONAL LEVEL**		
	Category	**Strategic Plan**	
	Appellation	**Description**	
	Repower EU	EU plan to accelerate the transformation of Europe's energy system, due to the need to end dependence on Russian fossil fuels, and tackle the climate crisis.	
		Association	**Need for Action**
		Energy consumption reduction, promotion of the use of energy from RES and GHG emissions reduction	It has been taken into account in the Climate Law and the updated NECP
	Appellation	**Description**	
	UN Objective 11 SUSTAINABLE CITIES and COMMUNITIES	The direction of the actions of the target is for cities to offer equal opportunities for all, access to services, energy, housing, transport, etc., addressing the challenges faced by urban centers, such as traffic congestion, lack of funds for the provision of basic services, degradation of infrastructure, as well as lack of adequate housing.	
		Association	**Need for Action**
		• Energy consumption reduction • GHG emissions reduction	
	Appellation	**Description**	
	UN Objective 13 CLIMATE ACTION	Goal 13 proposes measures to tackle greenhouse gas emissions, which are the main cause of global warming, resulting in extreme weather events affecting life around the planet.	
		Association	**Need for Action**
		• Energy consumption reduction • GHG emissions reduction	
	Appellation	**Description**	

	UN **Objective 7** **Cheap and clean energy**	The guidelines of Goal 7 are to ensure access for all to modern energy services, improve efficiency and promote actions for the production of energy from renewable sources	
		Association	**Need for Action**
		• Energy consumption reduction • GHG emissions reduction	
	Category	**Regulation**	
	Appellation	**Description**	
	Fit for 55	It makes it a legal obligation to achieve the EU's climate target of reducing EU emissions by at least 55% by 2030.	
		Association	**Need for Action**
		• Energy consumption reduction • GHG emissions reduction	

Table 2. Policies, Strategies and Regulations of European and International Level

Application level	**NATIONAL LEVEL**		
	Category	**Strategic Plan**	
	Appellation	**Description**	
	National Energy and Climate Plan (ΦΕΚ Β’ 4893)	Detailed roadmap for achieving specific Energy and Climate Goals by the year 2030. In this context, it presents and analyses policy priorities and measures across a wide range of development and economic activities.	
		Association	**Need for Action**
		Energy consumption reduction and GHG emissions reduction	
	Appellation	**Description**	
	Revised National Energy and Climate Plan **(NECP)**	In line with the Climate Law, the updated NECP will take into account that, in 2030, 80% of electricity will be generated from renewables and 20% from natural gas. Therefore, the emission factor for electricity production for the 2030 energy mix is taken into account	
		Association	**Need for Action**
		GHG emissions reduction	GHG emissions reduction

<table>
<tr><td rowspan="3"></td><td rowspan="3">National Strategic Road Safety Plan</td><td colspan="2">The National Strategic Plan leads to the definition, implementation and monitoring of the necessary actions to drastically reduce the number of road accidents and the number of fatalities and injuries in them.</td></tr>
<tr><td>Association</td><td>Need for Action</td></tr>
<tr><td>GHG emissions reduction</td><td>GHG emissions reduction</td></tr>
<tr><td rowspan="9"></td><td>Category</td><td colspan="2">Regulation</td></tr>
<tr><td>Appellation</td><td colspan="2">Description</td></tr>
<tr><td rowspan="3">Climate law
(Government Gazette A' 105/27.05.2022)</td><td colspan="2">It includes policies for transition to climate neutrality and adaptation to climate change, urgent provisions to tackle the energy crisis and protect the environment." Specifically:
Rule 11 :
Ban on electricity production from solid fossil fuels
Rule 17 :
1Measures to reduce emissions from buildings
In addition, it promotes:
1. Electromobility penetration,
2. Conversion of vehicles to LPG vehicles</td></tr>
<tr><td>Association</td><td>Need for Action</td></tr>
<tr><td>GHG emissions reduction</td><td></td></tr>
<tr><td>Appellation</td><td colspan="2">Description</td></tr>
<tr><td rowspan="3">National Air Pollution Control Program
(NAPCP)
(Government Gazette 182/B/22-1-2021)</td><td colspan="2">In line with the Climate Law, the updated EIS will take into account that, in 2030, 80% of electricity will be generated from renewables and 20% from natural gas. Therefore, the emission factor for electricity production for the 2030 energy mix is taken into account</td></tr>
<tr><td>Association</td><td>Need for Action</td></tr>
<tr><td>GHG emissions reduction</td><td>GHG emissions reduction</td></tr>
</table>

Table 3. National Level Policies, Strategies and Regulations

<table>
<tr><td>Application level</td><td colspan="2">REGIONAL AND LOCAL LEVEL</td></tr>
<tr><td rowspan="3"></td><td>Category</td><td>Strategic Plan</td></tr>
<tr><td>Appellation</td><td>Description</td></tr>
<tr><td>Regional Climate Change Adaptation Plan (PESPKA) of Peloponnese</td><td>PESPKA is an integrated plan that identifies and prioritizes necessary measures and actions for the Adaptation of the Region to Climate Change. As such, it analyses in depth the necessary sectoral policies and decides on the feasibility of</td></tr>
</table>

		individual adaptation measures and actions at local/regional level. It has been taken into account as in some cases the proposed measures and policies are related to the reduction of greenhouse gas emissions.	
		Association	**Need for Action**
		Energy consumption reduction and GHG emissions reduction	Approved by the Regional Council of the Peloponnese Region
	Appellation	**Description**	
	Strategic plan "Integrated regeneration for the upgrading of the quality of life and the revitalization of the urban space of the Municipality of Kalamata"	The Strategic Development Plan of Kalamata presents the appropriate actions to highlight the advantages and potential of urban space by maximizing their utilization for the benefit of the quality of life of residents and the economic development of the area, utilizing every financial tool	
		Association	**Need for Action**
		Energy consumption reduction leading to GHG emissions reductions	Search for financial instruments
	Appellation	**Description**	
	Digital Transformation Strategy		
		Association	**Need for Action**
		Energy consumption reduction leading to GHG emissions reductions	Search for financial instruments

	Category	**Action plan**	
	Appellation	**Description**	
	Sustainable Urban Mobility Plan (SUMP) of the Municipality of Kalamata	The main objective is to improve the accessibility of urban areas and provide high quality transport with an emphasis on walking, cycling and public transport, through and within the urban area. It is taken into account as the above are related to the reduction of greenhouse gas emissions.	
		Association	**Need for Action**

		Energy consumption reduction leading to GHG emissions reductions	Search for financial instruments
	Category	**Action plan**	
	Appellation	**Description**	
	Sustainable Urban Mobility Plan (SUMP) of the Municipality of Kalamata	The main objective is to improve the accessibility of urban areas and provide high quality transport with an emphasis on walking, cycling and public transport, through and within the urban area. It is taken into account as the above are related to the reduction of greenhouse gas emissions.	
		Association	**Need for Action**
		Energy consumption reduction leading to GHG emissions reductions	Search for financial instruments
	Appellation	**Description**	
	Sustainable Energy and Climate Action Plan of the Municipality of Kalamata	The aim of the SDAEK was to organize a comprehensive strategy based on sustainable and sustainable development. It proposes actions and measures aimed at reducing energy consumption and greenhouse gas emissions.	
		Association	**Need for Action**
		GHG emissions reduction	Search for financial instruments
	Appellation	**Description**	
	Electric Vehicle Charging Plan (EVS) of the Municipality of Kalamata	The approved SFEO of the Municipality places recharging points, as well as parking spaces for electric vehicles. It has been taken into account because it is related to the reduction of greenhouse gases.	
		Association	**Need for Action**
		Energy consumption reduction leading to GHG emissions reductions	Search for financial instruments
	Appellation	**Description**	
	Urban Accessibility Plan (PCD) Municipality of Kalamata	Plan that reflects the accessibility of all in the area of the city of Kalamata	
		Association	**Need for Action**
		Energy consumption reduction leading to GHG emissions reductions	Search for financial instruments

<table>
<tr><th rowspan="4"></th><th>Appellation</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">Business Plan for the Provision of Public and Public Benefit Spaces (E.S.E.K.K.) of the Municipality of Kalamata</td><td colspan="2">The Business Plan records all the areas characterized by the Urban Plan as public and public benefit areas of the Municipality of Kalamata, and which have not yet been acquired, in order to be incorporated into the city's functions.</td></tr>
<tr><th>Association</th><th>Need for Action</th></tr>
<tr><td>Energy consumption reduction leading to GHG emissions reductions</td><td>Search for financial instruments</td></tr>
</table>

Table 4. Regional and Local Level Policies, Strategies and Regulations

A-2.2: Policy description & evaluation

The basic vision of the Municipality of Kalamata is tosolve all local issues and problems, with a view to the continuous improvement of the standard of living and the local society, the development , the continuous improvement of local interests aswell as sustainability and environmental protection.

The Municipality's effort towards sustainable development and thereduction of greenhouse gas emissions is reflected in its inclusion in the 100 Europeancities that intend to reduce greenhouse gas emissions to zeroby 2030, organising interventions in the framework of international, national and local strategies, such as:

UN: Goal 11 → SUSTAINABLE CITIES and COMMUNITIES

Cities are hubs for the exchange of ideas, for trade, culture, science, productivity, social development, etc., where people progress socially and economically.

The challenges faced by urban centres are congestion, lack of funds for the provision of basic services, degradation of infrastructure, and lack of adequate housing.

It is a question of cities offering equal opportunities for all, access to services, energy, housing, transport, etc.

Objective 11 seeks to:

- 11.1 By 2030, ensure access for all to adequate, safe, affordable housing and basic services, and upgrade slums.
- 11.2 By 2030, provide safe, affordable, accessible and sustainable transport systems for all, improve road safety, notably through the expansion of public transport, paying particular attention to the needs of those in vulnerable situations, such as women, children, people with disabilities and the elderly.
- 11.3 By 2030, improve inclusive and sustainable urbanisation for all and capacities for participatory, integrated and sustainable human settlement planning and management for all countries.
- 11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage.

- 11.5 By 2030, significantly reduce the number of deaths and the number of people affected by natural disasters, as well as direct economic losses relative to global gross domestic product due to natural disasters, including water-related disasters, focusing on protecting the poor and people in vulnerable situations.
- 11.6 By 2030, reduce the per capita adverse environmental impact of cities, paying particular attention to air quality and the management of municipal and other waste.
- 11.7 By 2030, provide universal access to safe, inclusive and accessible green and public spaces, in particular for women and children, the elderly and persons with disabilities.
- 11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.
- 11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans aiming at social inclusion, resource efficiency, climate change mitigation and adaptation, disaster resilience, and the development and implementation of holistic disaster risk management at all levels; in line with the Sendai Framework for Disaster Risk Reduction 2015-2030.
- 11.c Support least developed countries, through financial and technical assistance, in building sustainable and resilient buildings using local materials.

UN: Goal 13 → Climate Action

Goal 13 proposes measures to tackle greenhouse gas emissions, which are the main cause of global warming, resulting in extreme weather events affecting life around the planet.

Objective 13 seeks to:

- 13.1 Strengthen the resilience and adaptive capacity of all countries to climate change risks and natural disasters.
- 13.2 Integrate climate change measures into national policies, strategies and plans.
- 13.3 Improving education, awareness-raising, as well as human and institutional capacity on issues related to climate change mitigation, adaptation, impact reduction and early warning
- 13.a Implement the commitment of developed country parties to the United Nations Framework Convention on Climate Change to the objective of jointly allocating USD 100 billion annually by 2020 through various sources to address the needs of developing countries, as part of meaningful mitigation actions and transparency in implementation; and the full operation of the Green Climate Fund by capitalising it as soon as possible.
- 13.b Promote mechanisms to increase capacity to effectively plan and manage climate change issues in least developed countries and small island developing States, including women, youth as well as local and marginalised communities.

UN: Goal 7: → Cheap and clean energy

The guidelines of Goal 7 are to ensure access to modern energy services for all, to improve efficiency and to promote actions for the production of energy from renewable sources.

Objective 7 seeks to:

- By 2030, ensure universal access to affordable, reliable and modern energy services.
- By 2030, significantly increase the share of renewables in the global energy mix.

- By 2030, double the global rate of improvement in energy efficiency.
- 7.a By 2030, strengthen international cooperation to facilitate access to clean energy research and technology – including renewables, energy efficiency and advanced and clean fossil fuel technologies – and promote investment in clean energy infrastructure and technologies.
- 7.b By 2030, expand infrastructure and upgrade technology to provide modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing countries as well as landlocked developing States, in accordance with their respective support programmes.

Repower EU

The plan is designed toaccelerate the transformation of Europe's energy system. The measures envisaged in theREPowerEU plan canmeet this objective **by savingenergy, diversifying energy supplies and accelerating the deployment of renewable energy sources** to replace the rigs fuels in housing, industry and electricitygeneration. The rapid **transformation will strengtheneconomic growth, security and climate action** forEurope and our partners. The measures proposed in the Plan are fully consistent with the reduction of greenhouse gas emissions, on the one hand due to the reduction of electricity consumption in the building sector and on the other hand due to the promotion of RES. These measures have already been taken into account in the National Climate Law and the new NECP.

Δέσμη Fit for 55

The' Fit for 55' publication covers a series of proposals to revise and update EU legislation and to define newinitiatives, with the aim of ensuring that EU policies arein line with the climate objectives agreed by the Council and theEuropean Parliament. The policiesand measures it promotes have already been taken into account innational legislation (National Climate Law, NECP).

National Energy and Climate Plan (NECP) (Government Gazette B' 4893/2019):

<u>The NECP has taken into account the followingongoing actions up to 2030:</u>

- ✓ Reduction of electricity consumption in the residential sector by 1.7% for 2030.
- ✓ Oil and gas consumption in the tertiary sector will decrease by 1.2% by 2030.
- ✓ Electricityconsumption in the tertiary sector fell by 0.1%.
- ✓ Oil and gas fell by 3.1% in the transport sector.
- ✓ Increase in the use of biofuels by62.7% in the transport sector.
- ✓ 755.6% increase in electricity use in the transport sector

The projected changes in energy use are not large,but it was considered appropriate to take them into account as they are included in Government Gazette 4893/B'/2019 and constitutea commitment of thecountry. However, it should be noted that some of the actions promoted by the NECP, such as increasing the use of biofuels and increasing electromobility, are considered important in terms of their impact on reducing emissions greenhouse gases.

Climate Law (Government Gazette A' 105/27.05.2022):

The climate law took into account Article 11 whichconcerns the prohibition of electricity production from solid fossil fuels (Article 11 par. 1 & 2). The above leads to significant reductions in emissions, as themix varies significantly and therefore emissionsare greatly reduced due to lignite phase-out and the high penetration of RES in electricityproduction.

In addition, Article 17 was adopted which promotes measures to reduce emissions in the building sector (Articles 1 &2). In particular, the sale and installation of heating oil burners is prohibited from 1 January 2025, and in addition until, at the latest, 1 January 2030 only the sale of heating oil, which is blended at least three percent(30%) by volume with renewable liquid fuels, is permitted. This date will be reassessed by the 31st December 2025.

This will lead toviral greenhouse gas emissions . With regard to increasing the share of biofuel, it is said to be a particularly important measure as biofuels have far fewer greenhouse gas emissions than biofuels.Conventional.

In addition, the Climate Law promotes the promotion of electromobility, which will lead to significant reductions in emissions from road transport, given the fact that it promotes an increase in electricity production from RES (NECP). The penetration of LPG-fuelled vehicles, promoted by the Climate Law, is also taken into account, although it is a measure which leads to small emission reductions, as the penetration of LPG vehicles, the use of LPG vehicles, the use of theClimate Law . provided for under the Climate Law, is notparticularly important.

New National Energy and Climate Plan (NECP) under update

Inaccordance with the current Climate Law, the updated NECP will take into account that, by 31 December 2028, 80 % of electricity will be produced from RES and 20% from natural gas. This leads to a reduction of about 89% in the CO2 emission factor from electricity compared to the corresponding factor in 2019. This undoubtedly leads to a very significant reduction in emissions.

National Air Pollution Control Programme(NAPCP)

The NAPCP contains national policies and measures based mainly on the established National Energy and Climate Plan (NECP) to comply with national emission reduction commitments for the years 2020 to 2029 and from 2030 onwards, for pollutants sulphur dioxide (SO2), nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOC), ammonia (NH3) and particulate matter PM2.5. However, it should be noted thatsome of the measures andpolicies proposed by the NAPCP There is no doubt that this has also led to a reduction in greenhouse gases, and that is whyit has been taken into account.

National Strategic Road Safety Plan

The National Strategic Plan leads to the definition, implementation and monitoring of the **necessary actions** to drastically reduce the number of road accidents and the number of fatalities and injuries in them.

The development of the new National Strategic Road Safety Plan is based on all new international trends, a detailed analysis of the potential of the Greek reality as well as systematic broad consultation.

The initial structure of the new National Strategic Road Safety Plan concerns four main directions:

- Ambitious vision
- Effective Implementation
- Innovative Technologies
- Shared Responsibility

Action Plan for Sustainable Energy and Climate of the Municipality of Kalamata (SDAEK)

The SDAEK of the Municipality of Kalamata takesinto account proposedactions and measures that lead to emissionreduction within the boundaries of the Municipality. These actions, which are considered important, are presented below. It is noted that many of them are inaccordance with other policies and plans, such as the NECP, the Climate Law, the PESPKA, the SUMP, the SFEO, etc.

The measures listed below include those measures which have been adopted and are being implemented by the municipality and which are notincluded in the ActionPlan of Part B.

Category: CROSS-SECTORAL MEASURES

1. Establishment of an Energy Economics Department

Through the SDAEK it is proposed to establish a Department to which residents of the Municipality ofKalamata can turn for their information on energy issues and which will be able toIt provides legaland techno-economicadvice on energy investments. This Department will be staffed by two people specialized in energy issues in order to promote Energy Saving actions.

It is estimated that the operation of the section could reduceCO2-eq emissions from the domestic sector by 832 tonnes.

2. Eco – Driving Seminars and Promotion of New Technologies

TheMunicipality will organize ecological guide seminars in which experienced speakers will participate. To inform drivers of ecological driving practices and to encourage as many people as possible to adopt these practices through which savings can be achievedEnergy (dieseland petrol) is the purpose ofthese seminars. Inthis context , it is recommended to distribute printed material to inform citizens about the advantages of eco-friendly and economical driving and about the new automotive technologies prevailing on the market. At the same time, reference can be made to the financial incentives provided by the policy topromote these technologies, such as subsidies for the purchase of electric cars and reduced charges for the use of low-emissionhybrid cars. This action is expected to result in a change in the driving behaviour of the population which will lead to significant savings in fuel and hence toa significant reduction in emissions, as shown in the table below:

DESCRIPTION	Amount of CO2 emissions in tn
Private Transfers	559
Commercial Transport	510
Public Transport	209
Municipal fleet	60,5
TOTALS	**1.338,5**

According to the guidelines of the Centre for Renewable Energy Sources (CRES), it is possible to reduce the fuelconsumption of vehicles by up to 10% if a series of practices related to ecological driving are followed. In order to implement these practices effectively, it is recommended toreward drivers who achieve the lowest consumption of fuel at the end of the year. The measurement of consumption will be done by installing a fuel consumption meter on all vehicles of the municipal fleet. The results of this action are immediate, so its NPVis positive.

The most important practices ofecological driving are summarised below:

- Gear change at 2,000 to 2,500 engine speeds, since it is the most economical range of operation of y (the analogous range for diesel engines is different and is in the range of 1,500 to 2,500 rpm).
- Use of thehighest possible gear ratio, driving atlow speed andavoiding unnecessary braking.
- Provision of trafficconditions to avoid unnecessary braking and acceleration.
- Smooth deceleration with high gear ratio and release of the foot throttle lever as earlyas possible.
- Switching off the engineduring short stops.
- Regular maintenance of the vehicles and the vehicle.
- Avoidance of transporting passageof cargo.
- Prudent use of the air conditioner with maximum temperature setting to 23 °C.
- Smooth deceleration when cornering without braking.
- Avoid using the vehicle for shortdistance journeys.
- Utilization ofthe vehicle's auxiliary equipment such as "cruise control", rev meter and "trip computer", as they help reduce consumption.
- Choosing the most efficient vehiclefor the real daily needs of the driver.
- Planning to find the route that requires the lowest consumption offuel.

3. Replacementof Old Diesel Municipal Fleet with New Technology

Older technology vehicles have lower performance than more modern diesel models, so replacing old vehicles with newer ones can make a significant contribution to reducing emissions. In order to calculate the emission reductionsfrom this project, it was assumed that about 20% of the municipality's fleet will be replaced by new vehicles of newer technology. According to the SDAP, however, this action, due to the high cost of new vehicles , is not viable andrequires financial resources outside the municipal budget. These are considered important as theCO_2-eq reduction is estimated at 13.4 tons.

4. Conversion of municipal fleet vehicles to LPG/LNG

LPG offers many benefits, including savings of up to 10% in fuel costs. LNG/LPG is a cleaner fuel than petrol and petroleum, emitting fewerCO_2 emissions, while vehicles running on it consume less energy.It contributes to the reduction of pollution of the urban environmentand, more generally, to the reduction of the greenhouse effect in relation to diesel vehicles, while at the same time it is considered economically viable as an action. In order to assess the reductions of this measure, it was assumedthat about 20% of the municipal fleet would be replaced byLNG/LPG vehicles. This actionis inaccordance with the National Climate Law. Theresulting virus is estimated at 6 tonnes of CO2-eq.

5. Installation of GPS system to calculate the optimal route and monitor the municipal fleet

It is proposed to install GPS systems in vehicles of the municipal fleet such as garbage trucks and buses, so that they canfollow the second best routes in relation to theservices provided. The routes will be registered in these systems and this will savemoney and control the course of vehicles in order to avoid unnecessary journeys. The implementation of this action will save a considerable amount of fuel and correspondingly, emissions are estimated to be reduced by about 25 tonnes.

6. Replacement of vehicles with electric vehicles

The measure of electromobility was proposed in the SDAP, as electromobility is a technology which has become particularly prominent in recent years. Electromobility refers to the use of vehicles equipped with motors operating on electric current instead of on the burningof petroleum products(e.g. X. petrol or diesel). These motors are much moreefficient and makeminimal noise. Another advantage of vehicles equipped with suchengines is that if the power mix is characterized by a large number ofThe introduction of renewableswhen these vehicles produceminimal pollutants. Therefore, the replacement of part of the vehicles in the municipal fleet with electricones is seen asan action that can provide significantbenefits in the field of energy saving and reduction of energy efficiency.In particular, in the coming years in which, according to nationalplanning, a significant increase in the use of RES is foreseen and the completephasing-out of lignite in the country. This proposal is also in line with the broader design of the NECP recommending the introduction of electric vehicles, as well as the National Climate Law. Specifically, for the Municipality of Kalamata, itwas estimated that about 20% of the total fleet will operate with electricdrive by 2030. It is noted that due to the high penetration of RES by then, the pollutants released will be particularly low and theemission reduction is estimated to be equal to about15 tons of CO2-eq.

PESPKA Peloponnese

PESPKAis a Plan for Adaptation to Climate Change which, based on the specific characteristics of the Region under consideration, finds its vulnerabilities in relation to climatechange and then proposes and prioritizes appropriate measures and actions in order to shield itagainst the coming climate change. In many cases the proposed measures lead to a reduction in greenhouse gas emissions and the Plan has therefore been taken into account. Indicatively, the measures for water supply and irrigation mentioned in the framework of the SDAP are proposed measures of PESPKA.

Sustainable Urban Mobility Plan (SUMP)

The main objective is to improve the accessibility of urban areasand toprovide high-quality transport with an emphasis on walking, cycling and public transport, through and within the urban area. This can reduce private travel and consequently significantly reduce greenhouse gas emissions, given the fact that the transport sector is one of the most polluting sectors.

Electric Vehicle Charging Plan (EVS)

The approved SFEO of the Municipality locates recharging points, as well as places for electric vehicles. It is in line with the National Climate Law and the new NECP inwhich electromobility is promoted. Given the promotion of RES (provision for their participation of 80% in the energy mix according to the Climate Lawand the new NECP) electromobility will be particularly environmentally friendly, saving a lotamount of CO2.

A-2.3: Emissions gap

The proposed interventions show a documented reduction of emissions by 94.23%, with the rest corresponding mainly to the emissions of buildings and livestock farming, as reflected in the table below:

N/A	Emission Category	Emissions 2019	%	Emission reduction	% Reduction	BALANCE
A	Buildings	151.199,70	59,14%	146.945,51	97,19%	4.254,19
B	Transport	66.736,01	26,10%	66.215,45	99,22%	520,56
C	Waste	5.246,00	2,05%	3.784,52	72,14%	1.461,48
D	Industrial processes	21.582,93	8,44%	21.270,66	98,55%	312,27
And	Agriculture	10.897,29	4,26%	2.694,42	24,73%	8.202,87
		255.661,93		**240.910,56**	**94,23%**	**14.751,37**

Table 5. Emissions Gap in the Municipality of Kalamata

3.3 Section A-3: Systemic barriers and opportunities for climate neutrality by 2030

Section A-3: **"Systemic barriers to climate neutrality by 2030**" presents a mapping of the ecosystem of stakeholders and analyzes the systemic barriers and opportunities that the city has on the road to climate neutrality.

A-3.1: Systems and stakeholder mapping

The table below describes the ecosystem of stakeholders on Kalamata's path towards climate neutrality by 2030. The classification was based on the principle of the quadruple helix, where the vectors were classified into the following sectors:

1. Governance and Policy
2. Universities
3. Economic operators (companies, professionals, etc.)
4. Civil Society

For each actor, it is briefly analyzed what is its influence and from where its interest in participating in the process of implementing the actions of the climate contract is documented.

A. Governance and Policy			
1.	**Institution Name**	**Ministry of Environment**	
	Description	**Influence**	**Interest**
	The Ministry of Environment and Energy (MEEN) collaborates with the Municipalities and strengthens their effort to achieve Climate Neutrality. promoting appropriate policies; and	The Ministry of Environment promotes national policies for climate neutrality and will support municipalities in increasing state funding, as well as in issuing regulatory decisions	The Ministry of Environment and Energy will cooperate with the Municipalities in order to promote the necessary policies at local level, so the benefit will arise at national level.
2.	**Institution Name**	**Peloponnese Region**	
	Description	**Influence**	**Interest**
	The Region of Peloponnese is an Institution of the 2nd Degree of Self-Government and operates in a geographical area that includes many Municipalities, thus having the ability to implement cooperative programs between Municipalities.	The Region: 1. It manages European and State funding programs, several of which concern the fields of action of the Mission. 2. It is responsible for issuing regulatory decisions necessary for the implementation of climate contract actions.	The promotion of policies, through the funding of similar actions. The construction of infrastructure to enhance mobility, clean transport, electrification of the car fleet. The creation of the right conditions for the enhancement of business activity
3.	**Institution Name**	**Clima Net Cities Network**	
	Description	**Influence**	**Interest**
	It is a network of cooperation with legal form of the six Greek municipalities, Athens, Thessaloniki, Ioannina, Kalamata, Kozani, Trikala and the Cypriot municipality of Limassol, as Municipalities participating in the Mission of Cities for Climate Neutrality.	The ClimaNet Network will support the efforts of cities by promoting common problems, especially legislative and regulatory content, to be solved and will contribute in particular to the utilization of the Mission Label, by securing additional funding.	The purpose of the establishment and operation of the Network is to promote the objectives of the climate contracts of its members, as well as the dissemination of the concept of climate neutrality, which will be reinforced by the presentation of results on the ground.
4.	**Institution Name**	**Pact of 85 Greek Municipalities**	
	Description	**Influence**	**Interest**

	Under the coordination of the Ministry of Environment and Energy, a cooperation protocol was drawn up between 85 municipalities from all over Greece,	The group of 85 municipalities, representing most of the population of Greek cities, has the capacity to influence both the promotion of such policies and the allocation of the necessary financial resources.	The diffusion of the concept of climate neutrality and the coordination for the implementation of similar actions and policies.
5.	**Institution Name**	**Network of Municipalities of Peloponnese Region**	
	Description	**Influence**	**Interest**
	The Municipality of Kalamata participates in a Network of 14 Municipalities from the Peloponnese Region, in order to promote climate neutrality.	The network could influence the formulation of regional policies, as well as the allocation of resources, with a view to achieving climate neutrality.	Network members will become familiar with the concepts of green and digital transformation and prepare their strategies by receiving the necessary technical assistance.
6.	**Institution Name**	**Chamber of Messinia**	
	Description	**Influence**	**Interest**
	The Chamber of Messinia is the institutional body that operates with the aim of promoting entrepreneurship and has as members those who are active in various professional sectors.	Because it acts as a promoter of policies that solve problems in the sectors of its members, but also as an intermediary body managing funding to enhance entrepreneurship, it can determine the scope of intervention of the planned policies.	The Chamber will be able to undertake initiatives to inform and familiarize its members with the actions of the climate contract, so that they acquire the learning skills and adapt to the new environment.
7.	**Institution Name**	**Legal Entities of the Municipality of Kalamata**	
	Description	**Influence**	**Interest**
	Under the supervision of the Municipal Council, the Legal Entities of the Municipality operate, with fields of intervention, sports, culture, entrepreneurship and water-sewerage infrastructure.	Through the change in the operating procedures of Legal Entities, energy saving policies will be promoted, as well as the awareness of citizens as users of the services they provide.	The implementation of the actions will result in an economic benefit, along with the upgrading of the services provided.

Table 6. Stakeholders and Partners (Governance and Policy)

B. Academic Institutions			
	Institution Name	**National Technical University of Athens**	
	Description	**Influence**	**Interest**
1.	Department of Transport Engineering of the National Technical University of Athens	The contribution of the professors members of the department to the formulation and documentation of actions in the field of Mobility – Transport is crucial.	The participation of a university structure in the drafting and monitoring of the implementation of the actions of the climate contract of Kalamata, creates the conditions for: 1. The city to function as an open laboratory for the implementation of innovative solutions, which will promote university research. 2. University proposals in various funding programs, if they include Kalamata as a partner, will have an additional score due to the use of the Mission Label.
	Electronic Sensors Laboratory of the School of Electrical and Computer Engineering, National Technical University of Athens	The department helped draft proposals for the installation and operation of mobility data recording sensors.	
	Department of Geography & Regional Planning, School of Rural and Surveying and Geoinformatics Engineering, National Technical University of Athens	Contribution to the development of geospatial systems, data mapping of the city.	
	Decision Systems & Management Laboratory, School of Electrical and Computer Engineering, National Technical University of Athens,	Contribution to the formulation of energy management actions and smart electricity distribution networks.	
	Laboratory of Spatial Planning and Urban Development of the School of Architecture of the National Technical University of Athens	Contribution to the formulation of interventions in urban space.	

2.	**Institution Name**	**University of Patras**	
	Description	**Influence**	**Interest**
	Laboratory of Atmospheric Physics	Participation in the formulation of public health protection policies, through the operation of a network of meteorological data recording sensors.	The participation of a university structure in the drafting and monitoring of the implementation of the actions of the climate contract of Kalamata, creates the conditions for: 1. The city to function as an open laboratory for the implementation of innovative solutions, which will promote university research. 2. University proposals in various funding programs, if they include Kalamata as a partner, will have an additional score due to the use of the Mission Label.
3.	**Institution Name**	**University of Piraeus**	
	Description	**Influence**	**Interest**
	Circular Economy Workshop	Contribute to the formulation of waste management actions and the promotion of circular economy policies	The participation of a university structure in the drafting and monitoring of the implementation of the actions of the climate contract of Kalamata, creates the conditions for: 1. The city to function as an open laboratory for the implementation of innovative solutions, which will promote university research. 2. University proposals in various funding programs, if they include Kalamata as a partner, will have an additional score due to the use of the Mission Label.
4.	**Institution Name**	**University of Peloponnese**	
	Description	**Influence**	**Interest**

	Department of Finance		
	Software Systems and Database Laboratory	Contribute to the development of open data creation and exploitation actions	The participation of a university structure in the drafting and monitoring of the implementation of the actions of the climate contract of Kalamata, creates the conditions for: 1. The city to function as an open laboratory for the implementation of innovative solutions, which will promote university research. 2. University proposals in various funding programs, if they include Kalamata as a partner, will have an additional score due to the use of the Mission Label.
5.	**Institution Name**	**Aristotle University of Thessaloniki**	
	Description	**Influence**	**Interest**
	Laboratory of Wireless Communications and Information Processing	Contribution to the formulation of actions for the creation of infrastructure for data transfer and utilization.	The participation of a university structure in the drafting and monitoring of the implementation of the actions of the climate contract of Kalamata, creates the conditions for: 1. The city to function as an open laboratory for the implementation of innovative solutions, which will promote university research. 2. University proposals in various funding programs, if they include Kalamata as a partner, will have an additional score due to the use of the Mission Label.
6.	**Institution Name**	**Research Centers**	
	Description	**Influence**	**Interest**
	National Centre for Scientific Research "DEMOKRITOS"	Contribution to the formulation of proposals for the production of energy	The participation of a research center in the drafting and monitoring of

		from photovoltaic systems, as well as to the implementation of programs for the protection of public health.	the implementation of the actions of the climate contract of Kalamata, creates the conditions for: 1. The city to function as an open laboratory for the implementation of innovative solutions, which will promote research. 2. The proposals of the research centers in various funding programs, if they include Kalamata as a partner, will have an additional score during the evaluation due to the use of the Mission Label.
	Centre for Planning and Economic Research (KEPE)	Participation for the scientific recording of the economic impact of the implementation of the actions on citizens and businesses.	
	Centre for Renewable Energy Sources (CRES)	Contribution to the formation of information and awareness actions for citizens on climate change.	

Table 7. Stakeholders and Partners (Academic Institutions)

C. Economic operators			
	Institution Name	**Urban Bus Station of Messinia**	
	Description	**Influence**	**Interest**
	The Urban Bus Service implements the transportation project in the urban area of Kalamata, with 21 buses running on 8 bus lines.	The daily service of large numbers of passengers is a crucial factor for the promotion of public and urban transport.	The direction of the actions is to encourage the use of public transport by citizens which will create additional economic benefits
	Institution Name	**Intercity Bus Station**	
	Description	**Influence**	**Interest**
	Intercity Bus implements the public transport project for the transportation of passengers to and from Kalamata, from all regions of Greece.	The traveling public, depending on its service, is encouraged to use public transport instead of cars for their transportation.	The direction of the actions is to encourage the use of public transport by citizens which will create additional economic benefits
	Institution Name	**QUEST Group**	
	Description	**Influence**	**Interest**
	UniSystems was founded in 1964 and is a member of the **Quest Group**. It is one of the most reliable ICT solution providers in Southeastern and Central	The Quest Group has created, under the umbrella of the IQnovus innovation center, ecosystems in which companies and research teams participate in order to	IQnovus, the Quest Group's Innovation Center, operates under the umbrella of Uni Systems' Research, Development and Innovation Division and is a

	Europe, with more than 1100 specialized ICT professionals, with an annual turnover that exceeded €154,000,000 in 2021 and subsidiaries in Belgium, Luxembourg, Romania and Cyprus. It is a strategic partner of financial institutions, EU agencies, telecoms providers and businesses. The company implements and supports large-scale, complex and critical ICT projects in European Organizations. Due to its true customer-centric approach, its commitment to excellence and its flexible and efficient management style, UniSystems is positioned as a focused ICT provider in the European market having already earned the respect of its partners and the trust of its customers. The portfolio of solutions and services includes: infrastructure modernization & redesign, Cloud services and supports, DevOps automation, distributed ledger technologies, IT security, telecommunications consulting and planning, case management, human capital management, application management, custom critical systems software development, financial systems, business support. The Quest Group is a dynamic group of companies that has charted a remarkable journey of business excellence spanning over four	adopt innovative solutions and methods as well as best practices on issues related to the digital transformation of cities. • **Pleiades IoT Innovation Cluster** • **FIWARE iHub** All actions that include integration of digital applications and innovation projects are supported by the IQnovus ecosystem.	vibrant hub for driving transformative developments. Its main purpose is to create an integrated innovation ecosystem through the promotion of collaborations between Academic and Research Institutions, Companies and other Organizations. Through careful monitoring of technological developments and seamless knowledge transfer, IQnovus enables the development of innovative products and solutions. With a focus on attracting top talent and leveraging advanced tools and methodologies, the center fosters creativity and drives groundbreaking projects. With access to investment and funding from European funds, IQnovus reinforces the Quest Group's commitment to sustainable development and excellence in the business effort. **IQnovus** seeks to participate **as a partner in the initiative of the net zero mission for the city of Kalamata**. In particular, it is considering supporting the city in the following ways, by: 1. Develop some of the proposed research activities in the fields of mobility and energy to increase their efficiency 2. Contribute to the acceleration of the process - "from lab to market" by promoting the value chain stage of the city's research produced

	decades. With a strong commitment to sustainable development and a people-centric approach, the Group has established itself as a leader in the markets in which it operates. With impressive sales of €1.03 billion. In 2022, the Quest Group has demonstrated its ability to create value and drive growth. The Group's global presence in 30+ countries is a testament to its diverse business activities, which include Information Technology and Telecommunications, E-Commerce, Air Conditioning, IT Services, Courier and Postal Services and Green Energy through its various companies. With an unwavering commitment to providing cutting-edge solutions and services, Quest Group continues to be at the forefront of innovation in the industry, driven by the collective vision of its dedicated workforce of more than 2,599 professionals.		3. Participation in events / workshops 4. Evaluation of potential sponsorship 5. Consider offering support in cash or in kind in exchange for services
	Institution Name	**Public Power Corporation PPC S.A.**	
	Description	**Influence**	**Interest**
	PPC is the public electricity operator in Greece, whose object is the production of energy and its distribution to consumers through its subsidiary company HEDNO, which manages the transmission networks.	PPC's program also includes the promotion of electromobility, with the installation and operation of a network of charging stations, as a necessary means for the use of electric vehicles. At the same time, PPC will contribute with the construction of photovoltaic parks and the integration of RES, and in changing the composition of the energy	The operation of the network of electric vehicle chargers for the company will have an economic benefit, while for the Municipality of Kalamata, apart from an economic benefit, there will also be a reduction in emissions.

		mix to one of lower emissions.		
	Institution Name	MYTILINEOS GROUP		
	Description	Influence	Interest	
	MYTILINEOS Group is a listed company on the Stock Exchange, with multifaceted activity in energy production and construction.	The Group's participation in the implementation of the actions of the climate contract, in the fields of energy production and management, as well as in the renovations of the building stock, will be decisive in the pace of their implementation.	With its participation, the Group will have an economic benefit and at the same time, will create innovative products.	
	Institution Name	AVOCADO		
	Description	Influence	Interest	
	AVOKADO is a SpinOff company that promotes smart energy management solutions, using artificial intelligence and big data processing technologies.	Its participation is crucial for the implementation of the contract, due to the know-how it develops in digital applications for energy management.	With its participation, it benefits from the evaluation and utilization of innovative methods in energy management	
	Institution Name	NOVOVILLE		
	Description	Influence	Interest	
	Novoville is a start-up with a vision and goal to facilitate citizens' daily lives and transform municipal services, making them more accessible and efficient. It has emerged as one of Europe's 10 best start-up companies in the field of government techonology	Novoville has the expertise to support urban and smart mobility actions	With its participation, it benefits from the evaluation and utilization of innovative methods in mobility actions and provision of services to citizens.	
	Institution Name	LOCAL AI		
	Description	Influence	Interest	
	Local AI is a high-tech start-up, based in Kalamata, aiming to implement artificial intelligence and GeoAnalytics projects.	Local AI's activities are related to the management and utilization of data from smart city systems.	The benefits of the company are financial and research	

	Institution Name	Ameresco Sunel Energy S.A	
	Description	Influence	Description
	Ameresco Sunel Energy S.A. has been active through its shareholders since 2010 in the fields of development, construction and maintenance of renewable energy projects, energy saving and storage, having participated in the implementation of numerous projects.	Ameresco Sunel Energy S.A. affects the implementation of the climate contract, in terms of applications of photovoltaic energy netting systems with the consumption of the Municipality of individuals and companies, interventions in infrastructure throughout the Municipality with priority given to the most energy-intensive installations, applications to address energy poverty and increased energy costs, electromobility applications as well as upgrading the environment and the quality of life of individuals Residents.	The benefits of the company are financial
	Institution Name		
	Description	Influence	Description
	Institution Name		
	Description	Influence	Description

Table 8. Stakeholders and Partners (Economic Operators)

D. Civil society			
	Carrier category	Professional Teams	
	Appellation	**Influence**	**Interest**
1.	Federation of Commercial Handicraft Enterprises of Messinia (OEBES)	The Federation has as members craft and commercial enterprises, in all sectors of manufacturing, which are directly affected by emission reduction actions.	The benefits for businesses will be mainly financial, due to the expected reduction of energy costs, the modernization of equipment, as well as the adaptation to new production models, while the use of the Shipment label for additional funding will play an important role.
2.	Kalamata Labour Centre (EKA)	The EWC, promoting the interests of all employees in private enterprises, will influence the implementation of actions for their benefit.	The EWC's interest focuses on: 1. adapting learning and improving employees' skills in order to increase their income. 2. The creation of safety and hygiene conditions in the workplace. 3. The reduction of family budget expenses by reducing energy costs. 4. the creation of comfortable living conditions in their home
3.	Commercial Association of Kalamata "Hermes"	The members of the association operate retail businesses in central parts of the city and will be affected by the proposed interventions in both urban space and city operations.	It creates for the members of the association, both the opportunity to adapt to the new operating conditions of the city and for new business activities, due to digital transformation and the integration of innovative products.
4.	Messinia Hoteliers Association	The members of the Association are the hotel	In the hotel industry, there will be changes in both the

		units and lodgings, which by their operation constitute a significant part of the gross product for Kalamata.	accommodation infrastructure and the services offered, with a direct economic impact on both entrepreneurs and employees.
5.	Catering Association of Messinia (SEM)	The members of the association have catering and leisure businesses, with a particular contribution to employment and the income generated for the city.	Due to their scope, businesses should adapt to less energy-intensive operations and show, in accordance with the proposed actions, sensitivity to the use of raw materials, promoting circular economy concepts.
6.	Association of Catering & Leisure Shopkeepers of Kalamata (SKEAK)	The members of the association have catering and leisure businesses, with a particular contribution to employment and the income generated for the city.	Due to their scope, businesses should adapt to less energy-intensive operations and show, in accordance with the proposed actions, sensitivity to the use of raw materials, promoting circular economy concepts.
7.	A.S. Union of Messinia	The Association acts as a trader, processor and seller of agricultural products, working with the farmers of the area.	The path to climate neutrality concerns agricultural production, as well as product processing processes, the environmental footprint of which will be a tool, both for the value of the product and for its promotion in the markets. The results are both economic and environmental.
8.	Association of Olive Millers of Messinia Prefecture	It has as members the entrepreneurs of the olive fruit conversion units into oil.	In the process of converting the fruit into oil, large amounts of energy are consumed, so with the interventions of modernization of equipment and change of processes, economic benefits and reduction of emissions will result.
9.	Union of Food Shopkeepers and Super Markets.	It includes food retailers, to consumers. Sector with large and small size businesses.	Businesses will be affected by the energy upgrade of facilities and equipment, as well as changes in the way they are supplied.
10.	Butchers' Union of Messinia "Proodos"	The association owns all fresh meat businesses.	In a butcher shop, emissions are generated both from the operation of the business and from the process of production and transport of fresh meat.

			The proposed actions will reduce the company's energy costs, while affecting the marketing processes of the products.
11.	Bakers' Guild of Messinia	It has as members all bread and pastry workshops	The exemption from fossil fuels (Diesel) operation of the unit, leads to the necessary modernization of the equipment, with the benefit of reducing energy costs.
12.	Hellenic Chamber of Transport Association (EESYM)	The members of the association are the freight transport operators, having either temporary storage warehouses for goods or the means of transport for their movement.	The implementation of measures to supply shops and other freight transport will have an economic impact, due to the necessary investments and the promoted change in the way goods are transported.
13.	Union of Trucks & Tricycles of Messinia Prefecture	It has as members the owners of public transport.	Members will be affected by the city's operating rules, the need to modernize their vehicle fleet, as well as proposals to reorganize freight transport.
14.	Association of Car & Machinery Repairers of Messinia Prefecture	The members of the association maintain wheeled vehicle repair businesses, of all kinds	The replacement of the fleet of internal combustion vehicles with low-emission ones creates a need for training and adaptation of the members of the association to new technologies, in order to create in the city the carrying capacity to maintain new vehicles.
15.	Association of Gas Station Owners of Messinia "Aristodimos"	The union owns all petrol stations, through which vehicles are refueled with liquid fuels and homes with heating oil.	Due to the proposed actions to get rid of liquid fuels, both for traffic and heating, the sector will suffer the greatest consequences of all.
16.	Kalamata Taxi Owners Association	Includes taxi owners	The industry will be affected by the promotion of electric vehicles, the encouragement of the use of public transport, means of mild transport, but also shared vehicles.
17.	New Association of Electrical Contractors of Messinia	It consists of electrical construction professionals.	Due to the transition to an era free of fossil fuels, the energy upgrade of homes and facilities, the modernization of equipment and appliances, the

			introduction of automation in the daily lives of citizens, but also of production lines, members will be at the forefront of promoting change.
18.	Association of Plumbing Installers of the Prefecture of Messinia "The Samaritan"	The association includes professionals installing plumbing systems for the operation of both buildings and production and processing units.	The abolition of central heating with oil will affect the working future of members of the industry.
	Carrier Category	**Scientific Bodies**	
	Appellation	**Influence**	**Interest**
7.	Kalamata Bar Association	All members of the association who provide legal services	In cases where the actions of the contract will include synergies between entities of different legal status, the agreements between them should have the legal documentation. Also, the implementation of some actions will require the adoption of regulatory or regulatory acts.
8.	Technical Chamber of Greece (Messinia Branch)	It includes the Engineers with specialization, the Civil, the Architect, the Electrician, the Mechanical, the Surveyor and the Chemical Engineer.	Engineers are responsible for the construction of buildings and facilities, the urban planning of areas, methods of energy production and distribution, as well as waste management. Therefore, it is the sector on which the implementation of the proposed interventions will be based, with economic benefits.
9.	Association of Accountants, Tax Consultants Freelancers of Messinia Prefecture ELFEE	It includes professionals who offer financial advisory services to citizens and businesses.	The movement of zero-emission goods, as well as their procurement procedures, leads to the imprinting of zero-footprint balance sheets, thus creating the need to inform and familiarize economists in terms of green accounting.

10.	Medical Association of Messinia	The daily contact with people in need of medical attention creates the framework of the influence of the members of the association on issues of information and awareness on climate change.	The protection of public health through the proposed interventions, as well as the reduction of energy costs of business premises are reasons for expressing interest in implementing the actions of the climate contract.
11.	Pharmaceutical Association of Messinia	The daily contact with people in need of medical attention creates the framework of the influence of the members of the association on issues of information and awareness on climate change.	The protection of public health through the proposed interventions, as well as the reduction of energy costs of business premises are reasons for expressing interest in implementing the actions of the climate contract.
12.	Dental Association of Messinia	The daily contact with people in need of medical attention creates the framework of the influence of the members of the association on issues of information and awareness on climate change.	The protection of public health through the proposed interventions, as well as the reduction of energy costs of business premises are reasons for expressing interest in implementing the actions of the climate contract.
	Category	**Education**	
	Institution Name	**Influence**	**Interest**
1.	**Ministry of Education** • (Directorate of Secondary Education) • (Directorate of Primary Education)	The Directorates of Education of the Ministry of Education are responsible for the proper functioning of school units. In a school yard coexist teachers, students and their parents.	The interventions in school units concern: • creating comfort conditions for students and teachers. • The reduction of school operating costs • Raising students' awareness • Informing parents
2.	Union of Secondary Education Officers of Messinia	Includes the teaching staff of secondary schools (Gymnasiums and Lyceums)	Teachers, apart from the benefit of creating appropriate teaching conditions, have as their most important role the awareness of students on climate change issues
3.	Association of Primary Education Teachers of Messinia	Includes the teaching staff of primary schools (Kindergartens and Primary Schools)	Teachers, apart from the benefit of creating appropriate teaching conditions, have as their most important role the

			awareness of students on climate change issues
4.	Union of Parents & Guardians Associations of the Municipality of Kalamata	As an association that has as members the parents of all schools of the Municipality, it influences the formation of opinion and implementation of policies for climate neutrality.	The focus is on the proper functioning of school units, in terms of teaching conditions and operating costs.
5.	School Committees of the Municipality of Kalamata • (for Primary Education) • (for Secondary Education)	School Committees finance the operating costs of school units with state subsidies	Energy saving interventions, as well as the installation of photovoltaics on roofs, reduce the operating costs of school units.
6.	Association of Foreign Language Schools of Kalamata	It has as members the owners of Foreign Language Learning Units operating outside public education. The need for interventions to reduce operating costs, but also the daily contact with students, determines the extent of their influence.	The information and sensitization of students on climate change issues, as well as the modernization of facilities, create requirements for a better learning environment, resulting in the improvement of the quality of educational work.
7.	Environmental Education Center of Kalamata	It is an institution of Education, which organizes and implements environmental programs of experiential nature, aiming at raising students' awareness on environmental issues.	The approach of climate neutrality broadens the scope of the Center's actions and creates prospects for collaborations of students from the cities of the Network.
8.	Central Public Library of Kalamata	It is a public body with the purpose of organizing and managing intellectual content, as well as disseminating it, through events.	The functions of the public library will contribute to raising awareness and informing citizens about climate neutrality.
	Category	**Non-Governmental Organizations**	
	Institution Name	**Influence**	**Interest**
1.	DIAZOMA Association	It is active in the protection of archaeological wealth and the interconnection of monuments of the natural and cultural environment with each other.	The actions for accessibility to archaeological sites and the protection of the built and natural environment.

2.	SEED	Users of mobility services	NGOs with mobility activities
3.	Association of People with Disabilities of the Prefecture of Messinia	It has as members people with difficulty in their movements.	For the development of infrastructure for accessibility in public space and protection of public health.
4.	Association for the Blind Regional Union of Southern Peloponnese	It has as members people with difficulty in their movements.	For the development of infrastructure for accessibility in public space and protection of public health.
5.	Mountaineering Club	It has as members explorers of the beauty of nature, who have a lifestyle towards consumption patterns	The actions for the protection of the built and natural environment reflect the sensitivities of climbers for the environment
6.	Association "Friends of Kalamata Bicycle"	It has as members people who have connected their daily lives with cycling.	They know better the needs of cities for the creation of cycling routes
7.	"Let's go for a walk" team	It is active in highlighting the history of the city through walking routes.	There is particular interest in the creation of pedestrian routes, which will facilitate the work of the Group.
8.	Hellenic Red Cross (H.R.C.S.) Kalamata Branch	It offers social work to vulnerable groups.	ECA's action contributes to improving social cohesion and public health protection
9.	Hellenic Rescue Team	It is a group of volunteers who intervene in dealing with emergencies and situations	They contribute through their action to environmental protection and social cohesion.

Table 9. Stakeholders and Partners (Civil Society)

A-3.2: Description of systemic barriers – text elements

During the journey of consultation and collaborations with the city's ecosystem, for the formulation of the strategy for achieving the goal of climate neutrality, as well as the process of recording CO_2 emissions for the year 2019, the gaps in emissions per sector and the main obstacles to the implementation of interventions emerged.

Emission gaps identifying transformation pathways, as well as the level of detail required, for effective implementation of actions. The result of which analysis is the categorisation of obstacles, as follows:

I. General obstacles

1. Governance and policies

Achieving the objectives of the Mission of Cities, because it is an interaction of multiple actors acting at many levels of government, requires adapting to the objective of both European and national policies, so that cities, at least at national level, have a common approach and support.

Due to many levels of governance, there are local responsibilities supervised from a higher level, resulting in lengthy procedures for obtaining the necessary approvals or authorisations to implement an intervention.

At local level, several interventions concern individuals for whom the municipality has no decisive competence.

2. Implementation

Because the interventions of a technical nature, are of large size, they require contractors for their implementation, with great operational capacity, in order to ensure both the supply of raw materials and the availability of the necessary manpower personnel.

The size and resilience of infrastructure are critical factors that substantiate the feasibility of interventions, such as: the capacity of the electricity transmission network, the number of electric vehicle charging stations, the length of sustainable mobility infrastructure.

Much of the content of the interventions of the cities of the Mission is common, such as electric vehicles, panels of photovoltaic systems, energy storage batteries, materials for thermal insulation of buildings, heat pumps, etc., so the demand for these in the next 7 years will increase rapidly, with the risk of a shortage in the market.

3. Funding

It is not clear whether European and National resources are involved in the way of financing the interventions of the Climate Contract.

Citizens are ignorant about the use of complex financial products, such as ESCO contracts, for the energy upgrading of buildings.

After the 2010 financial crisis, in Greece:

The Greek banking system is unable to finance large and particularly complex projects, such as the content of a climate contract.

A large part of businesses and citizens do not have access to the banking system, due to low credit rating.

4. Competence and Learning

The integration of digital applications in interventions also requires familiar citizens, many of whom today are considered digitally illiterate.

The introduction of new processes and products, in the field of business, requires training and familiarization of employees, e.g. maintenance of an electric vehicle or a photovoltaic system, require craftsmen with skills.

5. Social behavior

The awareness and acceptance of citizens, in everything that changes their daily lives, requires:

the provision of incentives to compensate for subversive interventions, such as: discount coupons from shops, for the use of parking spaces away from the mall.

For any demanding intervention that creates limitations, an antidote solution should be provided, such as: The delimitation of a zero emission zone prevents the use of an internal combustion car in it, but at the same time it should be possible to move by other means, such as public transport, or the receipt and use of electric means, from a mobility hub.

II. Systemic Barriers by Sector

1. Transport – Mobility

Regulatory decisions on both vehicle traffic and road use characterization (pedestrian zones, bicycle lanes) require licensing approvals from higher levels of government, through time-consuming procedures.

The supervision of the movement of vehicles within the urban area belongs in some cases to the Municipal Police and in others to the State Police, resulting in confusion of responsibilities.

The replacement of vehicles with lower emission ones, apart from financial incentives for the citizen, requires infrastructure for the supply of all forms of energy (electricity, biofuels).

The opening hours of shops and the possibilities of replenishing the market, outside peak hours, are an issue that concerns multiple levels of government, with the necessary decisions being time-consuming.

2. Buildings and facilities

The obstacles concern the availability of raw materials, as well as labour for the necessary repairs to the building stock. Raw materials, such as thermal insulation materials, frames, energy-efficient appliances, heat pumps, energy storage batteries and photovoltaic systems, are materials that will be in high demand and may be absent from the market.

3. Energy

The electrification of both transport and the operation of homes and business units of the secondary or tertiary sector requires new quantities of clean electricity, the distribution of which, due to the size of the quantities, needs increased network capacity, or smart management with modern tools, so as not to collapse the supply system at peak times.

The local production of clean energy distributed through the transmission network, is integrated into the national energy mix and regulates the corresponding emission factor and does not eliminate emissions in the city from its use. On the contrary, the production and distribution directly to the consumer of the energy produced by photovoltaic systems is zero emissions.

4. Waste

For the implementation of the "Pay as You Throw" policy to reduce the amount of organic waste, it creates higher costs for the consumer and at the same time the obligation to provide the necessary equipment for sorting at source.

III. Opportunities

Kalamata, as a member of the network of 100 cities and holder of the Mission Label, will have the following advantages:

- It will attract investment capital and human resources for the implementation of all interventions.
- It will have the potential to develop into a place of international scope, for the development of scientific and research programs.

- It will have additional funding from European programmes.
- It will gain international visibility, as a green and climate-neutral city, which will attract visitors, both for leisure purposes and for participation in research projects.

With the implementation of the interventions:

- The city will change form and functions to become more friendly and attractive for both residents and visitors.
- The lifestyle will be healthier, from reducing air pollutants and creating living conditions inside the dwelling.
- The energy self-reliance of households and businesses will create a high economic benefit from energy saving and independence from fuel and energy supply, in a volatile economic environment.

A-3.3: Description of the participatory model for climate neutrality of the city

The Mayor of Kalamata formed the Transition Team from representatives of city bodies and scientific disciplines, professionals in respective fields**, as well as executives of the Municipality of Kalamata,** with the aim of preparing the content for the drafting of the city's Climate Contract, as well as the political supervision of its implementation.

The Group, headed by the Mayor, consists of:

I. The five-member Coordination Team
II. The coordinators at the head of the following intervention axes:
1. Transport – Mobility
2. Buildings
3. Energy
4. Built and natural environment
5. Resilience
6. Waste and Circular Economy
7. Economy – Society

III. The 26 rapporteurs, as heads of the thematic units from each axis.

The work of the transition team, supported by external partners, coming either from universities or from professional sectors, was carried out in two phases:

Phase A

A long consultation with institutions and citizens of Kalamata was organized, either by organizing open dialogue events, or online through **mission.kalamata.gr** platform, or through open workshops, in which more than 1,000 of our fellow citizens, executives of market companies, academics and state institutions participated, who expressed themselves either by participating in online votes or by submitting proposals.

In this way, a stock of knowledge was created for the above axes of intervention, on which the content of the candidacy proposal for inclusion in the network of 100 cities of the Mission was based.

The roadmap of the events is presented in detail in the attached file entitled "**a-3.3-Consultation_PhaseA.doc**".

Phase B

Following the city's inclusion in the Mission's network of 100 cities, the Transition Team met on September 30, 2022, defining a roadmap of actions to draft the climate contract.

On October 1, 2022, at the amphitheater of the Philharmonic of Kalamata, the content of the proposal was presented to the public of the city, which was positively evaluated, so that Kalamata can join the network of 100 cities.

The event was attended by academics and researchers, market executives, representatives of city bodies, who at the end submitted their own views, which were taken into account for the drafting of the Climate Contract.

At a later stage, the areas of intervention were updated by the coordinators and rapporteurs of the modules of each axis and the strategic guidelines for the description of the actions were delivered.

With the beginning of 2023, the recording of base emissions began, by a scientific team, with the participation of representatives of the Academy of Athens. The reference year was considered to be 2019, which was also the last year before the pandemic when the city operated normally, so that the data had the greatest reliability (at the beginning of 2023, *there was no updated data in state services for 2022*).

At the same time, working groups were set up in the areas of:

1. Transport – Mobility
2. Energy systems
3. Waste and Circular Economy
4. Built and natural environment

In which participated:

1. The coordinator of the axis of assistance
2. representative of a corresponding University department
3. Designer, external collaborator of the Municipality
4. executive of the Municipality, in a corresponding scientific field.

The coordination of the operation of the working groups was carried out by the competent Deputy Mayor and coordinator of the whole effort, assisted by external experts.

On April 5, 2023, at the Cultural Center of Kalamata, the strategy of the Climate Contract was presented by the working groups, which transformed the political directions of the consultations into proposals with a technocratic approach and scientific documentation.

At the same event, the strategy for the city's Digital Transformation was presented, with actions that were incorporated and strengthened the content of the climate contract.

At the same time, events were organized to disseminate the effort to achieve the goal of climate neutrality, such as:

1. The 1st Scientific Conference on Climate Change

2. The 2nd Robotics Festival

3. Survey in which the environmental team of the 5th High School of Kalamata participated, on **"How much do the views of young people influence the decisions of the elected representatives of the city, to address the climate crisis**" conducted in two phases, with questionnaires to the municipal councilors and the submission of children's views, during their participation in a corresponding meeting of the Municipal Council.

In the small town of Kalamata (80.00 inhabitants) several activities take place, covering all thematic fields.

4. Part B – Trajectory towards climate neutrality by 2030

The Climate Contract of the Municipality of Kalamata includes the **Strategy** that was co-formulated through a process of long **consultation**.

Problems and **obstacles** were recorded**, opportunities** were sought, local **weaknesses** were highlighted, the **intellectual capital of the city** was mobilized **and** collaborations **were achieved with universities and private market bodies in order to** shape the framework of interventions that will **turn** the climate crisis into an **opportunity** for the city, so that citizens on the one hand prepare for the changes, but also have **benefits**.

The Strategy is in line with the Mission's guidelines for reducing CO2 emissions, so the following goals were set:

1. Changing human behavior
2. Getting rid of fossil fuels
3. Integration of New Technologies and application of innovative methods in all city functions.

The proposed interventions aim to reduce CO2 emissions, according to the updated data of the 2019 census and concern the respective sectors, as in the inventory table.

N/A	Emission Category	Emissions 2019 in (tn)	%
A	Buildings and facilities	151.199,70	59,14%
B	Transport	66.736,01	26,10%
C	Waste	5.246,00	2,05%
D	Industrial processes	21.582,93	8,44%
And	Agriculture	10.897,29	4,26%
		255.661,93	

The interventions were documented **in 77** related actions, organized in **16 portfolios**, which are included in **four transformation paths** or scenarios (**Impact Pathways**), according to the table below:

1. Kalamata, city to live in

L.1 Regeneration of urban areas
L.2 Aesthetics and functional upgrading of public space
L.3 Kalamata, clean city
L.4 Housing, climate neutral.
L.5 Sports and Education

2. **Kalamata, low-emission mobility**

   M.1 Sustainable Urban Mobility Infrastructure
   M.2 Promotion of travel by environmentally friendly means.
   M.3 Freight
   M.4 Promoting travel with low-emission vehicles

3. **Kalamata, city to produce and create**

   P.1 Emission reduction actions in the agricultural sector
   P.2 Transformation of manufacturing and craft units
   P.3 Energy upgrading of buildings and facilities of the tertiary sector.
   P.4 Energy production and distribution.

4. **Kalamata, a city that learns**

   R.1 Pilot and research activities
   R.2 Research and Innovation Structures
   R.3 Information and Awareness

The summary budget of Impact pathways is:

Transformation Paths	Budget
Kalamata, city to live in	1.075.652.142,20
Kalamata, low-emission mobility	719.656.905
Kalamata, city to produce and create	229.349.259,25
Kalamata, a city that learns	15.865.613,30
TOTALS	**2.040.523.919,75**

The actions described in each portfolio interact with each other in a way that is documented in detail in the Technical Bulletin of each action, in order to create a grid of **36 correlations** between the L,M,P portfolios excluding the R Portfolios, since these actions support all of them, as in the table:

Aa	PORTFOLIOS	M.1	M.2	M.3	M.4	L.1	L.2	L.3	L.4	L.5	P.1	P.2	P.3	P.4
M.1	Sustainable Urban Mobility Infrastructure		X	X	X	X	X							
M.2	Promotion of travel by environmentally friendly means.			X	X	X	X							X
M.3	Freight				X	X	X							X
M.4	Promoting travel with low-emission vehicles					X	X		X		X	X	X	X
L.1	Regeneration of urban areas						X	X						

L.2	Aesthetics and functional upgrading of public space							X						
L.3	Kalamata, clean city								X	X	X	X	X	X
L.4	Housing, climate neutral.													X
L.5	Sports and Education													X
P.1	Emission reduction actions in the agricultural sector													X
P.2	Transformation of manufacturing and craft units												X	X
P.3	Energy upgrading of buildings and facilities of the tertiary sector.													X
P.4	Energy production and distribution.													

Table 10. Correlations of Climate Contract Portfolios of the Municipality of Kalamata

(**Note**: *Each portfolio in the table has so many correlations resulting from the sum of its X points, columns, and rows; for example, portfolio M3 is associated with M1, M2, M4, L1, L2, and P4, while P3* ***is associated with M4, L3, P2, and*** *P4.*)

The scenarios determine how to achieve the goals set and analyze both the obstacles and opportunities, as well as the direct and parallel benefits for citizens, while in the portfolios and actions contained in them, an in-depth analysis is made.

At the end, the indicators for monitoring and evaluating the implementation of the actions are defined with appropriate documentation.

B. Summary of actions

The implementation of the actions, as well as their results in summary, follow the following steps:

I. For Public Space and Transportation

1. Revitalization and aesthetic upgrading actions (113.161.007,90 €)

in areas that incorporate everything that has been launched so far, but also new interventions, in the Center, the Beach and neighborhoods, such as:

- The completion of the urban planning in an area of 1,550 acres, including road openings and landscaping with bioclimatic materials, in the areas of Nissaki (330 acres), North of Navarinou in Paralia (1,100 acres) and the roadside area of Riga Feraios (120 acres).
- The recovery of the 16 km long coastal front, with the support of the World Bank.
- The revitalization of the area in the eastern part of the Historical Center from Anagnostara to Faron, covering an area of 112.5 acres.
- The interventions in the Eastern city (110 acres) and the West center (15 acres), with the simultaneous functional upgrade of Athinon Street.

- The completion of interventions in the Historical Center and the Central sector of the city, covering an area of 35 acres. approximately, already under way.
- The revitalization of the riparian zone of Nedontas (Northern part), with the removal of the Municipality and DEYAK crews.
- The expansion of the construction of pocket parks in all neighborhoods of the city.
- The creation of the area West of Artemis, 120 acres, as a climate neutral area, with pedestrian streets, bicycle paths, roads of mild traffic, common areas with bioclimatic materials and finally with the construction of a local cooling – heating supply network for all, which will be self-fed with clean energy from the sun and geothermal. Action that will operate on a pilot basis and will be extended to the area of Kipoupoli.

2. Sustainable Urban Mobility infrastructure construction actions (9.717.500, €)

- Creation of a 33Km cycle path network
- Creation of a pedestrian traffic network, 38 km long.
- Delimitation of a zero emission zone, covering an area of 200 acres. with restrictions on the movement of conventional vehicles, between Nedontos, Krontiri, Nikitara, Anagnostara, Ypapantis, and Tzanne streets.
- The construction of mobility stations, in the central Market and the eastern city, where commuters will be able to transfer by approaching the central areas by environmentally friendly means.

With the construction of the above infrastructure, an environment is created that enables travel with fewer cars and the creation of a microclimate that will favor travel, on foot, by bicycle or other micromobility vehicles.

3. Getting around the city (32.844.500 €)

It is an opportunity for the city to solve the problems created by the excessive occupation of public space by the car, to the detriment of pedestrians, creating new conditions of mobility in central areas.

In this spirit, in order to promote environmentally friendly travel and the organization of freight transport, interventions are proposed:

- Strengthening public transport
- The construction of infrastructure for the use of light micromobility vehicles.
- The implementation of controlled parking on 750 acres. (Faron, Platonos, Macedonia, Themistokleous, Nedontos, Tzanne, Mitr. Meletiou)
- The development of digital smart mobility applications for the immediate service of citizens and the reduction of unnecessary travel.
- The regulation of market supply rules, creating distribution warehouses in the same place and utilizing digital applications.

4. Vehicle replacement (677.094.905 €)

With the above interventions, the needs for car use are reduced, resulting in a reduction in the use of conventional fuels and a reduction in emissions.

But actions that are not enough, so the next step is to replace vehicles with low-emission ones, either electric or using biofuels, while creating the public infrastructure to supply them with clean energy. It is proposed to install and operate electric vehicle charging stations, as well as to replace vehicles:

- of the bus and taxi fleet
- municipal and state vehicles
- the fleet of vehicles engaged in commercial transport.
- Passenger cars

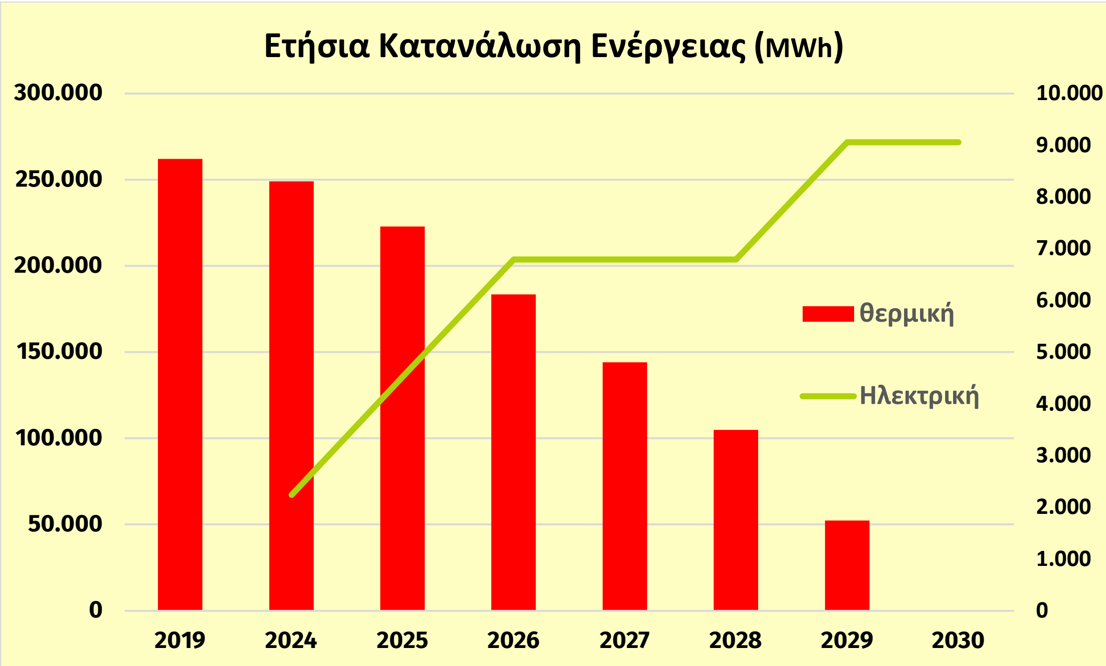
The estimated budget of all actions of all the above interventions is **832.817.913 €**

Interventions	Amount		%
Revitalization and aesthetic upgrading of urban space	113.161.008		13,59%
Sustainable Urban Mobility Infrastructure	9.717.500		1,17%
Getting around the city	32.844.500		3,94%
Vehicle replacement	677.094.905		81,30%
Commercial transport vehicles	*424.495.000*	62,69%	
TAXI buses	*52.650.000*	7,78%	
Passenger cars	*190.160.000*	28,08%	
	832.817.913		

The reduction of emissions is **66.215,45 tn**, which corresponds to 99,22% while the reduction of energy costs by **82,20**%, according to the table below:

DESCRIPTION	2019	2030	VARIOUS	%
Fuel Energy (MWh)	262.101,75	1.389,08	-260.712,67	**-99,47%**
Electricity (MWh)	0,00	45.273,92	45.273,92	**100,00%**
TOTALS	**262.131,75**	**45.273,92**	-215.438,75	**-82,20%**

The energy balance between the thermal fuel and the necessary electricity is:



II. For Buildings and Facilities (1.157.932.852 €)

The interventions concern the daily life of the citizen, in terms of residence, work, education and personal time, but also all public facilities and production units and concern interventions in:

- Houses
- Schools
- Sports facilities
- The primary sector
- Units of the secondary sector
- Tertiary sector installations.

In the buildings and facilities of the Municipality of Kalamata, in the inventory year 2019, **260.193** MWh of electricity and **115.355.45 MWh** of fuel energy were consumed, which created CO2 emissions, **172.791.87 tn**, corresponding to **67.58%** of total emissions.

In the building facilities, the following are proposed:

1. With interventions in the building envelope (masonry works, openings, roof), as well as in the upgrade of the operating equipment, the percentage of energy savings was calculated, depending on the application case

2. The remaining fuel energy was replaced by electricity, removing oil burners and installing heat pumps.

3. Based on the bearing capacity of the buildings, the installation of photovoltaic systems was calculated, in order to exploit the rich solar potential of the area.

4. It is proposed to install smart energy management systems, according to the producer – consumer model.

In the case of production units, the following are also proposed as measures:

1. The change of production processes on the basis of an energy audit of the plant.
2. The energy upgrade of equipment
3. the utilization of any waste form of energy by the plant.

The results of the proposed interventions, for all the above categories, are as in the table:

DESCRIPTION	HOUSES	SPORTS	SCHOOLS	1/genera	2/genera	3/genera	TOTALS
I. Energy Data OVERALL							
Energy BEFORE (**in MWh**)	197.474,00	1.241,80	2.232,75	14.007,35	40.266,37	120.326,20	375.548,47
Energy Saving (MWh)	139.686,13	917,57	1.601,78	1.366,05	12.603,07	68.696,75	224.871,35
Electricity requirement (MWh)	12.067,61	206,74	301,57	0,00	1.034,59	7.536,15	21.146,66
RES Energy Production	44.800,00	300,00	550,00	2.000,00	22.315,83	20.590,00	90.555,83
Energy META (**in MWh**)	12.987,87	24,23	80,97	10.641,30	5.347,47	31.039,45	60.121,29
ENERGY SAVING	184.486,13	1.217,57	2.151,78	3.366,05	34.918,90	89.286,75	315.427,18
% Energy Savings	93,42%	98,05%	96,37%	24,03%	86,72%	74,20%	**83,99%**
II. Emissions data OVERALL							
Emissions initially in tn	85.296,62	456,77	868,53	4.604,44	21.582,93	59.982,58	172.791,87
Reduction of CO2 emissions in tn	84.265,07	455,35	857,01	3.982,99	21.270,64	58.000,18	168.831,24
Final CO2 emissions	1.031,55	1,42	3,24	621,45	312,29	1.982,40	3.952,35
% emission reduction	98,79%	99,69%	98,67%	86,50%	98,55%	96,70%	**97,71%**
III. Financial data							
Estimated Budget	923.508.635	2.274.495	22.322.739	1.942.250	25.157.886	182.726.847	**1.157.932.852**
Cost €/tn CO2	10.959,57	4.995,05	26.047,23	487,64	1.182,75	3.150,45	6.858,52
Cost per MWh Save. Energy (€/MWh)	5.005,84	1.868,06	10.374,08	577,01	720,47	2.046,52	3.671,00

Table 11: Data on interventions in buildings and facilities

The table shows the following:

1. The budget of all interventions is: **1.157.932.852 €**
2. Fuel energy savings are **88.19%,** or **101,728 MWh,** from the initial quantity of 115,355.45 MWh, with the remaining part, which mainly concerns fuels for agricultural machinery, to be gradually replenished with cleaner fuels enriched with biofuels.
3. Energy is produced from photovoltaics **90,556 MWh**
4. The supply of electricity, with a carbon footprint from the transmission network, is reduced by **84%.**

5. The reduction of CO_2 emissions is by **97.71%** corresponding to **168.831.24 tn.**

III. Waste and Circular Economy (14.385.265,30€)

Interventions are proposed

1. Sorting of waste at source
2. In home composting
3. The promotion of recycling streams
4. Raising awareness for the reuse of materials.

The proposed interventions, costing € 14,385,265.30, **achieve a reduction of emissions by** 3,784.52 tn **or** 72.14%.

IV. Energy Production (13.520.275 €)

In Kalamata, a private investment for the construction of a network and a compressed natural gas (CNG) disposal unit will soon begin, the infrastructure of which will be used in the future by cleanly produced biofuels, from the following proposed units:

1. Unit for the utilization of sewage sludge of biological and liquid waste from the processing of olive husk for the production of Biomethane gas.
2. Green hydrogen production unit from the electrolysis of seawater.
3. Combined Heat and Power (CHP) Plant
4. Photovoltaic

The installation of the above units is proposed with the documentation of the National Technical University of Athens and have a cost of € 13,520,275 while they will produce **annually 32,110.70 MWh** of clean energy, which will be available either in the form of biofuels or in the form of electricity.

Another important element is the installation of smart devices that will manage energy exchanges between consumer and producer, utilizing **artificial** intelligence applications and big **data processing**.

C. Results of implementation of the climate contract

For the implementation of the actions, a **Citizens' Information Center** is being created, which will operate as **a OneStopShop point,** which in cooperation with the Communication Office, will **co-organize** information events for citizens, while providing **specialized** information to anyone interested, concerning:

1. technical or financial **advisory** services.
2. services for the acquisition **of skills** for a range of new professions.

The results and their processing will be done by the structure of the Climate Change Observatory.

According to the analysis of the portfolios, the implementation path will be summarized as follows:

1. Budget implementation progress

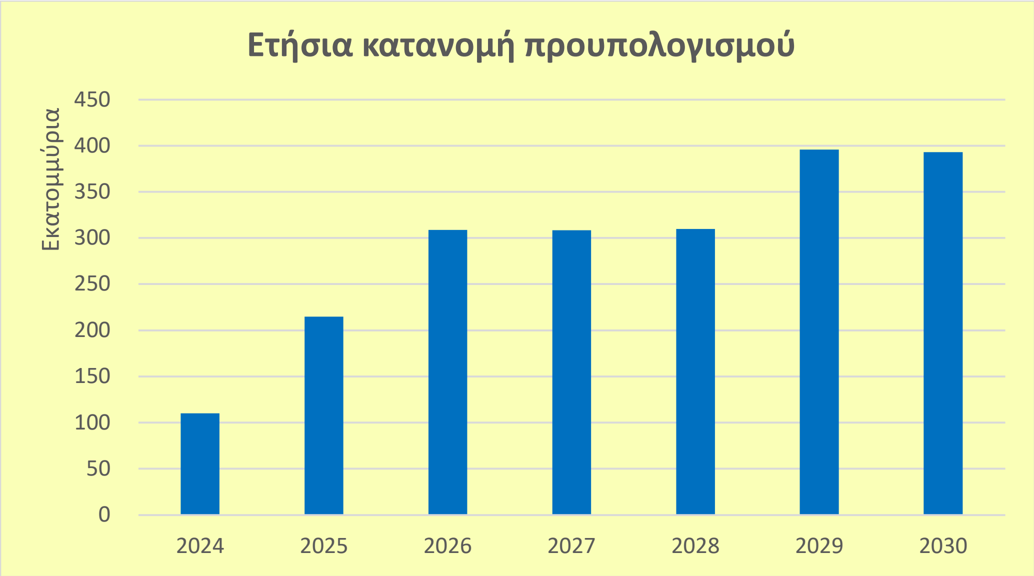
The annual budget breakdown of the portfolios is as follows:

PORTFOLIOS		2024	2025	2026	2027	2028	2029	2030	TOTALS
M1	Sustainable Urban Mobility Infrastructure	485.875	971.750	1.457.625	1.457.625	1.457.625	1.943.500	1.943.500	**9.717.500**
M2	Promotion of travel by environmentally friendly means.	978.000	1.956.000	2.934.000	2.934.000	2.934.000	3.912.000	3.912.000	**19.560.000**
M3	Freight	23.784.225	47.608.450	66.837.675	66.837.675	66.837.675	82.936.900	82.936.900	**437.779.500**
M4	Promoting travel with low-emission vehicles	15.856.317	31.679.148	39.935.840	39.880.916	39.807.684	42.720.000	42.720.000	**252.599.905**
L1	Regeneration of urban areas	4.659.784	9.319.567	13.979.351	13.979.351	13.979.351	18.639.134	18.639.134	**93.195.671**
L2	Aesthetics and functional upgrading of public space	998.267	1.996.534	2.994.800	2.994.800	2.994.800	3.993.067	3.993.067	**19.965.336**
L3	Kalamata, clean city	719.263	1.438.527	2.157.790	2.157.790	2.157.790	2.877.053	2.877.053	**14.385.265**
L4	Housing, climate neutral.	46.178.146	92.353.000	138.525.439	138.525.439	138.525.439	184.700.586	184.700.586	**923.508.635**
L5	Sports and Education	2.253.409	2.800.465	3.689.756	3.575.914	3.348.459	4.464.615	4.464.615	**24.597.234**
P1	Emission reduction actions in the agricultural sector	0	0	194.227	388.449	582.676	388.449	388.449	**1.942.250**

P2	Transformation of manufacturing and craft units	2.514.866	2.514.866	3.773.837	3.773.837	3.773.837	5.032.808	3.773.837	**25.157.886**
P3	Energy upgrading of buildings and facilities of the tertiary sector.	9.136.442	18.272.885	27.409.327	27.409.327	27.409.327	36.545.770	36.545.770	**182.728.848**
P4	Energy production and distribution.	976.014	1.952.028	2.928.041	2.928.041	2.928.041	3.904.055	3.904.055	**19.520.275**
R1	Pilot and Research Activities	974.640	1.362.760	1.279.079	1.031.569	2.460.000	3.200.000	1.600.000	**11.908.047**
R2	Research and Innovation Structures	242.500	187.500	185.000	185.000	185.000	185.000	185.000	**1.355.000**
R3	Information and Awareness	410.513	290.257	342.757	423.885	434.385	350.385	350.385	**2.602.566**
	TOTALS	**110.168.261**	**214.703.734**	**308.624.544**	**308.483.618**	**309.816.090**	**395.793.321**	**392.934.351**	**2.040.523.919**

Table 12. Annual budget breakdown by portfolio

The corresponding diagram for the annual implementation of the total climate contract budget is:



The portfolios in the table: M.1, M.2, L.1, P.4, R.1, R.2, R.3 with a total budget of **€ 157,859,060**, a percentage of 7.74%, support the actions of the other portfolios and contribute indirectly to the reduction of emissions, while the other portfolios with a total budget of **€ 1,882,664,860** include actions that lead to immediate emission reduction.

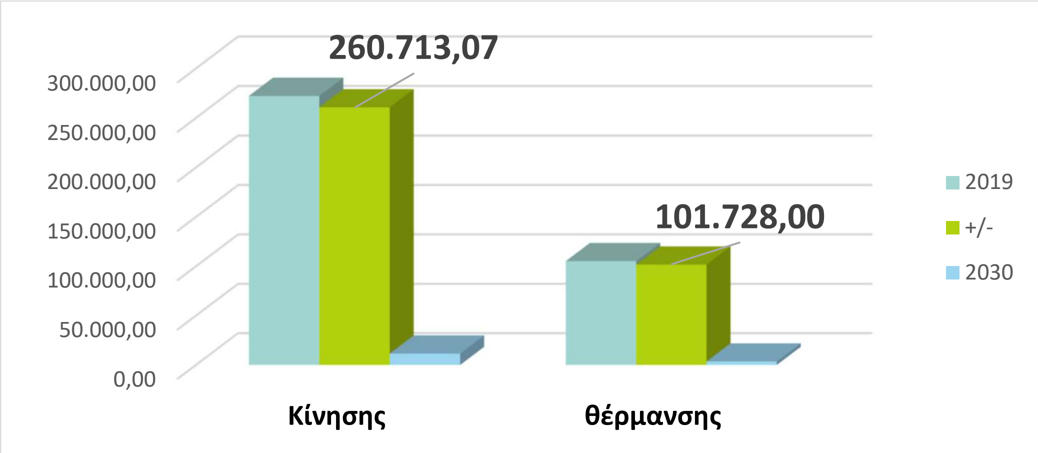
2. Energy Balance

All actions aim to decarbonise fossil fuels and replace them with clean and intelligently managed electricity. The energy balance of the actions is as follows:

A. Fossil fuels

The changes of fossil fuels for the movement of vehicles and heating of homes and installations arise as follows:

Fuel Use	2019	+/-	2030	% D
Motion	272.235,80	260.713,07	11.522,73	**95,77%**
Heating	105.251,10	101.728,00	3.523,10	**96,65%**
	377.486,90	362.441,07	15.045,83	**96,01%**



In total, fossil fuels are reduced by **362,441 MWh,** corresponding to approximately **3,624,410** cubic meters of fuel per year and at a rate of **96%.**

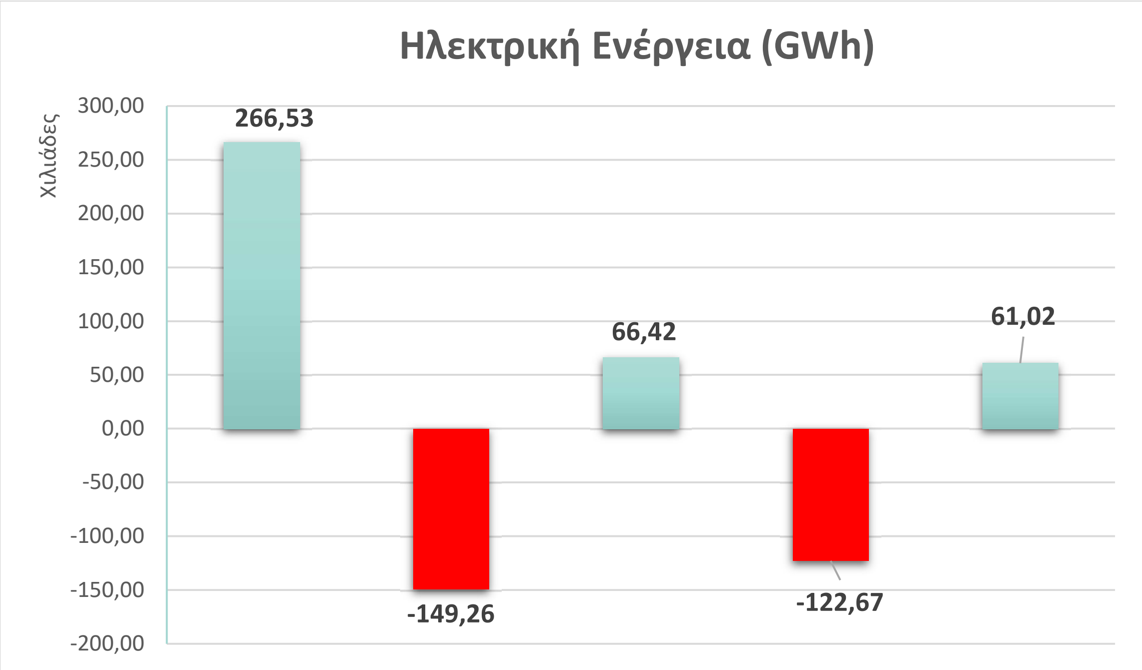
B. Electricity

The energy balance of electricity is derived:

1. From the supply of energy through the transmission network, for the years 2019 and 2030.
2. from energy saving due to the implementation of Energy Saving Measures.
3. new electricity requirements arising from the replacement of vehicles and oil burners
4. from clean electricity produced through RES.

They are according to the table

Electricity (MWh)				
Grid Energy 2019	**Saving HE (MWh)**	**EE requirements (MWh)**	**RES production (MWh)**	**Grid energy 2030**
266.526,21	149.261,55	66.420,58	122.666,54	61.018,70



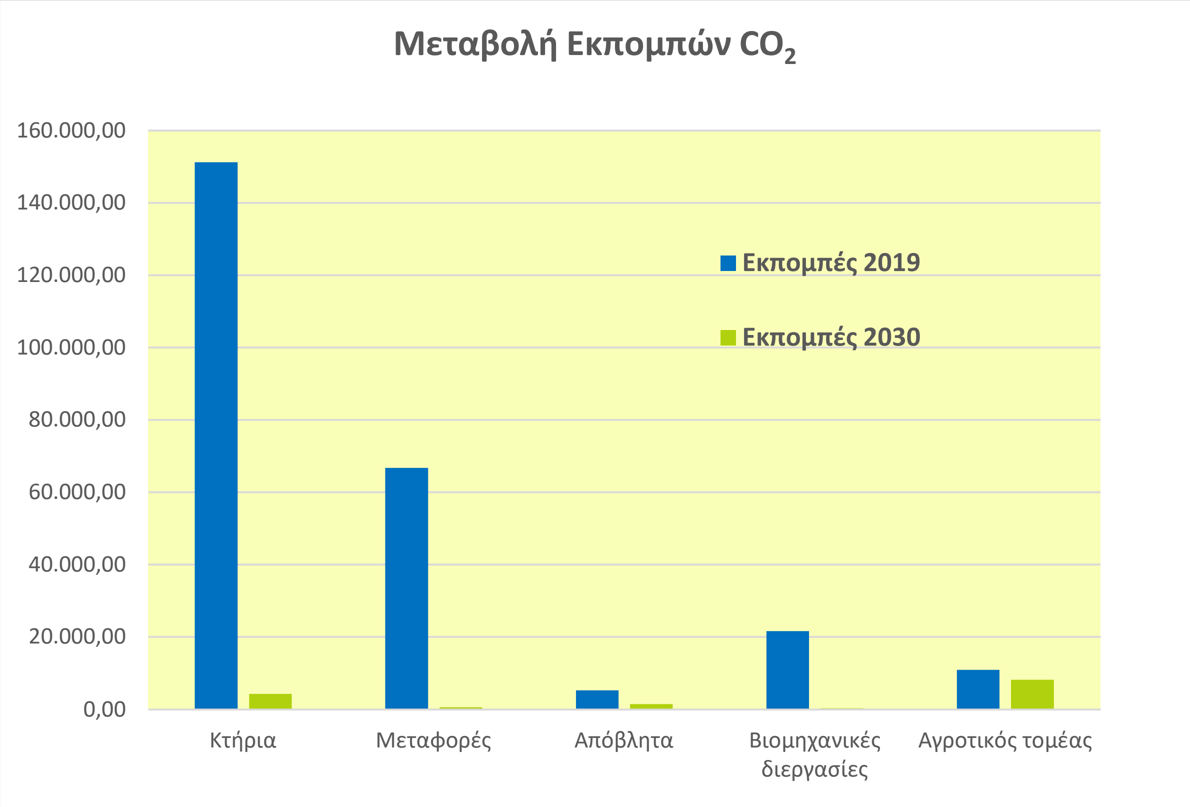
The data in the table show that:

1. In 2030, the electricity needs of a total of **183.69 GWh** are covered by self-generation through photovoltaic systems and production units, an amount equal to 122.67 GWh **and the rest through supply from the transmission network corresponding to a quantity** of: 61.02 GWh**. The percentage reduction in the use of electricity received through the grid is:** 77%
2. The penetration of RES in the local energy mix is: 122.67/183.69 = **66.78%.**

3. CO2 emissions

The change in emissions has as in the table and the corresponding diagram

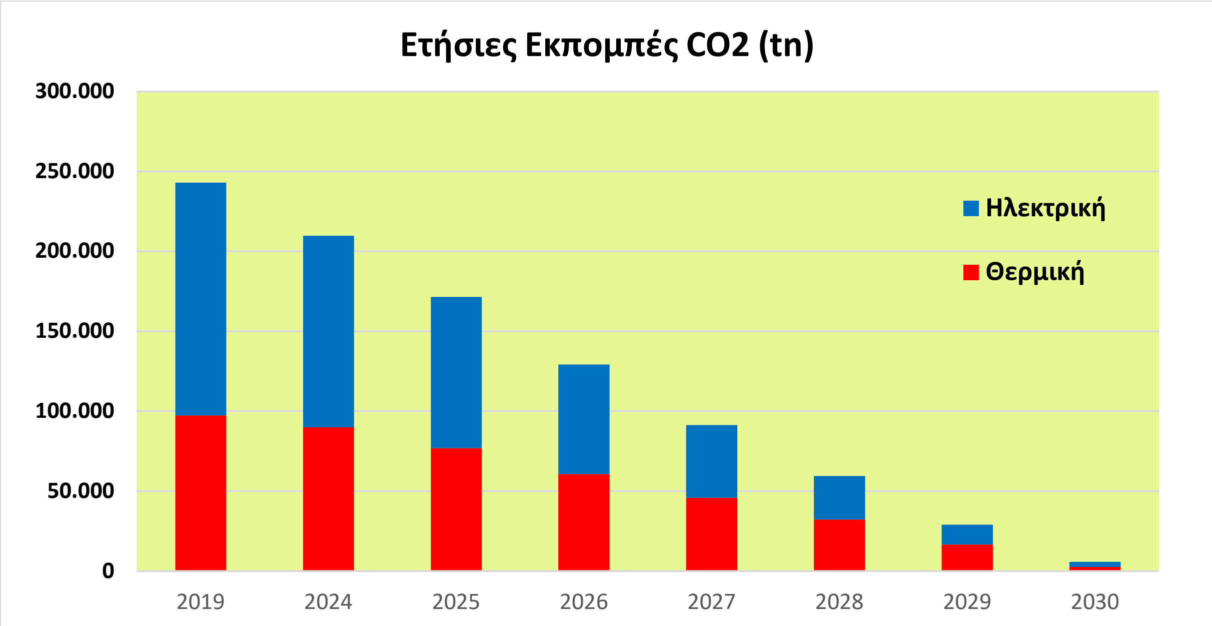
N/A	Emission Category	Emissions 2019	%	Emission reduction	% Reduction	Emissions 2030
A	Buildings	151.199,70	59,14%	146.945,51	97,19%	4.254,19
B	Transport	66.736,01	26,10%	66.215,45	99,22%	520,56
C	Waste	5.246,00	2,05%	3.784,52	72,14%	1.461,48
D	Industrial processes	21.582,93	8,44%	21.270,66	98,55%	312,27
And	Agriculture	10.897,29	4,26%	2.694,42	24,73%	8.202,87
		255.661,93		**240.910,56**	**94,23%**	**14.751,37**



The calculated annual CO2 emissions resulting from thermal and electrical energy, as well as their distribution, are:

Annual Emissions			
YEAR	**Thermal**	**Electric**	**Total**
2019	**97.198,94**	**145.798,57**	**248.282,35**
2024	89.782,24	119.934,75	209.746,44
2025	76.825,16	94.671,34	171.508,00
2026	60.634,42	68.409,16	129.063,22
2027	45.748,00	45.600,43	91.376,21
2028	32.172,56	27.242,68	59.412,17
2029	16.478,47	12.433,43	28.910,51
2030	2.535,93	3.243,81	5.780,06

The diagram of the distribution of emissions per year is as follows:



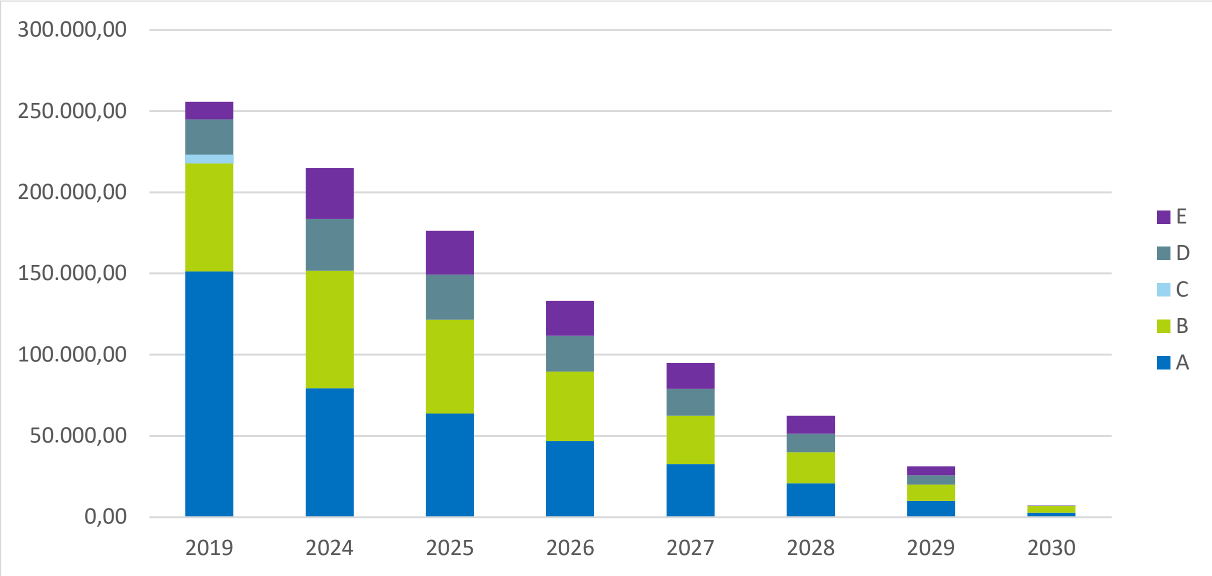
The annual reduction of emissions per sector, from the implementation of portfolio actions, is:

CODE	Sector	2019	2024	2025	2026	2027	2028	2029	2030
A	Buildings	151.199,70	79.343	63.665	46.844	32.579	20.835	10.011	2.568
B	Transport	66.736,01	72.301	57.764	42.627	29.691	19.026	9.990	4.154
C	Waste	5.246,00	0	0	0	0	0	0	0
D	Industrial processes	21.582,93	31.966	27.771	22.216	16.594	11.447	5.691	306
And	Agriculture	10.897,29	31.193	26.988	21.487	16.055	11.079	5.437	214
		255.661,93	**214.803,21**	**176.186,32**	**133.173,86**	**94.919,17**	**62.387,45**	**31.128,89**	**7.241,54**

Table 13: Annual emissions by sector

To the balance of 7.241.54 tn will be added the quantities of 6.254 tn from animal waste and 1.131 tn related to emissions from wood burning, for heating the homes of communities belonging to the Municipality of Kalamata, which quantities are not addressed by the proposed actions of the climate contract, but by the strategy for residual emissions (*note: the small difference is due to rounding of the calculations of annual consumption*)

The corresponding diagram is:



D. Parallel benefits

In summary, the indirect or parallel benefits that citizens will have are analyzed as follows:

Economics

1. Reduction of energy costs for every family
2. New jobs and new jobs
3. Modernization of businesses for better quality and more competitive products or services.
4. International promotion of the city and increase of traffic.
5. Reduce travel costs by 80%.

Environmental

1. Improvement of quality of life and living conditions.
2. Creation of 33 km of cycle paths
3. Configuration 400 acres. for friendly and safe pedestrian movements.
4. Clean environment without pollutants
5. New green and recreational areas

Social

1. Accessibility for all and inclusiveness
2. Free electricity for vulnerable social groups.
3. Low-cost combined transportation throughout the city.
4. Regulation of vehicle traffic in the Center and the Beach.
5. Provision of parking for permanent residents

Knowledge and Innovation

1. Kalamata is transformed into an open laboratory for knowledge production and innovation, establishing the following structures:
    - ✓ of the Kalamata Innovation Laboratory
    - ✓ Energy Research Institute
2. Integrating digital applications into its functions
    - ✓ For transportation in the city
    - ✓ For energy management
    - ✓ For smart farming

4.1 Section B-1 Climate neutrality scenarios and impact pathways

Below is the description of the Scenarios – Transformation Paths of the Climate Contract of the Municipality of Kalamata.

1. Kalamata, city to live in
2. Kalamata, low-emission transportation
3. Kalamata, a city to produce and create
4. Kalamata, a city that learns.

Scenario I

Kalamata, city to live in

KALAMATA
Our mission: go zero!

The extreme weather phenomena, which appear more and more frequently in recent years, with **rapid rainfall,** floods, high intensity **winds, coastal** erosion, prolonged **heat waves** and **drought**, warn that Climate Change is also in **Kalamata**.

The **challenge** for Kalamata is to take **initiatives** to change **human** behavior **and redefine** the productive model of the city, in order to create the **conditions** for shaping public and private space, where citizens will **produce** and **prosper**.

Kalamata, after the catastrophic earthquake of 1986, experienced a rejuvenating period characterized by:

1. from the rapid **reconstruction**, imposed by the immediate **housing needs** of the population, resulting in the construction of houses with **low** energy efficiency.
2. from the **extensions** of the city plan, to areas where **first** the houses were built and **then** the infrastructure (roads, networks, etc.)
3. from the low interest rates of the euro area, which changed the consumption **habits of all Greeks and created a** sense of **false abundance of goods, which led to the financial crisis of the 2010s.**

Today, **tackling** the climate crisis is the **opportunity** for the city, through mitigation and adaptation interventions, to **solve** chronic problems, such as:

- the completion of its urban planning,
- The recovery of the coastal front, as a source of life for the city
- The revitalization of areas in the neighborhoods of the city.
- The interconnection of green areas and common areas, with routes of mild traffic.
- the creation of a clean, functional and highly aesthetic public space,
- upgrading the building stock so that homes are energy autonomous
- changing citizens' consumer behaviour

In this context, interventions are proposed**,** shaping the public space that will **inspire** respect for the environment and promote another way of life, will be open to all and **inclusive**, will strengthen entrepreneurship and will **generate** wealth.

Interventions in places where citizens spend several hours of the day, whether **they are their homes**, their children's **schools, or** recreation and **sports** areas , **while creating the feeling that goods are not** inexhaustible **and require special management.**

The approach is to **change** the everyday life and habits of citizens**, shaping** the environment that will **inspire** them, whether it is **their public** or **personal** space.

The scope of the proposed interventions **will address** CO_2 emissions coming **mainly from** the housing **stock**, waste, **education** infrastructure, as well as from the operation **of sports** facilities, while by upgrading or constructing new **green spaces**, the possibility of **absorbing** CO_2 **will be created**.

The interventions are organized into portfolios, concerning:

1. urban space
2. Green in the city
3. schools and sports venues

4. the house
5. circular economy and waste management

The **objectives** of the interventions are:

1. The completion **of the urban** planning of the city
2. Recovery of the **coastal** front
3. The revitalization of areas in **the city's** neighborhoods
4. The improvement **of the aesthetics** and **functionality of** the central sector of the city
5. The creation **of new** green spaces and the **interconnection between them**
6. Protection of public **health**
7. The energy **upgrade** of the housing stock and the **decarbonization** of fossil fuels
8. The **production** of clean energy from photovoltaic systems, for the energy **self-reliance** of homes
9. Raising citizens' awareness on **the management** of natural resources
10. The installation of equipment to promote **waste** reduction policies

The portfolios of actions in the scenario (Impact Pathway) **"Kalamata, city to live** in" are:

1. Revitalization of Urban Areas

The portfolio includes interventions in large urban areas of the city such as the coastal front, the Historic Center and the central sector, the East and West center, where an attempt is made to create infrastructure, such as green spaces, pedestrian paths, bicycle paths, pedestrian streets, with which residents will be inspired and actively participate in the city's effort to achieve the goal of climate neutrality.

The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the table below and in the attached file entitled: ***Prtf_L.1_Vivification_En.doc***

2. Aesthetics and functional upgrading of public space

The portfolio includes actions that upgrade small urban sections, with the creation of pocket parks and small squares in the city's neighborhoods, with interventions in large green spaces, in Nedonta and OSE Park, with actions for the safety and protection of public health, upgrading the quality of municipal lighting and recording local environmental data with sensors, such as temperature, humidity, air pollutants, etc.

The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the attached file entitled: ***Prtf_L.2_QualiteOfLife_En.doc***

3. Kalamata, clean city

The portfolio of actions aspires to address the problem of waste management, promoting sorting at source, enhancing recycling streams and familiarizing citizens with the circular economy and the reuse of raw materials.

The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the attached file entitled: ***Prtf_L.3_CityClean_En.doc***

4. Housing, climate neutral

The portfolio describes an integrated intervention in the way a house operates, with interventions in the building stock to save energy, with actions to get rid of high-emission fossil fuels and energy production from Renewable Sources.

The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the attached file entitled: ***Prtf_L.4_House_En.doc***

5. Sports and Education

The portfolio describes the necessary interventions in the building stock and equipment of schools and sports facilities, so that, in addition to reducing emissions and energy costs, students and athletes can be sensitized to the necessary change in human behavior and become the best ambassadors of the message of climate neutrality.

The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the attached file entitled: ***Prtf_L.5_School-Gym_En.doc***

More specifically , the actions of each portfolio are as follows:

L.1 portfolio	**Regeneration of urban areas**	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**
Built environment	**Integrated Interventions for Urban Regeneration and Upgrading of areas of the Historical Center of Kalamata**	They concern interventions on streets of the Historical Historical (23rd Martiou, Kolokotroni, Anagnostara, Sfaktiria, etc.) that are currently in the implementation stage. Through the implementation of the proposed interventions, it is possible to unify all existing renovations in the Historic Center of the city, so that in their entirety they function as a single urban entity of recreation, greenery, promenade, attitude of residents and visitors, of the city.
	Integrated Interventions for Urban Regeneration and Upgrading of areas of the Central Sector of Kalamata	The intervention approaches the future of the city with holistic planning and includes the regeneration of the streets around the central square, south of the Historical Center. Upon completion, together with the regeneration of the streets of the Historical

		Center, it will form a single whole, which will add particular value to the area.
	Revitalization of the East Center area	The intervention concerns an area of 110,000 m2, located in the eastern neighborhood of the city and today is growing without heart and driving force, unregulated, remote and dysfunctional, without center of gravity, points of attraction and traffic.
	Recovery of the coastal front of Kalamata	The intervention concerns the recovery of the coastal front, i.e. the configuration of the East and West Beach, so as to create a single coastal front, from the beach of Mikri Mantineia in the east to the beach of Bournias in the west
	Improvement of West Center Operations	The western center is located on the axis of Athinon Street, to the west of the city and its facilities host itinerant commercial enterprises and social structures.
	Revitalization of the area of the Eastern Part of the Historical Center of Kalamata	This Action seeks to **upgrade and revitalize the Eastern part of the Historical Centre,** which is enclosed by Stadiou, Anagnostara, Kesari and Faron streets (an area equal to 112,487 sq.m.).
	Intervention zones with bioclimatic materials	This Action includes the following 4 interventions: 1. Regeneration of the "Nissaki" area (330.000 sq.m.) 2. Formation of a roadside area of Riga Fereou Street (120,000 sq.m.) 3. Regeneration of the Coastal Front (1.100.000 sq.m.) 4. Regeneration of the Historical Centre
	Operational Upgrade of Athinon Street	It includes the functional upgrade of Athinon Street from the West Center to its terminus at Nedontas, as well as its two branches, Messinis and Iras Streets. The aim is to gradually transform it into a pedestrian-friendly local traffic road with pedestrian and bicycle zones.

Table 11. Description of portfolio actions L.1 Regeneration of urban areas

Portfolio L. 2	**Aesthetics and functional upgrading of public space**	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**
Nature-based solutions	**Interventions for the formation of OSE Park**	The Railway Park (OSE Park) is an area of 54,000 m2, in which green spaces, railway network equipment and event spaces coexist. The Park is located on the imaginary north-south axis and is the link between the old town and the

		port and the beach, creating a route with strong signs of local history and culture.
	Creation of a network of pocket parks	Over the last 2 years, the Municipality of Kalamata has intervened in unused municipal open public spaces and urban gaps. The aim of these interventions is to transform these spaces into a sustainable network of pocket parks that will promote the principle of sustainability.
	Revitalisation of the Nedonta riparian zone (northern part)	The proposal concerns the preparation of: **(a)** Studies for the relocation of the Municipality & DEYAK crews **(b)** Nedonta riparian zone rejuvenation study as these studies are interdependent and complementary to achieving the ultimate goal of upgrading the riparian zone of the river Nedontas that crosses the city.
	Construction of an Open Air Olive Park	It is a green space, in the northern part of the river Nedontas, friendly and versatile for everyone. The park has a dominant element in the Olive Tree of Kalamata, as a life-giving source of economic activity for the area.
	Bioclimatic regeneration of Fytia Square	The Plantation Square is between the historical center and the eastern city and can acquire characteristics such as to become a new living cell of the urban fabric with a function that will upgrade the aesthetics and quality of life at neighborhood level, through a radical regeneration project according to the principles of environmental bioclimatic design.
Energy	**Energy upgrade and improvement of the efficiency of the municipal lighting system of the Municipality of Kalamata**	The upgrade of the street lighting system in the Municipality of Kalamata began in 2019 and 14,737 lighting points have been replaced, consisting of 8,008 LED luminaires with integrated controllers, 4,847 LED luminaires without controllers and 1,882 LED lamps., achieving energy savings of 78.5% during its full operation.
Built environment	**Installation of microclimate meteorological data monitoring systems**	The aim is to assess and monitor in real time the components of pollution such as particulate matter levels (PM 1, PM 2.5, PM 10), ozone ($O3$), nitrogen oxides (NO, $NO2$), carbon monoxide (CO) and sulphur dioxide ($SO2$). At the same time, basic meteorological parameters (temperature, humidity, atmospheric pressure) can be measured, which contribute to the accumulation of pollutants and the feeling of discomfort of citizens.

Table 12. Description of Portfolio Actions L.2 Aesthetics and functional upgrading of public space

L.3 portfolio	Kalamata, clean city	
Emissions Sector	Portfolio Actions	
	Action Title	Description of the Action
Waste and Circular Economy	Home and neighborhood composting actions for biowaste management	The Municipality of Kalamata promotes home and neighborhood composting, with actions either funded by European programs, NSRF, or with proposals that have already been submitted and are expected to be funded, by procuring the necessary equipment, which will be made available to households.
	Incentivising waste sorting at source	Familiarity with sorting actions at source is also enhanced by policies providing incentives to citizens, such as Pay As You Throw and Learn About What I Throw
	Installation of rewarding recycling houses	The Municipality of Kalamata has signed a Program Agreement with the Solid Waste Management Body of Peloponnese (FODSA Peloponnese), which has as its object the development of a network of Recycling Corners within the administrative boundaries of the Municipality, with the installation of the necessary equipment, the collection and transport of the recyclables produced, to the areas of responsibility of the Municipality. Recycling Corner (GA) is defined as a public or private space, of a very small area, without fencing or any constructions, where citizens deposit separately collected recyclable municipal waste or used objects in appropriate containers.
	Installation of green points and promotion of recycling streams.	The action includes the construction and operation of a space, called "Green Point", in which citizens will be able to move, on their own, any recyclable material, which they will deposit in the appropriate infrastructure. At the same time, recycling corners will be created in the city for the collection of recyclable materials and a mobile green spot will be created, which will receive bulky objects and metal constructions at home.
	Treatment and valorization of specific by-product and waste streams	The processing of coffee by-products and olive leaves is promoted, as well as the utilization of pruning for the composting of organic waste.

Table 13. Description of Portfolio Actions L.3 Kalamata, clean city

L.4 portfolio	Housing, climate neutral	
Emissions Sector	Portfolio Actions	
	Action Title	Description of the Action
Energy	Energy upgrading and energy saving actions in homes.	The action concerns interventions in homes aiming at their energy upgrade and the replacement of fossil fuels with clean energy from renewable sources.

Table 14. Description of portfolio actions L.4 Housing, climate neutral

Portfolio L.5	Sports and Education	
Emissions Sector	Portfolio Actions	
	Action Title	Description of the Action
Energy	Emission reduction actions in primary and secondary education school units of the Municipality of Kalamata.	The action concerns the energy upgrade of school buildings and the installation of photovoltaics on the roofs of school units.
	Energy upgrade and emission reduction actions for sports facilities	The action concerns interventions for the operation of sports facilities supervised by the Municipality of Kalamata with emphasis on the most energy-intensive, which are: 1. The Swimming Pool 2. The indoor gym TENT 3. 3. The indoor BEACH Gym 4. The outdoor football fields

Table 15. Description of Portfolio Actions L.5 Sports and Education

The estimated budget of all portfolio actions is **€ 1,075,652,142.20**, while the reduction of CO2 emissions is 92,729.86 **tn CO2**, or **94.23%,** as detailed in the following Table.

Aa	PORTFOLIOS	Estimated Budget	Emissions 2019	Reduction of CO2 emissions in Kg	Cost €/kg CO2
L.1	Regeneration of urban areas	93.195.671,44	0,00	0,00	0,00
L.2	Aesthetics and functional upgrading of public space	19.965.336,46	3.464,25	3.384,73	5.898,65
L.3	City clean	14.385.265,30	5.246,00	3.784,52	1.199,83
L.4	Residential, emission-free	923.508.635,00	85.296,62	84.265,07	10.959,57
L.5	Sports and Education	24.597.234,00	1.325,30	1.295,54	15.786,00
		1.075.652.142,20	**95.332,17**	**92.729,86**	**11.599,85**

Table 16. Scenario I portfolios (Budget, 2019 emissions, emission reduction)

In portfolios **L.4 and L.5**, **which include interventions in homes, schools and sports facilities, emission reduction interventions follow these steps:**

1. Interventions in the **shell** and **equipment** of the facilities, leading to energy savings by the percentage documented in each action fiche.

2. 85% of the remaining **thermal** energy **is replaced by** additional interventions (*e.g. replacement of oil burners by heat pumps*) by **electricity**.

3. Finally, the required electricity shall be supplied:

- From the electricity **transmission network**, which has a carbon footprint depending on the composition of the national mix, which determines the value of the emission factor.
- From **photovoltaic systems**, where the system of self-production will supply zero emission energy to consumers.

Emissions will be calculated from the use of remaining thermal energy and electricity consumption through the transmission network

Based on the calculations detailed in the actions and portfolios, the implementation and results schedule per year is as follows:

YEAR	Cost	Annual Energy Consumption (MWh)	Annual CO2 Emissions (tn)

			Electrical energy						
	1.075.646.781,87	Thermal	Power grid	RES	Total Electricity	Total Energy	Thermal	Electric	Total
2019		**82.907,25**	**124.374,49**	**0,00**	**124.374,49**	**207.281,74**	**22.053,33**	**68.032,85**	**90.086,18**
2024	54.805.869,45	78.504,84	113.870,25	2.282,50	116.152,75	194.657,59	19.940,24	54.316,10	79.342,56
2025	107.905.845,18	70.314,69	103.092,25	6.847,50	109.939,75	180.254,44	17.016,15	41.958,53	63.664,50
2026	161.347.022,09	58.207,60	87.021,02	13.695,00	100.716,02	158.923,62	13.387,73	29.326,08	46.844,09
2027	161.233.294,60	46.140,10	70.971,08	20.542,50	91.513,58	137.653,68	10.058,54	18.949,27	32.578,55
2028	161.005.839,61	34.151,78	54.963,72	27.390,00	82.353,72	116.505,50	7.035,27	10.827,84	20.835,32
2029	214.674.455,47	18.167,37	33.620,59	36.520,00	70.140,59	88.307,96	3.524,47	4.269,82	10.011,28
2030	214.674.455,47	**2.182,96**	**12.277,46**	**45.650,00**	**57.927,46**	**60.110,42**	**406,04**	**699,81**	**2.567,65**
	Decrease	**80.724,29**	**112.097,03**		**66.447,03**	**147.171,32**	**21.647,29**	**67.333,04**	**87.518,53**
	%	**97,37%**	**90,13%**		**53,42%**	**71,00%**	**98,16%**	**98,97%**	**97,15%**

Table 17. Scenario I: Implementation and Results Schedule per year

The annual energy consumption received from the transmission network as well as the annual emissions are shown in the following diagrams.

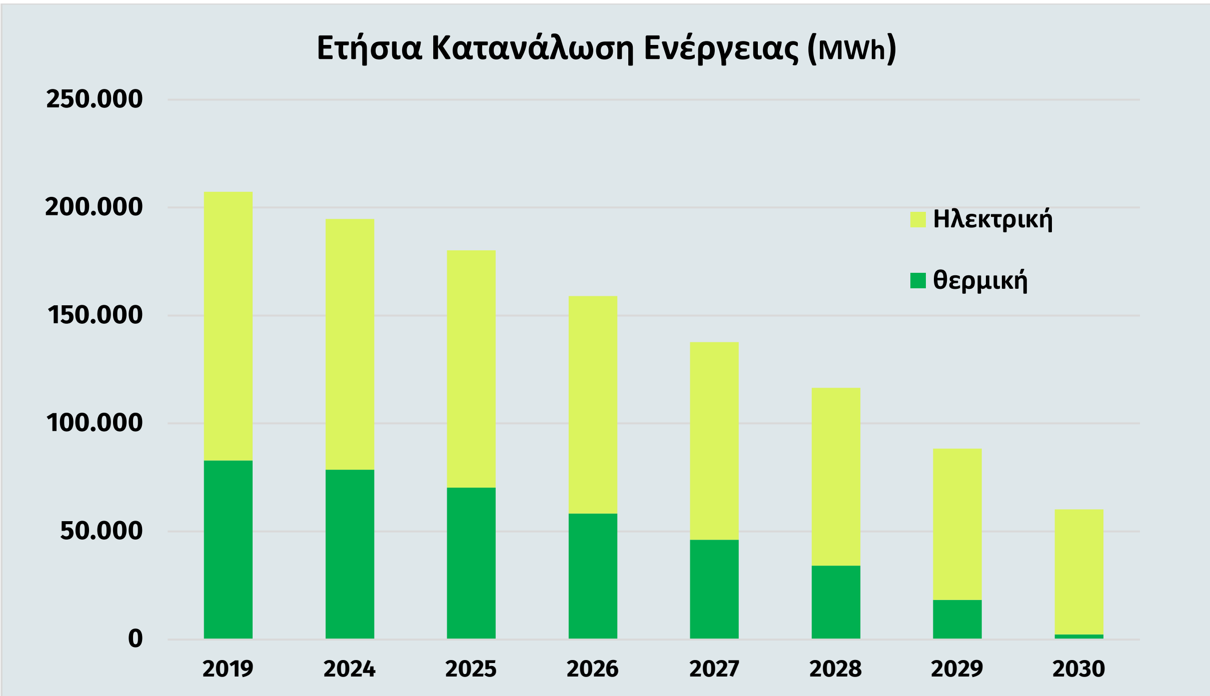


Image 6. Annual Energy Consumption (MWh) from the transmission network

The composition of the electrical energy mix, between grid energy and energy from Renewable Energy Sources, is shown in the Diagram below.

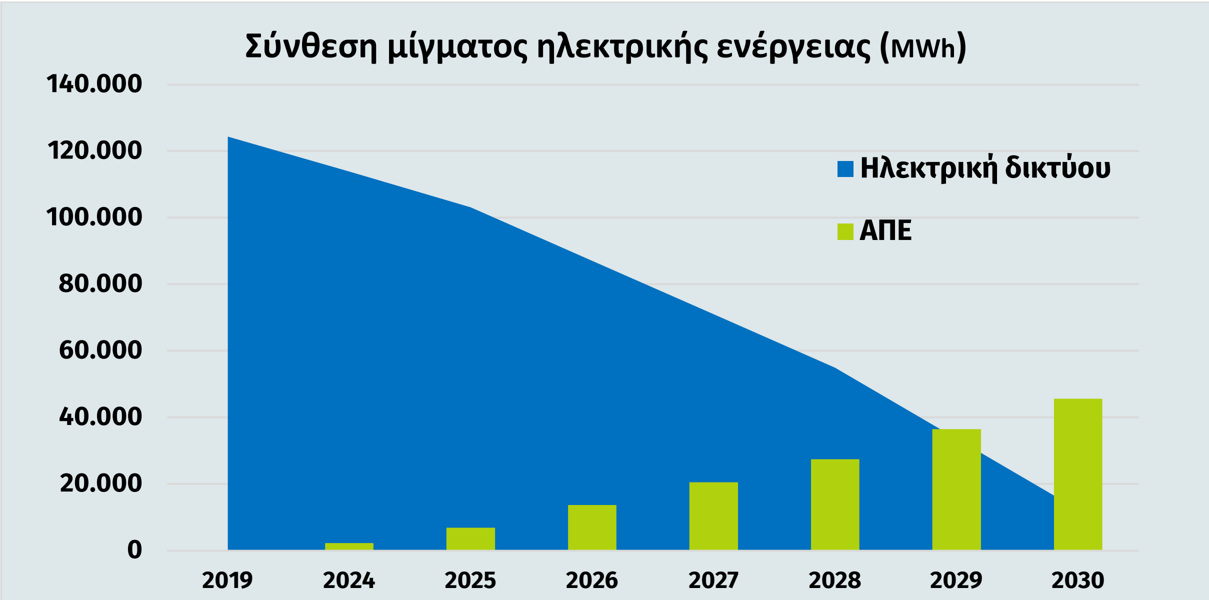


Image 7. Electricity Mix Composition (MWh)

The penetration of renewables in the electricity mix starts from 2% in 2024 and ends at 79% in 2030.

The reduction of emissions from thermal and electrical energy is presented in the following Chart.

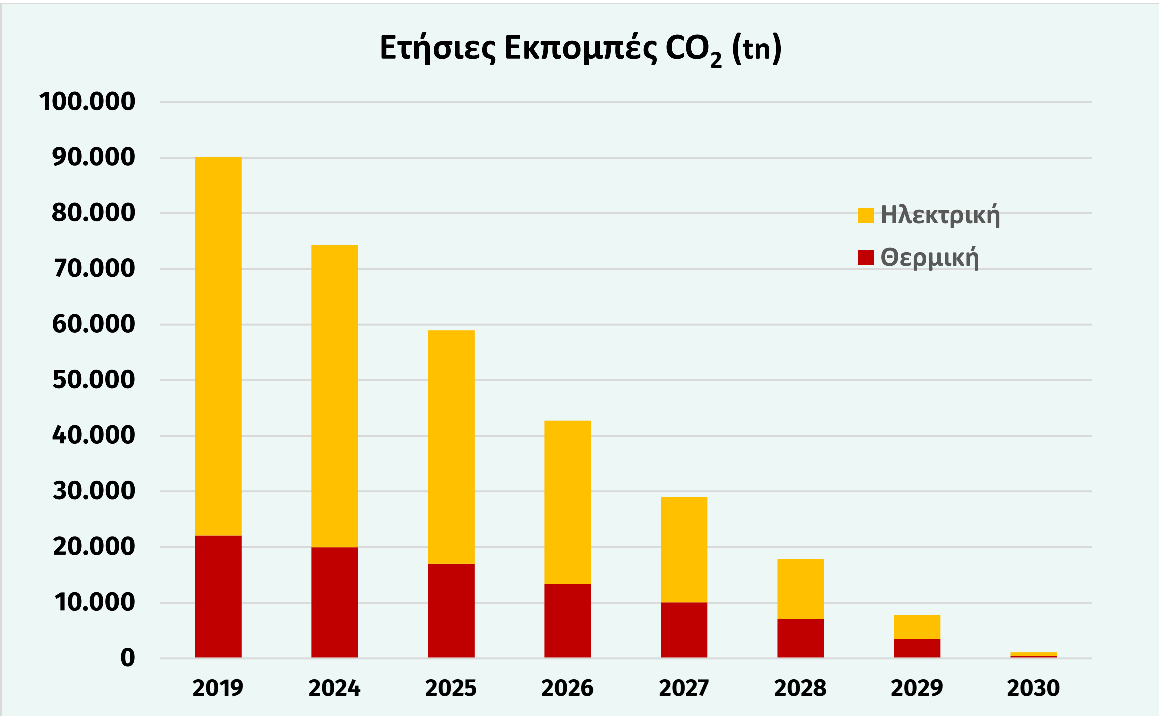


Image 8. Annual CO2 (tn) emissions and reduction of electricity and heat emissions

The **tools**, financial **resources** and **policies** with which the proposed interventions will be implemented are:

I. The **intellectual** capital of the city and the **strategies** developed by the Municipality, such as:

- The strategic plan "**Integrated** regeneration for the **upgrading** of the quality of life and the **revitalization** of the urban space of the Municipality of Kalamata**"**
- The Strategic **Sustainable** Urban **Mobility** Plan (SUMP)
- The Business Plan for the **provision of communal** and public benefit spaces (E.S.E.K.K.) of the Municipality of Kalamata
- The Urban **Accessibility Plan** (SAR)
- The Sustainable Energy and Climate Plan (SEAP)
- The strategy for the **Digital Transformation of** the Municipality of Kalamata.

II. Policies arising from state **laws**, such as:

- The **climate** law
- The National **Energy** and Climate Plan (NECP)

III. Policies arising from international organizations, such as:

- European **Green Deal**
- **Sustainable** Cities and Communities (Sustainable Development Goal 11 - UN)
- Climate action (Sustainable Development Goal 13 - UN)

IV. The resources for financing assistance shall be drawn from:

- Funding programmes **directly** from the European Union
- From the **NSRF** 2014-2021 and 2021-2027, for Greece
- From **government** funding programs
- From **Regional** funding programs
- From **Municipal Funds**
- From private **investments**
- Private citizen participation

The weaknesses recorded for the implementation of the above interventions are:

FINANCIAL

- Funding for projects of public interest, because they are not remunerative, can only come from regional, national and European sources.
- The upgrading of housing requires investments with high initial capital (~ 250 **€/m2**), which the Greek banking system is unable to finance.

- After a decade of economic crisis in Greece, homeowners are either financially weak or skeptical about the result of their investment in the energy upgrade of the building.
- There is a lack of knowledge and experience in the general population on how to finance interventions from the benefit that will result from energy saving.
- Interventions in schools have a high cost/benefit ratio because schools do not operate at all hours of the year.
- Sports facilities, because they were built many years ago, require more money for their energy upgrade.

IMPLEMENTATION

- The preparation of intervention studies in the public space and the issuance of the necessary permits are time-consuming procedures.
- The construction of infrastructure projects of a public nature will create difficulties both for the mobility of residents and visitors and for the operation of businesses.
- The size of the interventions for the entire Municipality requires a large amount of effort, with difficulties in finding both technical staff and raw materials.
- There is no certification process that ensures quality in both services and materials used for the energy upgrade of buildings.
- The rapid development of technology devalues methods and materials used for energy upgrades, thus creating a feeling of mistrust.

GOVERNANCE-PARTICIPATION-COMMUNICATION

- A great deal of communication of the effort is required in order to properly inform citizens.
- A reception and information office is needed for the proper organization of interventions.
- The large number of homeowners in each building creates communication problems and prevents participation.

For the co-formulation of the interventions included in the portfolios of the Transformation Path entitled "**Kalamata**: city to live **in", collaborations** were developed **with:**

1. the World Bank and the Directorate-General for EU Regions
2. the Peloponnese Region
3. the Solid Waste Management Body of Peloponnese Region
4. the University of Peloponnese
5. the Chamber of Messinia
6. the Federation of Professional – Craft and Commercial Associations of the Prefecture of Messinia
7. the Messinia Hoteliers Association
8. the Commercial Association of Kalamata
9. the Technical Chamber of Greece (Messinia Branch)

10. Energy service companies
11. the Hellenic Recycling Corporation
12. Collective recycling streams
13. teachers and students
14. sports clubs and sports federations

Everyone accepts, in the field they deserve, the proposed interventions, in accordance with the attached cooperation protocols.

The results expected from the implementation of the portfolio actions of the transformation path of Scenario I are categorized as follows.

<table>
<tr><th>Sector Emissions</th><th colspan="2">Built Environment</th></tr>
<tr><th rowspan="2">Lever Change</th><th colspan="2">Results</th></tr>
<tr><th>Short term</th><th>Long term</th></tr>
<tr><td>Technology & Infrastructure</td><td>1. Preparation of the studies and tender documents of the project Revitalization of the Eastern Center area
2. Elaboration and approval of the implementation studies, as well as the tender documents of the interventions, for the improvement of the operations of the Western Centre
3. Implementation of the project of Urban Regeneration and Upgrading of the Central Sector of Kalamata
4. Elaboration and approval of the implementation studies, as well as the tender documents of the interventions, for the functional upgrade of Athinon Street.
5. Preparation of a proposal for inclusion in a funding program for the project: Revitalization of the area of the Eastern Part of the Historical Center of Kalamata
6. Elaboration of actuarial studies for the areas: Nissaki, Riga Feraios, the coastal front and the northeastern part of the Historical Centre
7. Preparation of coastal front recovery studies</td><td>1. Implementation of interventions in the East Center of the city.
2. Commencement of works for the implementation of interventions in the West Centre
3. Implementation of interventions in the eastern part of the Historical Centre
4. Transfer of the Municipality and DEYAK crews from Nedonta to the Central Technical Infrastructure Area of the City
5. Interventions in the areas of Nissaki, Rigas Feraios, the coastal front and the northeastern part of the Historical Centre
5.1. Preparation of intervention studies
5.2. Construction of the necessary infrastructure
5.3. Implementation of renovations and configurations
6. Preparation of intervention studies on the coastal front
7. The installation and operation of microclimate meteorological data monitoring systems.</td></tr>
</table>

Governance & Policies	**1.** Permits for urban planning acts for the intervention areas: Nissaki, Rigas Feraios, the coastal front and the northeastern part of the Historical Centre **2.** Approval of the Master Plan of the Port of Kalamata **3.** Designation of traffic calm zones	**1.** Approvals of intervention studies for the recovery of the coastal front
Financing	**1.** Disbursements of projects already financed for interventions in the Central Sector and the Eastern Centre. **2.** Preparation of proposals for inclusion in programs for the financing of interventions: **2.1.** In the West Center **2.2.** The upgrading of Athinon Street **2.3.** Interventions east of the Historical Centre **3.** The proposal for the installation of stations measuring air pollutants, with a budget of **€ 85,064.00**, is for evaluation, and the tender process for the nomination of the contractor is expected to begin in early 2024	Preparation of a financing proposal for the implementation of actuarial acts, the necessary infrastructure works, as well as the technical interventions for the areas of Nissaki, Riga Feraios, the coastal front and the northeastern part of the Historical Centre.
Inclusivity	Consultation with the involvement of stakeholders, for the formulation of • the content of interventions in the East Centre. • interventions to improve the functionality of Athinon Street. • The recovery of the coastal front.	

Table 18. Scenario I: Results of actions - built environment

Sector Emissions	**Energy**	
Lever Change	**Results**	
	Short term	**Long term**
Technology & Infrastructure	1. The full operation of the municipal lighting system 2. Preparation of an energy inspection study for each sports facility unit.	**For sports facilities** 1. Installation of metering systems for monitoring consumption (BMS) in all areas.

	3. Replacement of heating and cooling system at TENTA Sports Center 4. Replacement of incandescent floodlights, with LEDs, at the Beach Indoor Gym 5. Energy upgrade of the Municipal Swimming Pool of Kalamata with the use of renewable energy sources (RES) 6. Interventions in school buildings of: a. Verga Elementary School. b. 1st Primary School of Kalamata c. Complex of 1st and 2nd Vocational Lyceums of Kalamata 7. Preparation of intervention studies in all school buildings. 8. Interventions in 2,963 residential buildings, corresponding to 14.95% of the total, according to the timetable of the action.	2. Replacement of old air conditioning units (local, semi-central & central) 3. Installation of automation in lighting systems **For schools** 1. Initiation of interventions in school units. **Houses** Interventions in 16.821 residential buildings, corresponding to 85.05% of the total, according to the timetable of the actions.
Governance & Policies	1. Establishment of a structure for supervising the implementation of interventions in housing. 2. Establishment of energy communities, for each urban and municipal unit of the Municipality of Kalamata 3. Solving the problem of school ownership as a prerequisite for licensing the installation of photovoltaics on roofs. 4. Drafting of a regulation for the use of sports facilities.	Operation of energy communities
Financing	1. Elaboration of feasibility studies for energy communities. 2. Preparation of investment plans 3. Elaboration of an economic and technical feasibility study for interventions in schools. 4. Procedures for the nomination of a contractor for interventions in schools, using the method of self-financing. 5. Proposal to the ELECTRA program for the energy upgrade of school units, which have full studies: a. Verga Elementary School.	

	b. 1st Primary School of Kalamata c. Complex of 1st and 2nd Vocational Lyceums of Kalamata	
Inclusivity	1. Establishment and commencement of operation of the Citizens' Information Office on the proposed interventions in buildings. 2. Organization of participatory information workshops and organization of interventions in each section. 3. Establishment of energy communities in the urban units of the city and in the Municipal Units of the Communities of the Municipality of Kalamata 4. Cooperation with sports clubs and federations for the drafting of regulations for the use of sports facilities. 5. Collaborations with teachers and students to organize a roadmap, with events and activities, promoting the concept of climate neutrality.	1. Implementation with teachers and students of the events included in the roadmap. 2. Operation of the Citizens' Information Office for interventions in housing.
Learning & Competences	1. Training actions for technical staff. 2. Informing and familiarizing citizens with funding tools and interventions.	1. Continuous updating on technological developments in energy upgrading products for buildings.

Table 19. Scenario I: Action Results – Energy

Sector Emissions	Waste and Circular Economy	
Lever Change	Results	
	Short term	Long term
Technology & Infrastructure	• The installation of the Green Point and recycling corners • The installation of rewarding recycling houses. • The provision of equipment for the start of home composting by households	The full operation of home and neighborhood composting
Governance & Policies	Approval of the location of equipment installation points, for neighborhood composters and recycling corners.	
Financing	The actions for the start of the operation of the home and neighborhood composting, the construction and operation of the green point, as well as the installation of the 7 rewarding recycling sites, have been approved by the Operational Program Y.ME.PER.A.A.	For the extension of source sorting actions, proposals have been submitted to the Ministry of Environment and Energy, where their positive evaluation is expected, in order to extend them beyond 2026.
Inclusivity	Initiation of actions and experiential workshops to inform and sensitize citizens on raw materials management.	

Table 20. Scenario I: Action Results – Waste and Circular Economy

Sector Emissions	Nature-based solutions	
Lever Change	Results	
	Short term	Long term
Technology & Infrastructure	1. Construction of the outdoor Olive Park 2. The bioclimatic regeneration of the Plantation Square 3. Preparation of intervention studies in the park of Nedontas.	The removal of the Municipality and DEYAK crews from the area of Nedontas Park

Governance & Policies	Approval of studies for the interventions in Nedontas Park	
Financing	All projects have secured funding and will start immediately, except for the proposal for the preparation of the studies of the interventions for the Environmental Park of Nedontas, with a budget **of € 348,812.00,** which is currently being evaluated	Upon completion of the studies for the action of the interventions in Nedontas Park, a fully costed proposal will be prepared to be submitted for funding.
Inclusivity	The consultation on the content of Nedontas Park	

Table 21. Scenario I: Action Results – Nature-Based Solutions

The direct impacts and co-benefits for citizens are presented in the following Table.

Effects	
Immediate benefits	Reduction of emissions by **92.729.46 tn CO2** corresponding to **92.27%.**
Parallel benefits	
Category	**Description**
FINANCIAL	• The interventions will create an attractive environment conducive to the development of entrepreneurship and create new jobs. • Infrastructure to promote travel in environmentally friendly ways enables residents, in particular, to reduce their travel costs to the city centre (fuel, parking costs). • Land properties in intervention areas will gain greater market value, while energy-upgraded homes will gain capital gains, both for rent and sale. • The operating cost of a house will be reduced due to energy saving interventions. • The green spaces created upgrade the image of the city, which becomes more attractive resulting in increased traffic. • The interventions will create new jobs in the construction industry. • There will be a reduction in energy costs for the operation of every school unit and sports facility. • The infrastructure for the promotion of recycling streams creates a new entrepreneurship that will create new jobs. • The citizens and the Municipality will have revenues from rewarding recycling.

	• Due to a reduction in the volume of waste directed to central management, there will be a corresponding reduction in cleaning fees to citizens.
ENVIRONMENTAL	• By intervening in the building stock, fossil fuels (oil) are removed and greenhouse gas emissions are reduced. • Reduction of noise and air pollutant levels • Improvement of the microclimate and tackling the urban heat island effect. • Use of clean energy from Renewable Sources • Care for the rational use of raw materials and the avoidance of their waste.
QUALITY OF LIFE	• By creating the urban environment, which prevents car travel, the quality of life of commuters and employees is improved. • Conditions are created for citizens to be encouraged and change their way of life, thus protecting Public Health. • The green spaces created, apart from the recreation of the residents, also contribute to their socialization. • Creating conditions of comfort during the stay at home • Better learning and sports conditions are created • With the organized collection of waste, a city environment without garbage is formed.
INNOVATION	• The establishment and operation of energy communities • The self-financing of interventions by reducing energy costs, as was done in the project of upgrading municipal lighting. • Participatory planning, in shaping the content of interventions, in public space and drafting the regulation of use of sports facilities. • The compilation of a roadmap of events in collaboration with all stakeholders of the educational community. • The implementation of the incentive policy, as I pay as I fly and learn about what I fly.
DIGITAL TRANSFORMATION	• The installation of environmental data recording systems, their processing and their availability to citizens through new digital applications. • The creation of a digital map mapping the characteristics of the urban heat island phenomenon and the mapping of dew routes. • The installation of systems for recording energy consumption in homes, schools and sports facilities. • The installation of automation in the operation of the dwelling. • Remote management of the operation of lighting points, street lighting system. • The creation of digital applications to promote policies providing incentives, reducing waste.

Table 22. Scenario I: Direct Impacts and Co-benefits for citizens

Scenario II

Kalamata, low-emission mobility

KALAMATA
Our mission: go zero!

Kalamata has in recent years charted an upward growth course, the result of which is the increase of professional activity, especially for catering and entertainment businesses in central parts of the city. The lack of hotel beds has created a wave of conversion of residential spaces into short-term rental apartments (BnB), resulting in visits for tourism and leisure to have increased rapidly in recent years.

At the same time**, the concentration** in the city of state services, banks, health care units, shops with a strong and international identity, as well as other activities that serve the daily needs of citizens, **increases** the number of **one-day** visits.

The common denominator for the majority of visitors is the **need** to use **the car**, both for the initial access to the city and for short trips within it, so there is an intense **competition** to find a **parking space**.

Public space is claimed unequally by cars at the expense of commuters, resulting in high traffic congestion, high noise and air pollutant levels and a dysfunctional and low aesthetic image of the city.

The **problems** created in the city's operations, especially in the central sector but also on the beach during the summer months, by the **movement** of **passenger** cars and those used for **business** purposes, are:

1. Traffic congestion on all roads.
2. Unnecessary car movements, to find a parking space.
3. Creation of a feeling of discomfort among citizens, due to the abuse of public space by cars, vis-à-vis pedestrians.
4. Increased levels of air pollution
5. Noise pollution, due to the noise emitted by internal combustion engines and driving behavior.
6. Financial burden from unnecessary travel, due to variable fuel costs.

Passenger and freight transport are the cause of 26.53% of total CO2 emissions in the Municipality of Kalamata. Based on the Draft Emission Inventory for the year 2019, it appears that the consumption of fossil fuels per category is as follows:

CATEGORY	Petrol (MWh)	Diesel (MWh)	LPG (MWh)	Total (MWh)	%
Municipal Fleet	124	2.532		**2.656**	**1,01%**
Public Transport		10.572		**10.572**	**4,03%**
Commercial Transport	42.058	89.870		**131.928**	**50,33%**
Private Transfers	107.177	8.111	1.687	**116.975**	**44,62%**
Total Municipality	**149.359**	**109.743**	**3.117**	**262.131**	
% per fuel class	**56,98%**	**42,38%**	**0,64%**		

Table 23. Fossil Fuel Consumption by Transport Category

Given that the total energy consumption, with reference year 2019, in the Municipality of Kalamata **is 677.207 MWh, the contribution of the consumed energy of all transport is at a rate of 262.131/677.207 = 38.71**%.

Respectively, the amount of CO2 emissions, according to the 2019 emission inventory, was calculated in the following Table.

CATEGORY	CO2 emissions in tn	%
Transportation of vehicles of the	652,83	0,98%
Public Transport	2.590,25	3,88%
Commercial Transport	33.037,35	49,57%
Private Transfers	30.455.58	45,57%
TOTALS	**66.736,01**	

Table 24. Quantity of CO2 Emissions per Transport Category

Based on the reference year 2019, the total emissions of the Municipality are 255.662,11 tn CO2, so the percentage of emissions from transport is: 66.736,01/255.662,11 = 26,10 **%**

The strategic **Sustainable Urban Mobility Plan (**SUMP), prepared for the Municipality of Kalamata in 2020, as well as the strategic **Action Plan for Sustainable Energy and Climate** (SDAEK), methodically analyze the traffic data of all kinds and based on them a set of interventions is proposed that concern **the reorganization** of the way citizens move, as well as the **transport** of goods.

Interventions **included** in the following portfolios:

1. Sustainable Urban Mobility Infrastructure

Where actions **are described, for the creation of infrastructure to promote transportation in the city with environmentally friendly means. The actions** demarcate **zero-emission zones and light traffic**, improve **road safety** and create cycle and pedestrian paths, while creating two spaces for small mobility stations.

The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the attached file entitled: ***Prtf_M.1_Mob_infra_En.doc***

2. Promotion of environmentally friendly travel

The portfolio **mainly includes** regulatory actions for urban mobility, **utilizing** digital applications.

The description and documentation of the portfolio, the actions it includes, as well as the results with their impact, are analyzed in the attached file entitled: ***Prtf_M.2_Mob_services_En.doc***

3. Organisation of freight transport

With the actions **of the portfolio, the system of freight transport and market supply** is reorganized, with the **construction** of transit spaces (Logistics), the use of digital applications and the promotion of the **replacement** of the fleet of commercial cars with low-emission ones.

The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the attached file entitled: ***Prtf_M.3_Mob_transport_En.doc***

4. Promoting mobility with low-emission vehicles

The portfolio describes actions for the construction **of electric vehicle** charging infrastructure and **documents** the cost and environmental benefit of replacing the fleet of passenger vehicles and public transport.

The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the attached file entitled: ***Prtf_M.4_Mob_Vehicles_En.doc***

In the Technical Fiches of the Actions of the above portfolios, the reduction **of** vehicle kilometers **that will occur after the interventions** is documented, as well as the corresponding reduction of CO2 emissions. A reduction that is not sufficient to meet the target, so there **is** a great **need** for gradual **replacement** the fleet of vehicles of all kinds, with other **low-emission** vehicles .

The use of clean **electricity and** low-emission biofuels by next-generation vehicles are technologies that **evolve and advance** according to user needs.

The **objectives** of the interventions for low-emission travel are:

1. The construction of infrastructure for:
   1.1. **promoting soft** travel (walking, cycling, micromobility vehicles,..)
   1.2. **Improving** citizens' **accessibility** to public space.
2. The development of digital **applications** to support all movements, in a **holistic way**.
3. The delimitation of a **low emission** zone in the **Central** sector of the city, which will increase traffic and commercial activity.
4. The **management of** public space, at the expense of cars and for the benefit of citizens.
5. The **reorganization** of the **freight** transport system.
6. The upgrading of the **aesthetics** and **functionality** of areas with high economic activity (Historical center, Central sector, Beach)
7. The construction of **electric vehicle** charging infrastructure
8. The **replacement** of conventional vehicles with **low-emission** ones .
9. Improving the quality of life with less car traffic on the roads and less **noise** and **pollutants**
10. The increase **of the city's** traffic and the **stimulation** of the commercial traffic of the shops.

The portfolios of actions on the Transformation Route for Low Emission Transportation in Kalamata are:

M.1 portfolio	**Sustainable Urban Mobility Infrastructure**	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**

Built environment	**Zero emission zone delimitation**	The delimitation of an area in the Historic Centre of the city, covering an area of 200,000 m2, is delimited as a low emission zone, with restrictions on the movement of conventional passenger vehicles and supply vehicles to shops in the area.
	Mobility Stations	Mobility hubs are built on the outskirts of the city and where all means of transport are concentrated. Commuters can also transfer by choosing a means of gentle transportation to approach the central areas.
	Demarcation of light traffic zones	It concerns the designation of areas in the urban fabric of the city, where legislative regulations, such as the reduction of the speed limit, will be implemented to create traffic conditions, comfort and safety.
	Road safety improvement interventions	The aim of the project is to improve road safety conditions within the urban area of the city of Kalamata, where there will be interventions at 230 dangerous points and the construction of an anti-slip carpet on the 4,691m long road surface.
	Create a pedestrian flow network	The overall network of axes, in which the implementation of the above measures is proposed, is approximately 38 km long. (in addition to existing infrastructure) and concerns road sections where significant pedestrian flows are observed, as well as sections that have the appropriate geometric characteristics to accommodate pedestrian flows.
	Creation of a network of cycle paths	The expansion of the cycle path network, in accordance with the Sustainable Urban Mobility Plan and the creation of road safety conditions for road use

Table 25. Description of portfolio actions M.1 Sustainable Urban Mobility Infrastructure

Portfolio M.2	**Promotion of travel by environmentally friendly means**	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**
Transport Mobility	**Promotion of transportation by public transport**	The planned enrichment of bus lines, together with the renewal of the urban transport fleet with clean vehicles, upgrades bus services and makes public transport more attractive.

	Controlled parking	Controlled parking in a large area in the city center with payment of a fee acts as a deterrent to the use of private vehicles, as it increases the total cost of transportation. Consequently, commuters are pushed towards the use of gentle travel.
	Bike Sharing & Light Personal Electric Vehicles (EPHO) System	The project will be implemented by developing infrastructure for the operation of the bike-sharing network in the areas of the East-West Center Axis, the Central Axis, the Coastal Front and the Historical Center (mainly its eastern part).
	Shared passenger vehicle system	It is the possibility of the use by the commuter of a shared vehicle, with which he can move in all areas and without prohibitions. Parking spaces for public vehicles in controlled off-road parking areas facilitate transfer to them and continuation of the route where they are allowed while private vehicles are prohibited.
	Πλατφόρμα (app) κινητικότητας–Smart City/ MaaS	The platform combines the use of all means of soft transportation and the commuter will be able to be informed and purchase mobility services through the digital application
	Uniform pricing policy for services	the combination of charges for controlled parking, public transport tickets, the use of shared bicycles and EPHO, creates favorable conditions (including the economic parameter) for the use of environmentally friendly means of transport.
	Providing incentives to promote environmentally friendly travel	Through synergies of all stakeholders involved in the city's operations, financial incentives and others will be provided for the use of environmentally friendly means of transport.

Table 26. Description of Portfolio Actions M.2 Promotion of travel by environmentally friendly means

Portfolio M.3	**Organization of Freight Transport**	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**
Transport Mobility	**Determination of loading and unloading hours**	Drafting of a regulation for the organization of freight transport in the city.

	Replacing a commercial fleet with low-emission small vehicles	Tackling freight transport emissions will come through modernising the fleet with low-emission vehicles.
	Creation of smart merchandise distribution windows	Installation of smart mailboxes in a public place or in stores with high traffic and operating time, in order to serve without loss of time the forwarding of small containers (goods from online purchases) to final recipients.
	Construction of communal land storage terminals for goods	Construction of temporary storage infrastructure for goods, in a single area, in order to forward goods to the recipients by grouping the routes, thus avoiding unnecessary and unnecessary cost routes.
	Creation of a digital application for freight transport management	The application will be used by all involved businesses to organize the grouped routes, while calculating emissions, as well as other elements related to the movement of the vehicle, such as cost, estimated delivery time, route length and more.
	Incentivising the promotion of environmentally friendly freight transport	Identification of incentives to enterprises to modernize their equipment and operating procedures, as well as to integrate them into a single freight transport system.

Table 27. Description of portfolio actions M.3 Freight transport organisation

Portfolio M.4	**Travelling in low-emission vehicles**	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**
Transport Mobility	**Installation and operation of electric vehicle charging stations in public space**	Installation and operation of electric vehicle charging stations in public areas, in accordance with their strategic location plan.
	Replacement of municipal and state vehicle fleet with low-emission vehicles	It concerns the replacement of polluting vehicles of the Municipality of Kalamata and other state services based in Kalamata.
	Replacement of bus and taxi fleet with low-emission vehicles	It concerns the replacement of the buses of the Urban and Intercity Transportation Authority that operate routes within the city, the fleet of TAXI vehicles,

	Replacement of passenger vehicles	Replacement of private passenger vehicles

Table 28. Description of portfolio actions M.4 Travel with low-emission vehicles

The estimated budget of all actions of all portfolios is **€ 719,656,905, while the reduction of CO2 emissions is** 66,215.45 tn**, as detailed in the Table below.**

Aa	PORTFOLIOS	Estimated Budget	Fuel Energy 2019	Fuel consumption reduction (MWh)	Electricity Requirements (MWh)	Emissions 2019	Reduction of CO2 emissions in tn
M.1	Sustainable Urban Mobility Infrastructure	9.717.500	0,00	23.494,44	0,00	0,00	
M.2	Promotion of travel by environmentally friendly means	19.560.000	0,00	33.032,42	0,00	0,00	
M.3	Organization of Freight Transport	437.779.500	131.928,00	131.911,80	26.581,40	33.037,35	32.731,25
M.4	Promoting travel with low-emission vehicles	252.599.905	130.173,75	72.274,00	18.692,52	33.698,06	33.484,20
		719.656.905	**262.131,45**	**260.712,67**	**45.273,92**	**66.736,01**	**66.215,45**

Table 29. Scenario II portfolios (Budget, 2019 emissions, emission reduction)

The timetable for the implementation of the actions included in the portfolios of Scenario II was formed in the following order:

1. From the energy consumed per fuel type included in the inventory of the year 2019, the amount reduced due to the interventions to promote travel by environmentally friendly means, as described in the actions of portfolios M1, M2 and M3, is deducted.
2. The remaining amount of energy shall be allocated to a number of vehicles, taking into account the following assumptions:
    a. The average number of kilometres travelled per year by each vehicle
    b. The average fuel consumption in lit/100Km, for each vehicle type, based on the data of the sources of the basic inventory of the year 2019.
3. For each vehicle replaced, the reduction of energy from the use of liquid fuels and the necessary amount of electricity needed by the vehicle are calculated, based on the average electricity consumption mentioned in the international press.

4. The cost of replacing a vehicle is estimated, according to what is registered in the international press, for the evolution of the purchase prices of a medium-range electric vehicle.
5. The allocation of the annual budget includes the mentioned technical and regulatory interventions of the M1, M2, M3 portfolios, the installation of the network of charging stations, as well as the replacement of vehicles.

In the Technical Fiches of the actions, the exact calculations are described, while aggregated for all portfolios, the implementation schedule, in which energy changes are recorded, as well as the annual emissions, is as follows:

YEAR	PC	Annual Energy Consumption (MWh)			Annual CO2 Emissions (tn)		
	719.656.905,00	Thermal	Electric	Total	Thermal	Electric	Total
2019		**262.131,45**		**262.131,45**	**97.198,94**	**145.798,57**	**248.282,35**
2024	41.104.417,00	248.996,34	2.243,24	251.239,58	62.089,13	1.070,05	63.159,18
2025	82.215.348,00	222.785,52	4.515,62	227.301,14	52.920,30	1.837,87	54.758,17
2026	111.165.140,00	183.469,29	6.793,46	190.262,75	41.413,35	2.289,41	43.702,76
2027	111.110.216,00	144.153,06	6.793,46	150.946,52	30.835,86	1.813,85	32.649,71
2028	111.036.984,00	104.836,83	6.793,46	111.630,29	21.187,77	1.338,32	22.526,09
2029	131.512.400,00	52.392,54	9.060,89	61.482,53	9.976,12	1.151,55	11.127,67
2030	131.512.400,00	0,00	9.060,89	9.060,89	3,12	516,84	519,96
	Decrease	262.131,45	-45.261,02	253.070,56	97.195,82	145.281,73	247.762,39
	%	100,00%		96,54%	100,00%	99,65%	99,79%

Table 30. Scenario II: Timetable for Implementation and Results per year

The energy balance as well as the composition of the energy mix are presented in the next Diagram.

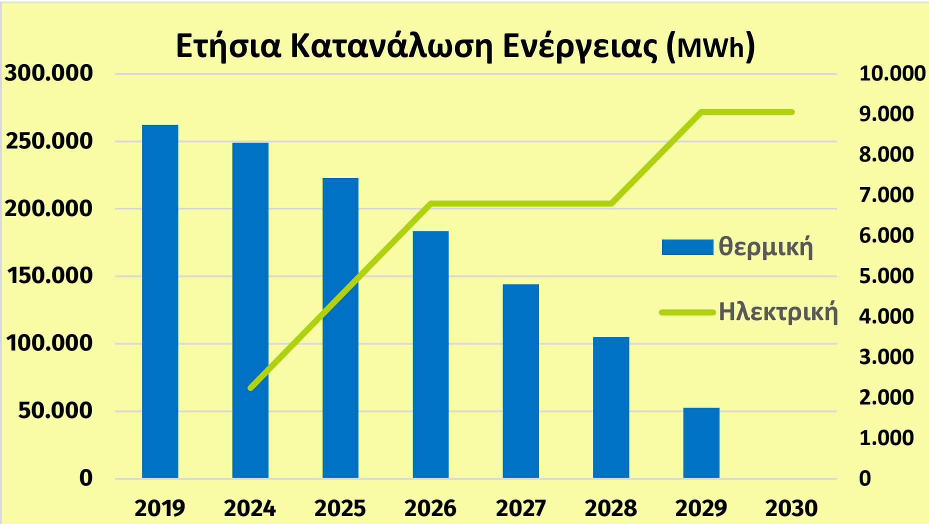


Image 9. Energy balance and composition of energy mix

The processing of the data of each portfolio results in complete exemption from the combustion of fossil fuels and introduction into the electricity system of very low emissions, resulting in a reduction of CO2 emissions by **99.22**%, while the energy cost of transportation is reduced by **82.20%,** as shown in the following Table.

DESCRIPTION	2019	2030	VARIOUS	%
Fuel Energy (MWh)	262.101,75		-260.712,67	**-99,47%**
Electricity (MWh)	0,00	45.273,92	45.273,92	**100,00%**
TOTALS	**262.131,75**	**45.273,92**	-215.438,75	**-82,20%**
Cost €/MWh	200,00	200,00		
Travel Energy Cost (€)	52.420.350,00	9.332.600,79	-43.087.749,21	**-82,20%**

Table 31. Scenario II: Phasing out fossil fuel combustion

The **tools**, financial **resources** and **policies** with which the proposed interventions will be implemented are:

I. The **intellectual** capital of the city and the **strategies** developed by the Municipality, such as:

1. The strategic plan "**Integrated** regeneration for the **upgrading** of the quality of life and the **revitalization** of the urban space of the Municipality of Kalamata**"**
2. The Strategic **Sustainable** Urban **Mobility** Plan (SUMP)
3. The Business Plan for the **provision of communal** and public benefit spaces (E.S.E.K.K.) of the Municipality of Kalamata

4. The Urban **Accessibility Plan** (SAR)
5. The Sustainable Energy and Climate Plan (SEAP)
6. The strategy included in the Electric Vehicle **Charging** Plan (EVS) concerning the location of the installation of electric vehicle charging stations in the public space.
7. The strategy for the **Digital Transformation** of Kalamata

II. Policies arising from state **laws**, such as:

1. The **climate** law
2. The National **Energy** and Climate Plan (NECP)
3. The National Plan for the Promotion of **Electromobility** (in Consultation)

III. Policies emanating from international organisations, such as

1. European **Green Deal**
2. **Sustainable** Cities and Communities (Sustainable Development Goal 11 - UN)
3. Climate action (Sustainable Development Goal 13 - UN)

IV. The resources for financing assistance shall be drawn from:

1. Funding programmes **directly** from the European Union
2. From the **NSRF** 2021-2027, for Greece
3. From **government** funding programs
4. From **Regional** funding programs
5. From **Municipal Funds**
6. From **private investments**
7. Private citizen participation

The weaknesses recorded for the implementation of the above interventions are:

1. The **difficulties** that will arise from the **construction** of infrastructure projects:
   a. mobility of residents and visitors,
   b. the system for supplying the market with goods,
   c. in the operation of enterprises.
2. Since interventions concern public works and cannot be described as remunerative, they can only **be financed** from regional, national and European sources.
3. Reactions from the **reduction** of car parking spaces, especially in residential areas.
4. The **habit** of residents to move **everywhere** and **quickly** with their private car, in the small urban area of the city.
5. The **inability** of companies engaged in freight work, either due to lack of knowledge or due to competition, to **cooperate** in the coordinated effort to **reorganize** freight transport.

6. The high **cost** of initial capital for the purchase of the electric vehicle.
7. The **insufficient** number of charging stations along roads.
8. The **inability** of factory electric vehicle production lines to **meet** growing **demand**.

For the co-formulation of the interventions, included in the portfolios of the transformation path (Impact Pathway) entitled "**Kalamata**, **low emission transportation",** collaborations **were developed** with:

1. the Peloponnese Region
2. the University of Peloponnese
3. the Chamber of Messinia
4. the Federation of Professional – Craft and Commercial Associations of the Prefecture of Messinia
5. the Messinia Hoteliers Association
6. the Commercial Association of Kalamata
7. the Technical Chamber of Greece (Messinia Branch)
8. the Association of Public Works Contractors
9. the urban transport provider (Urban Bus)
10. the provider of intercity transport (Intercity Bus)
11. the taxi owners association
12. the Association of Catering and Entertainment Shops of Kalamata
13. the Catering Association of Messinia
14. Enterprises promoting micromobility
15. Digital application developers

All the above stakeholders accept, in the field that belongs to them, the proposed interventions, in accordance with the attached cooperation protocols.

Sector Emissions	**Built Environment**	
Lever Change	**Results**	
	Short term	**Long term**
Technology & Infrastructure	**1.** Preparation of studies for the construction of mobility stations and issuance of the necessary permits.	**8.** Construction of mobility stations – creation of necessary infrastructure **9.** Construction of 33 km of infrastructure according to the

	2. Completion of the project "Improvement of Road Safety of the Municipality of Kalamata" **3.** Elaboration and approval of implementation studies for the proposed cycle paths and pedestrian flow networks	plan for the promotion of cycling and EPHO. **10.** Construction of 400,000 m2 of infrastructure according to planning to promote walking
Governance & Policies	**1.** Permits for the nature of the proposed interventions for the construction of new cycle paths **2.** Approval of a traffic study for the coexistence of all transportation infrastructure, especially in the central parts of the city **3.** Designation of traffic calm zones	**1.** Approvals for pedestrian route configuration interventions in residential areas west, south and east of the city
Financing	**1.** Disbursements of projects already funded and being implemented. **2.** Preparation of a techno-economic study for the operation and preparation of a financing proposal for the construction of mobility stations. **3.** Submission of a funding proposal for the interventions for the configuration of cycling and pedestrian routes.	
Inclusivity	**1.** Stakeholder consultation on the nature and use of proposed pedestrian routes as well as cycling routes.	

Table 32. Scenario II: Results of Actions - Built Environment

Sector Emissions	**Mobility and Transport**	
Lever Change	**Results**	
	Short term	**Long term**
Technology & Infrastructure	**1.** Development of a digital application for Mobility as a Service (MaaS) and interconnection of all systems. **2.** Start of implementation and operation of the project for the	**1.** Installation and operation of a controlled parking system **2.** Preparation of studies for the construction of the common transit centre.

	installation of the "Integrated Electric Bicycle Rental System". **3.** Creation of the network of collaborating companies, as a legal entity, for the shipment, transport and receipt of containers. **4.** Start of authorisation procedures for the establishment of a common warehouse centre **5.** Installation and operation of EV charging stations in **40%** of the spaces provided by the SFEO in common areas, by the selected investor. **6.** Replacement of 20% of municipal fleet vehicles **7.** Preparation and submission of a joint pilot proposal for Horizon funding, which will include: **7.1.** The purchase of small electric vehicles for the distribution of packaged goods **7.2.** The installation of a photovoltaic park of sufficient power for charging with electricity the above vehicles. **7.3.** The creation of a digital application for route management.	**3.** Start of works for the implementation of the infrastructure for the installation of the common transit centre. **4.** Relocation of transport companies to a common area **5.** Installation and operation of EV charging stations in the **remaining** spaces provided by the SFEO in common areas, by the selected investor. **6.** Replacement of the remaining vehicles of the municipal fleet
Governance & Policies	**1.** Elaboration of a traffic study **2.** Zoning of the area of controlled parking, **3.** Single ticket/charge with other services (parking, shared EPHO, etc.) **4.** Partial modification of public transport network. **5.** Drafting and approval of the regulation of the operation of freight transport. **6.** Simplification of authorisation procedures for the installation of filling stations. **7.** Drafting of the Rules of Operation of EV charging stations. **8.** Incentives for the purchase of an electric vehicle (reduction of road tax, access to areas with the	**1.** Full modification of public transport route network **2.** Implementation of a uniform pricing policy with all means of transport **3.** Incentives for the purchase of an electric vehicle (reduction of road tax, access to areas with the exclusion of conventional vehicles, etc.) **4.** Provision of financial incentives by the Municipality to promote environmentally friendly transportation **5.**

	exclusion of conventional vehicles, etc.)	
Financing	**1.** Purchase of new buses, according to the specifications of the action **2.** Preparation of financing proposals for the replacement of part of the fleet of freight vehicles **3.** Completion of the financier-investor selection process for the installation and operation of the charging stations. **4.** Claiming the drafting and implementation of subsidy programs by the state for the renewal of the fleet of private passenger vehicles, in accordance with the provisions of the respective national policies. **5.** Implementation of state subsidy programs for transport professionals, in accordance with the provisions of the respective national policies	**1.** Financing for the construction of the necessary infrastructure of the common freight centre **2.** Claiming the drafting and implementation of subsidy programs by the state for the renewal of the fleet of private passenger vehicles, in accordance with the provisions of the respective national policies. **3.** Implementation of state subsidy programs for transport professionals, in accordance with the provisions of the respective national policies
Inclusivity	**1.** Design of pricing policy for all services and transportation systems operating in Kalamata **2.** Formation of agreements between city companies and mobility system companies (shared bicycles, urban buses, etc.) **3.** Formation of incentives for the participation of businesses in the actions of the portfolio. **4.** Creation of a business cluster for the organization of common transport work. **5.** Registration of all businesses on the digital transport platform **6.** Creation of **an ecosystem** for the promotion of electromobility, with the participation of: **6.1.** **Operators** installing and operating charging stations. **6.2.** **Producers** and distribution of clean electricity.	**1.** Business incentives for citizens

	6.3. **Developers developing** digital applications to manage the operation of charging stations. **6.4.** Businesses **selling** electric vehicles. **6.5.** Training bodies for maintenance and repairers of charging stations and maintenance of electric vehicles.	
Learning & Competences	**1.** Analysis and organisation of the transport system **2.** Training – familiarization of all those involved in the operation of the new digital application, distribution of goods **3.** Establishment of an observatory for recording and evaluating data on the penetration of electromobility **4.** Promotion of procedures for the establishment and operation of sectors and specialties in Secondary Education, for the education of students in scientific fields related to electromobility. **5.** Organization and implementation of continuous training seminars for artificial cars on electromobility issues.	**1.** Full operation of the information system **2.** Implementation of continuous training seminars for artificial cars on electromobility issues. **3.** Creation of **Living Labs**, with the participation of the entire ecosystem of electromobility stakeholders, in order to record and interdisciplinary evaluation of the environmental, economic and network impacts of the application of electromobility

Table 33. Scenario II: Action Results – Mobility and Transport

Effects	
Immediate benefits	Reduction of emissions by **66.215,45** tn CO_2.
Parallel benefits	
Category	**Description**
FINANCIAL	**1. For Electromobility** 1.1. Creating business opportunities, through synergies in the energy and mobility sectors, to create sustainable business models. 1.2. Creation of new jobs 1.3. Reduction of the cost of daily travel, due to dependence on fossil fuels and the possibility of consuming electricity derived from self-production. 1.4. Reduction of maintenance costs of electric motors. **2. For Mobility** 2.1. The reduction of vehicle traffic in the city centre will create an attractive environment conducive to the development of entrepreneurship and the creation of new jobs. 2.2. The creation of infrastructure to facilitate mild travel, enables especially residents to reduce their travel costs to the city center (fuel, parking costs). 2.3. Housing in intervention areas will acquire a higher market value. 2.4. The reorganization of the routes for the promotion of goods will reduce unnecessary travel and will contribute to the reduction of operating costs for businesses.
ENVIRONMENTAL	1.1. Reduction of air pollutants 1.2. Reduction of noise levels 1.3. Getting rid of fossil fuels 1.4. Addition of urban furniture 1.5. Use of bioclimatic materials 1.6. Reduction of traffic congestion in central parts of the city
QUALITY OF LIFE	1.1. Improving road safety conditions 1.2. By creating the urban environment, which prevents car travel, the quality of life of commuters and employees is improved. 1.3. It is possible to travel with multiple options 1.4. Protection of Public Health
INNOVATION	**1. For Electromobility** 1.1. The possibility of creating a cluster of bodies promoting electromobility

	1.2. The operation of interdisciplinary laboratories for assessing the impact on the economy, the environment and the operation of the distribution network **2. For Mobility** 2.1. Cooperation between citizens and the concept of shared means of transport are promoted, resulting in a reduction in raw material needs. 2.2. Establishment of a courier service company 2.3. Participation of all freight forwarders in a common body
DIGITAL TRANSFORMATION	1. Ability to integrate electric vehicles into the ecosystem of Sustainable Urban Mobility. 2. Development of applications for managing the integration of a car's energy storage unit into the operations of the energy distribution network, especially during peak hours. 3. The choice of intermodal transport and the multiple data generated, enable the development of digital applications that will optimize the travel route, in terms of time, cost and environmental footprint. 4. The concept of transport sharing promotes the development of digital applications to support transportation. 5. Creation of a digital map of gentle travel routes. 6. Creation of a system (platform) for the management of all interconnected systems, serving freight transport. 7. The development of a digital application for the selection of the optimal travel route based on: 7.1. The economic benefit 7.2. Emissions of air pollutants and greenhouse gases

Table 34. Scenario II: Direct Impacts and Co-benefits for citizens

Scenario III

Kalamata, city to produce and create

KALAMATA
Our mission: go zero!

The Municipality of Kalamata, as an area with an evolutionary course that accelerated due to the construction of the motorway connecting with Athens, the development of the airport, but also the operation of the integrated tourism development area, Costa Navarino in Western Messinia, **generates** wealth mainly from the **tertiary** sector of services but also from **production** and **processing** agricultural products (Kalamata olives, olive oil, figs, vegetables, etc.).

The **primary** sector, which employs **7%** of economically active citizens, covers an area of 95,754,000 m2 with main activity olive cultivation in an area of 75,754,000 m2, where the internationally renowned Kalamatian Olive Oil and Kalamata Olives are produced.

The **secondary** sector, which employs **18%** of the economically active, focuses mainly on manufacturing and secondarily on construction activity, while electricity production (photovoltaic systems) and recycling companies are constantly increasing. Prominent is the internationally renowned tobacco company KARELIA, a producer of cigarette labels known all over the world.

The companies mainly active in processing are 66% companies processing and standardizing olive oil, olives, cold cuts manufacturing industries, cheese factories, nut peeling / packaging industries, bread and confectionery workshops, wineries and distilleries, while the vast majority of other businesses concern construction (aluminum and iron processing companies, window construction, construction iron products and related enterprises, industries of wood and wood and cork products, carpentry and workshops for the manufacture of wooden frames, publications, printing, manufacture of furniture, jewelry, toys). 32.1% of the enterprises of the secondary sector of the Municipality are active in the construction activity, with most enterprises being directly or indirectly related to the construction activity.

The **tertiary** sector, which employs **75% of the** economically active of the Municipality of Kalamata, provides services in the fields of health, education, accommodation, catering and entertainment, financial services, scientific advice (Lawyers, Engineers, Accountants), as well as and trade. Tourism has a particular growth, due to the increase in traffic to the city due to the extensive interventions in urban space over the last decade, which changed the physiognomy of the city, as well as the increase in airport flights to foreign destinations and the construction of the highway connecting Kalamata with the capital Athens.

The activities of all three sectors are interlinked and economically complementary, so they face the impacts of climate change in a common way.

The problems faced by the productive sector, due to the occurrence of extreme weather phenomena in the area, are indicatively:

- The reduction of agricultural production, due to drought, hail and heavy rainfall, which also affects the operation of processing and marketing units of agricultural products.
- Prolonged heat waves, such as in 2017 and 2023, reduce traffic to the area, thus the consumption of local products, while at the same time increasing the energy needs and operating costs of all tertiary sector units.

In conclusion, extreme weather events create dependencies on both energy quantities and the availability of raw materials, with a direct impact on CO_2 emissions and indirectly on the economic benefits of each activity.

Joint action to tackle extreme weather events due to climate change will have long-term effects, while managing energy consumption more directly.

Based on the emission inventory of the year 2019, for the Transformation Route "**Kalamata, city to produce and create**", the following emerge:

N/A	PRODUCTION SECTOR	Emissions (tn)	% Production Sector	% of total
1	**PRIMARY SECTOR**			
	Agricultural, Forestry and Land Use (AFOLU)	4.604,63		
	TOTAL	**4.604,63**	**5,22%**	**1,73%**
2	**SECONDARY SECTOR**			
	Industrial Process and Product Use (IPPU)	21.610,70		
	TOTAL	**21.610,70**	**24,52%**	**8,11%**
3	**TERTIARY SECTOR**			
	Private buildings other than residential buildings	61.207,17		
	Public buildings and facilities	709,34		
	TOTAL	**61.916,51**	**70,25%**	**23,23%**
	EMISSIONS PRODUCTION SECTOR	**88.131,84**		**33,07%**
	TOTAL MUNICIPAL EMISSIONS	**266.526,55**		

Table 35. Emissions 2019 by Production Sector

The energy sources for the Production Sectors are, according to the table below, 80% electricity and 20% fossil fuel energy.

n/a	Production Sector	Electrical energy (MWh)	Petroleum (MWh)	Petrol (MWh)	Sets
1	Primary	3.903	8.171	1.933	14.007
2	Secondary	25.415	1.546		26.961
3	Tertiary	106.689	22.845		129.534
		136.007	**32.562**	**1.933**	**170.502**

79,77%	**19,10%**	**1,13%**

Table 36. Energy Sources by Production Sector

To reduce emissions, the following are proposed:

A. in the primary sector

- The use of biofuels for the operation of agricultural machinery
- The energy upgrade of pumping units
- Informing – sensitizing farmers about low-emission cultivation methods.

B. in the secondary sector

- Energy upgrade and efficiency actions of each installation
- Actions to change plant operating procedures

C. in the tertiary sector

- Emission reduction interventions through the energy upgrade of the installation
- Actions to change the operating procedures of the enterprise

D. For the production and distribution of clean energy, the following are proposed:

- Installation of photovoltaic systems units
- Installation of a clean fuels distribution plant and network
- Hydrogen Production Unit
- Exploitation of geothermal load

Energy interventions concern the replacement of oil in the tertiary sector with electricity, in the primary sector with biofuels to supply agricultural machinery and in the secondary sector, with supply actions through the natural gas network. At the same time, clean electricity will be produced from photovoltaics, which will operate with the Net Metering system.

The challenge for the Municipality of Kalamata and for all those involved in the production sector is to redefine the production model and create opportunities so that through mitigation interventions, energy costs can be reduced and products and services with a low carbon footprint can be created.

At the same time, the prospects for investments in clean energy production units are opening, which on the one hand will contribute to the decarbonization of high-emission fossil fuels and on the other hand will ensure for Kalamata, energy self-sufficiency with low energy and environmental costs.

The proposed actions are organised into the following portfolios:

1. **Emission reduction actions in the agricultural sector**

   The portfolio includes actions related to the upgrading of farm pumping complexes and management of irrigation systems.

   The description and documentation of the portfolio, the actions it includes, as well as the results with their impact, are analyzed in the table below and in the attached file entitled **Prtf_P.01_1st_Sector (Attach_File)**

2. **Transformation of manufacturing and craft units**

   The portfolio describes interventions to change the operating procedures of businesses, as well as upgrade their equipment.

   The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the table below and in the attached file entitled **Prtf_P.02_2nd_Sector (Attach_File)**

3. **Energy upgrading of buildings and facilities of the tertiary sector.**

   The portfolio describes interventions in tertiary sector activities, such as offices, hotels and accommodation, catering and entertainment, out-of-school education, health care facilities, mass events, etc., in which interventions in their building stock and energy upgrade of their equipment are proposed.

   The description and documentation of the portfolio, the actions it includes, as well as the results with their impact, are analyzed in the table below and in the attached file entitled **Prtf_P.03_3rd_Sector (Attach_File)**

4. **Energy production, storage and distribution.**

   The portfolio describes the installation of energy production units, utilizing all forms of raw material with energy content, such as wastewater from the biological treatment plant, olive oil waste from the processing of the fruit of olive trees, any waste plant or animal matter, as well as the production of hydrogen from seawater. The results of the actions come to cover additionally the energy produced by photovoltaics in homes and businesses of the secondary and tertiary sector.

   The description and documentation of the portfolio, the actions it includes, as well as the results with their impacts, are analyzed in the table below and in the attached file entitled **Prtf_P.04_Energy (Attach_File)**

The actions of the portfolios in the Transformation Path **"Kalamata, city to produce and create**" are described below.

Portfolio P.1	Emission reduction actions in the agricultural sector	
Emissions Sector	Portfolio Actions	
	Action Title	Description of the Action
Agriculture, Forestry and Land Use (AFOLU)	Energy upgrading and energy saving actions in agricultural production	The action includes interventions to reduce electricity consumption in the pumping stations of agricultural holdings, the modernization of old technology agricultural tractors, the gradual replacement of fuel with lower emission ones, as well as the improvement of the irrigation system in the respective crops. Combined, the implementation of all three measures will change production processes in order to lead to savings in resources and energy.

Table 37. Description of Portfolio Actions P.1 Emission reduction actions in the agricultural sector

Portfolio P.2	Transformation of manufacturing and craft units	
Emissions Sector	Portfolio Actions	
	Action Title	Description of the Action
Industrial processes	Energy Upgrade of Water Supply and Sewerage Network Facilities of the Municipality of Kalamata	The action concerns interventions for the modernization and energy upgrade and efficiency of the electrical equipment of the water supply company of the Municipality of Kalamata, located in the pumping stations, boreholes, tanks and wastewater treatment plant.
	Energy upgrade of equipment and facilities of the Water Supply Association of Kalamata, Messini and surrounding areas	The action concerns interventions for the modernization and energy upgrade and performance of the electrical equipment of the Water Supply Association of the Municipalities of Kalamata, Messini and surroundings, located in the pumping stations, boreholes, and tanks used by the Association for the supply of drinking water to its members.
	Energy upgrade actions of the facilities of the Industrial Park of Kalamata	The action concerns interventions for the energy upgrade of infrastructure and equipment of businesses that have been installed and operate in the Industrial Park of Kalamata.
	Energy upgrading and energy saving actions in manufacturing units	The action is general and concerns all craft and manufacturing units operating outside the Craft Park and describes interventions to change the operating

		procedures of businesses, as well as upgrade their equipment.

Table 38. Description of Portfolio Actions P.2 Transformation of manufacturing and craft units

Portfolio P.3	Energy upgrading of tertiary sector buildings and facilities	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**
Energy	**Energy upgrade actions of municipal buildings**	The action concerns interventions in municipal buildings, which are used for the operation of the services of the Municipality and the service of citizens.
	Energy upgrade actions of the Central Market of Kalamata	The energy upgrade interventions concern the business premises housed in the area of the Central Market of Kalamata, ie. in food outlets, as well as in logistics companies, which use the premises for the distribution, in particular, of fresh vegetables.
	Emission reduction interventions in public gathering places	The action concerns interventions in catering and entertainment businesses, management of multipurpose spaces and transactions of citizens with financial institutions.
	Emission reduction interventions in commercial areas	The action concerns interventions in the areas of commerce, which include commercial stores and department stores of clothing and food, personal care stores and all retail businesses.
	Emission reduction interventions in accommodation areas	Interventions in hotels and accommodation are described
	Emission reduction interventions in Office spaces	Office space means buildings or parts of buildings which are used for intellectual or administrative activities, public or private, or for business activities, provided that they are not included in the category of commerce.
	Emission reduction interventions in healthcare facilities	This category includes those buildings or parts of buildings used for medical prevention, diagnosis and/or treatment, for the care of elderly or sick persons or with reduced mental or physical capacity, for sleep and physical hygiene of infants and children under six years of age.
	Emission reduction interventions in	The description of the action **includes:** • the buildings of the University of Peloponnese,

	educational service areas	• a private school, • as well as secondary education and foreign language schools operating in the Municipality of Kalamata. Public schools of primary and secondary education are examined separately.

Table 39. Description of Portfolio Actions P.3 Energy upgrading of tertiary sector buildings and facilities

Portfolio P.4	**Energy generation, storage and distribution systems**	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**
Energy	**Installation of a natural gas plant and construction of a distribution network.**	It concerns the installation of a liquefied natural gas plant and the construction of a distribution network, which can then be enriched with quantities of biofuels (Hydrogen, Biomethane).
	Energy utilization of sewage sludge of the Kalamata Wastewater Treatment Plant	The action concerns the construction and operation of an anaerobic digestion unit, which will carry out the biological treatment of sewage sludge created by the Kalamata wastewater treatment plant and will lead to the production of biogas which will then be upgraded to biomethane.
	Processing of olive-growing products	The action will result in the biological treatment of the olive husk produced by the pressing of the olives, in order to create by-products that will be exploited either energy (biogas) or commercial (organic fertilizer)
	Energy production from photovoltaic parks	The action describes the installation of photovoltaic parks in the Municipality of Kalamata as well as the monitoring of their operation.
	Installation of a Combined Heat and Power Plant with biogas combustion	*The* Combined Heat and Power (CHP) plant with the combustion of the produced biogas is one of the most efficient solutions for the utilization of renewable energy sources for the production of both electricity and thermal energy.
	Installation of a hydrogen production unit	Creation of a green hydrogen production unit, which will operate by electrolyzing either seawater or wastewater of the Wastewater Treatment Plant, using clean energy from photovoltaics.

	Installation of energy management systems	It concerns the installation of monitoring systems for the distribution, storage and consumption of electricity

Table 40. Description of Portfolio Actions P.4 Energy generation, storage and distribution systems

The proposed interventions to mitigate the effects of the climate crisis, in all sectors of production, are the **opportunity** for the Municipality, businesses and professionals to redefine their production model, promoting policies in terms of climate neutrality:

- Cultivating a spirit of neutrality in the human resources and the internal structure of the company, as well as in all those involved with it.
- Transforming business operating processes.
- Creating products and services with a low carbon footprint, thus improving their competitiveness in the market.
- Saving energy and every natural resource necessary for the operation of the business, thus reducing the operating costs of the business.

At the same time**, a dynamic is developing** for the **production** of energy from other alternative sources available in the region, such as:

- The rich solar potential with 1440 hours / year of sunshine, gives the prospect of installing photovoltaic systems, in order to make every business energy self-sufficient.
- The geothermal load of about 17o C, at a depth of just 5m, enables its utilization and performance for each production unit, but also residence, as an energy consumer.
- The proximity to the sea, the utilization of 15,000 m3 of waste water from the wastewater treatment plant, as well as the rivers of the area, enable the operation of a hydrogen production unit, which will be powered by the energy of photovoltaic systems.
- The cultivation of olive cultivation both within the boundaries of the Municipality of Kalamata and in neighboring areas has as a derivative product the olive husk, which can be exploited in terms of circular economy, in order to produce biogas that will be used as fuel.
- Waste agricultural products (fruits, etc.) can be exploited for biogas production.

The estimated budget of all portfolios of the Transformation Path "**Kalamata, city to produce and create**", as well as the balance of energy and emissions are presented in the following Table.

Aa	PORTFOLIOS	Estimated budget	Electricity 2019 (MWh)	Reduction of electricity consumption (MWH)	Increase of Electricity Consumption (MWh)	Energy Production from RES (MWh)	Grid Electricity 2030 (MWh)	Thermal Energy 2019 (MWh)	Fuel consumption reduction (MWh)	Emissions 2019	Reduction of CO2 emissions in tn
P.1	Emission reduction actions in the agricultural sector	1.942.250,25	3.903,00	1.366,05	0,00	2.000,00	536,95	10.104,35	0,00	4.643,29	2.694,42
P.2	Transformation of manufacturing and craft units	25.157.886,00	38.690,68	12.061,96	1.034,59	22.315,84	5.347,47	1.575,69	1.546,00	21.582,95	21.270,66
P.3	Energy upgrading of tertiary sector buildings and facilities	182.728.848,00	99.558,04	56.794,65	7.536,15	20.590,00	29.709,54	20.768,16	19.438,25	59.982,57	58.000,17
P.4	Energy generation, storage and distribution systems	19.520.275,00	0			32.110,70	0,00	0			0
		224.349.259,25	**142.151,72**	**70.222,66**	**8.570,74**	**77.016,54**	**35.593,96**	**32.448,20**	**20.984,25**	**86.208,81**	**81.965,25**

Table 41. Scenario III Portfolios (Budget, Energy Balance and Emissions)

The emission reductions per Production Sector are as follows:

N/A	PRODUCTION SECTOR	Emissions 2019 (tn)	Emission reduction	% Difference
1	**PRIMARY SECTOR**			
	Agricultural, Forestry and Land Use (AFOLU)	4.643,29	2.694,42	58,03%
	TOTAL	**4.643,29**	**2.694,42**	58,03%
2	**SECONDARY SECTOR**			
	Industrial Process and Product Use (IPPU)	21.582,95	21.270,66	98,55%
	TOTAL	**21.582,95**	**21.270,66**	98,55%
3	**TERTIARY SECTOR**			
	Private buildings other than residential buildings	59.273,23	57.303,86	96,68%
	Public buildings and facilities	709,34	696,31	98,16%
	TOTAL	**59.982,57**	**58.000,17**	96,70%
	Emissions by emission domain	**86.208,81**	**81.965,25**	**95,08%**

Table 42. Scenario III: Emission Reductions by Production Sector

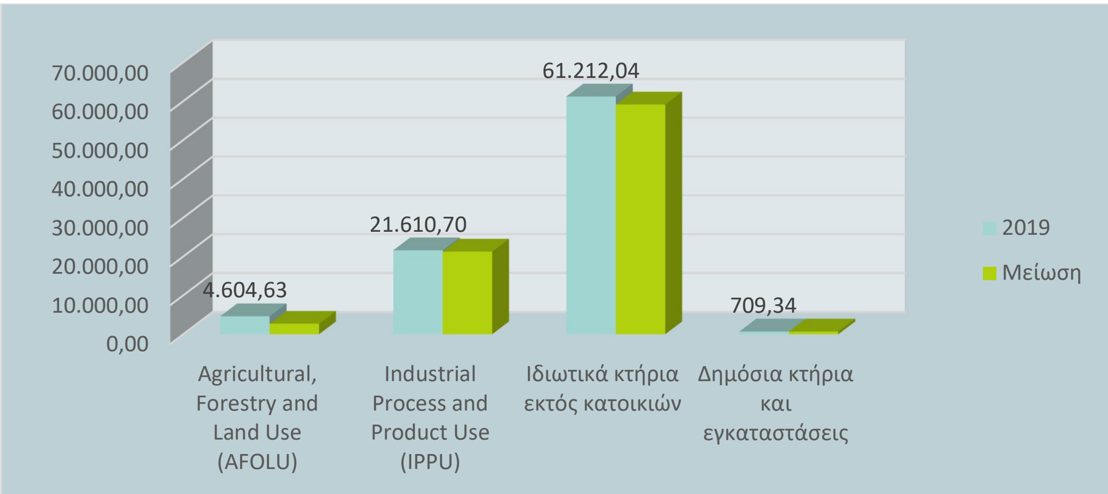


Image 10. Reduction of emissions 2019 by Production Sector

In portfolios **P.2 and P.3**, **which include interventions in Municipal Water Management and Sewerage Enterprises, manufacturing units, as well as tertiary sector enterprises, emission reduction interventions follow the following steps:**

1. Interventions in the **shell** and **equipment** of the facilities, leading to energy savings by the percentage documented in each action fiche.

2. 85% of the remaining **thermal** energy **is replaced by** additional interventions (*e.g. replacement of oil burners by heat pumps*) with **electricity**.

3. Finally, the required electricity shall be supplied:

- From the electricity **transmission network**, which has a carbon footprint depending on the composition of the national mix, which determines the value of the emission factor.
- From **photovoltaic systems**, where the system of self-production will supply zero emission energy to consumers.

Emissions will be calculated from the use of remaining thermal energy and electricity consumption through the transmission network

Based on the calculations detailed in the actions and portfolios, the implementation and results schedule per year is as follows:

YEAR	Cost	Annual Energy Consumption					Annual Emissions		
		Thermal	Electrical energy			Total Energy			
	229.349.259,28		Power grid	RES	Electrical energy		Thermal	Electric	Total
2019		**32.448,20**	**142.151,72**	**0,00**	**142.151,72**	**174.599,92**	**8.631,22**	**77.577,59**	**86.208,81**
2024	12.627.321,95	31.318,72	135.322,00	3.261,08	138.583,08	169.901,80	7.752,87	64.548,60	72.301,47
2025	22.739.778,10	29.217,32	124.999,86	7.551,66	132.551,52	161.768,84	6.888,71	50.874,94	57.763,65
2026	34.305.432,49	26.065,23	109.180,04	14.187,54	123.367,58	149.432,81	5.833,34	36.793,67	42.627,01
2027	34.499.654,05	22.913,14	93.023,62	21.023,42	114.047,04	136.960,18	4.853,60	24.837,31	29.690,91
2028	34.693.881,39	19.761,05	76.530,59	28.059,30	104.589,89	124.350,94	3.949,52	15.076,52	19.026,04
2029	45.871.081,09	15.558,26	55.213,10	37.040,46	92.253,56	107.811,82	2.977,88	7.012,06	9.989,94
2030	44.612.110,20	**11.434,26**	**35.593,96**	**44.905,84**	**80.499,80**	**91.934,06**	**2.126,77**	**2.116,23**	**4.243,00**
	Decrease	**21.013,94**	**106.557,76**		**61.651,92**	**82.665,86**	**6.504,45**	**75.461,36**	**81.965,81**
	%	**64,76%**	**74,96%**		**43,37%**	**47,35%**	**75,36%**	**97,27%**	**95,08%**

Table 43. Scenario III: Implementation and Results Schedule per year

The distribution of annual energy consumption in thermal and electrical is illustrated in the following Diagram.

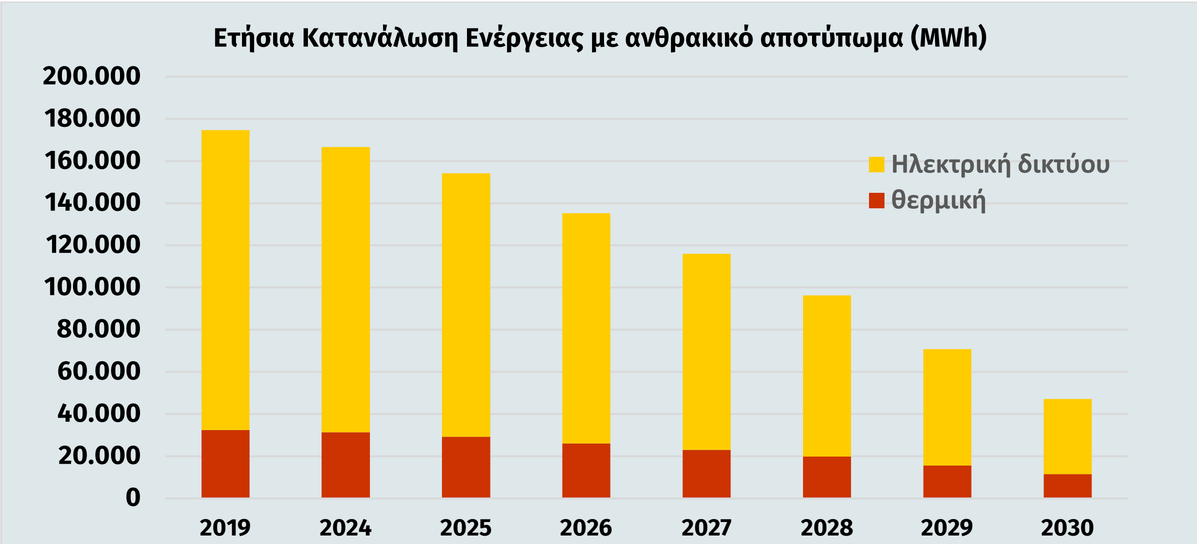


Image 11. Scenario III: Annual energy, thermal and electricity consumption

The composition of the energy mix of electricity is as in the diagram

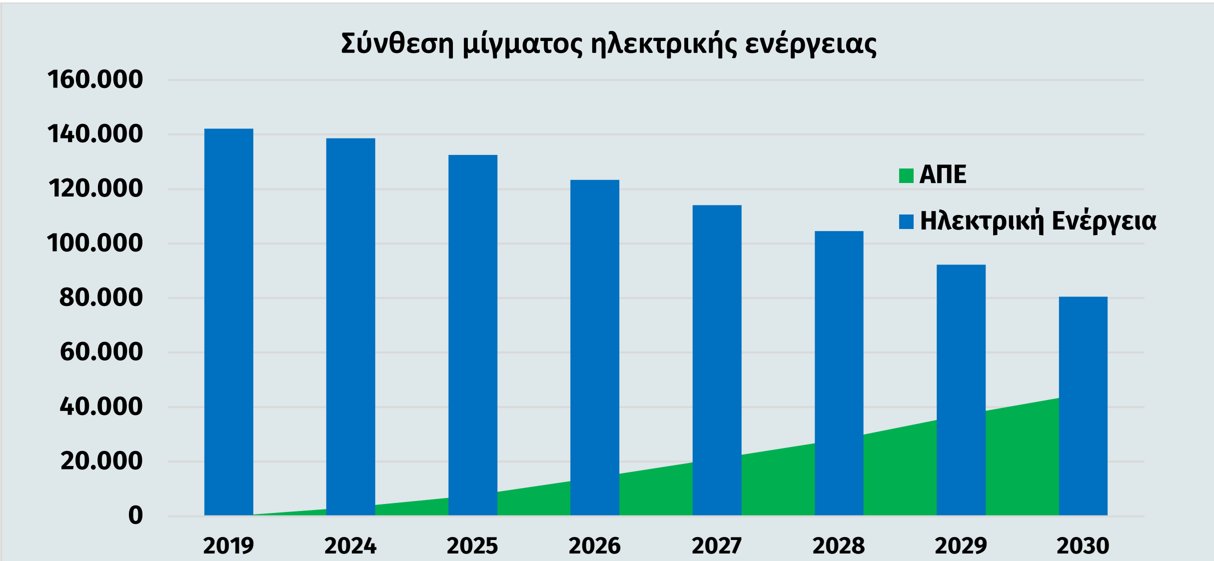


Image 12. Scenario III: Composition of electricity mix

The reduction of emissions is illustrated in the Chart below.

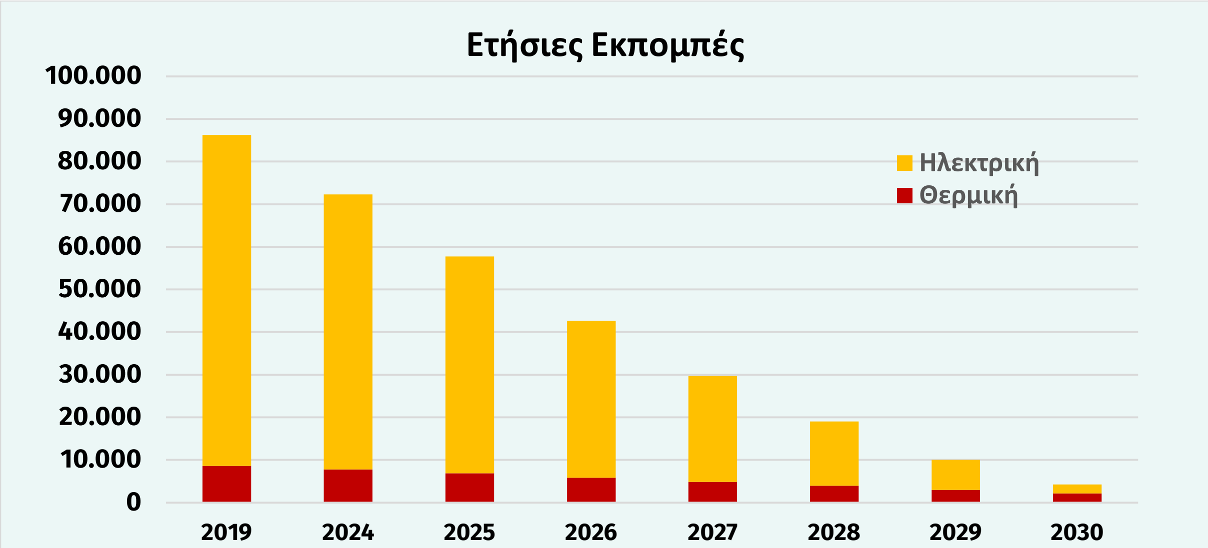


Image 13. Scenario III: Reduction of annual emissions

The **tools**, financial **resources** and **policies** with which the proposed interventions will be implemented are:

I. The **intellectual** capital of the city and the **strategies** developed by the Municipality, such as:
   1. The Sustainable Energy and Climate Plan (SEAP)
   2. The strategy for the **Digital Transformation of** the Municipality of Kalamata.
   3. The know-how gained from the implementation of the project to upgrade the municipal street lighting system.

II. Policies arising from state **laws**, such as:
   1. The **climate** law
   2. The National **Energy** and Climate Plan (NECP)

III. Policies emanating from international organisations, such as
   1. European **Green Deal**
   2. **Sustainable** Cities and Communities (Sustainable Development Goal 11 - UN)
   3. Climate action (Sustainable Development Goal 13 - UN)

IV. The resources for financing assistance shall be drawn from:
   1. Funding programmes **directly** from the European Union
   2. From the **NSRF** 2014-2021 and 2021-2027, for Greece
   3. From **government** funding programs
   4. From **Regional** funding programs
   5. From **Municipal Funds**

6. From **private investments**
7. Private citizen participation

The weaknesses recorded for the implementation of the above interventions are:

FINANCIAL

- Energy Saving Measures for crafts and manufacturing units are considered low priority investments and long payback time.
- The upgrading of small building infrastructure, such as office and retail spaces, requires investments with high initial capital (~250 **€/m2**), which the Greek banking system is unable to finance.
- There is a lack of knowledge and experience in the general population on how to finance interventions from the benefit that will result from energy saving.

IMPLEMENTATION

- In craft and manufacturing units, the concept of energy control and energy responsibility of the enterprise is missing, so any energy saving action is not among the first choices.
- There is no standard of procedures for the energy upgrade of a production process.
- The size of interventions for the tertiary sector throughout the Municipality requires a large amount of effort, with difficulties in finding both labor and raw materials.
- There is no certification process that ensures quality in both services and materials used for the energy upgrade of buildings.
- The rapid development of technology devalues methods, materials and equipment used for energy upgrades, thus creating a feeling of mistrust.

GOVERNANCE-PARTICIPATION-COMMUNICATION

- A great deal of communication of the effort is required in order to properly inform citizens.
- A reception and information office is needed for the proper organization of interventions.

For the co-formulation of the interventions, included in the portfolios of the Transformation Path (Impact Pathway) entitled "**Kalamata:** city you produce and create", collaborations **were developed with:**

1. the University of Peloponnese
2. the Chamber of Messinia
3. the Federation of Professional – Craft and Commercial Associations of the Prefecture of Messinia
4. the Union of Agricultural Cooperatives of Messinia
5. the Messinia Hoteliers Association
6. the Bar Association
7. the Medical Association
8. the Dental Association
9. the Commercial Association of Kalamata

10. the Technical Chamber of Greece (Messinia Branch)
11. Energy Service Companies

Everyone accepts, in the field they deserve, the proposed interventions, in accordance with the attached cooperation protocols.

The results and impacts of the scenario **"Kalamata, city to produce and create"** are presented in the following Tables.

Sector Emissions	**Agriculture, Forestry and Land Use**	
Lever Change	**Results**	
	Short term	**Long term**
Technology & Infrastructure	1. Preparation of the energy audit study of all pumping units. 2. Preparation of a study for the installation of photovoltaic systems	1. Implementation of energy upgrade works for pumping equipment 2. Installation of photovoltaic power systems to power the pumping units.
Financing	Promotion of investment plan to funding bodies	Promotion of investment plan to funding bodies
Inclusivity	Establishment of a Common Energy Community	Establishment of a Common Energy Community

Table 44. Scenario III: Action Results – Agriculture, Forestry and Land Use

<table>
<tr><th>Emissions Sector</th><th colspan="2">Industrial processes</th></tr>
<tr><th rowspan="2">Lever Change</th><th colspan="2">Results</th></tr>
<tr><th>Short term</th><th>Long term</th></tr>
<tr><td>Technology & Infrastructure</td><td>1. Energy upgrade and equipment efficiency of the Municipal Water Supply and Sewerage Company of Kalamata (DEYAK)
2. Installation of the Photovoltaic Park, 2MW, of DEYAK.
3. Preparation of an energy upgrade study for the equipment of the Kalamata-Messini Water Supply Association and the facilities of the Industrial Park.
4. Implementation of energy inspections of processing units
5. Installation of photovoltaic systems with a capacity of 3.5MW, for manufacturing units.</td><td>1. Implementation of energy upgrade works for the equipment of the Kalamata-Messini Water Supply Association.
2. Implementation of energy upgrade works for the equipment of processing units.
3. Installation of photovoltaic systems with a capacity of 10MW, for manufacturing units.</td></tr>
<tr><td>Governance & Policies</td><td>Promote policies for the establishment of emission standards, calculation for each manufacturing unit.</td><td></td></tr>
<tr><td>Financing</td><td>1. Informing and familiarizing citizens with funding tools and interventions.
2. Preparation of investment plans.</td><td></td></tr>
<tr><td>Inclusivity</td><td>1. Establishment of a common energy community for manufacturing plants.</td><td></td></tr>
<tr><td>Learning</td><td>1. Training – familiarization of members of professional sectors for technological changes in 50% of businesses.
2. Promotion of Green Accounting standards
3. Information and promotion of green procurement.</td><td>1. Training – familiarization of members of professional sectors for technological changes in 50% of businesses.
2. Promotion of Green Accounting standards.
3. Information and promotion of green procurement.</td></tr>
</table>

Table 45. Scenario III: Action Results – Industrial Processes

Emissions Sector	Energy	
Lever Change	Results	
	Short term	Long term
Technology & Infrastructure	1. Completion of interventions at the Kalamata Dance Hall 2. Preparation of intervention studies in the municipal buildings of the Municipal Unit of Kalamata. 3. Preparation of studies for the interventions in the shops of the Central Market of Kalamata 4. Implementation of the interventions, according to the methodology of the above timetable. 5. Installation of a gas plant and construction of a network for large consumers 6. Preparation of implementation studies for the construction and operation of clean electricity production units. 7. Creation of a digital application for the management of all energy data of the Municipality of Kalamata in real time.	1. Implementation of interventions in the Municipal Buildings of the Municipal Unit of Kalamata 2. Implementation of interventions in stores and construction of photovoltaic on the roof of the Central Market of Kalamata. 3. Preparation of studies and interventions in municipal buildings outside the city of Kalamata. 4. Implementation of interventions, according to the methodology of the above timetable 5. Extension of natural gas network 6. Construction of power plants
Governance & Policies	1. Development of information guides for professionals and dissemination of climate neutrality policies 2. Forward funding requests on a sector-by-sector basis. 3. Approval of permits for the construction and operation of power plants	
Financing	1. Preparation of an investment plan for each sector separately and their promotion to funding bodies. 2. Preparation of investment plans for the implementation of the construction of power plants	1. Promotion of investment plans to funding bodies.
Inclusivity	1. Establishment of a common energy community for the sectors of public gathering and temporary residence (tourism sector). 2. Establishment of a common energy community for commerce, offices,	

	health and education.	

Table 46. Scenario III: Action Results – Energy

The direct impacts and co-benefits for citizens are, as in the table:

Effects	
Immediate benefits	Reduction of CO2 emissions from all portfolios by: **81.965,25 tn**
Parallel benefits	
Category	**Description**
FINANCIAL	• Energy saving interventions in pumping units will reduce operating costs and at the same time create more competitive products or services. • Interventions in all forms of business will reduce operating costs as a result of changes in production processes, as well as energy upgrade works, building infrastructure and equipment. • The incorporation of climate neutrality terms by every tourism business creates conditions for special promotion to a demanding audience, sensitive to climate change issues. • The commercial premises covered by the interventions will acquire greater commercial and market value, both for rent and sale. • The production of certified products by manufacturing units or services from the tertiary sector as climate neutral, favors their advertising-promotion and promotion to the market. • The necessary interventions will create new jobs in the construction industry. • The transformation of each activity will lead to the creation of new needs and new jobs. • Creating investment in new forms of energy production creates new jobs and income for many. • With local clean energy production, dependence on energy price volatility is reduced.
ENVIRONMENTAL	• By intervening in the building stock, fossil fuels (oil) are removed and greenhouse gas emissions are reduced. • Increased awareness of the use of raw materials and natural resources and the avoidance of their waste. • Reduction of the quantities of exposed amount of olive oil waste and sewage sludge, by reducing unpleasant odors. • Utilization of waste water from biological treatment.
QUALITY OF LIFE	• Comfort conditions are created for employees and visitors of the

	premises.
INNOVATION	• Participatory planning, implementation of sectoral interventions and establishment of sectoral energy communities. • The optimization of the production processes of each processing unit • The establishment of an Emissions Certificate standard. • The recovery-reuse of energy waste. • The utilization of hidden energy sources (sewage sludge, olive waste). • The management of energy distribution between producers and consumers. • The use of hydrogen systems for energy storage.
DIGITAL TRANSFORMATION	• The installation of systems for recording energy consumption and automation in each production area. • The supervision of energy consumption of municipal buildings will be carried out from a central platform. • The integration of digital applications both in the management of the company's energy resources and in its operating procedures. • The development of an application for the management of energy data in real time.

Table 47. Scenario III: Direct Impacts and Co-benefits for citizens

Scenario IV

Kalamata,
City to learn

KALAMATA
Our mission: go zero!

Kalamata, as a learning city, will be an **ecosystem** in constant action, creating and being fed back by the results it will produce.

Through the **spirit** of the portfolios' actions, the process of **organizing**, **monitoring** and **evaluating** the **climate contract of Kalamata is** highlighted.

The **pilot** actions that have been proposed **aim** to inform, raise awareness and remove the hesitations that citizens have to take action to mitigate the effects of climate change **by participating** in the actions of the climate contract.

The **Citizens'** Information Center will operate as a **OneStopShop** point, which in cooperation with the Communication Office, which **will operate** within the Development Organization of the Municipality of Kalamata, a structure that will implement the Climate Contract, will **co-organize** the information events for citizens, as detailed in the respective actions R.3.02_75 and R.3.03_76, while providing specialized ones daily information to any interested party.

In the implementation phase of actions directly related to citizens or entrepreneurs, the following will be provided:

1. **technical or financial** advisory services
2. Skills acquisition services for a range of new occupations

The **results** that will be created, during the implementation of the actions, will be used by the structure of the **Climate Change** Observatory, to **evaluate** the course of the climate contract, but also for the scientific recording of the **impact** on economic, environmental and social level. Evaluation that will also be taken into account and **redefine policies** decisions of the competent collegiate bodies.

At the same time, **Research** and Innovation **structures will use all data for** research **purposes in the fields** of **energy,** transport**,** circular **economy and** production**.**

The proposed actions are **not** directly **related to** emission reduction, but will **affect** them through the evolution of the contract, with its periodic evaluation. They are organized into the following portfolios:

1. **Pilot actions (**Attach_File: Prtf_R.01_pilot**)**
2. **Research and Innovation Structures (**Attach_Files: Prtf_R.02_R&I**)**
3. Information and Awareness. (**(Attach_Files: Prtf_R.03_Sensitivation**)

The actions of the portfolios in the Transformation Path "**Kalamata, a city that learns**" are described below.

Portfolio R.1	**Pilot actions**	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**
Sensitisation	**Green school**	The action describes a daily day of students at school, recording the emissions observed and proposing interventions to reduce them, during the access and departure of students at school, their stay in the courtyard, but also during the learning process in the classroom or workshops. The action approaches in a holistic way, the sensitization of the whole family through students, through a set of

		interactive and collaborative events, among all members of the student community.
	Smart Farming	The action describes the process of installing environmental data production equipment, which can be used by growers in agricultural production, in order to reduce both the environmental footprint of agricultural products and the waste of natural resources.
	Climate neutral neighborhood west of Artemis Street	The action includes interventions in the area West of Artemis Street, in order to operate as a climate-neutral area, which will include infrastructure of common areas and roads of mild traffic with bioclimatic constructions, the construction of infrastructure of utility networks, as well as the installation of clean energy production units.
	Energy from sea waves	The pilot application describes the possibility of producing energy from the sea waves on the outer part of the Kalamata breakwater, an action that will contribute to making the port green.

Table 48. Description of Portfolio Actions R.1 Pilot actions

Portfolio R.2	**Research and Innovation Structures**	
Emissions Sector	**Portfolio Actions**	
	Action Title	**Description of the Action**
Sensitisation	**Climate Change Observatory of Kalamata**	The Observatory will be the main structure that will process the data and evaluate the progress of the implementation of the climate contract, in a scientific way. At the same time, it will record the economic, social and environmental impact of each action of the climate contract.
	Kalamata Innovation Laboratory	The Laboratory will be the area of research and exploitation of new technological products and methods, along with the evaluation of the effectiveness of digital applications incorporated in the Climate Contract.
	Kalamata Energy Research Institute	The Institute of Energy will promote research and the creation of applications in the field of energy production, storage and distribution.

Table 49. Description of Portfolio Actions R.2 Research and Innovation Structures

Portfolio R.3	Information and Awareness	
Emissions Sector	Portfolio Actions	
	Action Title	Description of the Action
Sensitisation	Circular Economy Center of Kalamata	With the operation of the Center, experiential activities will be provided to familiarize citizens with the reuse of raw materials.
	Citizens' Information Centre	The Information Center will function as a reception and information space to citizens on climate contract actions that directly concern them, such as the renovation of houses, etc.
	Awareness-raising actions	The action will implement an annual roadmap of information and awareness events, in cooperation with the other administrative structures implementing the climate contract.
	Skills acquisition actions	The action will include the organization of any educational process aimed at acquiring knowledge and skills.

Table 50. Description of Portfolio Actions R.3 Information and Awareness Raising

The budget of the portfolios' actions, apart from the pilot application "Green School", which is included in the actions from which it is created, is according to the table the following:

R.1	**Pilot actions**	
R.1.01_67	Green School	0,00
R.1.02_68	Smart Farming	358.137,30
R.1.03_69	Climate neutral neighborhood West of Artemis Street	11.399.910,00
R.1.04_70	Energy from sea waves	150.000,00

11.908.047,30

R.2	**Research and Innovation Structures**	
R.2.01_71	Climate Change Observatory of Kalamata	577.500,00
R.2.02_72	Kalamata Innovation Laboratory	302.500,00
R.2.03_73	Kalamata Energy Research Institute	475.000,00

1.355.000,00

R.3	Information and Awareness	
R.3.01_74	Circular Economy Center of Kalamata	1.202.566,00
R.3.02_75	Citizens' Information Centre	840.000,00
R.3.03_76	Awareness-raising actions	350.000,00
R.3.04_77	Skills acquisition actions	210.000,00
		2.602.566,00
	Total Portfolios	**15.865.613,30**

Table 51. Scenario IV Portfolio Budgeting

With the actions of the portfolios, the city is given the **opportunity** to:

1. to be transformed into an **open** laboratory that will function as **a research** center on energy issues
2. with the operation of the **Innovation Laboratory** and the utilization of digital applications in the operations of the entire ecosystem of the city, the conditions are created for a rapid transition to the META era.
3. The transfer of results from the laboratories to the city field will attract **investments** that will create jobs.
4. The recording and periodic evaluation of the **economic**, **social and environmental impact of the implementation of the climate contract will create the prospect of** addressing **the social** and **environmental problems** that will appear in the future in the city.

The **problems** on this route are mainly related to the necessary permits for the installation of **innovative** methods of energy production.

The **weaknesses** of the implementation of the actions include **the lack** of scientific staff at local level, the necessary **coordination** and cooperation between the different structures, as well as the **way of** communication with citizens.

The **operation** of the research structures will **be based on** sponsorships with collaborating private entities, while through awareness actions, **policies of incentives** to citizens will be followed to increase their participation.

The objectives of the actions are:

1. The **mobilization** of citizens through information actions
2. Scientific **monitoring** of the impact of actions on society
3. The recording of the results of the implementation of the climate contract, both for **the feedback** of the content of the actions, as well as for the development of **research** in the fields of energy, mobility and economy.

The **tools**, financial **resources** and **policies** with which the proposed interventions will be implemented are:

I. The **intellectual** capital of the city and the **strategies** developed by the Municipality, such as:

1. The Sustainable Energy and Climate Plan (SEAP)
2. The strategy for the **Digital Transformation of** the Municipality of Kalamata.

II. Policies arising from state **laws**, such as:

1. The **climate** law
2. The National **Energy** and Climate Plan (NECP)

III. Policies emanating from international organisations, such as

1. European **Green Deal**
2. **Sustainable** Cities and Communities (Sustainable Development Goal 11 - UN)
3. Climate action (Sustainable Development Goal 13 - UN)

IV. The resources for financing assistance shall be drawn from:

1. Funding programmes **directly** from the European Union
2. From the **NSRF** 2014-2021 and 2021-2027, for Greece
3. From **government** funding programs
4. From **Regional** funding programs
5. From **Municipal Funds**
6. From **private investments**
7. Private citizen participation

For the co-formulation of the interventions included in the portfolios of the Impact Pathway entitled "**Kalamata:** a city that learns", collaborations **were developed with:**

1. the Centre for Economic Research Planning
2. the University of Peloponnese
3. the Quest Group of IT companies and their Innovation Hub IQNOVUS
4. Mytilineos Energy Group and AVOKADO Innovation Hub
5. Private Energy Service Providers (ESCO)

Everyone accepts, in the field they deserve, the proposed interventions, in accordance with the attached cooperation protocols.

The timetable for the implementation of the actions of the portfolios of the Transformation Path is as follows:

Code. Action	**R.1**	**R.2**	**R.3**	**TOTALS**
Budget	**11.908.047**	**1.355.000**	**2.602.566**	**15.865.613**
2024	974.640	242.500	410.513	1.627.653
2025	1.362.760	187.500	290.257	1.840.516
2026	1.279.079	185.000	342.757	1.806.835
2027	1.031.569	185.000	423.885	1.640.454
2028	2.460.000	185.000	434.385	3.079.385

2029	3.200.000	185.000	350.385	3.735.385
2030	1.600.000	185.000	350.385	2.135.385
	11.908.047	**1.355.000**	**2.602.566**	**15.865.613**

Table 52. Scenario IV: Timetable for Implementation and Results per year

The chart illustrating portfolio budget implementation is as follows:

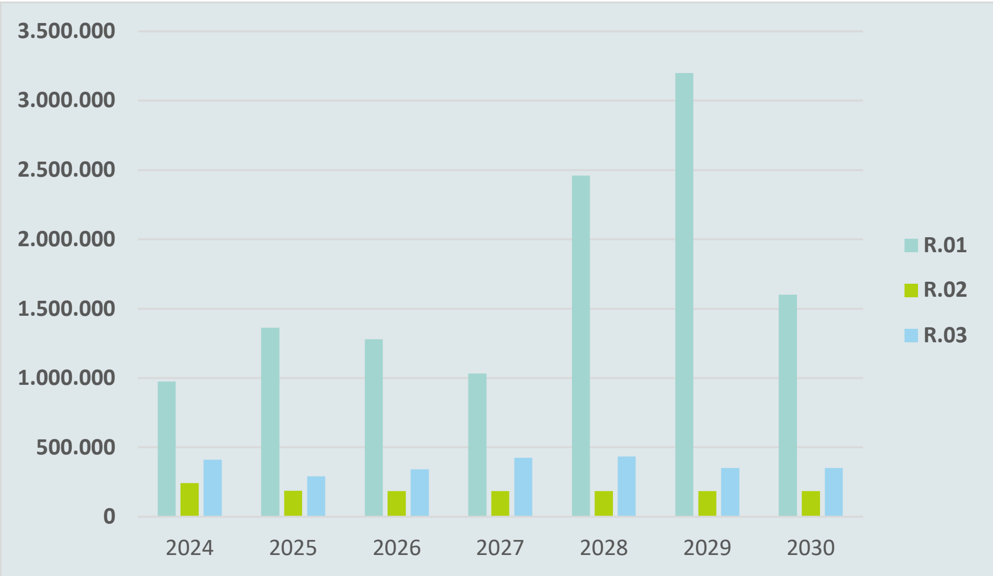


Image 14. Scenario IV: Visualization of portfolio budget implementation

The results and impacts of Scenario IV actions are illustrated in the following Tables.

Lever Change	Results	
	Short term	**Long term**
Technology & Infrastructure	• Preparation of studies for the configuration of common areas and roads of mild traffic in the area west of Artemis Street. • Preparation of studies for the construction of underground networks of public utilities in the area west of Artemis Street. • Implementation of the technical projects of the pilot action of the	• Construction of mobility infrastructure, networks, as well as the central cooling and heating unit in the area west of Artemis Street, • Implementation of the interventions of the action "**Smart Farming**". • Implementation of the marine wave power plant.

	"**Green School**".	• Creation of the Center for Circular Economy.
Financing	• Submission of a financing proposal for the construction of infrastructure in the area of Artemis	
Inclusivity	• Establishment and operation of the Citizens' Information Centre • Organization of a roadmap of awareness events.	• Implementation of an annual events roadmap.
Learning	• Establishment and operation of Research and Innovation structures. • Organization and implementation of skills acquisition training processes	• Operation of Research and Innovation structures. • Organization and implementation of skills acquisition training processes

Table 53. Scenario IV: Results of actions

Below, the direct impacts and co-benefits for citizens are presented.

Effects	
Immediate benefits	Reduction of CO_2 emissions does not occur from the actions, because they concern either emissions that have been calculated in other actions, such as the "Green School", or because they are actions of services at research level.
Parallel benefits	
Category	**Description**
FINANCIAL	• The operation of the Research and Innovation Centers will attract scientific staff and mobilize investments in the respective fields. • The city will gain international visibility and increase tourist income. • New jobs will be created.
ENVIRONMENTAL	• The operation of the Circular Economy Center will contribute to citizens' awareness regarding the reuse of raw materials. • The operation of the climate-neutral region will reduce the need to use carbon fossil fuels.
SOCIAL	• The operation of the Information Center will support vulnerable social groups so that they become familiar with the proposed interventions and the benefits they will have.
INNOVATION	• Research and Innovation structures will create innovative products and applications, benefiting the city.
DIGITAL TRANSFORMATION	• In the city's operations, every new technology will be integrated.

Table 54. Scenario IV: Impact of actions

B-2.3: Summary strategy on residual emissions

Kalamata's residual emissions strategy will be based on **nature-based** solutions that will contribute to both climate change mitigation and adaptation. The proposed solutions, with the shading they will offer and the acceleration of evapotranspiration, will help reduce the temperature during the summer months, while in the case of green roofs they will offer insulation to buildings from heat and cold. At the same time we will They also act as carbon sinks.

In this context, the following will be done:

- construction of green roofs and facades;
- Linear plantings of trees and plants along roads, parks and water bodies.
- development of peri-urban forests on an area of 200 hectares

For this purpose, a detailed study will be carried out to identify the areas to be included in the project, the estimated costs and the corresponding impacts in terms of CO2 capture. Incentives will be given to residents, professionals and entrepreneurs to participate in the extensive green project of Kalamata.

It is estimated that these actions will further support the minimisation of the use of vehicles for urban transport.

All these actions will be monitored for their progress and impact on CO2 removals. If efforts do not ensure that residual CO2 emissions remain, more measures will be taken, such as building renewable energy plants, further electrification of private cars and full electrification of buildings.

4.2 Section B-2: Table of Climate Neutrality Portfolios

The climate contract portfolios are described in the previous section B-1.

The proposed climate contract interventions were documented in **77** related actions, organized in 16 portfolios **and included** in four Transformation Pathways **or** Impact Pathways**, according to the table below. Each portfolio is analyzed with its actions in the corresponding attached file.**

Impact Pathway	CODE	PROTFOLIO	Attachment File
Kalamata, city to live in	**L.1**	Regeneration of urban areas	Prtf.L.1_Vivification_En
	L.2	Aesthetics and functional upgrading of public space	Prtf.L.2_QualityOfLife_En
	L.3	Kalamata, clean city	Prtf.L.3_CityClean_En
	L.4	Housing, climate neutral	Prtf.L.4_House_En
	L.5	Sports and Education	Prtf.L.5_School-Gym_En
Kalamata, low-emission mobility	**M.1**	Sustainable Urban Mobility Infrastructure	Prtf.M.1_Mob_Infra_En
	M.2	Promotion of travel by environmentally friendly means	Prtf.M.2_Mob_services_En
	M.3	Organization of Freight Transport	Prtf.M.3_Mob_transport_En
	M.4	Promoting travel with low-emission vehicles	Prtf.M.4_Mob_Vehicles_En
Kalamata, city to produce and create	**P.1**	Emission reduction actions in the agricultural sector	Prtf.P.1_1st_Sector_En
	P.2	Transformation of manufacturing and craft units	Prtf.P.2_2nd_Sector_En
	P.3	Energy upgrading of tertiary sector buildings and facilities	Prtf.P.3_3rd_Sector_En
	P.4	Energy generation, storage and distribution systems	Prtf.P.4_Energy_En
Kalamata, a city that learns	**R.1**	Pilot Research Activities	Prtf.R.1_pilot_En
	R.2	Research and Innovation Structures	Prtf.R.2_R&I_En
	R.3	Information and Awareness	Prtf.R.3_Sensitivation_En

Table 55. Climate Contract scenarios and attachments per Portfolio

4.3 Module B-3 Monitoring, Evaluation and Learning Indicators

The proposed indicators, selected from NZC's comprehensive sets of indicators, are as follows:

ID	Indicator Name	Unit of Measurement	Short description
01	Greenhouse Gas Emissions (GHGs)	tn CO2/year	It is the total emissions per sector
02	Electricity consumption.	MWh/year	It is the emissions from electricity consumption
03	Liquid Fuel Energy Consumption	MWh/year	It is the emissions from the consumption of liquid fuels.
04	Energy dependency	%	It expresses the proportion of imports in total consumption
05	Local RES production	%	It concerns the percentage of energy from RES produced locally
06	Greenhouse Gas (GHG) emissions from grid energy use	tn CO2/year	It concerns emissions resulting from the supply of energy from the transmission network

Table 56. Proposed Monitoring, Evaluation and Learning Indicators

B-3.1: Impact Pathways
The above defined indicators are then applied to each Impact Pathway, according to the following Tables.

Transformation path		Kalamata, city to live in				
Scope of indicator	**Related Actions**	**And. D**	**Indicator name**	**Target Values**		
				2025	**2027**	**2030**
ENERGY	L.4.01_44 L.5.01_45 L.5.02_46	ID.01_L-01	Greenhouse gas emissions from **Static Energy**	58.975	29.008	1.106

WASTE	L.3.01_39 L.3.02_40 L.3.03_41 L.3.04_42 L.3.05_43	ID.01_L-02	Greenhouse Gas Emissions from **Waste**	4.678	3.543	1.462
BUILT ENVIRONMENT ENERGY	L.2.06_37 L.4.01_44 L.5.01_45 L.5.02_46	ID.06_L-03	Greenhouse Gas (GHG) emissions from grid energy use	41.959	18.949	700
BUILT ENVIRONMENT ENERGY	L.2.06_37 L.4.01_44 L.5.01_45 L.5.02_46	ID.04_L-04	Energy Dependency	96,20%	85,08%	24,06%
ENERGY	L.4.01_44 L.5.01_45 L.5.02_46	ID.05_L-05	Local renewable energy production	3,80%	14,92%	75,94%
ENERGY	L.4.01_44 L.5.01_45 L.5.02_46	ID.03_L-06	Liquid Fuel Energy Consumption	70.315	46.140	2.182
BUILT ENVIRONMENT ENERGY	L.2.06_37 L.4.01_44 L.5.01_45 L.5.02_46	ID.02_L-07	Electricity Consumption	109.940	91.513	57.927

Table 57. Proposed Scenario Monitoring, Evaluation and Learning Indicators I: Kalamata, city to live in

Transformation path		**Kalamata, low-emission mobility**				
Scope of indicator	**Related Actions**	**And. D**	**Indicator name**	**Target Values**		
				2025	**2027**	**2030**
TRANSPORT - MOBILITY	M.3.2-15 M.4.2-21 M.4.3-22 M.4.4-23	ID.01_M-01	Greenhouse Gas Emissions from **Transport**	54.758	32.650	520
TRANSPORT - MOBILITY	M.3.2-15 M.4.2-21 M.4.3-22	ID.02_M-02	Electricity consumption in transport	4.515	6.793	9.061

	M.4.4-23					
TRANSPORT - MOBILITY	M.3.2-15 M.4.2-21 M.4.3-22 M.4.4-23	ID.03_M-03	Energy consumption of liquid fuels in transport	222.785	144.153	0

Table 58. Proposed Scenario II Monitoring, Evaluation and Learning Indicators: Kalamata, low-emission transportation

Transformation path		**Kalamata, city to produce and create**				
Scope of indicator	**Related Actions**	**And. D**	**Indicator name**	**Target Values**		
				2025	**2027**	**2030**
AGRICULTURE, FORESTRY, LAND USE	P.1.01_47	ID.01_P-01	Greenhouse Gas Emissions **Agricultural Sector**	3.852	2.834	1.910
INDUSTRIAL PROCESSES	P.2.01_48 P.2.02_49 P.2.03_50 P.2.04_51	ID.01_P-02	Greenhouse Gas Emissions from **Industrial Processes**	13.336	6.047	303
ENERGY	P.3.01_52 P.3.02_53 P.3.03_54 P.3.04_55 P.3.05_56 P.3.06_57 P.3.07_58 P.3.08_59	ID.01_P-03	Greenhouse Gas Emissions of Buildings **Tertiary sector**	40.576	20.810	1.941
AGRICULTURE, FORESTRY, LAND USE INDUSTRIAL PROCESSES ENERGY	P.1.01_47 P.2.01_48 P.2.02_49 P.2.03_50 P.2.04_51 P.3.01_52 P.3.02_53 P.3.03_54 P.3.04_55	ID.06_P-04	Greenhouse Gas (GHG) emissions from grid energy use	50.875	24.837	2.116

	P.3.05_56 P.3.06_57 P.3.07_58 P.3.08_59					
AGRICULTURE, FORESTRY, LAND USE INDUSTRIAL PROCESSES ENERGY	P.1.01_47 P.2.01_48 P.2.02_49 P.2.03_50 P.2.04_51 P.3.01_52 P.3.02_53 P.3.03_54 P.3.04_55 P.3.05_56 P.3.06_57 P.3.07_58 P.3.08_59	ID.04_P-05	Energy Dependence of Production Units	95,33%	84.65%	51,15%
AGRICULTURE, FORESTRY, LAND USE INDUSTRIAL PROCESSES ENERGY	P.1.01_47 P.2.01_48 P.2.02_49 P.2.03_50 P.2.04_51 P.3.01_52 P.3.02_53 P.3.03_54 P.3.04_55 P.3.05_56 P.3.06_57 P.3.07_58 P.3.08_59	ID.05_P-06	Local production of renewable energy in production units	4,67%	15,35%	48,85%
AGRICULTURE, FORESTRY, LAND USE INDUSTRIAL PROCESSES ENERGY	P.1.01_47 P.2.01_48 P.2.02_49 P.2.03_50 P.2.04_51 P.3.01_52 P.3.02_53 P.3.03_54 P.3.04_55 P.3.05_56 P.3.06_57	ID.02_P-07	Electricity consumption by production units	132.552	114.047	80.500

	P.3.07_58 P.3.08_59					
AGRICULTURE, FORESTRY, LAND USE INDUSTRIAL PROCESSES ENERGY	P.1.01_47 P.2.01_48 P.2.02_49 P.2.03_50 P.2.04_51 P.3.01_52 P.3.02_53 P.3.03_54 P.3.04_55 P.3.05_56 P.3.06_57 P.3.07_58 P.3.08_59	ID.03_P-08	Energy consumption of liquid fuels by production units	29.217	22.913	11.434

Table 59. Proposed Scenario III Monitoring, Evaluation and Learning Indicators: Kalamata, city to produce and create

B-3.2: Indicator metadata
The metadata for each proposed indicator is presented below.

Index metadata	
Index Code	**ID.01_L-01**
Indicator name	Greenhouse Gas Emissions from **Static Energy of Buildings**
Index unit	tn CO_2
Definition	Greenhouse gas emissions (mainly CO_2 emissions) from the operation of homes, public schools and sports facilities.
Calculation	Based on the GPC protocol, the calculation is made by multiplying the amount of energy multiplied by the corresponding factor
Indicator box	
The indicator measures direct impacts	YES
If so, which emission source sectors does it affect?	Houses Public Buildings and Facilities
The indicator measures indirect effects	NO
If so, with what parallel benefit does it count?	
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, city to live in
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	Electricity Transmission Network Operator
Expected availability	Direct
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 60. Index metadata ID.01_L-01

Index metadata		
Index Code	**ID.01_L-02**	
Indicator name	Greenhouse Gas Emissions from **Waste**	
Index unit	tn CO2	
Definition	Greenhouse gas emissions (mainly CO2 emissions) from the waste management process.	
Calculation	Based on the GPC protocol, the calculation is made by multiplying the quantity of waste by the corresponding factor	
Indicator box		
The indicator measures direct impacts		YES
If so, which emission source sectors does it affect?		Waste
The indicator measures indirect effects		NO
If so, with what parallel benefit does it count?		
Can the indicator be used to monitor impact pathways?		YES
If so, what impact trajectory does NZC relate to?		Kalamata, city to live in
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?		[yes/no]
Data requirements		
Expected data - Source		Municipality of Kalamata
Expected availability		Immediate
Recommended collection interval		One year
References		
Deliverables describing the indicator		
Other indicator systems using this indicator		

Table 61. Index metadata ID.01_L-02

Index metadata	
Index Code	**ID.06_L-03**
Indicator name	Greenhouse Gas (GHG) emissions from the use of energy through the grid.
Index unit	tn CO2
Definition	Greenhouse gas emissions (mainly CO2 emissions) from the requested through the electricity transmission network, consumed in homes, public schools and sports facilities.
Calculation	Based on the GPC protocol, the calculation is made by multiplying the amount of energy by the corresponding coefficient, as formed annually, based on the composition of the energy mix.

Indicator box	
The indicator measures direct impacts	YES
If so, which emission source sectors does it affect?	Electrical energy
The indicator measures indirect effects	NO
If so, with what parallel benefit does it count?	
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, city to live in
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	Electricity Transmission Network Operator
Expected availability	Immediate
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 62. Index metadata ID.06_L-03

Index metadata	
Index Code	**ID.04_L-04**
Indicator name	Energy Dependency
Index unit	tn CO2
Definition	The index determines consumers' dependence on suppliers of both liquid fuels and electricity.
Calculation	It is the percentage of total energy (Electricity and Fuel) channeled to homes, street lighting, schools and sports facilities, through supply networks, to the total energy required for their operation.
Indicator box	
The indicator measures direct impacts	NO
If so, which emission source sectors does it affect?	
The indicator measures indirect effects	YES
If so, with what parallel benefit does it count?	The independence from fossil fuels and the supply of energy through the grid.
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, city to live in
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	Electricity Transmission Network Operator
Expected availability	Immediate
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 63. Index metadata ID.04_L-04

Index metadata	
Index Code	**ID.05_L-05**
Indicator name	Local renewable energy production
Index unit	%
Definition	The index determines the penetration of RES in the local energy mix of electricity consumption.
Calculation	It is the percentage of self-generated energy from photovoltaic systems and geothermal energy, installed in homes, schools and sports facilities, to the total energy required for their operation.
Indicator box	
The indicator measures direct impacts	NO
If so, which emission source sectors does it affect?	
The indicator measures indirect effects	YES
If so, with what parallel benefit does it count?	The penetration of RES indirectly the reduction of energy costs.
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, city to live in
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	• Electricity Transmission Network Operator • Municipality of Kalamata
Expected availability	Immediate
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 64. Index metadata ID.05_L-05

Index metadata	
Index Code	**ID.03_L-06**
Indicator name	Energy consumption of liquid fuels
Index unit	MWh/year
Definition	The index determines the energy consumption of liquid fuels used by homes, schools and sports facilities.
Calculation	It is derived from the volume of fuels per category multiplied by their conversion factor into energy.
Indicator box	
The indicator measures direct impacts	NO
If so, which emission source sectors does it affect?	
The indicator measures indirect effects	YES
If so, with what parallel benefit does it count?	Getting rid of fossil fuels
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, city to live in
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	Statistics from SEPDEM and the country's energy balance.
Expected availability	Immediate
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 65. Index metadata ID.03_L-06

Index metadata		
Index Code	**ID.02_L-07**	
Indicator name	Electricity consumption	
Index unit	MWh/year	
Definition	The indicator determines the electricity consumption used by homes, schools and sports facilities.	
Calculation	It results from the data received through the Network Operator (HEDNO)	
Indicator box		
The indicator measures direct impacts		NO
If so, which emission source sectors does it affect?		
The indicator measures indirect effects		YES
If so, with what parallel benefit does it count?		The degree of electrification and indirectly the corresponding energy costs.
Can the indicator be used to monitor impact pathways?		YES
If so, what impact trajectory does NZC relate to?		Kalamata, city to live in
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?		[yes/no]
Data requirements		
Expected data - Source		• Electricity Transmission Network Operator • Municipality of Kalamata
Expected availability		Direct
Recommended collection interval		One year
References		
Deliverables describing the indicator		
Other indicator systems using this indicator		

Table 66. Index metadata ID.02_L-07

Index metadata	
Index Code	**ID.01_M-01**
Indicator name	Greenhouse gas emissions from transport
Index unit	tn CO2
Definition	Greenhouse gas emissions (mainly CO2 emissions) from private, commercial and public transport.
Calculation	Based on the GPC protocol, the calculation is made by multiplying the quantity of fuel per category by the corresponding factor

Indicator box	
The indicator measures direct impacts	YES
If so, which emission source sectors does it affect?	Private transfers Commercial transport Public and Municipal Transport
The indicator measures indirect effects	NO
If so, with what parallel benefit does it count?	
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, low-emission mobility
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	Statistics from SEPDEM and the country's energy balance.
Expected availability	Immediate
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 67. Index metadata ID.01_M-01

Index metadata	
Index Code	**ID.02_M-02**
Indicator name	Electricity consumption in transport
Index unit	MWh/year
Definition	The index determines the consumption of electricity used in transport and indirectly calculates the penetration of electric vehicles.
Calculation	It results from the data received through the Network Operator (HEDNO)
Indicator box	
The indicator measures direct impacts	NO
If so, which emission source sectors does it affect?	
The indicator measures indirect effects	YES
If so, with what parallel benefit does it count?	The degree of penetration of electromobility and indirectly the corresponding economic benefit
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, low-emission transportation.
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	• Electricity Transmission Network Operator • Municipality of Kalamata
Expected availability	Direct
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 68. Metadata Index ID.02_M-02

Index metadata	
Index Code	**ID.03_M-03**
Indicator name	Energy consumption of liquid fuels in transport
Index unit	MWh/year
Definition	The indicator determines the energy consumption of liquid fuels used in transport.
Calculation	It is derived from the volume of fuels per category multiplied by their conversion factor into energy.
Indicator box	
The indicator measures direct impacts	NO
If so, which emission source sectors does it affect?	
The indicator measures indirect effects	YES
If so, with what parallel benefit does it count?	Getting rid of fossil fuels
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, low-emission transportation.
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	Statistics from SEPDEM and the country's energy balance.
Expected availability	Immediate
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 69. Index metadata ID.03_M-03

Index metadata		
Index Code	**ID.01_P-01**	
Indicator name	Greenhouse gas emissions from the agricultural sector	
Index unit	tn CO_2	
Definition	Greenhouse gas emissions (mainly CO_2 emissions) from the consumption of liquid fuels of machinery in the agricultural sector.	
Calculation	Based on the GPC protocol, the calculation is made by multiplying the quantity of fuel per category by the corresponding factor	
Indicator box		
The indicator measures direct impacts		YES
If so, which emission source sectors does it affect?		Agricultural sector (Agriculture - Livestock)
The indicator measures indirect effects		NO
If so, with what parallel benefit does it count?		
Can the indicator be used to monitor impact pathways?		YES
If so, what impact trajectory does NZC relate to?		Kalamata, city to produce and create
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?		[yes/no]
Data requirements		
Expected data - Source		Statistics from SEPDEM and the country's energy balance.
Expected availability		Immediate
Recommended collection interval		One year
References		
Deliverables describing the indicator		
Other indicator systems using this indicator		

Table 70. Metadata Index ID.01_P-01

Index metadata		
Index Code	**ID.01_P-02**	
Indicator name	Greenhouse Gas Emissions from Industrial Processes	
Index unit	tn CO_2	
Definition	Greenhouse gas emissions (mainly CO_2 emissions) from the operation of craft and manufacturing units.	
Calculation	Based on the GPC protocol, the calculation is made by multiplying the amount of energy per category multiplied by the corresponding factor	
Indicator box		
The indicator measures direct impacts	YES	
If so, which emission source sectors does it affect?	Industrial processes	
The indicator measures indirect effects	NO	
If so, with what parallel benefit does it count?		
Can the indicator be used to monitor impact pathways?	YES	
If so, what impact trajectory does NZC relate to?	Kalamata, city to produce and create	
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]	
Data requirements		
Expected data - Source	Statistics from SEPDEM and the country's energy balance. Data from Network Administrator.	
Expected availability	Immediate	
Recommended collection interval	One year	
References		
Deliverables describing the indicator		
Other indicator systems using this indicator		

Table 71. Index metadata ID.01_P-02

Index metadata		
Index Code	**ID.01_P-03**	
Indicator name	Greenhouse gas emissions of tertiary sector buildings	
Index unit	tn CO2	
Definition	Greenhouse gas emissions (mainly CO2 emissions) from the operation of tertiary sector buildings.	
Calculation	Based on the GPC protocol, the calculation is made by multiplying the quantity of fuel per category by the corresponding factor	
Indicator box		
The indicator measures direct impacts		YES
If so, which emission source sectors does it affect?		Private buildings other than residential buildings Public buildings and facilities
The indicator measures indirect effects		NO
If so, with what parallel benefit does it count?		
Can the indicator be used to monitor impact pathways?		YES
If so, what impact trajectory does NZC relate to?		Kalamata, city to produce and create
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?		[yes/no]
Data requirements		
Expected data - Source		Statistics from SEPDEM and the country's energy balance. Data from Network Administrator.
Expected availability		Immediate
Recommended collection interval		One year
References		
Deliverables describing the indicator		
Other indicator systems using this indicator		

Table 72. Index metadata ID.01_P-03

Index metadata	
Index Code	**ID.06_P-04**
Indicator name	Greenhouse Gas (GHG) emissions from the use of energy through the grid.
Index unit	tn CO2
Definition	Greenhouse gas emissions (mainly CO2 emissions) from the requested through the electricity transmission network, in all actions of the portfolios "Kalamata, city to produce and create"
Calculation	Based on the GPC protocol, the calculation is made by multiplying the amount of energy by the corresponding coefficient, as formed annually, based on the composition of the energy mix.

Indicator box	
The indicator measures direct impacts	YES
If so, which emission source sectors does it affect?	Electricity (Scop2)
The indicator measures indirect effects	NO
If so, with what parallel benefit does it count?	
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, a city to produce and create.
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	Electricity Transmission Network Operator
Expected availability	Immediate
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 73. Index metadata ID.06_P-04

Index metadata	
Index Code	**ID.04_P-05**
Indicator name	Energy Dependency
Index unit	%
Definition	The index determines consumers' dependence on suppliers of both liquid fuels and electricity.
Calculation	It is the percentage of total energy (Electricity and Fuel) channeled to the facilities and means of transport of the "Kalamata, city to produce and create" portfolios, through supply networks, to the total energy required for their operation.

Indicator box	
The indicator measures direct impacts	NO
If so, which emission source sectors does it affect?	
The indicator measures indirect effects	YES
If so, with what parallel benefit does it count?	The independence from fossil fuels and the supply of energy through the grid.
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, city to produce and create
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	Electricity Transmission Network Operator
Expected availability	Immediate
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 74. Index metadata ID.04_P-05

Index metadata	
Index Code	**ID.05_P-06**
Indicator name	Local production of renewable energy in production units.
Index unit	%
Definition	The index determines the penetration of RES in the local energy mix of electricity consumption.
Calculation	It is the percentage of self-generated energy from photovoltaic systems installed in the buildings and facilities included in the Portfolio to the total energy required for their operation.
Indicator box	
The indicator measures direct impacts	NO
If so, which emission source sectors does it affect?	
The indicator measures indirect effects	YES
If so, with what parallel benefit does it count?	The penetration of RES and indirectly the reduction of energy costs.
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, city to produce and create
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	• Electricity Transmission Network Operator • Municipality of Kalamata
Expected availability	Immediate
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 75. Index metadata ID.05_P-06

Index metadata	
Index Code	**ID.02_P-07**
Indicator name	Electricity consumption by production units.
Index unit	MWh/year
Definition	The index determines the electricity consumption in the buildings and facilities of the "Kalamata, city to produce and create" portfolios.
Calculation	It results from the data received through the Network Operator (HEDNO)

Indicator box	
The indicator measures direct impacts	NO
If so, which emission source sectors does it affect?	
The indicator measures indirect effects	YES
If so, with what parallel benefit does it count?	The degree of electrification and indirectly the corresponding energy costs.
Can the indicator be used to monitor impact pathways?	YES
If so, what impact trajectory does NZC relate to?	Kalamata, city to produce and create
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?	[yes/no]
Data requirements	
Expected data - Source	• Electricity Transmission Network Operator • Municipality of Kalamata
Expected availability	Direct
Recommended collection interval	One year
References	
Deliverables describing the indicator	
Other indicator systems using this indicator	

Table 76. Metadata Index ID.02_P-07

Index metadata		
Index Code	**ID.03_P-08**	
Indicator name	Energy consumption of liquid fuels by production units.	
Index unit	MWh/year	
Definition	The index determines the energy consumption of liquid fuels used by the facilities and means of transport of the "Kalamata, city to produce and create" portfolios.	
Calculation	It is derived from the volume of fuels per category multiplied by their conversion factor into energy.	
Indicator box		
The indicator measures direct impacts		NO
If so, which emission source sectors does it affect?		
The indicator measures indirect effects		YES
If so, with what parallel benefit does it count?		Getting rid of fossil fuels
Can the indicator be used to monitor impact pathways?		YES
If so, what impact trajectory does NZC relate to?		Kalamata, a city to produce and create.
Is the index captured by existing CDP/SCIS/Covenant of Mayors platforms?		[yes/no]
Data requirements		
Expected data - Source		Statistics from SEPDEM and the country's energy balance.
Expected availability		Immediate
Recommended collection interval		One year
References		
Deliverables describing the indicator		
Other indicator systems using this indicator		

Table 77. Index metadata ID.03_P-08

5. Part C – Facilitating climate neutrality by 2030

Part C 'Facilitating climate neutrality by 2030' aims to describe any interventions that facilitate, i.e. in terms of organisational framework or collaborative governance models, or are related to social innovations – designed to support and enable the climate action portfolios described in Module B-2, as well as to pursue co-benefits outlined in the impact trajectory (Module B-1).

5.1 Module C-1 Innovation Interventions in Organizations and Governance

Section C-1 "Innovation interventions in organisations and governance" consists of a summary table listing organisational and administrative interventions describing their impact (C-1.1) and a section for more detailed descriptions and comments (C-1.2).

C-1.1: Activation of organisational and governance interventions

The following tables present in detail how organizational and governance interventions are activated.

Name of intervention	1. Climate Neutrality Transition Group		
Description	The Mayor of Kalamata formed the Transition Team from representatives of city bodies, from representatives of scientific disciplines, from professionals in respective fields, as well as from executives of the Municipality of Kalamata, with the aim of preparing the content for the drafting of the city's Climate Contract, as well as the political supervision of its implementation. The Group, headed by the Mayor, consists of: **I.** The five-member Coordination Team **II.** The coordinators at the head of the following intervention axes: 1. Transport – Mobility 2. Buildings 3. Energy 4. Built and natural environment 5. Resilience 6. Waste and Circular Economy 7. Economy – Society **III.** the 26 rapporteurs, as heads of the thematic units from each axis. The work of the transition team was supported by external partners, coming either from universities or from professional sectors.		
Jurisdiction	**Municipality of Kalamata**		
	Stakeholders	**Effect on the goal**	**Effect on co-benefits**

	• Municipality of Kalamata • Universities • Business executives • Professional sectors	The intervention area of the actions of the Climate Contract proposed covers all possible sources of emissions and at the same time examines the respective causes, thus directly affecting the achievement of the target.	In the proposed actions, there is a full analysis of the co-benefits as a result of the operation of the team members.

Table 78. Organizational and Governance Interventions: 1. Climate Neutrality Transition Team

Name of intervention	**2. Management Structure for the implementation of the Climate Contract**		
Description	The Municipality of Kalamata has established, as provided by law, an administrative structure under the name: "Development Organization of the Municipality of Kalamata" and the distinctive title AEIFOROS POLI, in order to support the functions of the Municipality, in the implementation of development programs. For the implementation of the actions of the Climate Contract of Kalamata, the staffing of the administrative structure is required, which, acting within the legal frameworks, will carry out the administrative and financial functions, will supervise all monitoring systems, will prepare the periodic evaluation reports, will organize the information and awareness events, and whatever else is required, regarding the implementation of the actions of the Climate Contract.		
Jurisdiction	**Development Organization of the Municipality of Kalamata "SUSTAINABLE CITY"**		
	Stakeholders	**Impact on goal**	**Effect on co-benefits**
	Municipality of Kalamata	It will carry out the daily operational needs for the implementation of the Climate Contract.	The implementation of all actions

Table 79. Organizational and Governance Interventions: 2. Management Structure for the implementation of the Climate Contract

Name of intervention	**3. Network of Cities "ClimaNet"**
Description	The Municipality of Kalamata participates together with the Greek Municipalities of Athens, Thessaloniki, Ioannina, Trikala, Kozani and the Limassol Municipality from Cyprus, which are also members of the Mission of the Cities, in a network

	called ClimaNet, which aims to support Municipalities to address funding issues, the adoption of legislative acts and the formulation of policies, at local level. regional, national and European level.		
Jurisdiction	**Board of Directors of ClimaNet Network**		
	Stakeholders	**Impact on goal**	**Effect on co-benefits**
	MUNICIPALITIES Kalamata, Athens Thessaloniki, Ioannina Trikala, Kozani, Limassol	The promotion of the network's actions will support the transition of Municipalities towards climate neutrality.	The promotion of the network's actions will support the transition of Municipalities towards climate neutrality, with a positive impact and parallel benefits for citizens

Table 80. Organizational and Governance Interventions: 3. Network of Cities "ClimaNet"

Name of intervention	**4. Network of Municipalities of Peloponnese Region**		
Description	The Municipality of Kalamata is the only Municipality from the Peloponnese Region that participates in the Mission of 100 cities and for the promotion of good practices and for the information-sensitization of citizens, participates in a group of 14 Municipalities, of the Peloponnese Region, through a cooperation protocol. With the collaborations within the network, similar actions are expected to be taken by neighboring municipalities in order to accelerate climate neutrality.		
Jurisdiction	**Regional Union of Peloponnese Municipalities**		
	Stakeholders	**Impact on goal**	**Effect on Co-benefits**
	Municipalities of Peloponnese Region 1) Municipality of Argos – Mycenae, Prefecture of Argolis 2) Municipality of Nafplio, Prefecture of Argolis 3) Municipality of Epidaurus, Prefecture of Argolis 4) Municipality of Ermionida, Prefecture of Argolis	Through the exchange of good practices, the improvement of the self-assessment system for the implementation and achievement of the climate contract target is achieved.	

	5) Municipality of South Kynouria, Arcadia Prefecture 6) Municipality of Xylokastro – Evrostini, Prefecture of Korinthia 7) Municipality of Sparta, Laconia Prefecture 8) Municipality of Evrotas, Prefecture of Laconia 9) Municipality of Monemvasia, Prefecture of Laconia 10) Municipality of Elafonisos, Laconia Prefecture 11) Municipality of Messini, Messinia Region 12) Municipality of Pylos-Nestor, Messinia Prefecture 13) Municipality of Trifylia, Messinia Region 14) Municipality of Oichalia, Prefecture of Messinia		

Table 81. Organizational and Governance Interventions: 4. Network of Municipalities of Peloponnese Region

Name of intervention	**5. Collaborations with Universities and Science Centers**		
Description	The Municipality of Kalamata has developed collaborations with research centers and laboratories of Universities, which ensure the scientific documentation of the content of the climate contract.		
Jurisdiction	**The Municipality of Kalamata**		
	Stakeholders	**Impact on goal**	**Effect on co-benefits**
	NATIONAL TECHNICAL UNIVERSITY OF ATHENS **1.** Department of Transport Engineering of the National Technical University of Athens **2.** Electronic Sensors Laboratory of the School of Electrical and Computer Engineering, National Technical University of Athens **3.** Department of Geography & Regional Planning, School of Rural	With the collaborations that the Municipality of Kalamata has developed with universities and research institutions, it will receive the necessary scientific	The implementation of innovative and scientifically substantiated actions, create new jobs and ensure the results related to mobility, public health and entrepreneurship.

	and Surveying and Geoinformatics Engineering, National Technical University of Athens (NTUA) **4.** Decision Systems & Management Laboratory, School of Electrical and Computer Engineering, National Technical University of Athens, **5.** Laboratory of Spatial Planning and Urban Development of the School of Architecture of the National Technical University of Athens **UNIVERSITY OF PATRAS** **1.** Bouras Christos, Professor, School of Computer Science, Rector of the University. Patron **2.** Laboratory of Atmospheric Physics, Univ. Patron **UNIVERSITY OF PELOPONNESE** 1. Department of Accounting and Finance, School of Management and Economics, Kalamata, University of Peloponnese. **UNIVERSITY OF PIRAEUS** 1. Circular Economy Workshop **RESEARCH CENTERS** **1.** National Centre for Scientific Research "DEMOKRITOS" **2.** Centre for Planning and Economic Research (KEPE) **3.** Center for Renewable Energy Sources & Saving (K.A.P.E.)	support to promote innovative actions that will accelerate the transition towards climate neutrality.	

Table 82. Organizational and Governance Interventions: 5. Collaborations with Universities and Scientific Centers

Name of intervention	**6. Participation in International Cooperation Networks**		
Description	Since 2019, the Municipality of Kalamata participates in International Networks, whose mission is to promote policies that will contribute to the green and digital transformation.		
Jurisdiction	**Municipality of Kalamata**		
	Stakeholders	**Impact on goal**	**Effect on co-benefits**

	1. Intelligent Cities Challenge 2. Energy Cities 3. CIVITAS 4. Covenant of Mayors for Energy and Climate 5. Major Cities of Europe 6. **SUSTAINABLE CITY**	Participation in networks of cities with international activity enhances the extroversion of the Municipality of Kalamata and at the same time transfers international good practices to a local level.	The integration of international good practices in the actions of the climate contract ensures results and co-benefits to citizens.

Table 83. Organizational and Governance Interventions: 6. Participation in International Cooperation Networks

Name of intervention	**7. Partnerships with companies**		
Description	For the implementation of the actions of the climate contract, partnerships have been developed and, in accordance with what the law stipulates, companies that have a large participation in the Greek market, in the fields of energy, transport and mobility, electromobility and digital transformation.		
Jurisdiction	**Municipality of Kalamata**		
	Stakeholders	**Impact on goal**	**Effect on co-benefits**
	1. PPC **2.** QUEST **3.** MYTILINEOS **4.** AVOKADO **5.** AMERESCO **6.** NOVOVILLE **7.** LOCAL AI	They ensure, with their know-how and financial figures, the implementation of actions in an effective way.	Citizens will benefit from the high quality of the projects and will become familiar with innovative actions, which will affect their daily lives.

Table 84. Organizational and Governance Interventions: 7. Partnerships with companies

C-1.2: Description of organisational and governance interventions

A. INTERNAL ADMINISTRATION

The Municipality of Kalamata, for the preparation of the proposal for inclusion in the network of the Mission of Cities, as well as for the drafting and implementation of the content of the Climate

Contract, has formed the Transition Group for Climate Neutrality, headed by the Mayor Mr. Athanasios Vasilopoulos.

The Transition Team includes executives of the Municipality, representatives of institutions and professional groups of the city, business executives, academics and external partners. The structure of the group is as follows:

I. The five-member Coordinating Team, headed by the Mayor.

II. The coordinators at the head of the following intervention axes:

a. Transport – Mobility
b. Buildings
c. Energy
d. Built and natural environment
e. Resilience
f. Waste and Circular Economy
g. Economy – Society

III. the 26 rapporteurs, as heads of the thematic units from each axis.

The transition team had the mission of implementing open workshops in order to co-shape with city and civil society actors the framework of policies towards achieving the goal of climate neutrality.

The work of the transition team was supported by external partners, coming either from universities or from professional sectors.

In each thematic unit, project teams were created, in which participated the Coordinator, a member of a university institution and an external collaborator with experience in the operation of the market, who transformed the political guidelines of the transition team into a proposal text.

The role of the Transition Team, for the next years of the implementation of the climate contract, will have the role of disseminating to citizens the policies that will be implemented, recording comments and observations and evaluating the results.

The management, administrative and financial, of the actions for the implementation of the Climate Contract, will be done by a special structure, which will be integrated into the internal operation organization of the Development Organization of the Municipality of Kalamata, under the name "SUSTAINABLE CITY".

The mission of the structure AEIFOROS POLI is to support and provide technical assistance to the Municipality of Kalamata, for the preparation of studies and implementation of any development action. In this context, a special part of it will manage the implementation of the Climate Contract.

B. MULTI-LEVEL GOVERNANCE

The Municipality of Kalamata has developed partnerships with the Region of Peloponnese, participating in the Managing Authority of the European Programs of the Peloponnese Region, as well as with state agencies as a member of the network of the Mission of the Cities.

C. NETWORKS WITH MUNICIPALITIES

The Municipality of Kalamata participates together with the Greek Municipalities of Athens, Thessaloniki, Ioannina, Trikala, Kozani and the Limassol Municipality from Cyprus, which are at the same time members of the Mission of the cities, in a network under the name "**ClimaNet CITY NETWORK**", which aims to support Municipalities in addressing funding issues, issuing legislative acts and formulating policies. at local, regional, national and European level.

Kalamata is the only Municipality of the Peloponnese Region that participates in the 100 Cities Mission and has signed a cooperation protocol with 14 Municipalities of the Region, which provides for cooperation on issues of transfer of good practices and dissemination of policies towards climate neutrality.

D. COLLABORATIONS WITH UNIVERSITIES AND RESEARCH CENTRES

The drafting of the proposals, as well as the procedures for their implementation, will have the scientific documentation and inspiration of professors from the collaborating with the Municipality, University laboratories or Research Centers, according to table C-1.1.

The guidance of University professors in Mobility, Energy Production, Built Environment and Circular Economy has been decisive and in the same spirit there will be participation in the implementation of the actions of the climate contract, in order to achieve a reliable process of monitoring and evaluating the results.

E. PARTNERSHIPS WITH INTERNATIONAL NETWORKS

Since 2019, the Municipality of Kalamata participates in International Networks, as mentioned in table C-1.1, whose mission is to promote policies that will contribute to the green and digital transformation of cities.

The benefits of the collaborations will be the exchange of views and good practices, the participation in joint funding proposals for the implementation of projects and the recognition of the city internationally, as a result of an extrovert activity.

F. PARTNERSHIPS WITH COMPANIES

The Municipality cooperates, both for the drafting and implementation of the Climate Contract, with companies that have both the know-how and the operational capacity to implement the planned actions of the climate contract.

1. PPC Blue

Company of the largest energy production group in Greece, with which the installation and operation of the number of electric vehicle chargers provided for by the Plan prepared by the Municipality can be launched.

2. QUEST GROUP

One of the largest IT groups in Greece, a company listed on the Greek Stock Exchange, will support, with its subsidiaries and headed by the Group's Innovation Center, any activity related to Mobility, Freight Transport, Electromobility, as well as the mechanism for monitoring and evaluating the implementation phases of the Climate Contract.

3. MYTILINEOS GROUP

It is a company listed on the Greek Stock Exchange, with multifaceted international activity, especially in the energy sector.

With the company's Innovation Center, actions will be promoted to integrate Artificial Intelligence (AI) technologies to create smart electricity distribution grids to improve grid capacity.

At the same time, there will be cooperation for the creation of a pilot plant for the production of clean hydrogen with the utilization of liquid waste from biological treatment.

4. AMERESCO

A company listed on Wall Street, of American interests, whose Greek arm will support the energy upgrade of buildings and facilities, leveraging private capital.

5.2 Section C-2 Social and Other Innovative Interventions

Section C-2 entitled "Social and other innovation interventions" lists in a table the social innovation interventions, as well as an interpretation of their impact on the implementation of the climate contract actions, as well as the co-benefits that will arise.

C.2.1: Social innovation interventions

Name of intervention	**Consultation Platform**		
Description	Internally in the Municipality, an online Consultation platform has been created, at the electronic address: mission.kalamata.gr, where citizens can freely submit their views on issues raised and concerning, mobility, urban space, etc		
Jurisdiction	**Municipality of Kalamata / Department of Informatics**		
	Stakeholders	**Impact on goal**	**Effect on co-benefits**
	Citizens	The participation of citizens in the design and implementation of the actions of the climate contract is strengthened, which is a decisive step in raising awareness and accepting these results.	Citizens become accustomed to change, adapt and seize every opportunity.

Table 85. Social Innovation Interventions: Consultation Platform

Name of intervention	Participatory Workshops		
Description	In phase A, for the formulation of the proposal for inclusion in the network of 100 cities, sectoral participatory workshops were organized, where representatives of city and civil society institutions, academics, executives of market enterprises and citizens, listened, evaluated and suggested.		
Jurisdiction	Municipality of Kalamata		
	Stakeholders	Impact on goal	Effect on co-benefits
	The participation of stakeholders is recorded in detail in the attached file entitled: **a-3.3-Consultation_PhaseA.doc**	The participation of all strengthens the acceptance of the results, since the actions were co-shaped	

Table 86. Social Innovation Interventions: Participatory Workshops

Name of intervention	Open Workshops for the co-shaping of Urban Space		
Description	It is a process of involving everyone in the public debate, to record opinions, to be evaluated and processed, in order to formulate substantiated proposals.		
Jurisdiction	Municipality of Kalamata		
	Stakeholders	Impact on goal	Effect on co-benefits
	✓ Municipality of Kalamata ✓ Chamber of Messinia ✓ Trade Association ✓ Hoteliers Association ✓ Technical Chamber of Greece (Messinia Branch) ✓ Business	Participation of all stakeholders in the co-formulation of proposals for the implementation of the actions of the climate contract in urban space.	With the participation and acceptance of interventions, the transition to neutrality will be accelerated, with all the positive results for citizens.

Table 87. Social Innovation Interventions: Open Workshops for the co-shaping of Urban Space

Name of intervention	Energy Communities
Description	Energy communities, as urban cooperatives, promote the cooperation of citizens to address common problems related to the production, storage and distribution of electricity, while at the same time issues of energy upgrading of homes and facilities can be addressed.

Jurisdiction	Energy Community Council.		
	Stakeholders	**Impact on goal**	**Effect on co-benefits**
	✓ Citizens ✓ Energy companies ✓ Funding bodies	The achievement of the systemic goal of getting rid of fossil fuels, due to the high capital of the initial investment, but also the lack of familiarity of citizens with energy issues, requires synergies with those who have the know-how, the operational capacity, but also the financial resources to implement the interventions.	With the operation of the energy community, the pace of energy upgrades is accelerated, while vulnerable households are also given the opportunity to benefit.

Table 88. Social Innovation Interventions: Energy Communities

C-2.2: Description of social innovation interventions

The consultation platform at mission.kalamata.gr email address gave a platform for expressing opinion and opinion to citizens, regarding the formulation of the strategy for the selection of intervention axes and the individual thematic units that formed the basis for the foundation of the proposed interventions included in the Climate Contract. Indicatively, from the processing of the platform's data, The participation had the following results:

AXES	COMMENTS		POSITIVE OPINION
	On the AXLES	Outside the AXES	
Transport – Mobility	40	4	602
Buildings / Facilities	11	1	465
Energy / Environment	26	11	443
Urban Planning & Urban Environment	11	4	375
Circular Economy & Waste Management	11	4	369
City Resilience and Related Infrastructure	10	7	424
Economy – Society	12	8	405

Table 89. Results from participation in the consultation platform of the Municipality of Kalamata

The participatory workshops co-shaped the intervention areas for each axis and operated according to what is mentioned in the attached file entitled

a-3.3-Consultation_PhaseA.doc

Through the Climate Contract, major interventions in urban space are pursued, which are deemed necessary, both for the aesthetic and functional upgrading of areas that will affect greenhouse gas emissions, and for the creation of a positive impact on citizens, at an economic and social level. The formation of areas with high environmental objectives is achieved by scientifically recording and evaluating every aspect of those who interact with them.

In Kalamata, open workshops have been scheduled for:

1. highlighting the coastal front
2. Interventions for the revitalization of the eastern centre
3. the formation of the park in the northern part of the river Nedontas
4. the pilot action for the construction of infrastructure and urban planning projects in the area west of Artemis Street.
5. the operational upgrade of Athinon Street

The establishment of energy communities in each urban unit of the city and per professional group, as described in the respective portfolios, aims at the creative coexistence of technological actors, investors and citizens, in order to:

1. To finance energy saving interventions in homes and facilities, with payback from the reduction of energy costs for households and professionals.
2. To ensure the uninterrupted progress of all works, in order to achieve the emission reduction targets and the results to be immediate for the beneficiaries.
3. To create a sense of energy democracy, where no one is excluded from access to energy sources accessible to all.

5.3 Section C-3 Financing of portfolios of actions

Section C-3 'Financing of portfolios of actions' contains the list of action portfolios and interventions described in Sections B-2, as well as those from C-1 and C-2 with cost implications, to provide a concise list of interventions to be included in the investment plan.

	C-3.1: Summary of interventions with cost implications					
ETC	**Portfolio Name**	**Responsible entity**	**Date start/end**	**Emissions Sector**	**Emission reduction (Kg)**	**Estimated total cost**
M.1	Sustainable Urban Mobility Infrastructure	The city in partnership	2024-2030	Transport - Mobility	0,00	**9.717.500**
M.2	Promotion of travel by environmentally friendly means	The city in partnership	2024-2030	Transport - Mobility	0,00	**19.560.000**
M.3	Organization of Freight Transport	The city in partnership	2024-2030	Transport - Mobility	32.731,25	**437.779.500**
M.4	Promoting travel with low-emission vehicles	The city in partnership	2024-2030	Transport - Mobility	33.484,20	**252.599.905**
L.1	Regeneration of urban areas	The city in partnership	2024-2030	Built environment	0,00	**93.195.671,44**
L.2	Aesthetics and functional upgrading of public space	The city in partnership	2024-2030	Built environment	3.384,73	**19.965.336,46**
L.3	Kalamata, clean city	The city in partnership	2024-2030	Waste	3.784,52	**14.385.265,30**
L.4	Residential, emission-free	The city in partnership	2024-2030	Energy	84.265,07	**923.508.635,00**
L.5	Sports and Education	The city in partnership	2024-2030	Energy	1.295,14	**24.597.234,00**
P.1	Emission reduction actions in the agricultural sector	The city in partnership	2024-2030	AFOLU	2.694,42	**1.942.250,25**

P.2	Transformation of manufacturing and craft units	The city in partnership	2024-2030	IPPC	21.270,66	**25.157.886,00**
P.3	Energy upgrading of tertiary sector buildings and facilities	The city in partnership	2024-2030	Energy	58.000,17	**182.728.848,00**
P.4	Energy generation, storage and distribution systems	The city in partnership	2024-2030	Energy	0,00	**19.520.275**
R.1	Pilot actions	The city in partnership	2024-2030			**11.908.047,30**
R.2	Research and Innovation Structures	The city in partnership	2024-2030			**1.355.000,00**
R.3	Information and Awareness	The city in partnership	2024-2030			**2.602.566,00**
				TOTALS	**240.910,16**	**2.040.523.919,75**

Table 90. Summary of Climate Contract Portfolios of the Municipality of Kalamata with cost implications.

6. Outlook and next steps

This section should draw any necessary conclusions on the above Action Plan and highlight the next steps and plans to further improve the Action Plan under the City Climate Convention.

Plans for the next iteration of CCC and action plan - text elements
The Climate Contract, as a living document, will be evaluated on an annual basis, through the procedures described in action R.2.01_71 of the portfolio entitled "Research and Innovation Structures", according to which the following apply. The implementation data of the progress of the actions will be recorded by the team that will operate within the structure called "Climate Change Observatory of Kalamata" and will be evaluated on an annual basis. Given that detailed projections are available for all actions and portfolios, for each year in terms of budget, energy and emissions, results will be obtained to achieve the objectives of the climate contract implementation path. At the same time, a unit will operate within the structure to record the economic, social and environmental impact of actions, the analysis of which will highlight the parallel benefits of citizens. At the same time, it will detect the weaknesses of social groups (Young, Elderly, unemployed, digitally illiterate, etc.) for their inclusion and participation in the actions of the Contract, formulating and proposing appropriate measures. The results of all will be evaluated together with a series of other parameters of the internal or external environment and based on the evaluation, the necessary revisions will be proposed, which may lead to a change in the political choices of the competent collective bodies. The Climate Contract, as a living document, will be able to accept changes both in terms of content and future collaborations, with any body seeking to accelerate the achievement of its goals.

7. Appendixes

CODE	Description	File Name
1	Emission Inventory for the year 2019	GHG_2019_En
2	Phase A Consultation Roadmap	a-3.3-Consultation_PhaseA_En
3	Projects and actions for the environment of the Municipality of Kalamata 2016 - 2021	Action2016_2021
4	Guide for communicating environmental actions from the BEACON project	Beacon_From_ideas_to_action_Final_Report

5. Files of Portfolios

Impact Pathway	CODE	PROTFOLIO	Attachment File
Kalamata, city to live in	**L.1**	Regeneration of urban areas	Prtf.L.1_Vivification_En
	L.2	Aesthetics and functional upgrading of public space	Prtf.L.2_QualityOfLife_En
	L.3	Kalamata, clean city	Prtf.L.3_CityClean_En
	L.4	Housing, climate neutral	Prtf.L.4_House_En
	L.5	Sports and Education	Prtf.L.5_School-Gym_En
Kalamata, low-emission mobility	**M.1**	Sustainable Urban Mobility Infrastructure	Prtf.M.1_Mob_Infra_En
	M.2	Promotion of travel by environmentally friendly means	Prtf.M.2_Mob_services_En
	M.3	Organization of Freight Transport	Prtf.M.3_Mob_transport_En
	M.4	Promoting travel with low-emission vehicles	Prtf.M.4_Mob_Vehicles_En
Kalamata, city to produce and create	**P.1**	Emission reduction actions in the agricultural sector	Prtf.P.1_1st_Sector_En
	P.2	Transformation of manufacturing and craft units	Prtf.P.2_2nd_Sector_En
	P.3	Energy upgrading of tertiary sector buildings and facilities	Prtf.P.3_3rd_Sector_En
	P.4	Energy generation, storage and distribution systems	Prtf.P.4_Energy_En
Kalamata, a city that learns	**R.1**	Pilot Research Activities	Prtf.R.1_pilot_En

	R.2	Research and Innovation Structures	Prtf.R.2_R&I_En
	R.3	Information and Awareness	Prtf.R.3_Sensitivation_En

the use of energy from the sun. At the same time, the upgrading of the electricity distribution network is promoted, while ways of storing electricity are proposed.

5. Circular Economy and waste

Where promotions are proposed to reduce the production of organic waste, with sorting methods at source, the promotion of home and neighborhood composting, the strengthening of recycling streams, but also the raising of awareness on issues of reuse of raw materials.

6. Industrial Processes and Product Uses (IPPU)

Where certified production of climate-neutral products is proposed, with the replacement of equipment and changes in the steps of production processes, processing units.

7. Agriculture, Forestry and Land Use (AFOLU)

It is proposed to modernize the equipment of pumping stations and means of transport.

The targets set for the reduction of emissions by 2030 are implemented through the following scenarios or transformation pathways (Impact Pathways):

1. Scenario I: Kalamata, city to live in
2. Scenario II: Kalamata, low-emission travel
3. Scenario III: Kalamata, city to produce and create
4. Scenario IV: Kalamata, a city that learns

Scenarios which are analysed in detail in Part B of the Action Plan.

The achievement of such an ambitious venture will be achieved through the mobilization, mobilization and collective action of the actors of an ecosystem described in the plan of commitments and includes:

1. The transition team towards climate neutrality, which has been formed in the Municipality and includes executives of the Municipality, representatives of city bodies and market executives.
2. Networks of Local Government Organizations and State structures at all levels of government.
3. Universities and Research Centers.
4. Companies and private entities.
5. Civil society, with associations, associations, action groups, etc.

At the same time, the Municipality of Kalamata has created a wide framework of partnerships, through which it exchanges good practices necessary to achieve the goal, participating in city networks, such as:

1. ClimaNet Network of the 6 Greek cities and 1 Cypriot city, participating in the Mission of Cities
2. Net Zero Cities
3. Intelligent Cities Challenge
4. Energy Cities
5. CIVITAS

BEACON Bridging European & Local Climate Action

From Ideas to Action: Supporting municipalities, schools and national governments in the transition to climate neutrality

Final report of the Bridging European and Local Climate Action project

On behalf of:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

European Climate Initiative EUKI

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The project Bridging European and Local Climate Action was financed by the European Climate Initiative (EUKI). EUKI is a project financing instrument by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). It is the overarching goal of the EUKI to foster climate cooperation within the European Union in order to mitigate greenhouse gas emissions. It does so through strengthening cross-border dialogue and cooperation as well as exchange of knowledge and experience.

The information and views set out in this report are those of the authors and do not necessarily reflect the official opinion of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

On behalf of:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
European Climate Initiative EUKI
of the Federal Republic of Germany

CONTENTS

WHAT IS THE BEACON PROJECT?

BEACON – building bridges for climate action

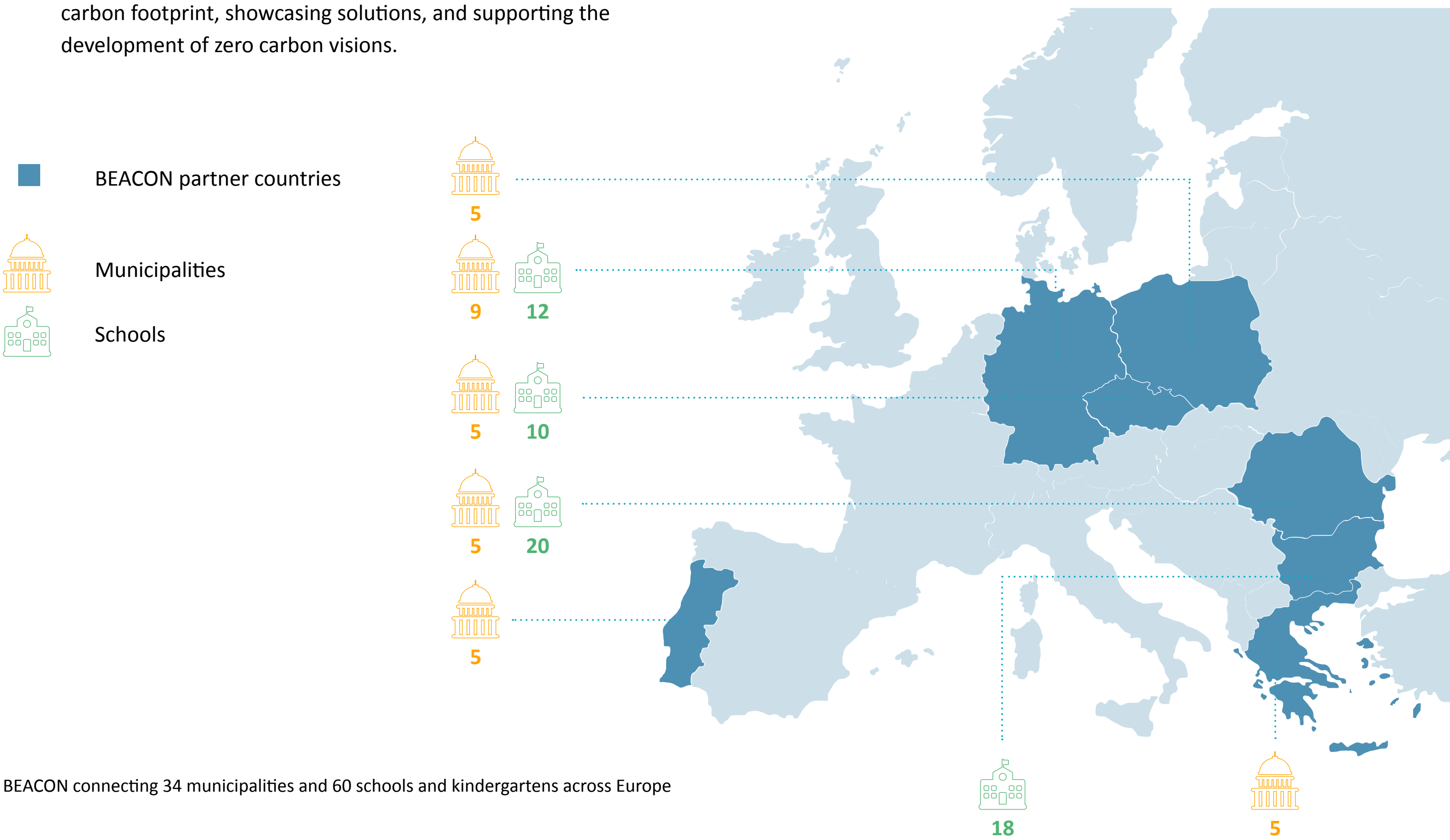
Setting the scene

Transformative action is required to mitigate climate change and meet the objectives of the Paris Agreement and the targets set by the EU's climate and energy framework for 2030. The EU Green Deal is Europe's strategy for a carbon-neutral transformation supported by substantial funding to support and accelerate this process, including from the Next Generation EU fund, the historical stimulus package for the recovery after the COVID-19 pandemic. Now, climate action needs to be enhanced across all levels of governance to meet these mid- and long-term targets:

- **National governments:** To a large extent, delivering on international and EU-wide commitments depends on the development and provision of effective policies and reliable framework conditions set up by national governments.
- **Local governments:** Municipalities can act as a major driving force in implementing climate change mitigation measures. Urban climate leadership can lead to profound decarbonisation and social transformation processes.
- **Schools:** Besides raising awareness among citizens, educating future generations on causes and impacts of climate change and empowering them to take actions against it is imperative. Schools can lead by example by reducing their own carbon footprint, showcasing solutions, and supporting the development of zero carbon visions.

Examples of successful local climate change mitigation measures can be found all across Europe. Municipalities, local communities, and younger generations are shaping the path towards net-zero emissions. In addition to critical and urgent environmental concerns, actors in all parts of the world have recognised the added benefits of climate action such as increasing well-being and health, promoting innovation, and stimulating the local economy.

Vertical collaboration among and between different levels of government under a multilevel governance framework is a fundamental element to scale up and accelerate local climate actions. A joint understanding of the challenges of local climate action and the role local and regional actors play in reaching national and EU climate goals is required to create the necessary conditions at national level for local climate action.

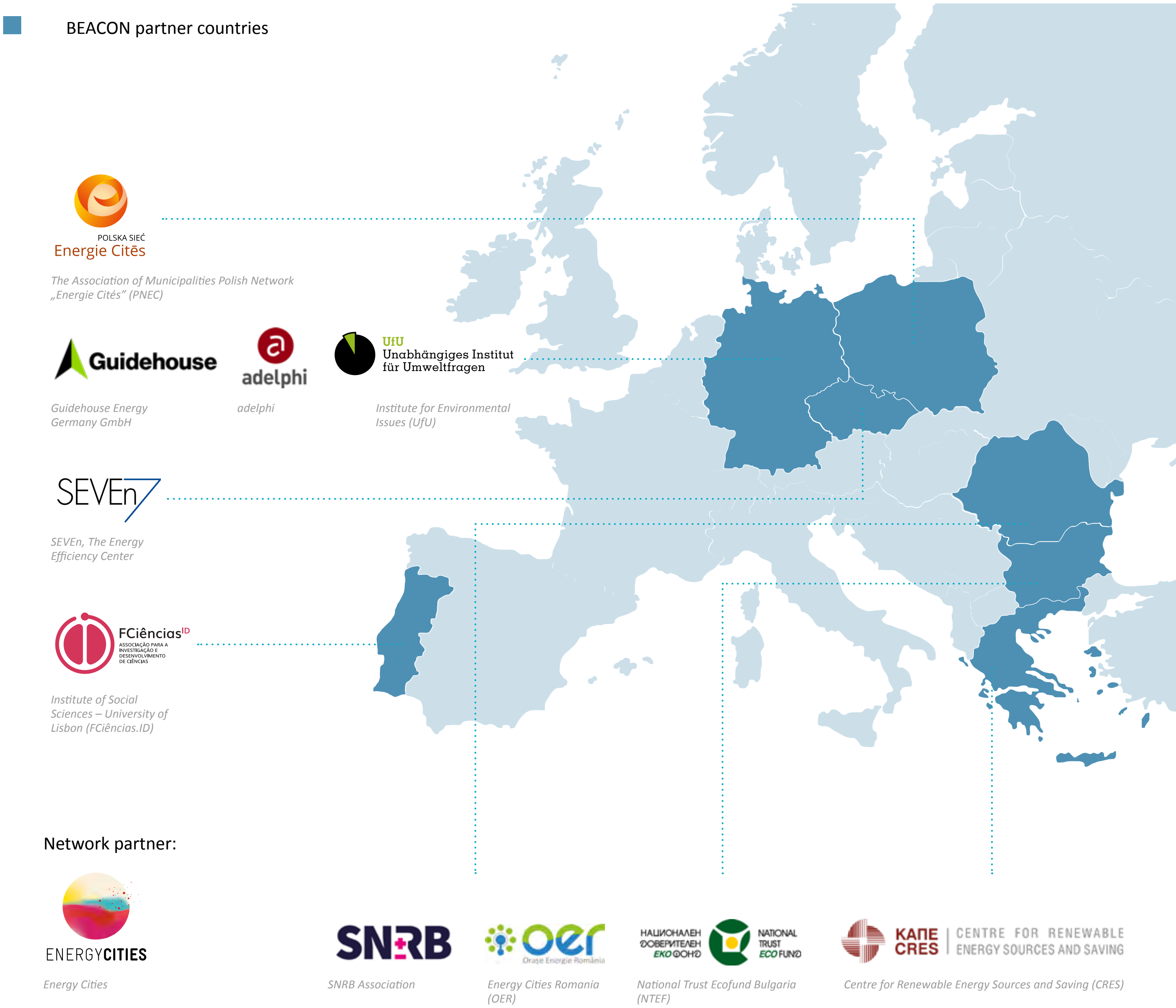


BEACON connecting 34 municipalities and 60 schools and kindergartens across Europe

About the project

Between 2018 and 2021 the project Bridging European and Local Climate Action (BEACON) supported the implementation of local climate action by connecting local stakeholders horizontally within countries and across borders, and vertically from the local to national and EU levels. Funded by the German Environment Ministry's European Climate Initiative (EUKI), BEACON's support focused on local actors in Poland, Czech Republic, Bulgaria, Romania, Greece and Portugal, while also connecting them with counterparts in Germany for the exchange of good practices. Through joint learning, networking, and needs-based advisory services, policymakers, municipal actors, and educators gained technical and process-related skills that helped them develop, refine, and implement measures to reduce greenhouse gas emissions. BEACON built bridges for climate action within countries and across borders, within peer groups and between different actors.

Successful practices in local climate action were identified and shared across a network of 34 small and medium-sized local authorities from the Czech Republic, Romania, Greece, Poland, Portugal, and Germany. To develop awareness and knowledge about climate change and to create incentive models for energy savings, 58 schools and two kindergartens in Bulgaria, the Czech Republic, Romania, and Germany participated in the project. These local stakeholders were connected with regional and national authorities in integrated vertical workshops to stimulate collaboration and joint climate action. BEACON also helped aligning national climate policies with the goals of the Paris Agreement by examining successful national climate policies from across Europe in dedicated in-depth factsheets focusing on the buildings, transport, small industry, and agriculture sectors. Led by Guidehouse, adelphi, and Independent Institute for Environmental Issues (UfU), BEACON was implemented by a project team of altogether 11 partner organisations.



BEACON connecting 11 partner organisations across Europe

The overarching goal of the BEACON project is to contribute on different levels to the successful implementation of the Paris Agreement in Europe. The underlying assumption is that local actors such as municipalities and schools play an important role in achieving this goal. We furthermore assume that actors move at different pace, that all over Europe good practice examples exist on the local level, and that challenges need to be addressed to realise the full potential of these stakeholders The following graphic shows the intervention logic of the BEACON project.

ACTIVITIES

Local capacity building for municipalities
- Needs-based coachings & advisory
- Guidance for PR
- Guidelines & publications

Cross-border dialogue & exchange
- 2 European municipalities conferences
- 12 transnational thematic workshops
- 7 municipal climate change partnerships

Education on climate change & exchange
- 80 teacher trainings
- 30 climate action days
- 14 bike cinema screenings; 1 comic book
- 12 school partnerships & 6 study visits

Incentivising energy savings in schools
- Energy tours and support for 57 schools
- 14 workshops on incentive systems

Stimulating vertical collaboration
- 12 vertical workshops and conferences with municipalities, schools, regional and national authorities

Supporting national climate policies
- Analysis of 21 national climate policy instruments from across Europe
- Technical workshops & dissemination

OUTPUT

Know-how & means to step up local climate action, e.g. for:
- Developing targets & commitments
- Identifying & pursuing financing opportunities
- Initiating projects to save GHG emissions

Enabled mutual learning & collaboration:
- Knowledge transfer, inspiration from good practice
- Cross-border collaboration & building of a European network

Raised awareness among pupils & staff
- Raised awareness for climate change
- Transnational exchange, inspiration and mutual learning

Know-how for incentive schemes
- Enhanced knowledge about technical building systems & related energy use
- Knowledge how to implement incentive schemes

Awareness for good practices & challenges
- Among national decision-makers: enhanced understanding of needs for local climate action; knowledge of successful national climate policies across Europe
- Improved understanding of national policies & programmes among local actors

OUTCOME

Bolstered municipal action for mitigating climate change
- Enhanced integration of climate change in municipal planning & management structures
- Strengthened technical competencies
- Improved awareness for benefits of climate action among citizens & stakeholders
- Additional municipalities beyond those directly supported inspired to take action

Education & activities on climate change
- Implemented pedagogical activities
- Transnational collaboration, e.g. joint school action days
- Additional schools beyond those directly supported inspired to take action

Behavioural change for energy savings
- Among pupils and school staff
- Implementation of incentive schemes

Improved framework conditions for local climate action
- National decision-makers consider feedback of local actors, e.g. when updating or initiating support programmes

Enhanced national climate policies
- Effective instruments or elements from other countries are transferred & adopted

IMPACT

Municipalities contribute effectively to the goal of the Paris Agreement of keeping global warming well below 2°C
- Municipalities actively promote climate action among citizens and stakeholders
- Strengthened bi- and multilateral collaboration across borders to address climate change
- Enhanced sense of a European community

Climate change and climate action become a formative element of school education
- Schools contribute effectively to the carbon-neutral transformation by saving energy and leading by example
- Pupils & teachers are empowered for climate-friendly behaviour and act as multipliers

Enhanced alignment of national climate policies with Paris Agreement goals
- Vertical dialogue and collaboration on climate action is strengthened and sustained
- National frameworks empower local climate action

Implementation and impact of the BEACON project

About this report

The BEACON project made a difference in its communities in a myriad of ways – from raising climate ambition to developing strategies and from implementing climate protection projects to enabling visions of a carbon-free world. Over the course of the project, qualitative and quantitative evaluations we carried out, providing a good overview of the challenges, needs, and success factors to local climate action. The data shown in this report is drawn from evaluations with more than 25 municipality and 40 school staff members of the BEACON countries. Since it is not possible to capture the individual stories of all the pupils, teachers, and municipal administrators or technicians we worked with along the way, this report summarises the achievements of the BEACON project along the following five steps:

1. Identify needs and create support structures
2. Establish cross-border networks and collaboration
3. Build capacities and raise awareness
4. Develop long-term strategies, support ambitious policies and vertical collaboration
5. Create ideas and implement projects

To bring meaning to these, specific examples are included or referenced throughout, linking to outputs of the project or successful initiatives.

For even more impact stories from BEACON municipalities and schools, we have developed an accompanying brochure entitled ***From Action to Impact: Supporting municipalities, schools and national governments in the transition to climate neutrality.*** The brochure outlines stories of how many of BEACON's 60 schools and kindergartens and 34 municipalities have been affected by the project, including numerous photos to bring their experiences to life. References to the brochure are scattered throughout this report. These references can be found in the yellow call-outs which each include a link to the report.

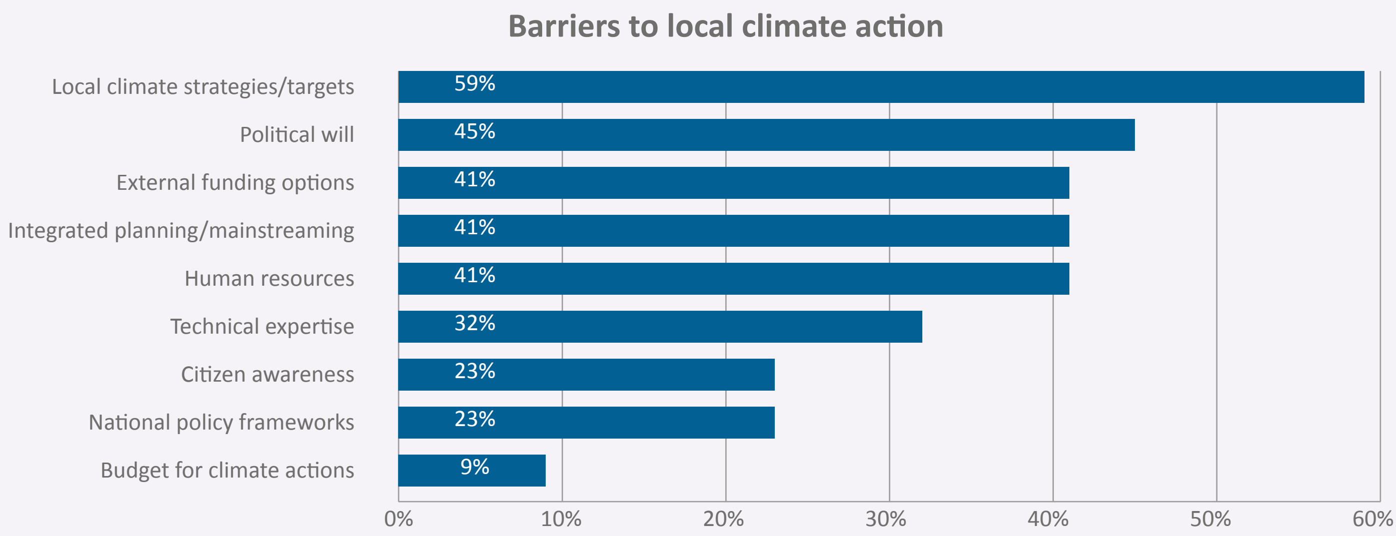
See page X of *From Action to Impact*

We would like to encourage you to become active, to get inspired, and to implement climate action projects in your school, your municipality, or your region. If you have questions, please get in touch with the organisations involved. We hope you enjoy this report.

Challenges of local climate action

Municipalities

Municipal staff are confronted with a number of challenges when setting ambitious climate goals and taking action to fulfil their commitments, as confirmed by the municipalities participating in BEACON.



Barriers to local climate action perceived by BEACON municipalities.

Finance

- The **lack of financial resources** for climate action investments remains a major challenge. Municipalities often struggle with low budgets and other investment priorities prevailing over climate change investments.
- The **lack of knowledge** about appropriate external public and private funding sources omits or slows down climate investments. Accessing external funding is also hampered by shortages in municipal staff. Surveyed representatives from national and regional authorities confirmed that having sufficient human resources (70% rating it important or very important) and budget for climate action (55%) as well as the needed technical expertise (57%) represent key challenges for municipalities in implementing climate action measures.
- Municipalities and national governments agree that **difficulties in accessing funding** slows down the timely achievement of climate targets.

Awareness

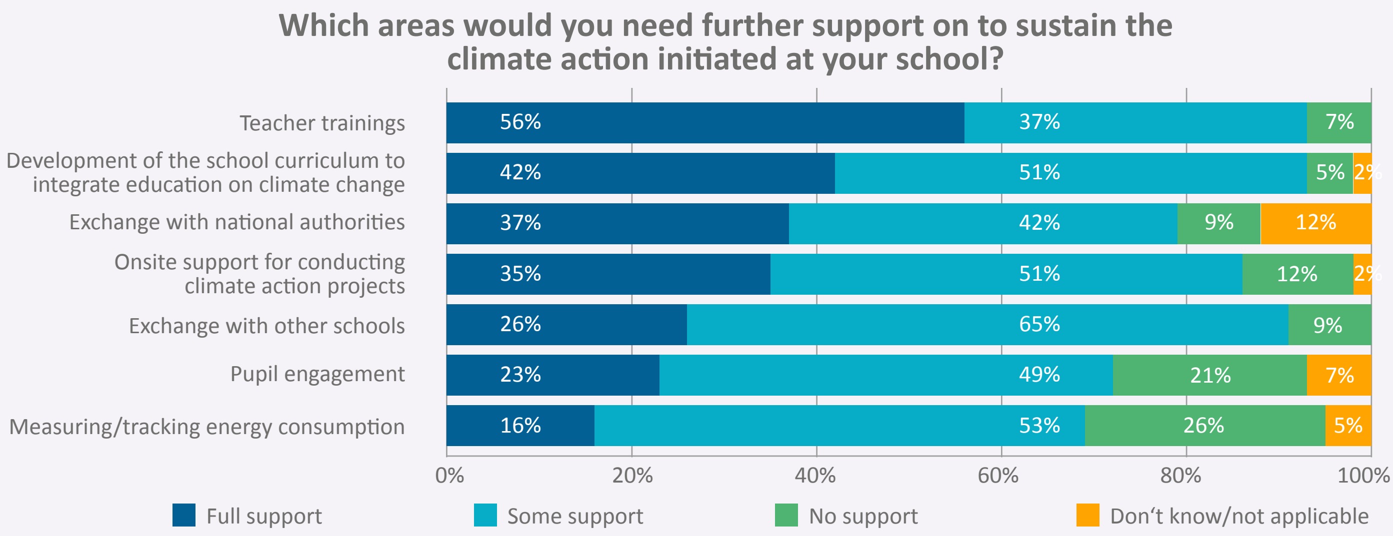
- Local narratives for climate action often clash with more reluctant discourses in broader media, undermining local efforts and discouraging municipal representatives. Nearly one in five BEACON participants said they **needed support to raise awareness** for climate action within the municipal administration and local leadership, or they stressed the need to address young people and set up educational programmes in schools.
- National and regional officials also found **citizen awareness and stakeholder engagement** a major challenge for municipalities, with 80% of the surveyed representatives rating them as important or very important.

Governance

- Of the municipal representatives participating in BEACON, 45% see certain **unfavourable national climate and energy policy frameworks** as the main obstacle for municipalities to implement climate action. Related obstacles include lack of vertical coordination, limited municipal power to influence relevant action areas, national zoning and spatial planning or procurement guidelines.
- A **lack of municipal staff and technical expertise** in the municipal administration to coordinate, plan, and implement climate-related actions was mentioned by 41% of respondents.
- About one-third of municipalities struggle to implement climate action throughout municipal fields of responsibility, mainly due to a **lack of awareness in the relevant departments and cooperation between the responsible administrative units.** Mainstreaming climate action in all municipal planning and strategies thus remains a challenge.
- Many respondents (23%) acknowledged that a **lack of political will** to engage in climate action among key decision makers is hindering local climate action, too.
- One in ten respondents added that their municipal **climate strategies or targets were outdated or incomplete**. However, only one reported having adopted a climate neutrality target but 89% of the municipalities have this under consideration.

Schools

Good education on climate change and mitigation is of key importance for future generations. BEACON's educational work in schools served to train future generations in the adequate and economical use of resources and to create awareness of climate change and ways to tackle it. Practical learning material, supportive equipment and school buildings which are energy efficient and own energy producers can help to activate students and teachers, as well as municipal stakeholders. Schools are often not yet equipped to become climate-neutral or to offer roadmaps for climate projects on a regular basis in the near future. As the graphic shows, teacher trainings, integrating topics into the school curriculum, and dialogues with other schools and responsible ministries are rated as the most important fields of action by school staff.



Areas requiring further support to sustain climate action at schools.

- **Teacher education:** Climate action topics are complex and good preparation is necessary for interdisciplinary teaching. Therefore, teachers need appropriate advanced trainings and corresponding teaching material. Such trainings and tools in most cases do not exist and teachers need to develop own material and ideas.
- **Onsite support:** It is important and motivating for pupils to work with external climate and energy experts. These experts can provide support, especially in technical areas (for example energy tours in the school building), have the necessary expertise to explain complex climate issues, and advise schools on the concrete implementation of climate action measures.
- **Development of school curricula:** Climate action topics are still far from being a standardised part of the school curricula and cross-sectional aspects of it are not consistently covered. An important task for national ministries will be to integrate these topics into the school curricula and the national curricula framework.
- **Relationships between schools and municipalities:** Schools are among the largest public consumers of energy, so municipalities should reduce the energy consumption of these buildings. To become climate-proof for the future, school buildings have to undergo deep renovations. While municipalities have no or little influence in implementing educational and user behaviour projects, the energy cost savings do not remain with the school and provide little incentives. A good communication and coordination between municipality and school is, hence, necessary and incentive systems should be developed.

Vertical dialogue between governance levels

Many of the before-mentioned challenges remain due to a lack of communication between governance levels. The streamlining of climate policies and strategies, best practices or financial support schemes can maximise the potential of climate action. For this reason the BEACON project provided dedicated platforms for **vertical exchange and collaboration on local climate mitigation action, i.e. between the local, regional, and national levels**. Only 17% of the representatives from surveyed national and regional administrations deemed vertical integration dialogues as well-established in their countries, while 72% characterised it as developing. The main reasons for missing vertical integration platforms are lack of budget or time of national authorities (65% of respondents), missing priority of multilevel exchange on the political agenda (47%), and missing fora for such dialogue (27%).

According to **92%** of school staff, stimulating the environmental behaviour of pupils and school staff is the area with the highest potential for schools to advance the energy transition.

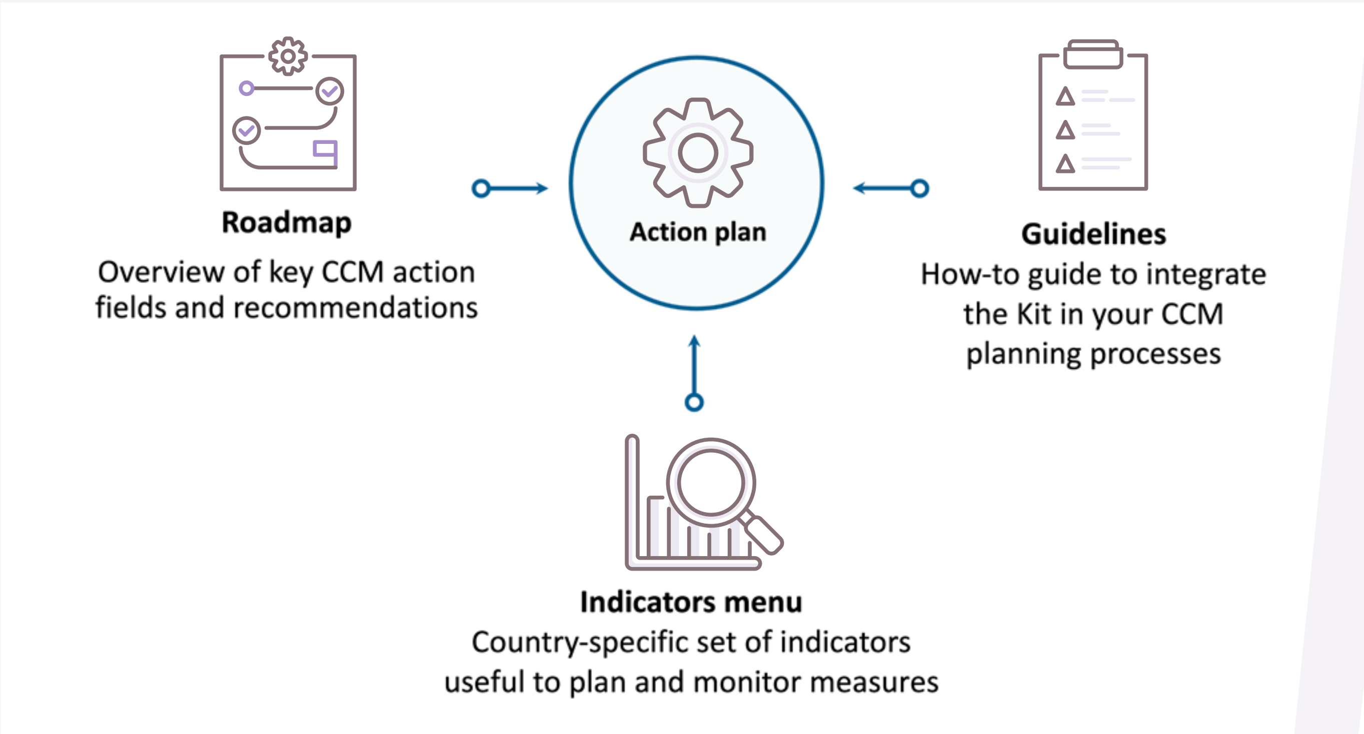
HOW CAN IT BE DONE? – FIVE STEPS FROM IDENTIFYING NEEDS TO IMPLEMENTING CLIMATE ACTION

1 Identified needs and created support structures

Municipalities

The BEACON municipalities had already taken first steps to mitigate climate change before the project started. Many had completed a climate or energy strategy but wanted to deepen their knowledge and extend their activities. Using an initial needs assessment, we supported them in systematically taking stock of their current climate action effort across relevant sectors like energy, buildings, and transport. As a result of this effort, administrations had a clear understanding of what climate change mitigation action entails, which endeavours they want to prioritise, who needs to be involved, and what data and indicators are helpful for planning, implementing, and evaluating the measures. The efforts were summarised inter alia in the BEACON publication - Climate Change Mitigation Kit (CCM Kit). The kit, available in all BEACON languages, helps bridge the gap between theory and practice by helping municipal actors know which actions to explore, how to track and measure them, and how to successfully implement them. We used the kit as a basis for helping the municipal actors structure their post-BEACON activity-planning. If in need of fresh ideas for climate action, or where there is national funding and data sources to realise these actions – then the CCM Kit is the place to look.

Looking for guidelines to plan and monitor your climate change mitigation (CCM) measures? The CCM Kit provides guidance for municipalities in all BEACON languages.



BEACON's climate change mitigation kit

Tailored and needs-based support helped several BEACON municipalities introduce or consolidate work processes and structures that broke down sectoral silos and enabled more ambitious and effective climate action. These processes span from informal and formal meetings that took place on a regular basis after being initiated by BEACON to the initiation of joint working processes and new permanently positions or units being created in the administration to facilitate a synergised implementation of climate strategies. In Greece, every participating municipality reported either restructuring their municipal government to better facilitate tackling cross-sectoral climate change challenges or an increase in interdepartmental liaising for climate change goal setting and climate plan coordination. In all countries, the enhanced communication has fostered a culture of improved knowledge exchange and inclusion in decision-making. As a result, BEACON participants across countries observed more support for climate action from colleagues in their administration since the project start.

Examples

- In Sztum (Poland) a **new unit**, the Integrated Development Department, was established to lead local climate and energy policy and introduce appropriate organisational changes throughout the entire administration. A new position for climate projects and policy will also be filled soon.
- In Setúbal (Portugal) an interdepartmental **climate action team** was established to deal with all matters regarding the planning and implementation of climate action measures, creating both awareness and ownership throughout the municipal administration.
- In Agios Dimitrios (Greece) internal municipal structures were optimised and strengthened to enhance **cross-departmental collaboration** on climate action.

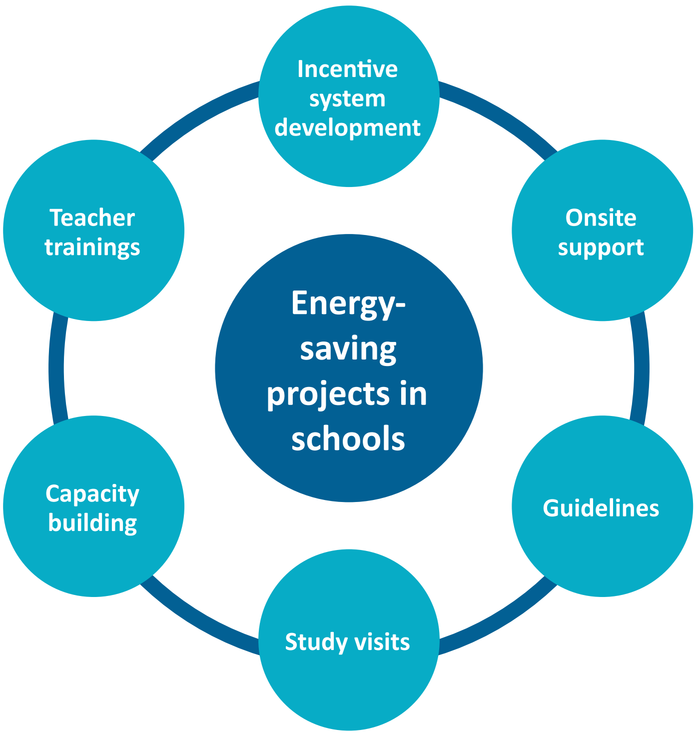
Schools

We supported participating schools in introducing and implementing pedagogical energy-saving models. In addition, further matters of sustainability and climate action were introduced in teacher trainings and climate action days, such as effects of climate change, water protection, biodiversity, or healthy nutrition.

Through energy-conscious behaviour, energy consumption and CO_2 emissions can be reduced without any (or low) financial investments. To take stock of the situation, we conducted **energy tours** in 57 of the participating schools. During these onsite visits, data on relevant factors such as the energy consumption and technical building systems was recorded, which allowed schools to develop a list of measures and guidelines that were used by the teachers in their pedagogical work.

Lesson Learned

Enabling cross-departmental collaboration and breaking down administrative sectoral silos can create synergies and efficiencies through the pursuit of common climate action goals.



Overview of BEACON activities which supported schools

BEACON filled the gap of schools typically lacking staff and know-how to implement energy-saving projects. While some schools had already included aspects of resource efficiency and environmental education in their lessons, climate change and ways to mitigate it were missing from the **curriculum**.

The project team supported schools and the corresponding municipalities in developing tailored **incentive models** that were key to initiate self-sustaining energy-saving projects and motivate schools to participate. BEACON also enabled teacher trainings, study visits to Germany, and exchanges with partner schools to stimulate insights and ideas on how to implement environmental and energy-saving projects in schools.

2 Established cross-border networks and collaboration

Municipalities

BEACON offered various opportunities for dialogue and networking across countries – at conferences, thematic workshops, and municipal partnership meetings, municipalities shared tips, experiences, and know-how on specific climate action fields.

In 12 thematic workshops, municipal staff connected with peers and experts, facilitating small communities of practice on a range of specific topics. These topics included:

- municipal energy management
- energy communities
- municipal climate governance
- data management for and evaluation of climate change mitigation
- nature-based solutions
- smart city
- waste management
- sustainable tourism
- transition pathways

Based on knowledge gained in the workshops, several municipalities revised their priorities, adjusted the weighting of individual measures, and added new topics to their agenda. Peer learning with other municipalities accelerated the measure planning in their administrations.

Example:
Inspired by the energy management software presented by Rožnov pod Radhoštěm (Czech Republic) at a BEACON workshop, Cieszyn (Poland) decided to look for a similar solution to systematically monitor energy consumption in public buildings. The city decided to start with a tailored, non-commercial solution that will provide the data required to update its Low-Emission Economy Plan (LEEP), which was initiated in 2021.

Within BEACON we established seven climate municipal partnerships for long-lasting cross-border cooperation. The exchanges offered insights into climate action practice at eye level. Tried and tested approaches were transferred between municipalities with similar profiles.

Example:
The partner municipalities Schwäbisch Hall (Germany) and Zamość (Poland) revived their partnership by bringing together their public utility companies to discuss common renewable energy project ideas. Mutual visits by experts with onsite inspections were part of the exchange and helped to showcase projects worthy of replication.

Through cooperation in climate action, partner municipalities also expanded their knowledge. If expertise in a certain subject area was lacking in one city, colleagues from the partner city might have been able to provide support.

Example:
An expert from Bottrop (Germany) provided input and advice to colleagues from the municipality of Agios Dimitrios (Greece), which is switching its streetlighting to LED, reducing greenhouse gas emissions and public spending.

Municipalities were also encouraged to join external cross-border projects, which provide additional networking opportunities.

Example:
Ciezsyn (Poland) joined the Erasmus+ project EYES, which aims to foster youth participation in local energy and climate planning. Coruche (Portugal) joined the Green City Accord launched by the European Commission.

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Schools

The BEACON schools had several opportunities to network and learn from each other through teacher study visits to Germany, reciprocal partner school visits of 24 schools, and a transnational climate change workshop.

Study Visits
In two series of study visits, school representatives from Bulgaria, the Czech Republic, and Romania visited schools and educational institutions that carry out energy-saving projects as well as energy-saving laboratories and other environmental educational institutions in Germany. The visits connected actors with one another to discover commonalities in their climate action work.

Due to the COVID-19-pandemic, the second series of study visits took place virtually and provided multipliers with informative and illustrative best practice examples for local climate action. The two short videos *Wind, Venture, Involvement and Networked-Active-Sustainable* were developed for this exchange.

School partnerships
In 12 school partnerships German schools and selected schools in the partner countries exchanged on leading practices in the area of Education for Sustainable Development (ESD), concrete activities and actions for climate action, and mutual learning on equal terms. The partner schools implemented joint activities, such as a joint climate action day or workshops. They also sent ambassadors to their respective partner school to participate in joint activities in person.

Beyond the school partnerships, more than half of the school representatives surveyed indicated their school joined a climate action network or environmental network during the BEACON project or that they are planning to do so.

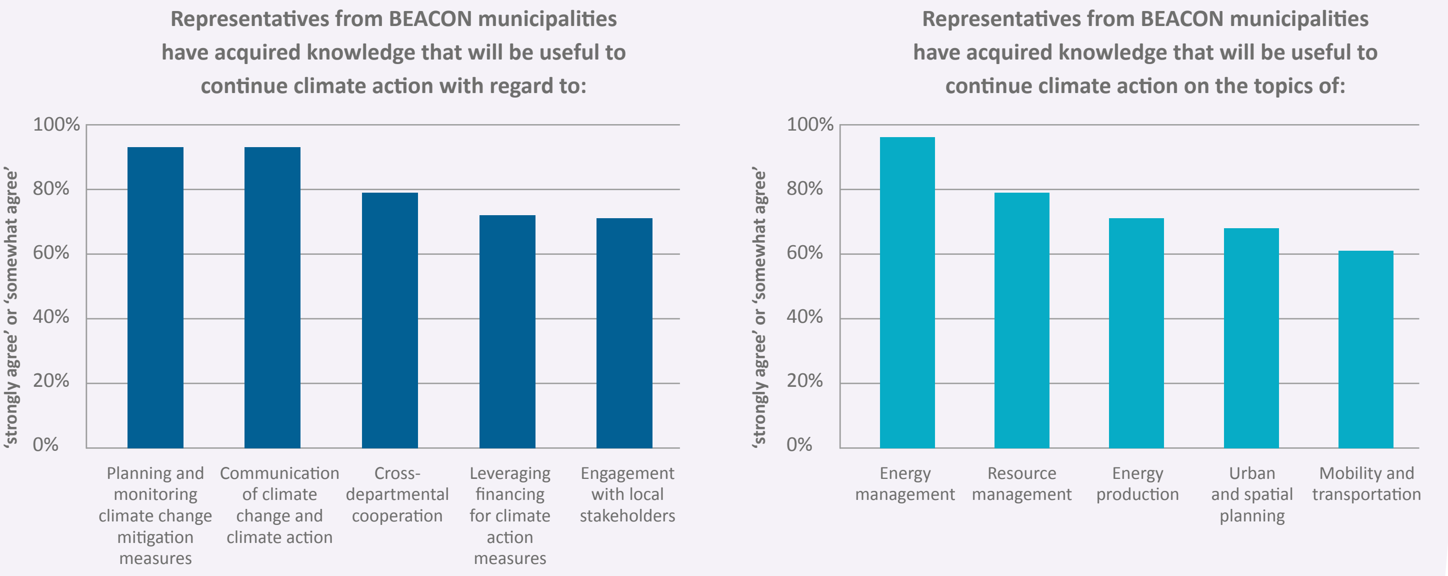
Workshop on climate change
Representatives from schools and educational institutions, research and training institutions, and local administrations in the Czech Republic, Romania, Bulgaria, and Germany came together to gain a deeper understanding of Education for Sustainable Development (ESD) and the link to climate action in a virtual BEACON workshop.

Participants discussed the implementation of ESD regarding climate action, barriers to implementing ESD in their country, and ways to overcome these barriers. The discussions were inspired by leading practice examples from across Europe. In separate country sessions, the discussions focused on specific topics like climate neutrality and the obstacles to introducing it in schools (Bulgaria), the necessity of digitalisation to gain attention from the younger generation (Romania), and reasoning and ways to teach about climate change (Czech Republic).

3 Built capacities and raised awareness

Municipalities

BEACON provided extensive support to municipalities to improve their in-house technical and strategic skills required to accelerate the implementation of climate change mitigation measures. Capacity building ranged from internal climate governance to communication of climate action and collaboration with external stakeholders.



Capacity building for municipalities in BEACON

Example:
Climate and Energy Managers make a huge difference! Polish municipalities learned about the role, necessary skills, and expected tasks of a climate and energy manager in a coaching session featuring Polish pioneer city Bydgoszcz. Technical staff gained a tangible understanding of energy management best practices and funding opportunities available for such a position.

BEACON also helped municipalities to address the lack of public awareness about climate change, an aspect they repeatedly named a key obstacle.

- We offered trainings on climate communication in various settings – be it a conference session on communicating the effects of climate change at the local level, a national training session on communicating pro-climate actions of the local government towards citizens in Poland, or a workshop on climate communication addressing municipal representatives and journalists in Portugal.
- The Romanian cities of Deva, Făgăraș, and Râmnicu Vâlcea implemented the Traffic Snake Game campaign in selected elementary schools. Originally a European campaign, these action days help raise the awareness of children and their parents for walking and cycling to school with the aim to reduce traffic, environmental, and health issues.
- In Přeštice (Czech Republic), we supported a communication strategy, which led to the creation of a communication officer position with a mandate that includes climate change communication. The municipality also created an app that broadcasts important municipal information, including on sustainability and climate-related topics, to about half of the municipal population.
- Písek (Czech Republic) and Pirna (Germany) joined forces to boost sustainable mobility, so they developed a guidebook with best practice examples[1]. The guidebook is targeted towards teachers, municipal representatives, and parents, showcasing how cycling, walking, and public transportation contribute to a safer environment in the vicinity of schools and help reduce air pollution.

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1 Guidebook available for download in Czech, German, Greek, and Polish.

BEACON supported municipal staff in expanding and solidifying their cooperation with relevant external stakeholders:

- On the Greek island of Syros, we helped pave the way for a local climate forum, bringing together key local stakeholders such as hotel owners and representatives from the island hospital who are both large energy consumers and renewable energy producers. Municipal staff learned how to strategically map actors, define responsibilities, and draw links to ongoing projects, consequently developing a consolidated pathway for climate protection.
- In Setúbal, a major harbour city in Portugal, we re-established an exchange on climate action with industry leaders for the first time in years. The group provided input to the development of the Sustainable Energy and Climate Action Plan (SECAP). The final plan will be presented to private sector stakeholders in the near future to mobilise funding. In Coruche, we initiated a collaborative process between local authorities and the charcoal industry, which led to a joint strategy to reduce emissions in the sector.

Over 270 municipal staff participated in the project activities or received tailor-made support from BEACON experts.

What will your city look like in 30 years from now? BEACON helps you to create visions of a net zero emission future.
We don’t know how cities and communities will look like in the future. But we know that digitalisation, innovation, and decarbonisation will transform the way we work, live, consume, or travel. A successful transition path puts citizens first and develops a vision of the future with them. We developed concepts and tools for “vision workshops” to create and idea and spread awareness about climate neutrality. Click the link to find a dedicated toolbox with everything required to implement vision workshops in your municipality or schools (available in Bulgarian, Greek, Polish, and Romanian).
In an inclusive and interactive format, these vision workshops bring together representatives from different groups (the general public, local administrations, and schools) in their local context to make the concept of climate neutrality accessible and to develop a vision for a climate-neutral future. Vision workshops help foster awareness of how national and EU climate policy goals can be broken down to the local level and citizens’ immediate environment.

Schools

The BEACON team provided schools with comprehensive support in developing pedagogical concepts to foster the implementation of climate change education in their school curriculum. From each school interested teachers and the groundskeepers (technical staff) received training on technical and organisational matters of efficient heating, ventilation, and use of lighting and electricity.

The training included a theory section on the anthropogenic greenhouse effect, the resulting climate change, and the most important measures for climate action. We also included hands-on approaches or topics – in particular on the ways how energy saving, protecting biodiversity, recycling and CO_2-savings can be taken up or conveyed in an interesting way in class.

The effects of capacity building and project-related teaching in the classes became noticeable with time. A vast majority of the teachers observed behavioural changes in favour of saving energy, including proper ventilation and room heating.

90% of school representatives reported that their school established a working group on climate action or energy saving.

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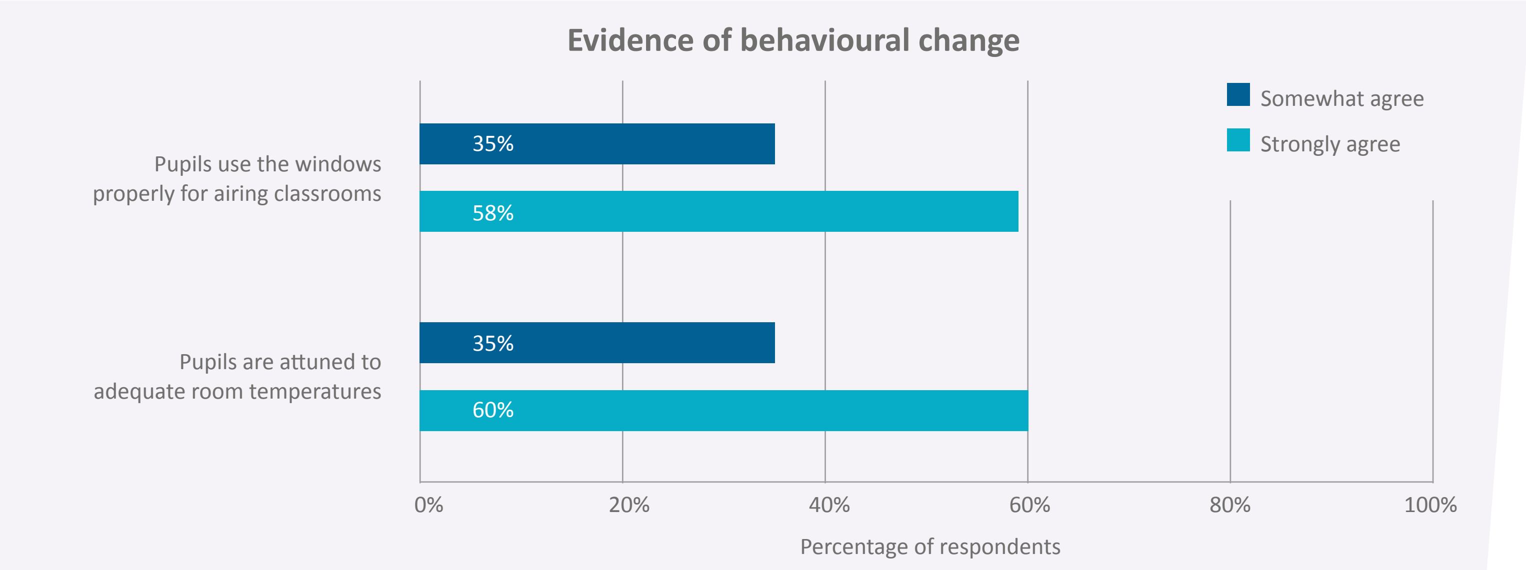


Behavioural change stimulated among pupils

88% of school representatives have observed increased interest in or engagement with climate action among their pupils as a result of BEACON.

Pupils everywhere make themselves heard on climate action
Pupils from participating BEACON schools in Romania, Bulgaria, and Germany solidarized with the Fridays for Future movement. They participated in the Global Climate Strike on 15 March 2019. Just like youth all over the world they are concerned about climate change, pollution, and the loss of biodiversity.

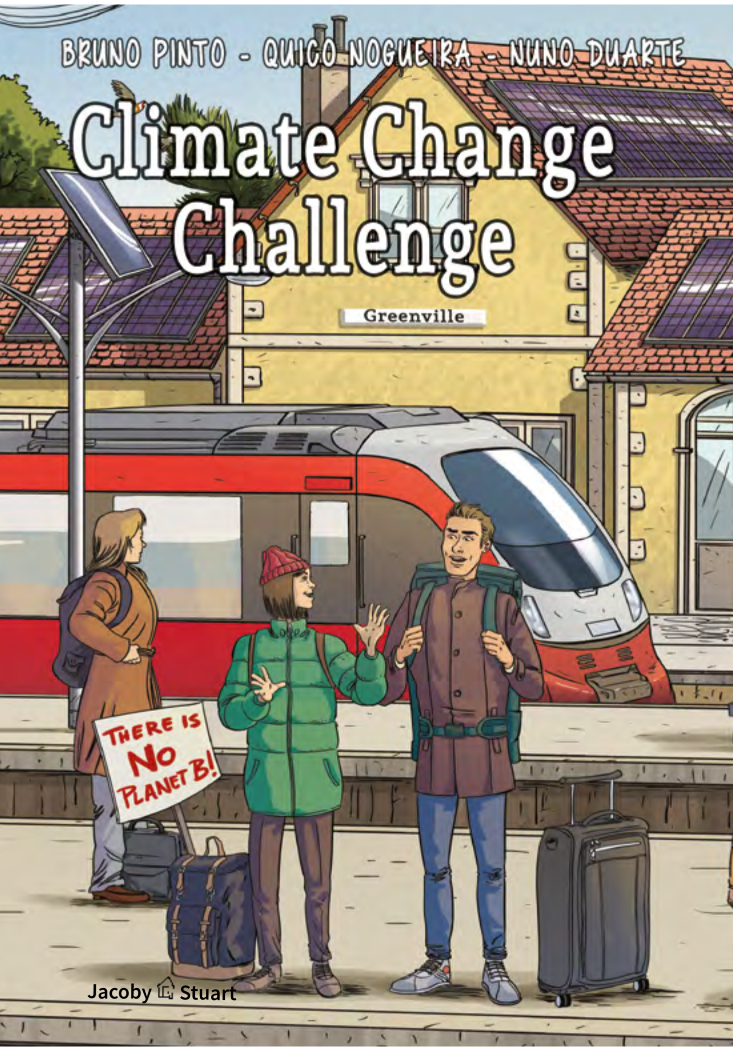
Pupils in Germany, Romania, and Bulgaria demand more climate protection, © photo: BEACON

Examples of teacher trainings

- **Bulgaria:** Trainings in Sofia and Veliko Tarnovo covered pedagogical and technical content of climate protection and climate change education, which otherwise are not part of regular teacher education and thus successfully sparked participants' interest and motivation to implement climate protection activities.
- **Czech Republic:** Even the smallest school can successfully engage in energy saving projects. In the village of Kněžice (u Městce Králové) the teacher training was conducted in the local elementary school which hosts only three teachers and 17 pupils! The headmaster, the responsible teacher and the caretaker developed an action plan based on the learnings of the teacher training, which also includes the local biomass plant, which produces energy from surrounding agricultural biomass.

Over
6,320+
pupils participated in BEACON activities.

- **Romania:** Due to the COVID-19 pandemic, the third round of trainings took place in a hybrid format and thus tried different approaches. A network of teachers and other pedagogical multipliers gathered for an exchange of experiences and discussed the question "What new input can educational staff get to implement an energy-saving project?" Also the importance of extracurricular learning centers has been emphasized.
- **Now it is your turn!** You want to find out how you can implement energy saving projects in schools? We have translated the updated LENA handbook on energy saving projects in schools into Czech, Romanian and Bulgarian. It's no coincident, that the handbooks were strongly demanded and immediately used in teacher trainings and regular school classes. Intuitively structured, one surely can find fast and easy suggestions for schools and their administrators to implement energy-saving projects in schools.



Comic book cover, © Verlagshaus Jacoby & Stuart, Berlin

***Climate Change Challenge*, a comic book developed by BEACON**

You are tired of long texts and want to approach climate change education in a more creative way? Maybe we can help you out: our comic book takes children and adults alike on a journey across Europe to learn about climate change and climate action.
You can follow Sofia and her younger brother Gabriel on this trip to gather information and ideas for a game Sofia is developing about climate change. They come across different countries and people and learn about the devastating effects of climate change and how communities are developing innovative ways to fight against it. Their first-hand experiences reinforce their understanding that climate change is complex and real, but that individuals, communities, and cities can make a big difference.

Currently, the following versions are available:

German: #KlimawandelChallenge. Jacoby & Stuart
Romanian: Problema schimbărilor climatice. Curtea Veche
Greek: The Challenge of Climate Change. Mikros Iros

The German and English versions are available on the EUKI website as free PDF.

4 Developed long-term strategies, supported ambitious policies and vertical collaboration

Municipalities

Experience in the BEACON project have demonstrated that municipalities benefit from support in developing and defining climate plans and goals. Goal definition and plan creation is important on multiple levels. Firstly, in order to find out what can be done, it is necessary to find out what is currently being implemented. BEACON helped garner not only an overview of what was being done, but who was involved, thereby allowing for (re)new(ed) opportunity for interdepartmental collaboration. Bringing different departments helped goals be oriented in a synergistic sectoral-overarching manner. Secondly, goal definition and plan creation help create direction. The planning process undertaken in the context of the project helped identify what the main priorities were. Once the priorities were clear, the accompanying actions were easier to identify and plan for. Thirdly it provides the basis for further political commitment and other integrated processes that can simultaneously support and create internal momentum for further climate action. One such example is participation in the Covenant of Mayors (CoM).

At the start of the project, 15 of the 25 participating municipalities in Poland, Czech Republic, Romania, Portugal, and Greece were signatories to the CoM. Eight of them have renewed or are working on renewing their commitment to the CoM for 2030, and/or have advanced the development of their SECAP. Kalamata (Greece) has joined the CoM during BEACON and is working on delivering its SECAP commitments. Joining the CoM was an important landmark for BEACON municipalities because this commitment requires adoption by the local council and cannot easily be dismissed.

Beyond the decision to commit to a 2030 target, we supported the municipalities in the realisation of the commitment itself. This includes preparing emissions baselines, defining targets, prioritising measures, and submitting reports to comply with the CoM requirements. Taking these steps imply a lengthy process, which tends to lose steam after the initial pledge due to the limited staff resources. It is noteworthy that of the 177 Romanian signatories to the CoM, only 68 have submitted action plans. Of these 68, only 10 have submitted all three plans within the scope of the Covenant (the initial 2020 action plan, the 2030 plan, and the adaptation plan), with three of these 10 being BEACON municipalities.

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In Greece, we focussed on strategically linking prevalent initiatives and projects with the SECAP under development. This created a solid basis for carrying out the municipalities' commitments. Beyond plans linked to the CoM, in certain instances, such as Bielawa (Poland), we facilitated the update of other types of long-term, integrated climate strategies, in this case the Low-Emission Economy Plan. Other municipalities received support on developing a Sustainable Urban Mobility Plan.

In addition to results in overarching strategy and political framing, several municipalities developed or revised planning documents for specific sectors – for example a land use plan in Přeštice (Czech Republic) and a circular economy action plan in Loulé (Portugal). Alba Iulia, Zalău, and Deva (Romania) developed an integrated strategy for urban development focusing on climate change. The strategy looks at consequences and mitigation and adaptation potential. Inspired by its Czech partner municipality Písek, Pirna (Germany) developed a smart city strategy with its own funds that emphasises climate, energy, and mobility. The strategy is feeding into its targets of ramping up climate action and reducing motorised traffic.

Schools

Developing financial incentive systems to establish long-term energy-saving projects

In all BEACON countries we developed concepts for incentive systems for energy savings in schools to motivate schools to continuously carry out energy-saving projects. These differ across countries because the approach, local context, and involved actors differed from country to country. However, all systems are similar in the fact that they are adapted to local contexts, have been developed by the key people on the ground, and are based on the BEACON project work in the schools. The incentive systems can be transferred to other municipalities in the country or have even been set up at national level such as in Bulgaria so that they can be introduced nationwide. In the Czech Republic and Romania, the national level has also expressed interest in expanding the incentive system.

Are you interested in establishing an energy saving incentive system in your school? Reach out to the BEACON partners NTEF (Bulgaria), SNRB (Romania), or SEVEn (Czech Republic). They have prepared reports that outline the objectives, methodology, and design of the incentive system.

Incorporating climate action in curricula

An important factor for the long-lasting implementation of energy-saving and climate action projects is that they are embedded in the right framework conditions. BEACON assessed how climate action is reflected in the national curricula framework and the schools' individual curricula. These conditions were then addressed in different ways:

- In Romania, a curricula task force consisting of a dedicated group of Romanian teachers was established to embed climate action in the national framework curriculum.
- In the Czech Republic, the need for a national task force was mutually agreed and the relevant contents have been identified. The aim of the task force is to better integrate climate protection and education for sustainable development into national and school curricula. In addition to the Ministry of the Environment, the Ministry of Education and the National Pedagogical Institute are supposed to participate in the task force.
- In Bulgaria, a draft document was developed describing the concept of a National Initiative for energy saving projects in schools to be adopted by the Government of Bulgaria (Ministries of Education and Environment) and supported through financial instruments. It describes the roles of key stakeholders in how to structurally integrate climate action and energy efficiency into the curricula.

Better schools – better climate, a refurbishment guide for Romanian schools[2]

You want to renovate your school building? We show you what steps to take to "get the basics right" or to achieve a "high performance" building in our refurbishment guide.
During the BEACON school visits in Romania, it became evident that many school buildings have poor energy performance and lack the basic technical system components to adequately manage and reduce energy consumption and related greenhouse gas emissions. To support local authorities' technical and administrative staff in taking the right measures to improve the energy efficiency of schools, we compiled concrete guidance in a refurbishment guide. The guide addresses the key aspects for a successful implementation of energy-saving measures and efficient operations and maintenance afterwards, including estimates of the savings in energy, costs, and greenhouse gas emissions expected from typical measures as well as references to available funding sources.

Sector	Country	Policy
Transport	France	Bonus-Malus Scheme
	Norway	Incentives for E-mobility
	Sweden	Company car taxation
	Switzerland	Modal shift
Buildings	Denmark	Energy Performance Certificate Database
	France	Energy transition tax benefit
	Sweden	Innovation cluster
	Czech Republic	New Green in Savings Programme
	Latvia	Latvian Baltic Energy Efficiency Facility (LABEEF)
	Slovakia	Slovak Sustainable Energy Financing Facility (SlovSEFF)
Small industry	Belgium	Tax reduction for energy savings
	Denmark	Energy Efficiency Obligation
	Sweden	CO_2-Tax
	United Kingdom	Climate Change Agreements
Agriculture	Denmark	Action Plan Aquatic Environment
	France	Biomethane support
	United Kingdom	GHG Action Plan
	Luxembourg	Agrocovenant

Overview of factsheets compiled on national climate policy instruments

2 The refurbishment guide is available in English and Romanian.

Supported ambitious national policies

We supported the governments and administrations to enhance their climate policies through best practice examples. Effective climate policy instruments implemented by governments across Europe have been compiled in 21 in-depth factsheets and a synthesis report. Eighteen factsheets address instruments in sectors outside of the EU Emissions Trading Scheme where action by national governments is particularly important, such as in transport, buildings, agriculture, waste, and small industry. For each policy we presented success factors and transferability. Further three factsheets examined the Energy Transition Act of France, the Climate Act of Sweden, and the Climate Change Act of the United Kingdom.

Findings from the comprehensive analyses were shared and discussed with national officials through a series of workshops on learnings and potential transferability of the instruments. The learnings fed into the political processes of the German government and informed policy makers on international best practice measures for climate action.

85% of national and regional representatives and experts agree that BEACON helped to promote joint solutions to advance climate action across local and national levels of governance.

Enhanced vertical collaboration

BEACON developed targeted action to promote collaboration between national governments and local and regional authorities (vertical collaboration). The project team brought together local representatives with officials from national ministries, agencies, and regional administrations to develop common approaches and joint solutions on climate action.

- In Bulgaria, results of BEACON and TICA (Towards introduction of Climate Action in the Educational Curriculum of Bulgarian Schools) led to the development of a concept for a national programme for teacher trainings and energy efficiency projects, proposed to be incorporated in the 2022 state budget, and submission of a wider concept to the working group developing the Bulgarian National Recovery Plan and the Bulgarian Operational Programmes channelling EU funding.
- In Portugal, representatives from different governance levels and relevant funding agencies jointly discussed ways to improve the funding conditions for local climate action, resulting in the preparation of a policy brief with recommendations to share with policymakers.
- In Poland, the vertical collaboration enabled small and medium-sized municipalities to discuss the national Energy Strategy 2040 with the government and to provide input on the further development of funding programmes such as the 'City with Climate' programme. Joint conclusions covered a broad scope from energy efficiency and renewable energies to improving air quality.

The vertical exchange enabled municipalities and school representatives to voice challenges and showcase leading practice solutions for local climate action. Likewise representatives from national and regional institutions presented national initiatives and (financial) support mechanisms. The vertical integration and, hence, harmonisation of climate action measures and initiatives is of fundamental importance, leading to more effective and collective efforts as well as allowing for a top-down and bottom-up exchange of information.

Of the national and regional representatives and experts surveyed, 77% strongly agree that BEACON contributed to expanding their understanding of the challenges and needs of local authorities in the field of climate action. More than half of municipal representatives surveyed observed action by national authorities to improve the conditions for local climate action. The feedback received suggests a lasting impact of the vertical networks enhanced by BEACON – almost all respondents expect to continue the multilevel exchange on climate action.

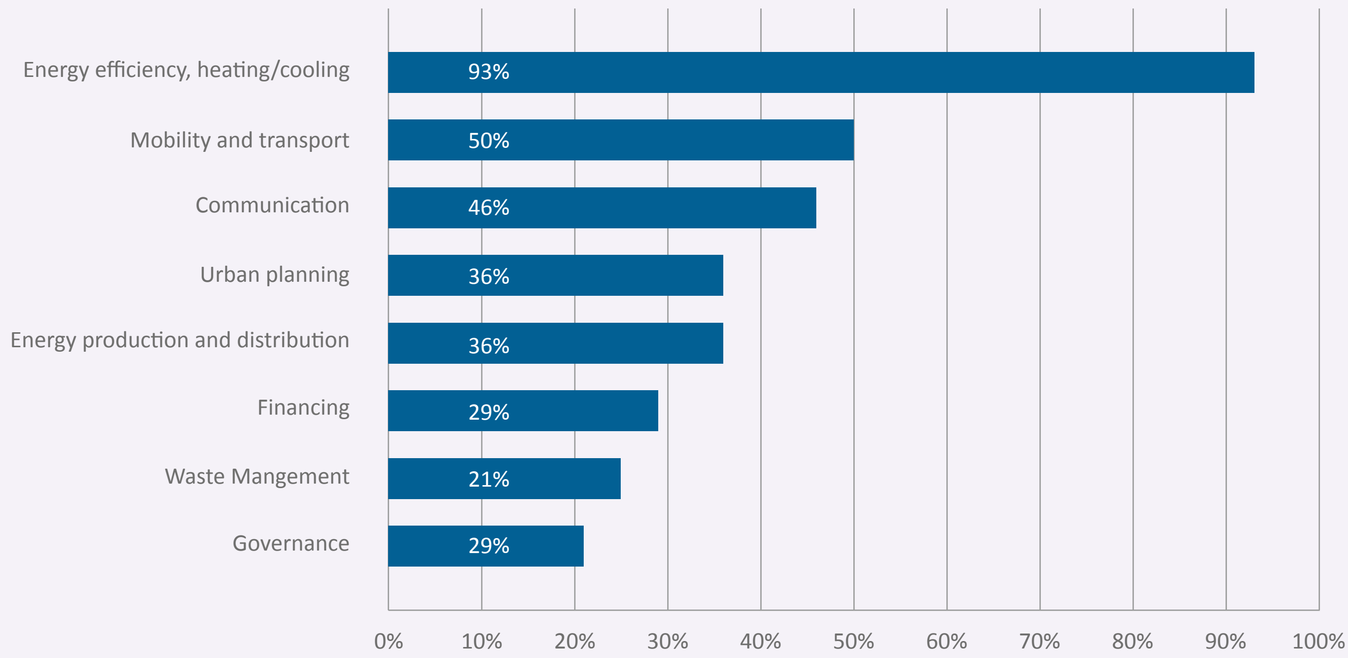
Lesson Learned

Vertical dialogue from local to national level supports better framework conditions for climate action.

5 Created ideas and implemented projects

Municipalities

Over 90% of BEACON participants reported that the project created a general atmosphere that led to the prioritisation and multiplication of climate action measures in their municipality. In many cases, prevalent project ideas were advanced due to strategic or technical support, partially up to implementation. In other cases, new ideas were brought to life.



Areas in which new projects have been realised or advanced as a result of BEACON.

A wide range of topics was addressed, with a notable focus on **energy efficiency improvements**.

- In Greece, Agios Dimitrios, Dorida, Farsala, and Syros-Ermoupoli were supported to set up energy management systems following the ISO 50001 standard. The emphasis was on establishing the necessary internal structures within the administration and on initiating systematic data collection. In parallel and as a consequence to these efforts, single energy-related retrofits and renewable energy investments in public buildings (for example the town hall and schools in Farsala, or the hospital in Syros) or in streetlighting and the municipal fleet in Dorida were initiated or completed.
- In Romania, most BEACON municipalities started tracking or improved the monitoring of energy usage of public buildings and produced annual energy reports. These reports provide invaluable data for the further measure planning and to apply for relevant grants.

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Many municipalities were adamant in boosting **renewable energy production**.

- Dorida and Farsala achieved important milestones in establishing local energy communities. In Farsala, the municipal board approved the creation of the energy community that is to include the local water treatment company, a day-care centre, and several municipal associations. In Dorida, the energy community is expected to encompass the ports of Agios Nikolaos and Aigio.
- In Romania, all the municipalities conducted an initial study of the rooftop photovoltaic (PV) potential for six public buildings. The study evaluated the power that could be produced, the costs saved, and potential emissions reduced. The success of the initial study led them to extend it to eight additional buildings in each municipality (total of 14), and Alba Iulia has used the results as a basis to apply for funding via a EEA Norway grant to undertake the PV installation.

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Linking climate change mitigation and adaptation was an important topic, particularly in the context of the climate municipal partnerships.

- Coruche (Portugal) and Dorida (Greece) are over 3,000 km apart, but distance did not diminish their ambitious plans that stemmed from inspiring expert meetings during their partnership activities. Because both struggle with droughts and high energy consumption in buildings, the municipalities will start a new chapter of cooperation on their roofs: Dorida will conduct a study on a combined green roof and PV system with the goal of reducing consumption and producing their own energy. Coruche will conduct a pilot project by greening the roof of the municipal library to see whether this practice could be expanded to other municipal buildings. The municipalities built a network around this idea to continue the exchange of results and further initiatives .
- Inspired by similar efforts in their partner municipality of Bottrop (Germany), Agios Dimitrios (Greece) decided to rethink its strategy towards private car use and take action. The municipality is going to redesign two traffic hot spots by adding green spaces and walkways to discourage speeding. With this, the municipality aims to give more space to people, reduce air pollution, and increase liveability.

In Coruche, a **deep transformation process of the local industry** was initiated with the support of BEACON: The city started addressing the decarbonisation of its traditional charcoal production by entering into a structured dialogue with producers and civil society. The result of this dialogue was a two-tier approach agreed on by all stakeholders. The majority of producers will form a cooperative and operate with a low-emission facility (zero-coal factory) built on municipal land. The remaining producers will take extensive measures to increase efficiency of their ovens (for example refurbishment) to minimise pollution.

These projects could not be realised without funding, so we continually advised and supported the participating municipalities in every BEACON country on **funding opportunities**. Examples of successful access to financing include the following:

- Jasło and Cieszyn (Poland) received support from the local BEACON partner to apply for the Norway Grants (part of the EEA development grants). Cieszyn was assisted in its successful application to the fund for energy and climate and receives support to prepare an energy consumption plan. The municipality will receive funding from the Local Development Programme worth €3.5 million. Jasło applied for the fund on local development, also receiving €3.5 million. In the latter case, BEACON work was instrumental in integrating climate change mitigation in an application with an otherwise broader focus, making use of existing financing opportunities and priorities of the local decision makers to advance climate action.
- Alba Iulia (Romania) used the results of a rooftop PV study to apply for funding through the EEA grants to realise the installation.
- Sztum (Poland) was successful in acquiring funds from the European Cities Facility (EUCF) – one of two Polish municipalities selected in the first EUCF call. The municipality plans to realise new investments in its water and sewage management system. This includes the installation of renewable energy sources, the reduction of the energy intensity of the water supply and wastewater collection, and the possible introduction of electric vehicles as a form of energy storage.

BEACON participants were also advised to **implement financing mechanisms** that do not (solely) rely on grants.

- Rožnov pod Radhoštěm (Czech Republic) decided to set up an Energy Performance Contracting scheme to implement public building retrofitting in 30% of its public buildings. Annual savings are estimated to reach 1 GWh or 1.2 million CZK (€46,000), and investment of around 12 million CZK (€460,000). With our support the tendering process is to start in September 2021, and the contract to be awarded by the end of the year.

To further enhance **strategic financial planning and project development** for municipal climate action, we developed country-specific guidance reports for the Czech Republic, Greece, Romania, Poland, and Portugal. These reports summarise information on all available funding and financing opportunities for local climate action, both on the national and European levels. They are available for download on the EUKI website.

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Schools

Thanks to the incentive systems developed and energy-saving pilot projects implemented during BEACON, schools were able to achieve energy savings up to 9% in electricity and up to 8% in heat consumption through low or no investment energy-saving projects carried out by pupils, teachers, and caretakers. Over 88% of surveyed school representatives found that BEACON contributed to reducing energy, waste, or water consumption in their schools and the project helped to engage with pupils on climate action.

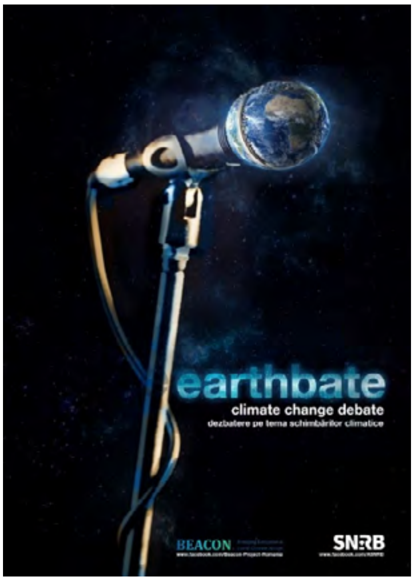
536 tons of CO_2-equivalent were saved in participating schools through energy-saving activities supported by BEACON.

Pupils from Bulgaria are top-grade in energy saving

- BEACON schools in Bulgaria reduced their energy consumption by 7% per year, on average without any financial investments.
- If BEACON activities were implemented in all Bulgarian schools the saving potential is huge:
  - More than 43,000,000 kWh energy savings per year (heat and electricity)
  - More than € 2.7 million energy costs savings per year
  - Over 14,000 tonnes of CO_2 emissions saved per year[3]
- A national programme is being developed based on the positive experience with the energy-saving models promoted by BEACON.

Over the course of the project, we developed various complementing creative ideas for more targeted external communication and to increase public awareness. These ideas were often the result of insights gained through the direct exchanges with the schools and municipalities, but they also constituted a way to respond to the COVID-19-related restrictions by creating new channels and platforms for exchange. In all cases, the schools benefited from the continuous and open sharing of ideas across borders in the project.

Examples



Earthbate – the climate change debate competition:
During the COVID-19 pandemic, the local BEACON school partner in Romania created an interactive virtual format called Earthbate to raise pupils' awareness and motivation to discuss climate change-related topics. Earthbate is based on an existing concept of debate teams in schools and was inspired by the desire to include a local debate competition in the climate action days of BEACON. The Earthbate competition involved 20 debate teams of three pupils and one teacher each, all from different schools. The debates took place in online live streams with up to 400 attendants and included participant voting to select the winners.

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Bike cinema:
In Bulgaria and Romania, children and adults can experience how much energy is needed to show a movie by producing the energy themselves. In bike cinemas the electricity is generated by participants cycling on connected bicycles to power the projection of a movie on a screen. The events raised awareness for a responsible use of energy and resources and were often integrated in public fairs and festivals. Due to the high interest from schools and municipalities, additional events are already under preparation.

Bike cinema screening in Sofia, Bulgaria, © photo: BEACON

3 Own estimations based on Bulgarian emission factors.

Floor stickers: These floor stickers created by our comic book authors remind pupils and teacher each morning of energy-saving and climate-friendly behaviour.

BEACON floor sticker with energy-saving tips

Involving Bulgarian kindergartens: Due to high interest from kindergarten teachers the municipality of Burgas introduced energy-saving activities in all their schools and kindergartens. We supported them with a teacher training for kindergartens that also involved lecturers from Sofia University. In total, 30 kindergarten teachers participated and received an official certificate and credits. Thanks to the training and measuring equipment received, six kindergartens were enabled to initiate energy-saving projects.

93% of school representatives found BEACON was effective in supporting the implementation of climate action measures and projects in their schools.

WHAT CAN WE DO NEXT?
SUCCESS FACTORS AND ACTION AREAS

Success factors

Overarching

- **Cross-border dialogue:** Connecting local authorities and schools from different countries into one network and facilitating regular exchange stimulated inspiration for robust climate action and created real added value in terms of mutual learning, the ensuing collaboration, and a sense of common identity. The project's success in creating actual beacons was also illustrated by additional schools and municipalities outside of those initially selected joining BEACON activities using their own resources.
- **Tailored support, flexibility, and innovation:** Grounding our support in a comprehensive needs' assessment carried out jointly with the municipalities involved allowed us to provide targeted support and helped maximise effectiveness. Similarly, fine-tuning project activities based on feedback from regular evaluations and adapting planned activities to the remote working and learning situations induced by the COVID-19 pandemic secured BEACON's sustained relevance and added value for all actors involved. The BEACON team continuously developed new ideas and innovations to meet target groups' demands and to increase the project's impact.
- **Vertical collaboration:** During the project, it became clear that many levers for climate action are not entirely in the hands of local actors but also depend on national framework and financial support. BEACON addressed these gaps and involved national, regional, and local decision makers in targeted exchange, and facilitated new relationships and networks. Only through vertical collaboration proven bottom-up initiatives have the potential to be scaled up to a nationwide programme.
- **Leveraging local knowledge:** Local partners led the implementation of BEACON in each partner country. In all project activities, these organisations used their knowledge of local policy frameworks, funding opportunities, and stakeholder networks to engage with target groups effectively and tailor project support to the local contexts.
- **Sustained support:** Building networks and meaningful collaboration within and across borders takes time. The effective project lifespan of nearly 3.5 years allowed us to become a trusted advisor for the diverse target groups, to build capacities, and to foster planning and implementation of concrete climate action projects. This laid the foundation to ensure replication and sustainability of the project impacts.

Guiding principles for effective collaboration in BEACON
Bilateral and multilateral cooperation are at the core of the EU and are paramount to the success of its climate and energy policy. For BEACON to succeed as a large-scale European project involving multiple work streams, target groups, and partner organisations, it was key to ground all project action in a collaborative framework. Five guiding principles were incorporated in all activities:

1. Climate action as a European vision – making the benefits visible
2. European community spirit – building a network
3. Working together at eye level – jointly examining decisions
4. Building bridges – creating synergies between different areas
5. Creating continuity – anchoring and multiplying knowledge

Municipalities

In addition to the overarching success factors, the following were specific to the municipalities during the BEACON project:

- **Political backing:** Municipalities that had their political leadership backing and engaged in the climate change activities were particularly successful in advancing the local agendas. High-level networking opportunities – such as the BEACON conference back-to-back to the International Conference on Climate Action in Heidelberg in 2019 – played an important role in shifting the perspective of elected representatives and placing climate action higher up the local agenda.
- **Clear responsibilities:** Municipalities that had clearly defined in their administration who coordinates climate action and/or specific domains related to climate action were better equipped to progress faster. In several cases, BEACON helped providing that clarity, which laid the ground for long-term impact. Oftentimes, the success of projects relied on the feeling of responsibility and commitment of individual staff members. It is therefore important to provide appropriate incentives and promote individual talents.
- **External expertise:** Support from external experts on strategic priority-setting, financing, and technical implementation was instrumental in reaching tangible impact. External experts helped fill capacities and/or knowledge gaps in the short term and therefore accelerated the pace of measures realisation.

- **Convening power of external facilitators:** Having persons external to the municipal administration initiate, moderate and/or inform the dialogue on climate action, often made it easier for staff members to exchange on priorities and develop a common approach. A new culture of collaborative work could be initiated, and cooperative approaches of municipalities led to better financing conditions. In some cases, this external impetus was paramount in committing to new climate goals.
- **Overarching narrative:** BEACON was particularly effective when municipal staff perceived it as one intervention in a continuum of efforts to tackle climate change spanning beyond the projects' lifespan. Linking strategies among each other, understanding various measures as being part of climate action when they used to be perceived as sectoral endeavours, and embedding projects in an overarching narrative helped create a climate identity, a general atmosphere conducive to the multiplication of climate action measures.

100%
of municipal representatives intend to continue climate action measures supported by BEACON after the project ends.

Top three learnings for local authorities

1

Create a dedicated position – if possible, a team – for climate action in the municipal administration.
Skilled and dedicated staff will make a big difference in the pace and quality of transition to a sustainable and climate-friendly municipality. In a first step this may mean to reorganise available capacities. When doing so, you should distribute clear roles and bring staff members from various units together. Cross-departmental cooperation facilitates high consistency of the measures across the administration and helps to mainstream climate policy into various sectoral strategies and projects. Climate-proofing or Paris-alignment will become the standard for basically all investment decisions of a municipality, making additional staff necessary. Depending on your country, funding for staff costs may be leveraged via project-related grants or funding supporting the development of strategic concepts. For instance, this was the case in the Czech Republic via the National Programme Environment (NPŽP).

2

Work with people outside of the administration that can facilitate participation processes and provide additional expertise.
Their convening power helps build trust and cooperation among stakeholders. Their expertise also contributes to the high-quality development and technical realisation of the municipality's climate projects.

3

Engage with the younger generations!
Young people carry powerful messages. Create opportunities to amplify their voices – invite them to share their visions and demands, involve them in decision-making processes, open a direct dialogue between them and elected representatives. They help put pressure on political leadership and raise awareness of the local population on the urgency and benefits of climate action.

Schools

The following factors set the foundation for BEACON's success in increasing knowledge of climate change and climate action as well as for implementing climate action projects in schools and ensuring these are sustained long-term:

- **Whole school approach:** Schools were encouraged to act responsibly, actively pursue climate action and involve all relevant actors in an inclusive fashion. This involvement included headmasters, teachers, pupils, parents, technical staff, sports clubs, neighbours and the owners of the school buildings – the municipalities.
- **Cooperation with municipality:** The cooperation between school and municipality was found to be paramount to achieve long-term energy savings and emission reductions. While being the building owner, the municipality typically has no mandate regarding education. Therefore, municipalities were asked to include school operations in their strategy to reach their climate policy targets.
- **Networking and adoption of learnings:** All relevant stakeholders from schools and municipalities were brought together – within a municipality, within a country and also in exchange with their peers in other countries. Stakeholders were provided with relevant knowledge and experience to adopt learnings in their context which was paramount to long-lasting climate action in schools.
- **Integration of climate action into school curricula:** This integration was necessary to set up the pedagogical and organisational framework of the school, to ensure continuity and to contribute to the quality of teaching. It also helped to create a unique, progressive school profile, leading to increased ownership of the public with its school.
- **Profound trainings and capacity building:** Appropriate trainings and corresponding teaching material were necessary to carry out successful climate action projects. This included training for teachers, technical caretakers, and municipal representatives.
- **Long-lasting incentives for project implementation:** To make energy saving at schools a long-lasting, viable, and self-sustaining institution, it proved important to start with determining the duration of the project in agreement with the municipality and ask schools to sign an agreement with the municipal council. Experience has shown that the relevant stakeholders need incentives to implement energy-saving projects through incentive models tailor-made to the local context. Apart from financial benefits from savings in energy costs or other financial incentives for teachers (for example salary increase), schools have been motivated by the following factors: Pedagogical added value, equipment with measuring devices, onsite or external support on technical matters. Incentives for municipalities on the other hand included: Tangible energy savings and associated greenhouse gas emissions reductions.Technical know-how

Top three learnings for schools

1

Build up knowledge.
Through dedicated trainings and materials, teachers gain the necessary knowledge and tools to teach on climate change and to develop and implement their own projects.

2

Create networks to join forces and exchange experience. Building networks and conveying the feeling of not being alone is an important factor to motivate teachers and other school representatives. Working in networks also means joining forces to overcome obstacles and push for structural changes as well as the opportunity to exchange good practices.

3

Involve pupils and increase their awareness.
Young people are the generation of tomorrow. They will have to live with the consequences of climate change for much longer. Hence, it is important to sensitise them to the issue at an early stage and to tap their creativity to work on solutions.

86%
of school representatives intend to continue climate action measures supported by BEACON after the project ends.

Action areas and outlook

- **We need to reach net zero emissions rather sooner than later: national actors need to scale up activities and projects initiated in BEACON by establishing support structures.** Municipalities and schools should get the strategic and technical knowledge they need to design, develop, and finance their projects, for example through institutionalised advisory facilities. An important aspect is also to help build project development skills in municipal administrations. To establish such structures, possible institutional forms need to be investigated in each country, funding for the institutional set-up provided, capacities built, and funding sources identified, which would then be channelled via the institution to the local municipalities and schools.
- **Municipalities need capacities to set climate targets, develop ambitious strategies, and monitor their implementation in line with national targets and strategies.** Frameworks need to be created to provide incentives as well as financing for creating dedicated positions such as climate (and energy) managers or teams in the local administration to mainstream climate action throughout all sectors. The German National Climate Initiative provides interesting experience and knowledge to set up such frameworks. Initiatives such as the Czech Association of Energy Managers or national city associations that have built and shared expertise over decades are a promising starting point.
- **Platforms for effective collaboration between relevant national ministries and across governance levels need to be provided.** In most countries, thorough work on national regulatory frameworks is still needed to provide clear, long-term, adequate rules and incentives for climate action – particularly but not exclusively in the field of renewable energy generation. Understanding the obstacles local authorities face in the area of climate action is key to reflect local needs in national strategies and funding schemes and to maximise their effectiveness. Institutionalised communication channels on climate change mitigation could address the current lack of consistency – and partly ambition – across governance levels. Using such channels to identify leading practices and enable climate champions to showcase their achievements also inspires peers to emulate successful approaches and lays the foundation for multiplying impact. Enhanced collaboration across governance levels is thus paramount to turn climate goals into tangible greenhouse gas emissions reductions.
- **Make smart use of cohesion policy funds and green recovery funding.** Ramped up EU funding provides extended opportunities for financing the transformation towards carbon neutrality. Capacity building on how local actors can access available funding needs to be provided. Facilitating diverse financing sources should be part of this exercise. Enabling access to financing is closely linked to the needed institutionalised support structures, dedicated positions in the administration, and vertical dialogue described in the previous three bullets.
- **Shape skilled professionals.** Competent staff in municipalities and schools is still too rare to reach the level of ambition and volume of climate projects needed to meet the Paris Agreement goals. In a world that will look different in only a few decades, if not years, it is paramount to teach relevant knowledge on climate change and climate change mitigation to pupils and young professionals now.

BEACON Bridging European & Local Climate Action

Visit the BEACON page on the EUKI website:
www.euki.de/euki-projects/beacon

Follow EUKI on Twitter:
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Email us at:
BEACON_HelpDesk@guidehouse.com

On behalf of:

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

of the Federal Republic of Germany

European
Climate Initiative
EUKI

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KALAMATA

Greenhouse Gas Emission Inventories and Quantification of Impacts from Implementation Measures and Policies in the Municipality of Kalamata

NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

ΑΞΩΝ

AXON ENVIROGROUP LTD.
ΑΞΩΝ ΠΕΡΙΒΑΛΛΟΝΤΙΚΗ ΕΠΕ.

March 2023

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Project Drafting – Design Team

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Abbreviations

IPCC: Intergovernmental Panel on Climate Change

UNFCCC: United Nations Framework Convention on Climate Change

RES: Renewable Energy Sources

DAPEEP: Operator of RES & Guarantees of Origin S.A.

HEDNO: Hellenic Electricity Distribution Network Operator

EU: European Union

ELSTAT: Hellenic Statistical Authority

EXEN: Energy Saving

NECP: National Energy and Climate Plan

K.EN.A.K.: Energy Performance of Buildings Regulation

CFR: Net present value

SUMP: Sustainable Urban Mobility Plan

SEAP: Sustainable Energy and Climate Action Plan

SEPDEM: Environmental, Building, Energy and Mining Inspection Body

RIS: Ministry of Environment and Energy

Natural Gas: Natural

Gas

PV: Photovoltaics

Government Gazette: Government Gazette

Landfill: Landfill

United Nations: United Nations

GHG: Greenhouse Gases

P.E.: Regional Unit

D.E.: Municipal Unit

Summary

In December 2022, the Municipality of Kalamata concluded a contract with the company AXON Environmental Ltd in order to update the Greenhouse Gas Emissions Inventory. In particular, within the framework of the contract, the greenhouse gas emissions arising from all sectors for the year 2019 were calculated, with the aim of recording and mapping the course of the Municipality's emissions and actions. In the same context, The proposed emission reduction actions have been assessed and updated and the emission reductions to be achieved by their implementation by 2030 have been reassessed. When updating the emissions, all greenhouse gases, i.e. carbon dioxide (CO2), methane (CH4) and nitric oxide (N2O), were calculated for the final calculation of the $_{CO2-eq}$ carbon dioxide equivalent. and therefore conduct a more integrated approach.

The purpose of the Project is to cover the obligations of the Municipality of Kalamata for the year 2030, according to the NetZeroCities project which supports the European Mission of "100 Climate-Neutral and Smart Cities by 2030" launched as part of the Horizon Europe program on greenhouse gas emissions in the five main sectors of anthropogenic activities. The importance of updating the SEAP lies in the fact that, Through this, there is a clear picture of the course of emissions and consequently the selection of appropriate actions can be made more accurately to achieve the set emission reduction target in the Municipality of Kalamata. As presented later in this Plan, the Municipality of Kalamata, through its participation in the 100 European cities of the NetZeroCities Mission, set climate neutrality as a goal for 2030.

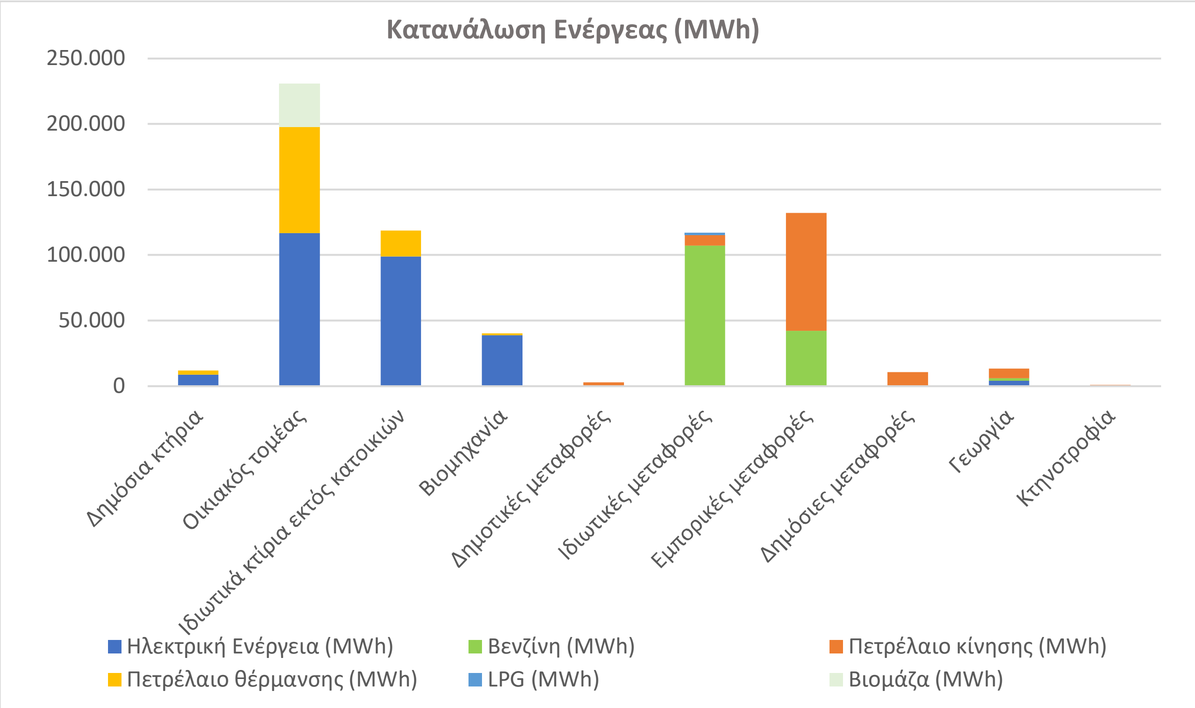
The **scope** of the project to achieve the above objective includes the following:

1. Update of greenhouse gas emissions in the area of the Municipality of Kalamata according to the above for the year 2019
2. Evaluation and quantification of the impact on greenhouse gas emissions in the area of the Municipality of Kalamata from the implementation of measures and policies, according to the above for 2030.

The first chapter of this Report describes the area of study and provides useful statistics. The second chapter includes the methodology applied to calculate emissions, the data required and the emissions calculated for 2019. According to the updated data, for the reference year 2019, the consumed energy of the Municipality amounts to 677.21 GWh. 34% of them came from the Residential Sector, 18% from the Tertiary (professional/commercial/craft) Sector, 19.5% from commercial transport and 17% from private, road transport. The remaining approximately 12% is allocated to energy consumption by industry (~6%), buildings and facilities of the Municipality (~2%), while the contribution of public transport, agriculture and livestock is much lower. Given that Private and Commercial Transport constitute the largest part of energy consumption (both sectors in total 37%), it is expected that the use of fossil fuels will also have a dominant role in the energy mix in the area of the Municipality of Kalamata. Specifically, petroleum products in 2019 accounted for 55% of total energy consumption (22.3% gasoline, 17.6% diesel and 15.5% heating oil). Another important

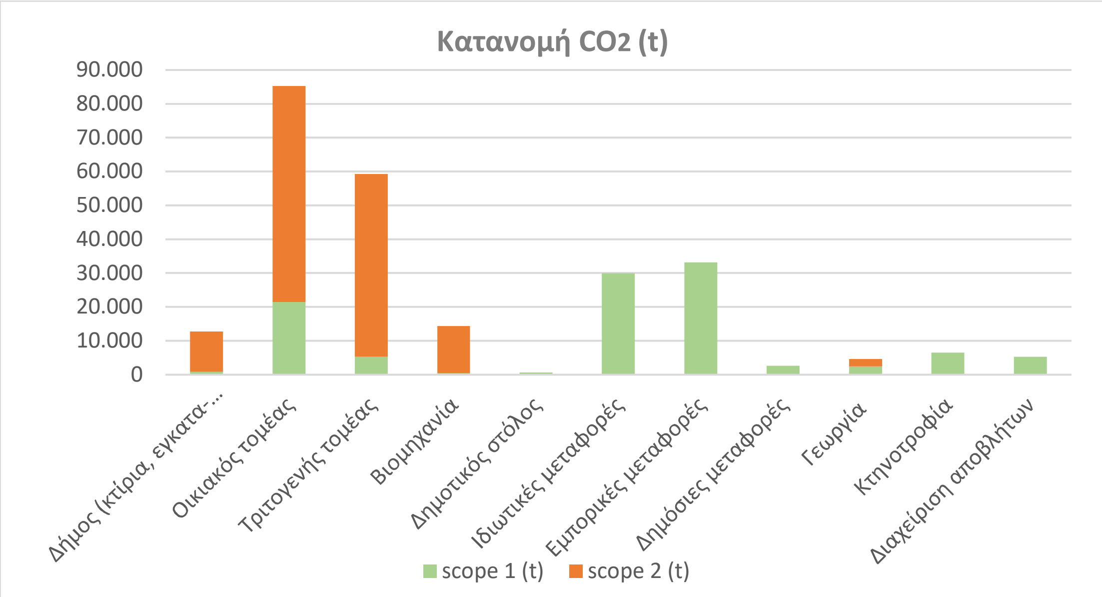
form of energy is electricity, which accounts for 39% of total energy consumption. The remaining 5% concerns forms of energy such as LPG, biomass, etc.

The following figure shows the energy consumption for each sector of the Municipality of Kalamata per energy source.



Shape 1: Final energy consumption by energy source and sector (2019)

From the above energy consumptions, summing up the emissions due to waste management, it appears that the total carbon emissions for the reference year exceeded 255.66 thousand tons of CO2, the distribution of which is illustrated in the figure below. It is clarified that the following figure sets out CO2 emissions from electricity consumption (scope 2) and fossil fuels (scope 1). As shown in the figures below, the sectors that emit the largest quantities of greenhouse gases are the domestic and tertiary sectors, followed by commercial and private transport. However, regarding emissions from the first two sectors, it is expected that, due to the significant penetration of RES in 2030, their emissions will be significantly reduced.



Shape 2: Final CO2 emissions -eq. by sector and by source (2019)

The last 20 years have seen significant changes in the global climate that negatively affect citizens' lives in many ways. The third chapter of this Report reflects the current situation in the Municipality of Kalamata, as well as the vulnerability and risks due to the effects of climate change. The data come from the Regional Climate Change Adaptation Plan (PESPKA) of the Peloponnese Region (2020). Finally, the fourth chapter describes the planned measures until 2030, assesses their contribution to reducing GHG emissions and recalculates total emissions for 2030. It is noted that total emissions within the area of the Municipality of Kalamata are expected to be reduced by at least 60% by 2030, taking into account the measures provided for in the SDAEK.

In summary, this study is structured in the following four chapters:

- Overall Strategy: Demographic, financial and organizational elements necessary for the preparation and implementation of SDAEK as well as the long-term vision of the Municipality for 2030.
- Reference Emission Inventory: Recording of final energy consumption within the boundaries of the Municipality and calculation of greenhouse gas emissions (carbon dioxide, methane and nitrogen dioxide) for each sector of activity for the reference year 2019.
- Assessment of potential risks from the effects of climate change and the extreme weather events it entails.
- Measures and Actions for the mitigation of emissions until 2030: Information on local electricity generation projects from RES, energy saving and energy saving measures
efficiency as well as other actions related to the energy system.

1. Current situation

The Municipality of Kalamata is located in the Prefecture of Messinia, in the southwestern part of Peloponnese and is the merger of four former municipalities with the implementation of the program "Kallikratis": the Municipality of Arios, the Municipality of Arfara, the Municipality of Thouria and the Municipality of Kalamata [1]. The Municipality administratively belongs to the Regional Unit of Messinia of the Peloponnese Region, to which belong 4 more Regional Units (O.E.), which are listed below [2]:

- P.E. Argolida
- P.E. Arcadia
- P.E. Korinthias
- P.E. Laconia

The geographical position of the Prefecture of Messinia and the Region of Peloponnese are shown in Figures 1.1 and 1.2.

Source: Wikipedia

Image 1: Messinia Prefecture

Source: Wikipedia

Image 2: Peloponnese Region

The Municipality of Kalamata borders with the Municipalities of Messini, Oichalia, Megalopoli, Sparta and Western Mani (these Municipalities are listed in the order of numbering in Figure 1.3) [3]. The total area of the municipality is 440.3 square kilometers. According to the 2021 ELSTAT census, the population of the Municipality amounts to 72,906 permanent residents. The geographical boundaries of the Municipality are presented below.

Source: Wikipedia

Image 3: Municipality of Kalamata

1.1 Demographic Trends

According to the demographic data of ELSTAT, the Municipality of Kalamata [4] presented a continuous increase in its population since 1991, which continued until 2011, however in the 2021 census the trend shows a negative sign. Specifically, based on the 1991 census, the population of the Municipality amounted to 44,052 permanent residents, in 2001 its population increased significantly reaching 61,373 while the 2011 census showed a further increase to 69,849 permanent residents Inhabitants. Finally, in the 2021 census there is a decrease and the permanent residents now amount to 72.906.

According to ELSTAT's demographic data for the Municipality of Kalamata, the population of the Municipality increased by 39.32% during the decade 1991-2001 and by 13.81% in the following decade (2001-2011). However, the opposite picture is presented in the last census, during which a decrease of about 5% is recorded. Regarding the Prefecture of Messinia, there is a slight decrease of 0.24% in the decade 1991-2001 and an even greater decrease of 3.97% in the decade 2001-2011. Finally, during the decade 2011-2021 the population of the Prefecture decreased by approximately 8.7%. From all the above data, which are reflected in detail in Table 1.1., it is observed that in the decade 2001-2011 there was a wave of urbanization in the southern Peloponnese, which had already begun to occur from the previous decade.

Table 1: Population evolution of permanent population in the period 1991-2021

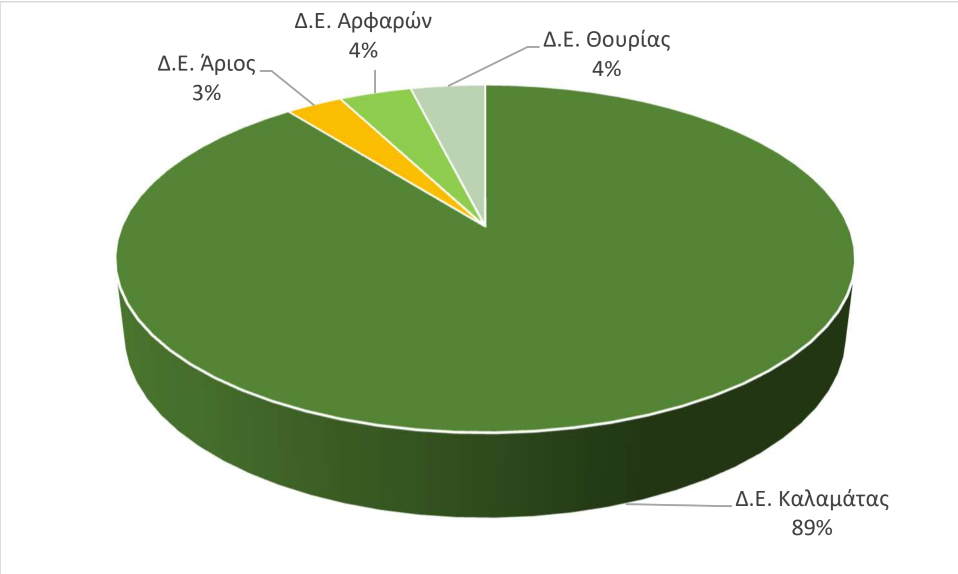
Population	1991	2001	2011	2021

Greece	10.259.900	10.934.097	10.816.286	10.482.487
Messinia Region	166.964	166.566	159.954	146.080
Municipality of Kalamata	44.052	61.373	69.849	72.906

In the table below, the population distribution for the four Municipal Units of the Municipality is recorded. The final, corresponding data of the 2021 census are not available.

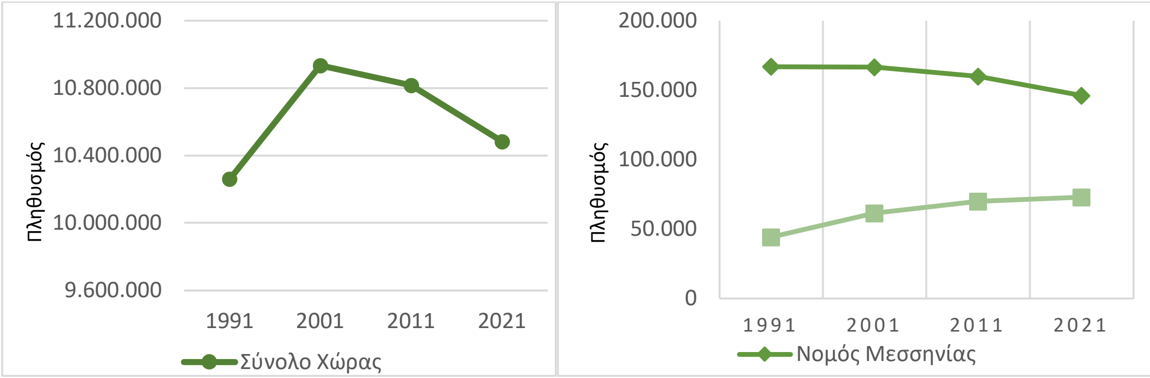
Table 2: Population distribution of the permanent population of the Municipality by Municipal Unit

	1991	2001	2011
Municipality of Kalamata	50.641	57.620	62.409
D.E. Arios	2.345	2.189	2.071
Arfara	3.081	3.212	2.648
D.E. Thourias	3.575	4.106	2.721
Total	**59.642**	**67.127**	**69.849**



Shape 3: Population distribution of the permanent population of the Municipality by Municipal Unit (2021)

More specifically, the population changes at the level of the Municipality, the prefecture and the country are presented below:

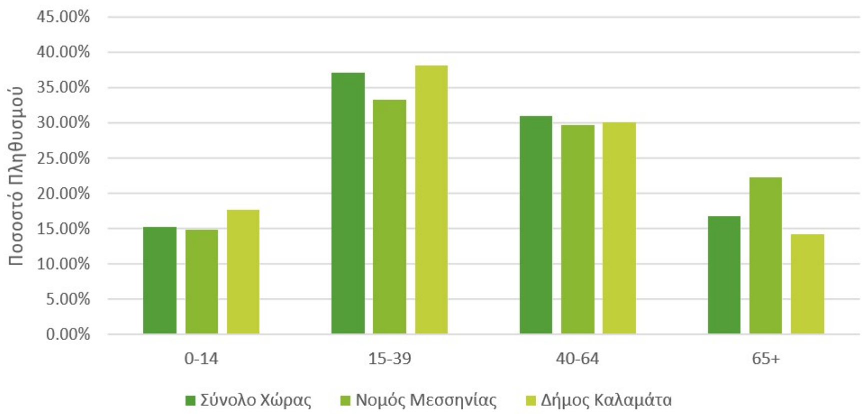


Source: ELSTAT

Shape 4 Population evolution at Municipality, Prefecture and Country level

ELSTAT data are also used to study the age distribution of the Municipality. It is important to note that the data of 2001 are used as the data of 2011 are incomplete and do not offer a clear picture of the age groups of the Municipality, while the corresponding data from the population census of 2021 are not available.

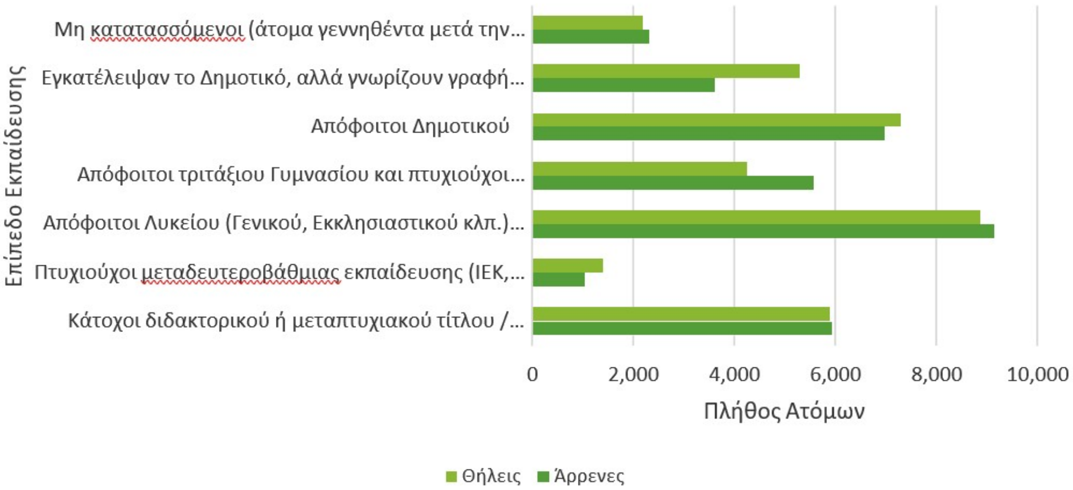
In order to examine the distribution of the population into age groups, a comparison will be made with the age structure at the level of the municipality, prefecture and country. In the Municipality of Kalamata, as well as at prefecture and country level, the largest percentage is occupied by ages 15-39. In the Municipality the corresponding percentage is 38.18%, in the Prefecture of Messinia 33.30% and throughout the country 37.15%. The second largest age group is that of those aged 40-64 with a percentage of just over 30% in the Municipality. At county and country level, a similar percentage is slightly reduced. Ages 0-14 account for 17.60% of the population. Finally, it is noted that the Municipality is characterized by a percentage of residents close to that of children 0-14 years old who belong to the category of 65 years and over, with a percentage of about 14.20%. Nationally this percentage amounts to 16.71%, while in the prefecture of Messinia it shows an even higher value, reaching 22.29%. Therefore, it can be stated that the Municipality of Kalamata does not strongly address the problem of population aging, a problem that increasingly plagues Greece.



Source: ELSTAT

Shape 5: Solar structure of population (2001)

Another interesting demographic data provided by ELSTAT is the educational level of the residents of the Municipality, which is presented in absolute numbers for the entire population as well as for each gender separately. It is noted that the data presented refer to the population census of 2011, as the corresponding data of the census carried out in 2021 are not available. In particular, It is observed that the largest population group according to educational level are high school graduates and amount to 18,030 people, constituting 25.81% of the total population. The second largest population group, with 14,265 inhabitants, are primary school graduates and amount to 20.42%. The third largest population group by educational attainment is holders of a tertiary education qualification; at a rate of 16.95%. The remaining 36.72% is allocated to tertiary high school graduates, people who dropped out of primary school but know how to write, people who hold a post-secondary education title (e.g. IEK) and people who are not classified in any of these categories (preschool children). In more detail, all the above information is presented in Figure 1.5. Also, this figure shows that at all levels of education the percentage of men and women is about the same.



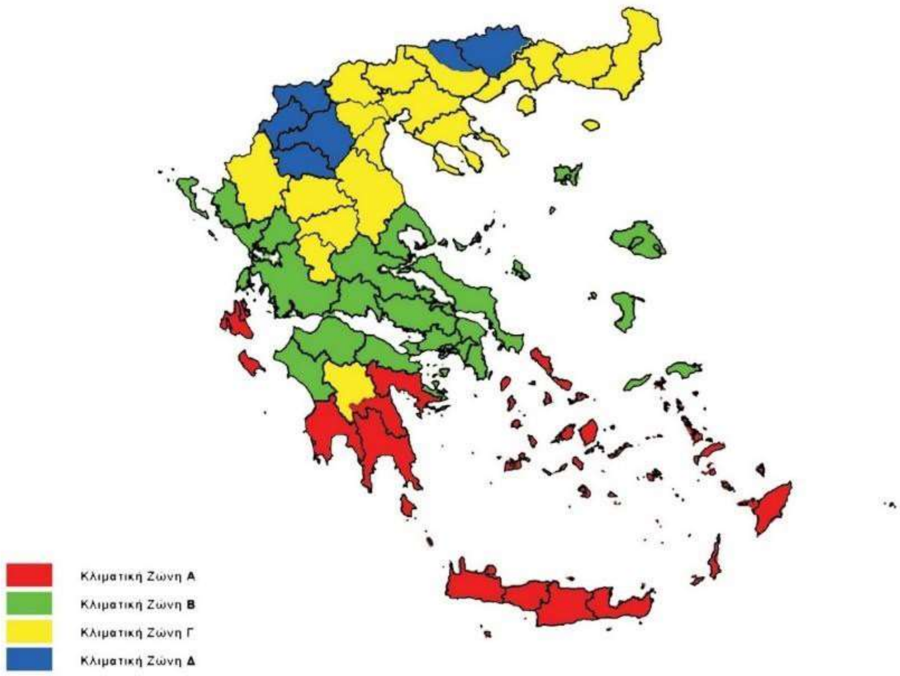
Source: ELSTAT

Shape 6 Level of education by gender (2011)

1.2 Climatic characteristics

The wider area of the Municipality of Kalamata is characterized by a typical Mediterranean climate, with hot and dry summers and mild winters with rainfall. The prevailing climate is directly influenced by both the Messinian Gulf and the presence of Taygetos, which regulate humidity levels in the area. The cold season lasts from November to April and the warm from May to October.

According to the Energy Performance of Buildings Regulation (K.EN.A.K.), Greece is divided into four climatic zones depending on their climate based on heating degree days. Zone A is characterized by the warmest climate and mainly includes areas of the South and islands while the coldest zone (Zone D) includes some areas of Western and Eastern Macedonia. The Municipality of Kalamata, since geographically belongs to the prefecture of Messinia, belongs to the first warmest zone (Zone A). The climate of the region, as mentioned below, is characterized by mild winters with increased rainfall and warm summers with minimal rainfall. Then, a table is presented with climatic data, on a monthly basis, collected from a meteorological station in the airport area located 6 km west of Kalamata.



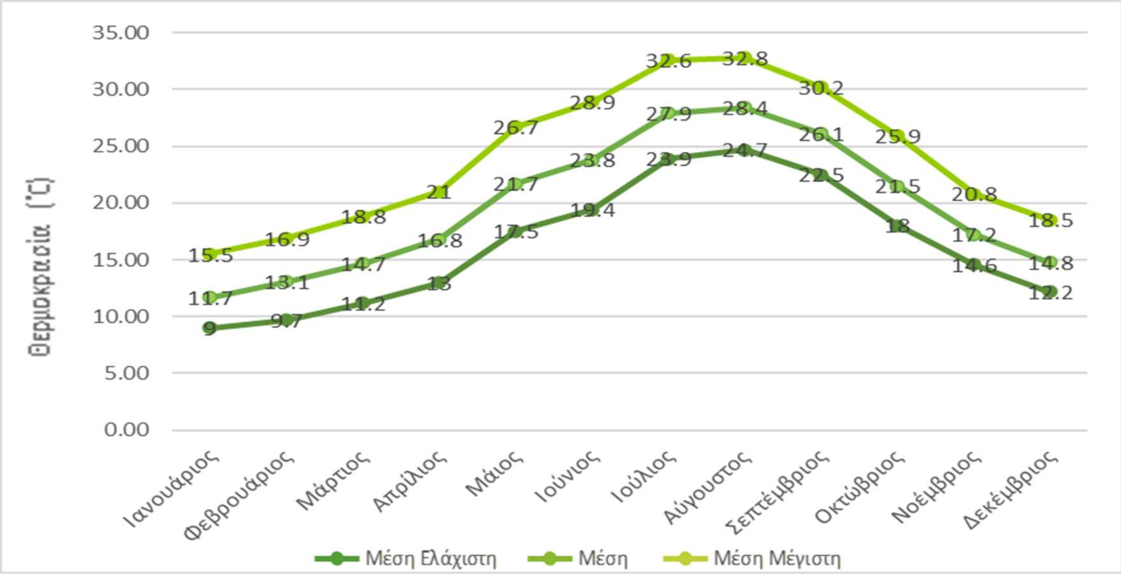
Source: K.EN.A.K.

Image 4 Climate Zones of Greece with KENAK

Table 3: Climate Data (2022)

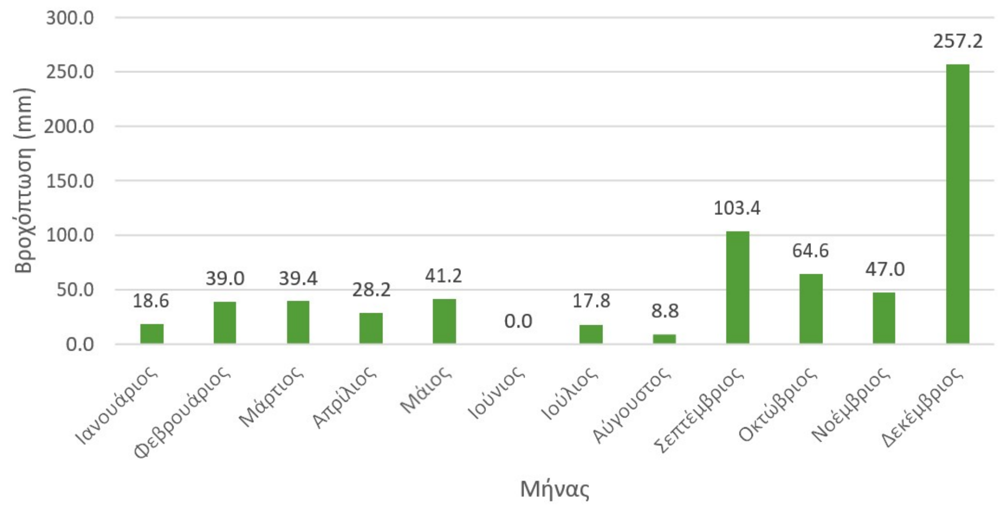
Months	Temperature (°C)			Rainfall	Wind speed
	Average Minimum	Waist	Average Maximum	mm	km/h
January	8,0	10,9	14,6	108,8	3,3
February	9,2	12,5	16,3	107,4	2,7
March	8,1	11,4	15,4	54,6	3,5
April	13,6	17,5	21,8	36,2	1,1
May	17,1	21,3	26,3	26,2	0,8
June	22,4	26,3	31,3	27,8	1,0
July	24,5	28,7	33,5	66,4	1,2
August	24,6	28,4	33,2	4,4	1,4
September	21,3	25,0	29,4	50,8	1,2
October	18,2	21,3	25,3	62,2	1,6
November	14,4	17,3	21,2	214,9	1,6
December	12,8	15,4	19,1	86,6	0,8

The next figure shows graphically the fluctuations in the middle. average maximum and average minimum temperature observed in 2022 in the region [5].



Source: http://kalamata.meteoclub.gr/NOAAPRYR.TXT

Shape 7: Temperature fluctuations (2022)

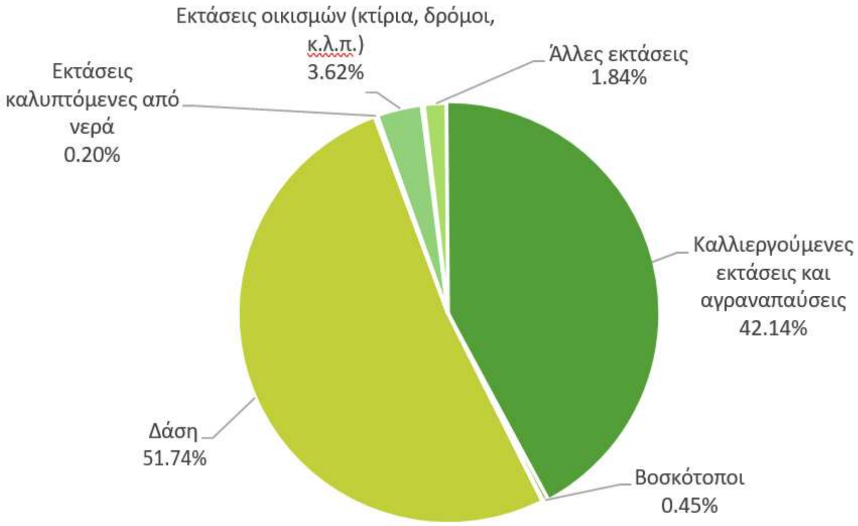


Source: http://kalamata.meteoclub.gr/NOAAPRYR.TXT

Shape 8: Rainfall fluctuations (2022)

1.3 Geomorphological Features

The Municipality of Kalamata is characterized by generally lowland areas which are mainly covered by olive groves. At the same time, in the eastern part is located the massif of Taygetos which separates Messinia from Laconia and is covered throughout its area by dense forest. Also, the Municipality is crossed by three rivers, Nedontas, Pamisos and Ari, which, in addition to the natural beauty they give, supply the irrigation projects of the Municipality. Finally, the geomorphological variety of the place is completed by the coastline of about 10.3 km length, accompanied in its largest part by a long beach. The waters and coasts of the Messinian Gulf have been awarded and have a Blue Flag mark in the areas of Anastasi (East Kalamata), Terma Navarino (East Kalamata), Almyros (Verga) and Mikri Mantineia. The Figure below shows in more detail the distribution of land use.



Source: GEODATA

Shape 9 Land use

1.4 Sectors of Economic Activity

Another important demographic factor is the economic activity of the residents of the Municipality, therefore ELSTAT data on whether the residents have a job or not are presented in the Table below [6]. It is noted that the following data refer to 2011 census data, as the corresponding data of 2021 are not currently available.

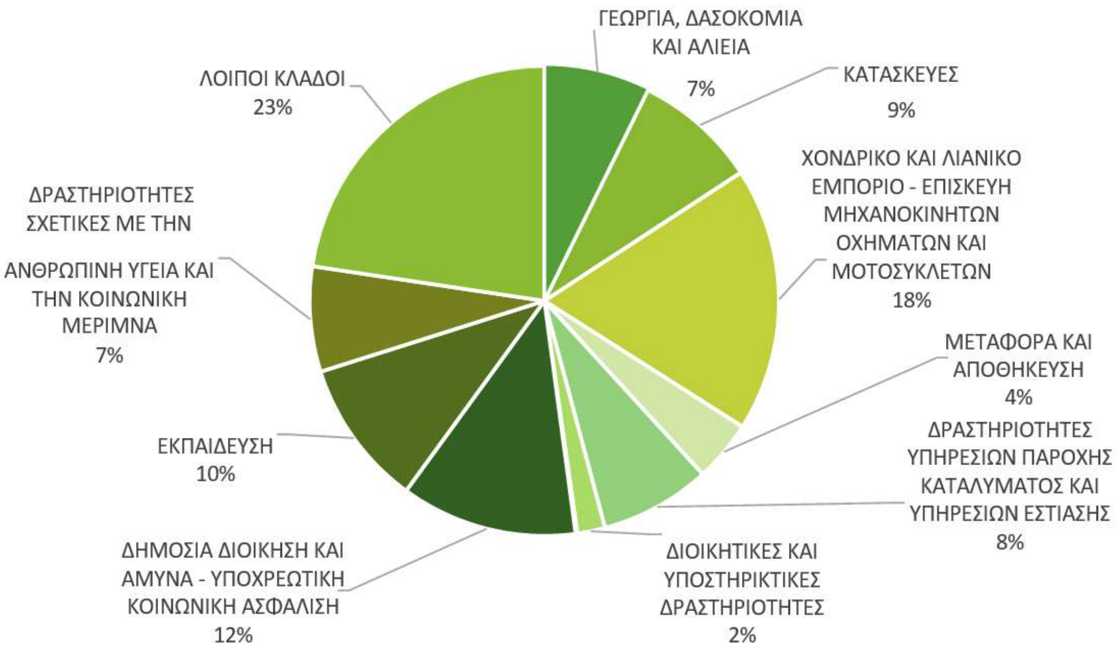
Table 4: Distribution of housing into economically active and non-economically active (2011)

		Population	Percentage (%)
Economically Active	Employed	23.967	34,31%
	Unemployed Former Employed	1.641	5,52%
	Unemployed Young People	821	2,76%
	Total	**29.749**	**42,59%**

Economically Inactive	Pupils-Students	11.835	16,94%
	Pensioners	14.883	21,31%
	Other	13.382	19,16%
	Total	**40.100**	**57,41%**

Next, the type of employment of residents is examined in more detail. According to ELSTAT data (2011), the Municipality of Kalamata, as an urban area, which is not characterized by any particular industrial activity, has as its main economic sector the trade and repair of motor vehicles and motorcycles with a percentage of 18%, which includes all kinds of commercial activities, i.e. both the trade-maintenance of vehicles and the sale of fuel, as well as wholesale and retail trade. Three other sectors with significant activity are public administration and social security with 12% as well as education (10%), accommodation services and food services (8%). The primary and secondary sectors of the Municipality include agriculture and forestry, with about 7% of the population employed in this sector and 9% active in construction. Some examples of activities in these sectors are the production of agricultural products (olives, raisins, figs, etc.), the manufacture of metal products, e.g. frames, iron products by aluminium, iron processing enterprises and related activities, as well as the manufacture of furniture.

Regarding olive production, in the Municipality of Kalamata there are large olive groves that cover most of the arable land of the Municipality. The olive groves, in addition to their contribution to the preservation of the local ecosystem that develops around them, are an important element of the economy and employment of the inhabitants of the area. The production of olives and olive oil, as well as the processing-standardization of edible olives are the axes of the primary and respectively the secondary sector. However, despite the strong presence of agricultural production, the economy of the Municipality has been oriented in recent years towards the activities of the tertiary sector. More details are presented in the figure below, which shows the distribution of the economic activities of the Municipality, according to the data of the census of the year 2011.



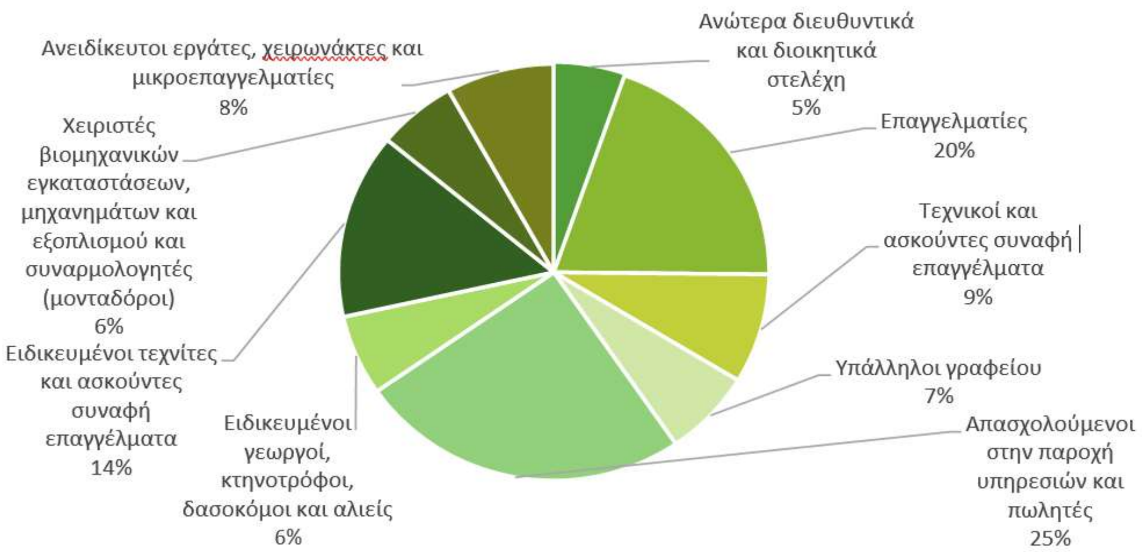
Source: ELSTAT

Shape 10 Allocation of economic activities

According to ELSTAT statistics, about 80% of enterprises belong to the tertiary sector [7]. The city of Kalamata is the administrative and economic center of the entire Prefecture of Messinia as well as a tourist destination, especially during the summer months.

At the same time, it is a transport hub to neighboring cities that gather a large number of holidaymakers, such as Verga, Koroni, Kardamili, etc. Consequently, the Municipality of Kalamata concentrates a number of administration, health, education, transport, etc., as well as tourist services, due to the tourist traffic that continues throughout the year, both in the city of Kalamata and in the wider region.

More specifically, 25% of residents earn their living from the services sector, accommodation, catering and trade. The catering sector includes restaurants, taverns and cafes, while in the tourism sector room rental businesses are found extensively. Also, 7% of residents are office workers. In addition, another large population group belongs to the category of professionals, namely 20%. More data is presented in the next figure.



Source: ELSTAT

Shape 11: Distribution of occupations

1.5 Infrastructure

Indicatively, the most important infrastructures of the Municipality that are under its management, and aim to serve and meet the needs of citizens, always with a view to protecting the environment, will be mentioned.

1.5.1 Water supply – Sewerage – Sewage treatment

The water supply-irrigation network of the Municipality of Kalamata is managed by the Municipal Water Supply and Sewerage Company of Kalamata (DEYAK), which is responsible for water supply, drainage of rainwater and sewage and irrigation within the boundaries of the Municipality.

1.5.2 Road network

The Municipality of Kalamata has an extensive road network, the majority of which consists of local roads. However, it is important to mention that the Municipality is connected by road via the motorways "Moreas", "Olympia Odos" and "Aegean Motorway" with Athens and Thessaloniki.

1.5.3 Waste Management

Located within an urban complex, the Municipality of Kalamata does not have its own landfill but uses for the landfill of its waste in landfills within the boundaries of the Peloponnese Region. The collection of waste in the Municipality is done from green and blue bins (recycling bins). That is, recycling is done with the system "Sorting at Source" by citizens and then by separating packaging into one stream in cooperation with the Hellenic Recovery and Recycling Corporation (HE.R.Co SA), which has been approved by the Ministry of Environment and Energy (RIS) for the collection of recyclable packaging. In addition, since 2014 the Municipality has developed a neighborhood composting network, the expansion of which is in progress and the number of home and neighborhood composting bins is expected to exceed 1100, aiming at reducing organic waste and at the same time producing compost by citizens.

1.5.4 Energy Infrastructure

In the Municipality of Kalamata, as in the whole country, a significant number of photovoltaic installations operate. Of these installations, the largest part concerns RES projects that provide electricity to the grid, while, in addition, photovoltaic systems are installed on the roofs of some buildings.

Apart from the existence of photovoltaic installations, a significant percentage of homes use solar thermal installations (solar panels) to provide hot water to households. According to ELSTAT data, the use of solar panels for Domestic Hot Water amounts to 51.17%, a percentage that is expected to have increased today, given that the latest available data of ELSTAT refer to 2011.

1.5.5 Kalamata National Airport "Captain Vassilis Constantakopoulos"

Kalamata National Airport is located west of the city at a distance of about 9 km. It was put into operation in 1959 and named in honor of the captain and shipowner Vasilis Konstantakopoulos, who played a leading role in upgrading the airport. Today, the airport annually hosts domestic and international flights, connecting passengers directly with international cities including Vienna, London, Paris, Berlin, Zurich and Copenhagen.

1.5.6 Railway Network

The Municipality of Kalamata was connected via two railway lines with the rest of the cities of the Peloponnese such as Tripoli, Argos, Corinth etc. However, these lines were partially discontinued until 2011, cutting off the Municipality from the railway connection with the rest of the network, which pushed travelers to travel exclusively through private cars and buses. However, the railway connection of Kalamata is part of the planning of the Peloponnese Region.

1.5.7 Port of Kalamata

The Port of Kalamata is located at the southernmost tip of mainland Greece and the EU and is the terminus of the Trans-European land roads. Commercial traffic is quite limited and passenger routes are no longer served. For this reason, the Municipality aims to improve infrastructure and reorganize the operation of both the commercial and passenger sections, in order to serve larger vessels such as cruise ships, yachts, etc.

1.6 Development Vision

The basic vision of the Municipality of Kalamata is to solve all local issues and problems, based on the continuous improvement of the living standards and the local community, development, continuous improvement of local interests as well as sustainability and environmental protection.

The effort of the Municipality towards sustainable development and the reduction of greenhouse gas emissions is reflected in its inclusion in the 100 European cities that intend to reduce greenhouse gas emissions to zero by 2030.

2. Reference emission inventory

2.1 Methodological Framework

2.1.1 Reference Year

The **Purpose** of the Project concerns to cover the obligations of the Municipality of Kalamata for the year 2030, according to the NetZeroCities project which supports the European Mission of "100 Climate-Neutral and Smart Cities by 2030" launched as part of the Horizon Europe program on greenhouse gas emissions from five key sectors of anthropogenic activities (refer to 2.1.2).

The **scope** of the project to achieve the above objective includes the following:

1. Update of greenhouse gas emissions in the area of the Municipality of Kalamata according to the above for the year 2019.
2. Evaluation and quantification of the impact on greenhouse gas emissions in the area of the Municipality of Kalamata from the implementation of measures and policies in accordance with the above for 2030.
3. Support the municipal authority in drafting the proposal for the creation of a structure for monitoring emissions and other indicators by 2030.

It is noted that the year 2019 was chosen because it is the last year, before the pandemic, with normal operating conditions of the city.

2.1.2 Areas of Study

The areas of energy consumption under study are analyzed and divided into the following categories:

i. Energy
ii. Industrial processes and product use
iii. Agriculture
iv. Waste

It is noted that within the energy sector transport and consumption of the building sector are included, which includes the consumption of the Municipal, Domestic and Tertiary sectors. At the same time, the agricultural sector will be included, as it has small, but not insignificant, amounts of emissions.

The emissions from the port and airport of Kalamata were also examined and it was found that the sum of the emissions associated with these activities amounts to approximately 1.5% of the total emissions in the area of the Municipality of Kalamata. The calculations took into account vessel and aircraft movement data and applied the 2006 IPCC Directives [17]. Finally, emissions from these sectors are lower than those of all operators concerned and therefore, according to the inventory guidance ([43], they are not taken into account in the emission inventory.

2.1.3 Methodology

The methodology used to collect the necessary data for the Emission Inventory is based on the methodology applied in the National Inventories, in order to ensure both reliability and compatibility with

National Inventories. Therefore, the calculations will be made in accordance with the IPCC and UNFCCC guidelines [17].

More specifically, aiming at the creation of the Reference Emissions Balance, energy data were initially collected from reliable sources, as listed below. In cases where it was not possible to provide data at Municipality level, the necessary estimates and assumptions were made, which are different depending on each case, based on the available data. The assumptions made are part of the UNFCCC's good practices for the preparation of inventories. The main assumptions adopted as well as the energy conversion indicators are listed below.

Table 5 Population Data (2021)

Messinia Region	Municipality of Kalamata	Percentage of Municipality over Prefecture
146.080	72.906	49,90%

Source: 2021 census, ELSTAT

Table 6 Number of Normal Houses (2011)

Messinia Region	Municipality of Kalamata	Percentage of Municipality over Prefecture
2.991.000	440.300	14,72%

Source: 2011 census, ELSTAT

Table 7: Cultivated areas (acres) (2019)

Messinia Region	Municipality of Kalamata	Percentage of Municipality over Prefecture
83.962	61.612	7,33%

Source: OPEKEPE, 2019

Table 8: Fuel Energy Conversion Index

Oil (KWh/lt)	Petrol (KWh/lt)
10,00	9,20

Source: Covenant of Mayors – Guidebook

2.2 Collection of Energy Consumption Data

The data collection was done using the following sources:

- Municipality of Kalamata (Services, School Committee, Sports Organization)
- Hellenic Statistical Authority (ELSTAT)
- Hellenic Electricity Distribution Network Operator (HEDNO)
- Agency for Payments and Control of Community Guidance and Guarantee Aid (OPEKEPE)
- Geoinformation Map of the Regulatory Authority for Energy (RAE)
- KTEL Messinia
- National Printing House
- 2006 IPPC Guidelines for National Greenhouse Gas Inventories

2.2.1 Municipality of Kalamata

The data concerning the consumption of the Municipality, from which the carbon footprint is derived, were drawn from its services. These data come from electricity consumption in municipal buildings, water supply/irrigation facilities and street lighting, heating oil of buildings as well as diesel fuel of the municipal fleet.

2.2.2 External Bodies

For the completion of the study, several information was required from services to which the Municipality does not have direct access. These external bodies are:

- ***ELSTAT:*** The data used by the website of the Hellenic Statistical Authority reflect population data, household characteristics, vehicle ownership as well as energy data such as consumption of petroleum products and electricity.
- ***HEDNO:*** Data on electricity consumption were used for the Municipality of Kalamata
- ***Google Maps:*** This Google app collected mileage data to calculate distances traveled by public transport vehicles.
- ***OPEKEPE:*** Through the website of the Organization, the species and areas of exploitable crops as well as data of the livestock sector were recorded.
- ***RAE's Geoinformation Map:*** RAE's Geoinformation Map collected data on RES stations located on public and private land and licensed for production in the Municipality of Kalamata.
- ***KTEL Messinia:*** The KTEL website has extracted the routes and frequency of bus routes within the boundaries of the Municipality. Also, personal communication obtained data on vehicle traffic, annual kilometers, etc.
- ***National Printing Office: The national emission factor for electricity production has been extracted from the website of the National Printing Office, which can be found in a relevant Government Gazette.***
- ***2006 IPPC* Guidelines for National Greenhouse Gas Inventories**: This manual used emission factors for the livestock, agriculture, building and transport sectors.
- ***COPERT MODEL (EMISIA S.A.):*** In the transport sector, the COPERT model was used to calculate CH4 and N2O emissions

2.3 Agriculture - Agriculture, Livestock, Forestry and Land Use (AFOLU)

2.3.1 Georgia

Electrical energy

In agriculture, an amount of electricity is consumed for the operation of private pumping stations. This consumption was provided by the Municipality through the "Application of real estate fees and information to Municipalities" of HEDNO S.A.

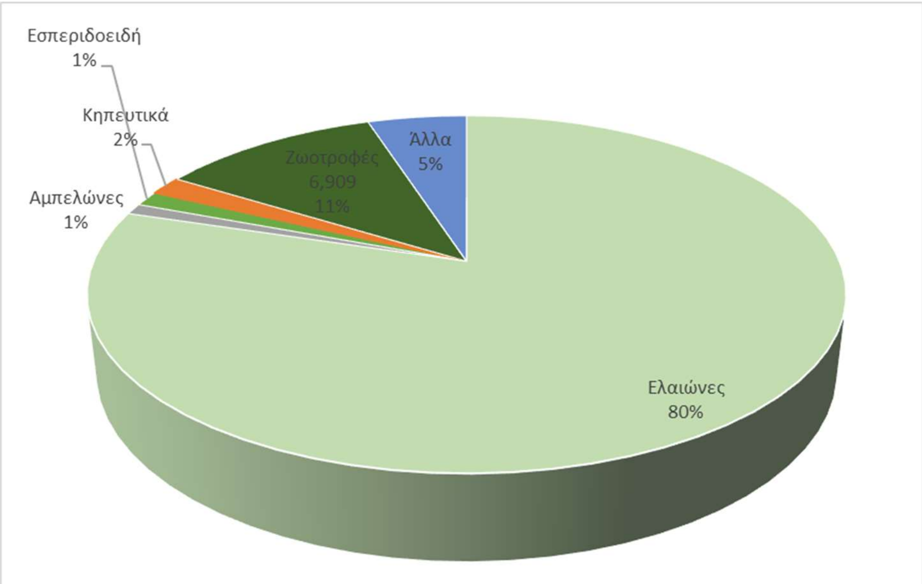
Table 9 Electricity in agriculture (2019)

	Electricity Consumption in Agriculture (MWh)
Municipality of Kalamata	3.903,33

Source: HEDNO S.A.

Diesel

In the Municipality of Kalamata, a significant number of different crops were recorded which require plowing, sowing, fertilization and harvesting. To meet the above needs, growers use agricultural machinery and consequently consume diesel. To calculate total consumption, area data were collected by crop type [8]. In the Figure below, the data on the distribution of cultivated areas of the Municipality are presented. The olive groves (for olive oil production, table olive production and two-way production) occupy the largest area among crops with 49,112 acres out of a total of 61,612 acres.



Source: OPEKEPE

Shape 12: Percentage distribution of cultivated areas of the Municipality of Kalamata (2019)

This was followed by the collection of data on litres consumed by type and area of cultivation [9]. The following table presents these consumptions, which reach a total of 7,297.20 MWh of diesel. A table with detailed data on crops and corresponding consumption is available in Annex A.

Table 10 Cultivated areas and oil consumption (2019)

Type of crop	Areas (acres)	Oil consumption (lt)	Oil consumption (MWh)
Olive groves	49.112	540.229	5.346,92
Vegetables	1.072	32.172	318,42
Citrus	816	14.275	141,29
Feed	6.909	110.549	1.094,16
Other	3.703	40.053	396,42
Sets:	61.612	737.277	7.297,20

Source: OPEKEPE, National Printing House

It is clear from the results and from the next reconstruction, that olive groves require the largest amount of diesel oil. The Figure below shows the consumption of diesel oil per type of crop.

Finally, the table below presents the data concerning gasoline consumption in olive oil crops.

Table 11 Gasoline consumption in areas of olives of oil production (2019)

Area of olives for oil production (acres)	Petrol (lt)	Petrol (MWh)
48.917	217.557	1.932,97

Source: OPEKEPE

2.3.2 Livestock farming

In the Municipality of Kalamata there are livestock units that consume diesel oil for the breeding of sheep, goats, cattle and bees. The data were drawn from OPEKEPE. At the same time, coefficients with litres of oil per animal were used to calculate final consumption as shown in the table below [9].

Table 12 Oil consumption in livestock farming (2019)

	Number of	Coefficient (lt/animal)	Oil consumption	Oil consumption (MWh)
GOATS - EWES - RAMS/GOATS	20.018	2,90	58.052,20	574,57
BOVINE ANIMALS UP TO 6 MONTHS	64	1,20	76,80	0,76

CATTLE UP TO 6-24 MONTHS	163	6,00	978,00	9,68
BOVINE ANIMALS UP TO > 24 MONTHS	326	24,00	7.824,00	77,44
HONEY – HIVES	5.348	4,00	21.392,00	211,73
Total:	**25.919**	**-**	**88.323**	**874,18**

Source: OPEKEPE, National Printing House

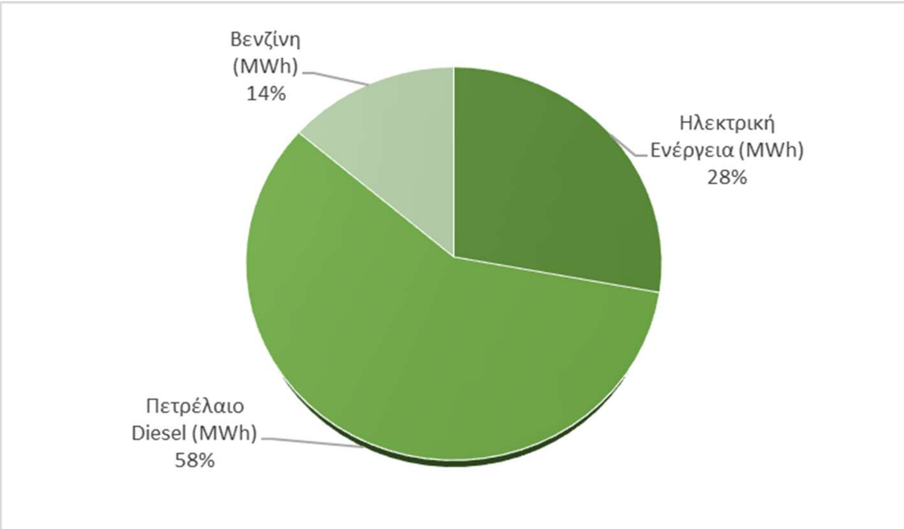
2.3.3 Agricultural Sector Summary (Agriculture, Livestock, Forestry and Land Use (AFOLU))

After collecting all data for the agricultural sector, the following table and the corresponding picture are presented with a schematic representation of consumption by sector and fuel.

Table 13 Final consumption in the Agricultural Sector (2019)

MWh	lectricity Energy	Petroleum Diesel	Petrol	Total
Georgia	3.903,33	7.297,20	1.932,97	13.133,46
Livestock farming		874,18		874,18
Total:	**3.903,33**	**8.171,38**	**1.932,97**	**14.007,63**

Source: OPEKEPE, ELSTAT, National Printing House



Source: OPEKEPE, ELSTAT, National Printing House

Shape 13 Percentage distribution of fuels in the Agricultural Sector (2019)

2.4 Buildings

2.4.1 Public Buildings and Public Lighting

This category includes buildings and facilities that are owned by the Municipality and their management also belongs to it. These include the municipal buildings, sports facilities, schools, kindergartens and energy consumption of the Municipal Port Fund of Kalamata, including yachts calling at the port of Kalamata.

In order to determine electricity consumption, the annual electricity consumption data, which were provided by the services of the Municipality and by HEDNO, were used. Also, the Municipality of Kalamata provided the total quantities of oil consumption. Consumption data are presented in Tables 14 and 15 below for electricity and oil respectively.

2.4.1.1 Electricity in the buildings and facilities of the Municipality

Data concerning the electricity of municipal buildings and facilities were provided by the services of the Municipality of Kalamata. In particular, according to the data, the total electricity consumption in the buildings of the Municipality amounts to 2,194 MWh. The Table below presents the electricity consumption per use.

2.4.1.2 Heating oil in the buildings and facilities of the Municipality

Data concerning heating oil were provided by the services of the Municipality of Kalamata. Specifically, according to the data, the total consumption of heating oil amounts to 315,040 liters or 3,118.31 MWh. In particular, the Table below presents the consumption of heating oil per use.

2.4.1.3 Electricity consumption for municipal public lighting

All the lighting needs of the Municipality are presented in this section. These needs include street lighting, lighting of squares as well as illumination of other common areas. In order to calculate the consumption of municipal lighting, data provided by HEDNO [10] and the Municipality are used. This shows that the total electricity consumed for the luminaires managed by the Municipality is 6,333.19 MWh.

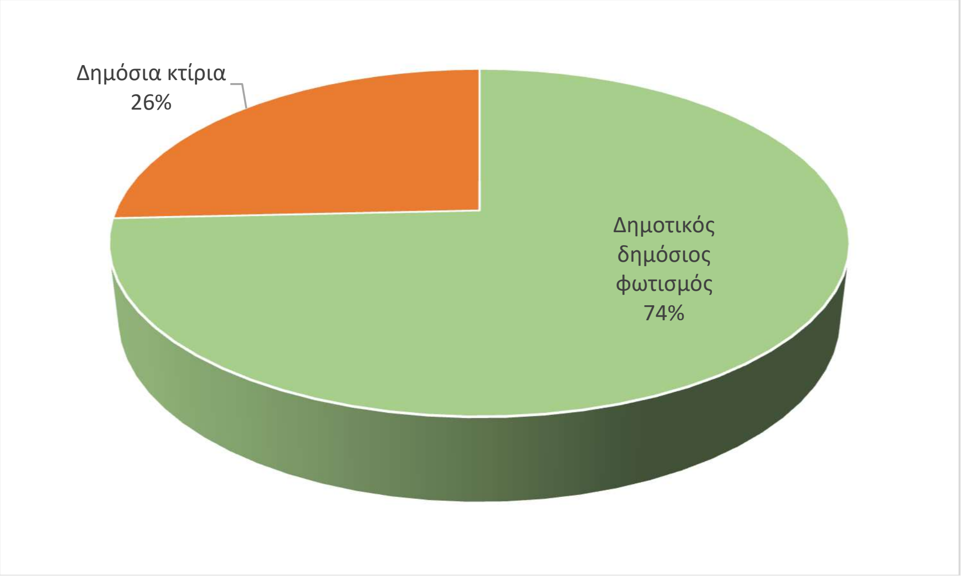
Table 14 Summary of electricity consumption in municipal buildings, equipment and installations (2019)

Electricity consumption of the Municipality of Kalamata	2019 (kWh)
Building consumption	1.590.000
Street lighting and lighting of K/V spaces	6.333.188
Sports Organization	450.000
FARIS	21.543
Central Market	132.000
Total	**8.526.731**

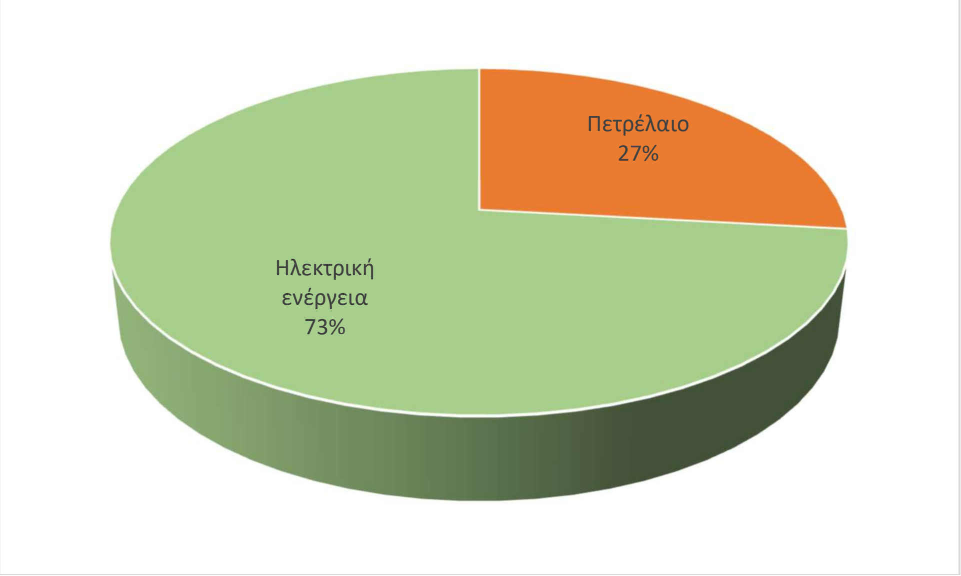
Table 15 Final consumption of heating oil in the buildings and facilities of the Municipality (2019)

	Heating oil (liters)	Heating oil (MWh)
Municipality of Kalamata	100.000	989,75

Sports organization	80.000	791,80
Faris	8.195	81,31
Primary education	53.600	530,51
Secondary education	73.245	724,94
Total:	**315.040**	**3.118,31**



Shape 14 Distribution of electricity consumption in municipal buildings, equipment and installations (2019)



Shape 15 Final energy consumption in municipal buildings, equipment and installations by energy source (2019)

2.4.2 Residential (Residential Sector)

The consumption of electricity in the residential sector was provided by the Municipality, through the application "HEDNO S.A. - Application of real estate charges and information of municipalities" [10].

For the consumption of petroleum products (mainly heating diesel) and biomass (e.g. firewood) in the domestic sector, no statistics are available. For their calculation, statistical data from SEPDEM [12] and the energy balance of the country [14] were used. Various assumptions and estimates were also made. The specific procedure is presented below. The most important element for this process is that the total number of inhabited houses in the Municipality of Kalamata is 25,905.

2.4.2.1 *Electrical energy*

Households in the Municipality of Kalamata consume electricity for cooking, lighting, heating water and spaces and for the operation of electrical appliances. In addition, they consume petroleum products for heating. Data on electricity consumption were provided by HEDNO [10], for the year 2019. In total, based on HEDNO data, the consumed electricity in the residential sector in the area of the Municipality of Kalamata amounts to 116,614 MWh.

2.4.2.2 *Space & Water Heating*

The residential houses cover their thermal needs mainly with the use of heating oil. Other sources of energy for heating are wood and electricity, which was calculated above. However, no corresponding data on oil consumption were available. Therefore, statistical data and energy consumption indicators from literature studies, such as data from ELSTAT, were used to calculate thermal energy consumption in homes. [11] and SEPDEM [12]. More specifically, in order to approximate the consumption of heating oil, data such as the number of households in the whole country and in Kalamata were used (source: ELSTAT. [13]) and the ratio of these two figures was used in the calculations.

Table 16 Number of households in Kalamata to the whole country

	Country Total	Kalamata
Number of households	4.134.540	25.905
Ratio of Kalamata to total country:		0,63%

Source: ELSTAT.

For the detailed calculations, apart from the number of houses located within the boundaries of the Municipality, data such as the average annual consumption of primary energy for heating in Kalamata, per square meter, were used to the corresponding value for the whole country (Source: SEPDEM [12]), in order to take into account the climate subcategory to which the area belongs. This methodology has recently been applied to corresponding published papers in peer-reviewed scientific journals [44, 45].

Table 17 Average annual consumption of primary energy for heating in the Municipality of Kalamata throughout the country

kWh/m2	Kalamata	Country Average

Average	171,64	239,60
Ratio of Kalamata to country average:		71,64%

Source: SEPDEM

Finally, oil and biomass consumption data for the whole country for the year 2019, as given by the country's energy balance [14], were used to determine the energy consumption for heating. To approximate the amount of consumption in Kalamata, the total amount of energy was multiplied by the above percentages (Tables 16 and 17). The Table below presents the energy consumption for the whole country and for Kalamata respectively.

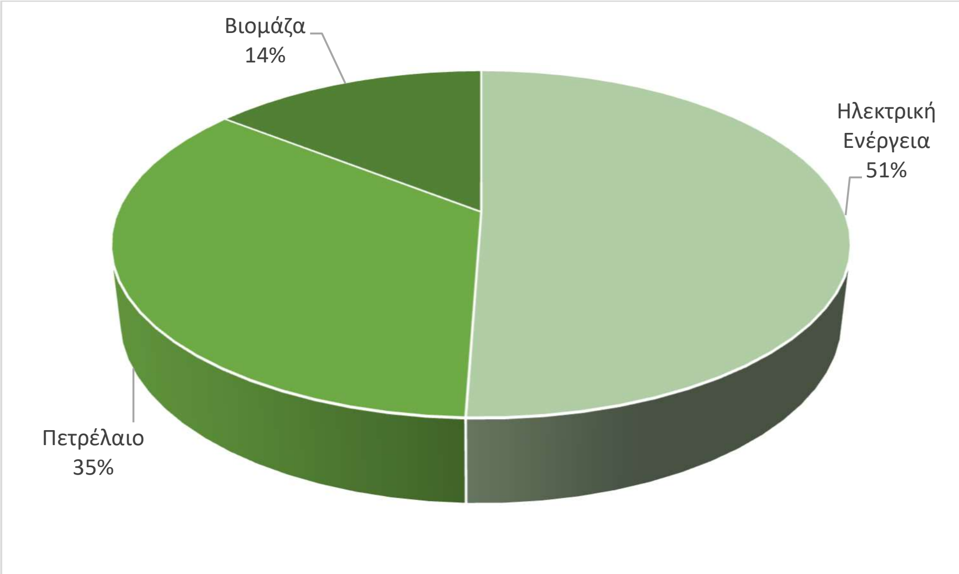
Table 18 Energy consumption for residential heating in Greece (2019)

	TJ	MWh
Heating oil MWh	64.855	18.015.220[1]
Biomass MWh	26.624	7.395.453

Table 19 Final energy consumption in residential dwellings (2019)

Energy Sources	Consumption (MWh)
Electrical energy	116.614
Petroleum	80.860
Biomass	33.194
Total (MWh) :	**230.668**

[1] The whole country includes the consumption of petroleum products and natural gas



Shape 16 Distribution of final consumption in the Household Sector (2019)

2.4.3 Private Non-Residential Buildings (Tertiary Sector)

The tertiary sector includes all buildings and services managed by private individuals or the state and are not under the jurisdiction of the Municipality. The main object of the Tertiary Sector is trade, services and tourism which includes offices, shops, catering businesses, accommodation, hospitals, etc.

2.4.4.1 Electrical energy

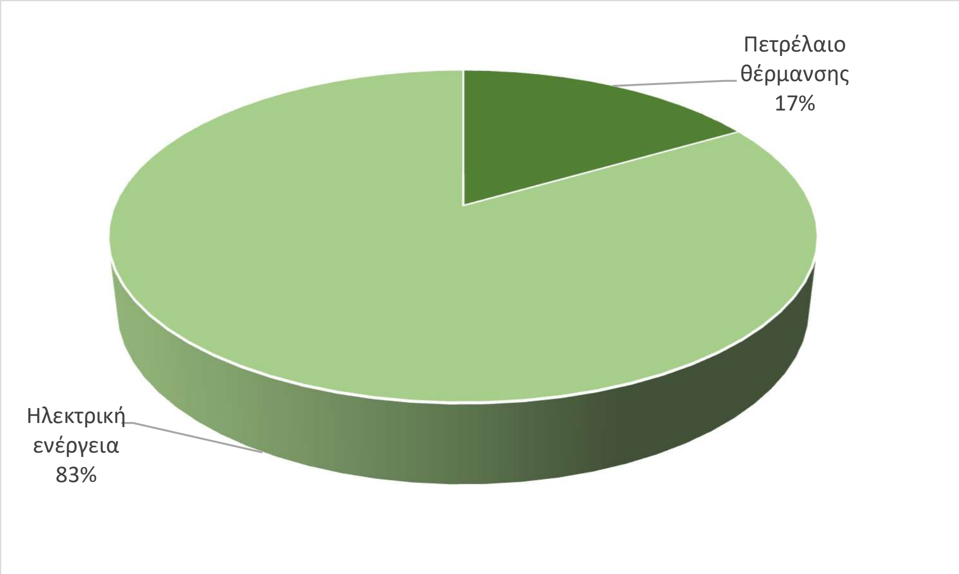
For the calculation of electricity, data from HEDNO were used in the tertiary sector [10]. According to these data, electricity consumption in the tertiary sector for Kalamata in 2019 corresponds to 98,781,515 MWh.

2.4.4.2 Heating Oil

Regarding heating oil, because we do not have specific data, unlike in the case of municipal facilities, the same procedure was followed as for the domestic sector. Primary energy consumption data were used for the tertiary sector of Kalamata per square meter and per quarter, as well as the corresponding average consumption for the whole country (Source: SEPDEM [12]). Also, the total electricity consumption in the tertiary sector was used for Kalamata (Source: HEDNO [10]) and the total amount of electricity for commercial use for Greece (Source: Energy balance [14]). Based on the above data and the total consumption of fossil fuels for heating in the tertiary sector for the whole country (source: ELSTAT. [11]), the oil consumption for the tertiary sector of the Municipality of Kalamata was calculated and it emerged that the total energy consumed in the form of heating oil amounts to 19,697 MWh. Finally, a summary of all consumption of the tertiary sector is included in the table below in which all energy consumption categories of the tertiary sector are listed as well as in the chart below that depicts their percentage distribution.

Table 20 Tertiary final consumption (2019)

Electricity (MWh)	Heating oil (MWh)	Total (MWh)
98.782	19.697	118.479



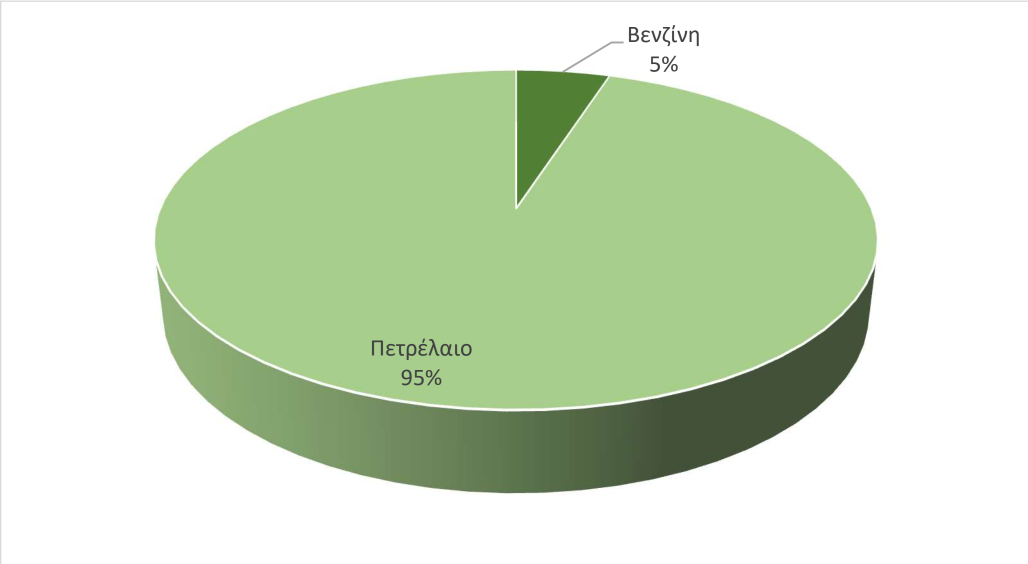
Shape 17 Distribution of consumption in the tertiary sector (2019)

2.5 Transport

2.5.1 Municipal Transport

The Municipal fleet includes vehicles that serve various activities of the services of the Municipality such as garbage trucks, tankers, fire brigades, etc. Consumption concerns diesel and unleaded petrol. The data to be used come from data collected by the Municipality and refer to the year 2019. The total energy consumption shown below is allocated based on the fuel type of the vehicles.

Based on the data collected by the Municipality, it appears that the vehicles of the municipal fleet consume 2.532.31 MWh of diesel and 124.35 MWh of gasoline. Therefore, the total fuel consumption amounts to 2.656,66 MWh. These consumptions concern garbage trucks, bin washers, trucks, tankers, cranes, earthmoving, passenger vehicles as well as sweepers, buses and tractors of the Municipality. Below is a chart illustrating the percentage distribution of the above fuels.



Shape 18 Fuel allocation in municipal transport (2019)

2.5.2 Public Transport

This section examines the energy consumption of urban and intercity buses, as well as taxis. Specifically, the kilometers traveled by all buses within the geographical boundaries of the Municipality were calculated using data from the website of the Municipality of Kalamata and the KTEL of the Prefecture of Messinia as well as personal communication with the competent bodies and telephone interviews. The collected data show that 9 bus lines pass through the Municipality of Kalamata, which operate routes exclusively within the Municipality, 51 intercity lines, with the cities of the Municipality of Kalamata being either the start/end of these routes or intermediate stops to the other neighboring municipalities, as well as 4 lines of municipal transport (intercity routes subsidized by the Municipality). From the above, it follows that the total kilometers traveled within the boundaries of the Municipality amount to approximately 2,166,467.

2.5.3 Private Transfers

As already mentioned, the COPERT model [15] was used to calculate non-carbon greenhouse gas emissions [15]. The required entry data of the model are the number of vehicles, per type and per technology, the mileage traveled by each vehicle and the total fuel, per type. Therefore, due to the unavailability of fleet data, at municipal level, data from various sources were used to approximate the number of vehicles. Specifically, the number of vehicles (passenger, light, heavy and two-wheeled) for the year 2019 was used, at the level of the Regional Unit (ELSTAT) and based on the ratio of the population of the Municipality of Kalamata/Regional Unit of Messinia, the fleet of the Municipality of Kalamata was derived. The fleet was allocated by technology based on the distribution of the country's total fleet. It is noted that from the number of passenger cars obtained by the above method for the city of Kalamata, the number of TAXIs, as well as private vehicles operating as TAXIs, was subtracted. It is noted that the same methodology is applied to national censuses and other tasks on a smaller spatial scale (e.g. Athens and Thessaloniki).

For the energy consumption of all private transport (passenger vehicles, commercial and public transport)

ELSTAT data were used. [11] At prefecture level for energy consumption as there is no relevant information at municipal level. Then, the required extrapolation was made to calculate consumption at municipal level. The data provided by ELSTAT are the total consumption of gasoline and diesel. From the total energy consumption, the consumptions already calculated in the previous sections and relating to the municipal fleet as well as public transport were subtracted. Based on the above, it emerged that the total energy consumed for the private and commercial transport sector amounts to 248,903 MWh. It is worth noting that in Kalamata logistics services have a significant share in transport. Two tables illustrating the stages of the above procedure are presented below.

2.5.4 Commercial Transport

Similarly with private transport, so with commercial transport, in order to estimate the number of light and heavy vehicles, the proportion of the population of the Municipality of Kalamata and the Regional Unit of Messinia was used, which was multiplied by the number of light and heavy vehicles of the Regional Unit of Messinia, as given by ELSTAT. (2019) [16]. The fleet was broken down by technology based on the proportion of the country's total fleet.

2.5.5 EnergyConsumption in Transport

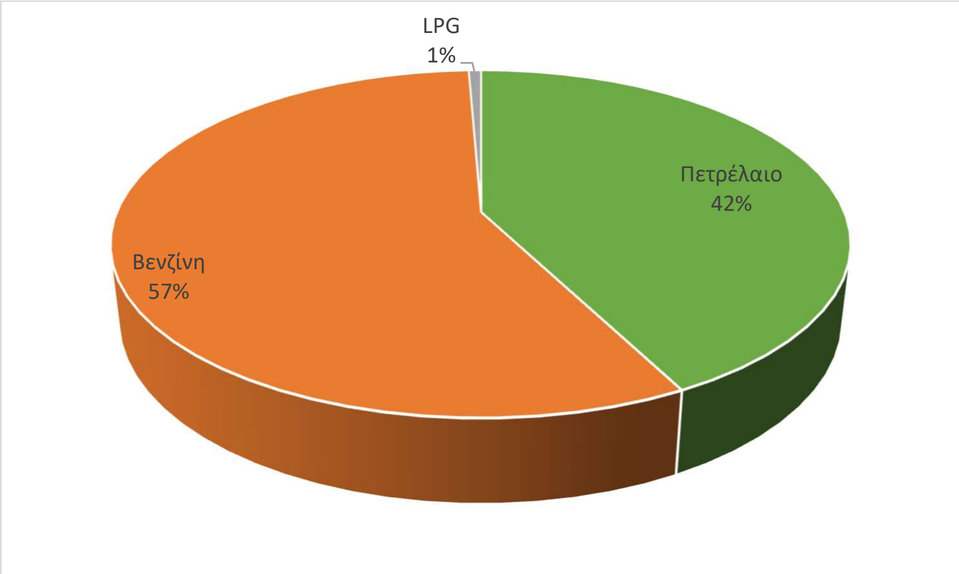
The following tables present the energy consumption in the area of the Municipality of Kalamata in total and by sector and type of fuel.

Table 21 Fuel consumption in County and Municipality (2019)

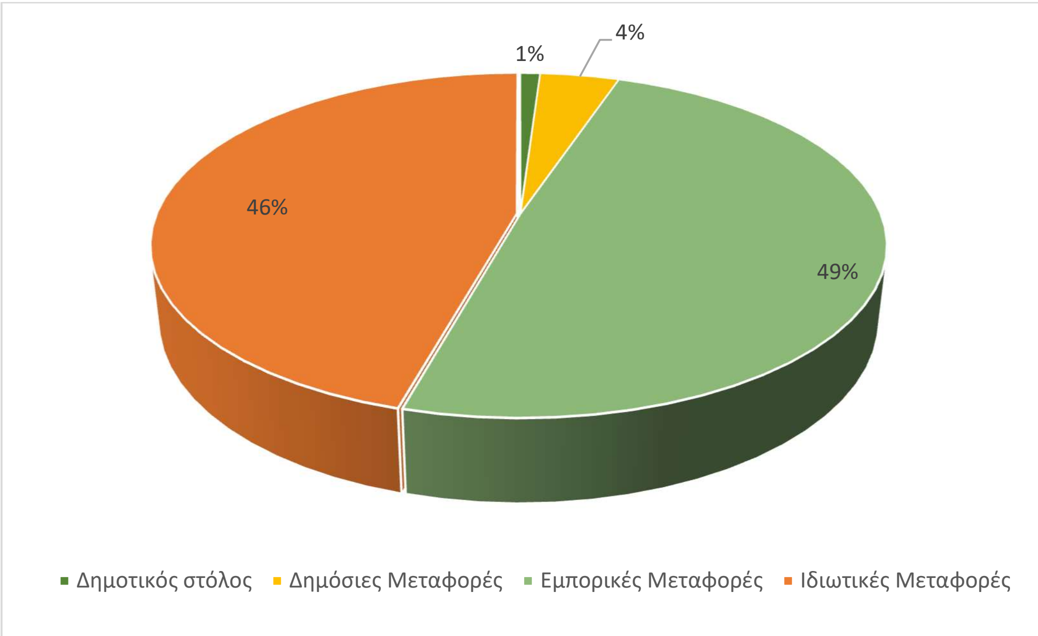
	Petrol (MWh)	Diesel (MWh)
Messinia Prefecture (all sectors)	450.690	473.618
Municipality of Kalamata (in all areas)	149.359	109.743

Table 22 Final energy consumption in private, commercial and public transport (2019)

	Petrol (MWh)	Diesel (MWh)	LPG (MWh)	Total
Municipal Fleet	124	2.532		**2.656**
Public Transport		10.572		**10.572**
Commercial Transport	42.058	89.870		**131.928**
Private Transfers	107.177	8.111	1.687	**116.975**
Total Municipality	**149.359**	**111.085**	**1.687**	**262.131**



Shape 19 Fuel allocation in road transport (2019)



Shape 20 Allocation fuels by transport sector (2019)

2.6 Industry – Industrial Processes

Energy consumption in industry was provided, for electricity consumption, by HEDNO and, for oil consumption, by the Environmental Impact Assessment (EIA) of the Pomace Oil Mill of the company PYRINAS S.A. In addition, in the industrial sector were added the consumption of the pumping stations of the Municipality as well as the energy consumption from the installation of the biological treatment of the Municipality and the Industrial Park of Kalamata (DIOCLES), the elements of which were provided by the Municipality of Kalamata. The following aggregate table shows the consumptions by sector.

2.7 Total Energy Consumption in the Area of the Municipality of Kalamata

According to all the data collected and the subsequent calculations performed, it appears that, in 2019, energy consumption in the Municipality of Kalamata amounts to 677,240 GWh. Below is the energy balance with the final consumption per sector and per energy source used.

Table 23 Final energy consumption of the Municipality of Kalamata in 2019

	Electricity (MWh)	Petrol (MWh)	Diesel (MWh)	Heating oil (MWh)	LPG (MWh)	Biomass (MWh)	Total (MWh)	%
Public buildings	8.537			3.118			11.655	**1,7**
Houses	116.614			80.860		33.194	230.668	**34,1**
Private non-residential buildings (Tertiary sector)	98.782			19.697			118.479	**17,5**
Industry	38.691			1.576			40.266	**5,9**
Municipal transport		124	2.532				2.656	**0,4**
Private transfers		107.177	8.111		1.687		116.975	**17,3**
Commercial transport		42.058	89.870				131.928	**19,5**
Public transport			10.572				10.572	**1,6**
Georgia	3.903	1.933	7.297				13.133	**1,9**
Livestock farming			874				874	**0,1**
Total (MWh)	**266.526**	**151.292**	**119.256**	**105.251**	**1.687**	**33.194**	**677.206**	**100**

2.8 Calculation of CO2 emissions

2.8.1 Emissions from Energy Consumption

The Energy Balance calculated above has as its ultimate purpose the recording of CO_2 emissions within the boundaries of the Municipality of Kalamata in the reference year 2019. In this section, energy consumption will be used to calculate CO_2 emissions with the help of IPCC factors [17], the COPERT model [15], country-specific CO_2 factors derived from the National Inventory as well as emission factors for electricity production according to DAPEEP [18], for the year 2019, and the NECP, for the year 2030. Finally, the coefficients have taken into account the carbon content of each fuel.

2.8.1.1 Energy from Heating Oil

According to the National Census [19], the CO_2 emission factor is 73.78 t/TJ for heating oil.

2.8.1.2 Energy from Diesel

The CO_2 emission factor for diesel fuel, according to the National Inventory, is equal to 73.23 tn/TJ. However, due to the blending of biodiesel with diesel, this coefficient was appropriately adjusted based on the blending rate of biodiesel in diesel fuel, 7.28% for 2019, according to data derived from the National Energy Balance of the same year, and assuming that all biodiesel is derived from fatty acid methyl esters (FAME), [20]. The final CO_2 emission factor is 0.15 tn/tn biodiesel or 3.510 tn/TJ.

The revalued coefficient shall be calculated using the following formula:

$$F{-}w = PCD * F + PBD * F_{biodiesel}$$

Where:

F-w: The corrected emission factor for diesel in the reference year (tn/TJ)

PCD: Percentage of conventional diesel

F: The standard emission factor for diesel (tn/TJ)

PBD: Biodiesel percentage

$F_{biodiesel}$: The standard emission factor for biodiesel (tn/TJ)

$$F{-}w = 0{,}9272 * 73{,}23 + 0{,}0728 * 3{,}510 = 68{,}1544 \text{ tn/TJ}$$

2.8.1.3 Energy from Petrol

The CO_2 emission factor for petrol, according to the National Inventory, is equal to 73.26 tn/TJ. Biopetrol has a low emission factor, so the diesel emission factor needs to be adjusted based on the blending rate of biopetrol in petrol. This percentage amounts to 1.59% for 2019, according to data derived from the National Energy Balance of the same year. In the same way, analysed in Section 2.4.1.2 the emission factor for petrol is 72,63 tn/TJ.

2.8.1.4 Solar Thermal Energy

Solar thermal energy, always according to the Directives, has no CO_2 emissions and therefore its emission factor is zero.

The table below shows the conversion factors for all forms of energy examined.

Table 24: CO2 emission factors

Fuel Type	Prtype CO2 Emission Factor (tn/MWh)

Electrical energy	0,547
Heating Oil	0,266
Diesel "Diesel"	0,245
Petrol	0,262

2.8.2 Other emissions

2.8.2.1 Waste management

In addition to greenhouse gas emissions from the activities of the Residential, Tertiary, Municipal sector as well as Transport, greenhouse gas emissions, specifically methane and nitrous oxide, are released from the management of municipal solid waste. The organic fraction of municipal waste is composted in ventilated piles.

In 2019, 250 tons of pruning and 11,700 tons of organics were composted from mixed municipal waste, according to data from the Municipality of Kalamata. It is assumed that the entire amount of organic load is composted, according to data from the Municipality. In particular, from the total waste produced by the Municipality, organic waste is separated, which, as already mentioned, is composted. The remaining composites are deposited in the landfill.

Organic waste is responsible for emissions of methane (CH4) and nitrous oxide (N2O). According to the IPPC [17], the emission factor CH4 is equal to 10 g/kg of waste, while for N2O, the emission factor is 0,6 g/kg of waste. The calculations show that a total of 120 tonnes of CH4 and 7 tonnes of N2O are emitted from the waste; corresponding to 5 246 t CO2eq. The conversion of CH4 and N2O to CO2 equivalent was done using the coefficients 28 tCO2/tCH4 and 265 tCO2/tN2O, respectively, from the 5th IPCC Fifth Assessment Report (AR5).

2.8.2.2 Biomass Combustion in the Domestic Sector and Pruning

Emissions from biomass combustion are considered zero (CO2 neutral), on the grounds that the carbon dioxide absorbed by plants through photosynthesis is equivalent to the CO2 released during their combustion. Therefore, CO2 emissions from pruning combustion were not calculated because they are considered of biological origin, in accordance with the national inventory and IPCC guidelines [17]. Also, CO2 emissions from the combustion of biomass (wood stoves, etc.) in the domestic sector were not calculated because they are considered of biological origin and concern biomass collected sustainably (e.g. it concerns biomass collected from forests according to existing forest management plans or comes from olive pruning). However, for biomass combustion, CH4 and N2O emissions were calculated, which were translated into CO2-eq using the factors 28 tCO2/tCH4 and 265 tCO2/tN2O, respectively, from the IPCC 5th Fifth Assessment Report (AR5). The total amount of CO2-eq. was estimated at 1,131 tonnes.

2.8.2.3 Livestock emissions

The livestock sector, in addition to emissions from oil combustion in the machinery and vehicles used, is associated with CH4 and N2O emissions of animals. Methane is produced by enteric fermentation of sheep, goats and cattle and animal waste management, while nitrous oxide is produced by animal waste management.

The emissions were calculated using statistics from OPEKEPE [8] regarding the populations of sheep, goats and cattle of the Municipality of Kalamata, applying the same methodology applied in the National Greenhouse Gas Inventory by NTUA.

For the year 2019, 217.94 tons of CH4 and 0.57 tons of N2O were calculated, or a total of 6,254 tons of CO2eq.

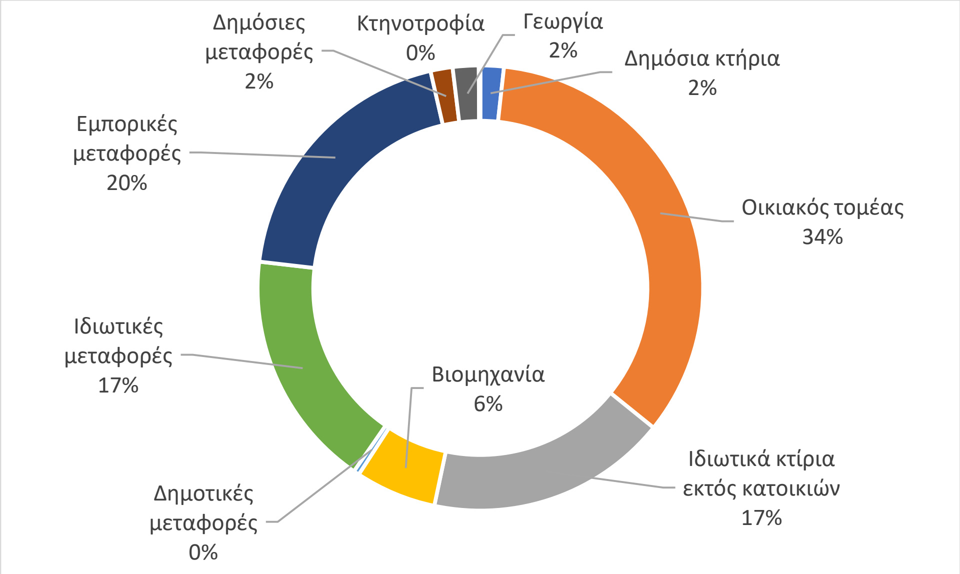
2.8.3 Final CO2 Emission Inventory

According to the calculations presented in this chapter, the following aggregate table is presented in which the carbon footprint of the Municipality for the year 2019 is recorded.

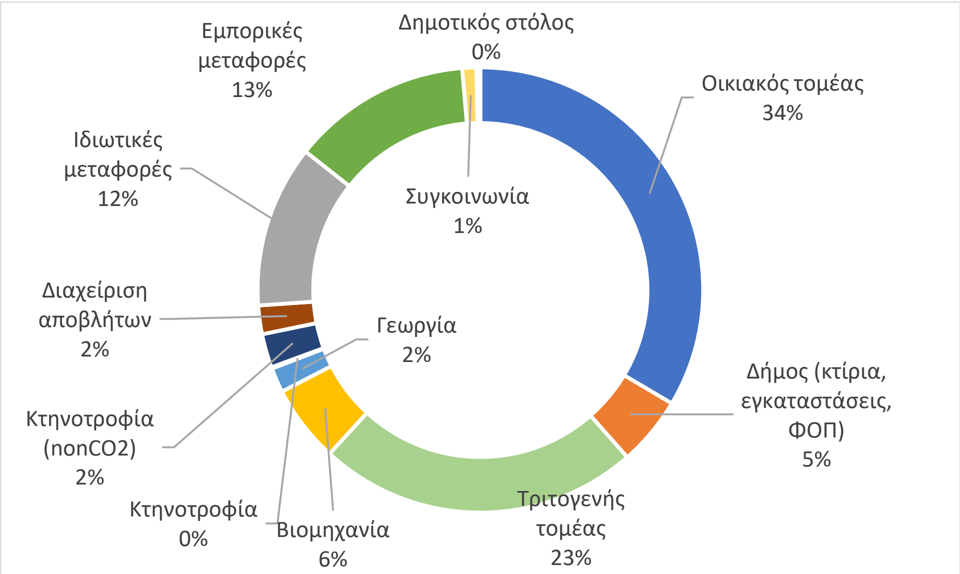
Table 25 CO2 emissions (t) in the Municipality of Kalamata in 2019

Sector	2019		
	scope 1	scope 2	Total
Buildings	**28.708,6**	**122.491,0**	**151.199,7**
Residential (Residential)	22.639,7	63.787,9	**86.427,6**
Public buildings	829,5	4.669,5	**5.498,9**
Private non-residential buildings (Tertiary sector)	5.239,4	54.034,8	**59.273,2**
Industry – Industrial Processes	419,1	21.163,8	**21.582,9**
Agriculture (agriculture, forestry, land use)	8.762,3	2.134,9	**10.897,2**
Agriculture (energy)	2.294,2	2.134,9	
Livestock (Energy)	214,1		
Livestock farming (nonCO_2)	6.254,0		
Waste management	5.246,0		**5.246,0**
Transport	66.736,1		**66.736,1**
Private transfers	30.455,6		
Commercial transport	33.037,4		
Public transport	2.590,3		
Municipal transport	652,8		
Total Kalamata			**255.661,9**

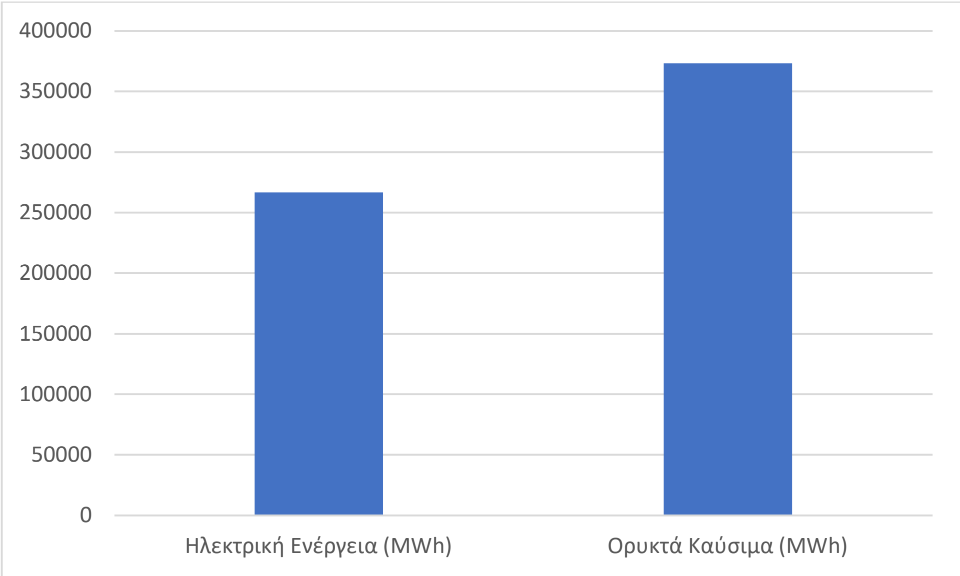
2.8.4 Graphical Analysis of Results



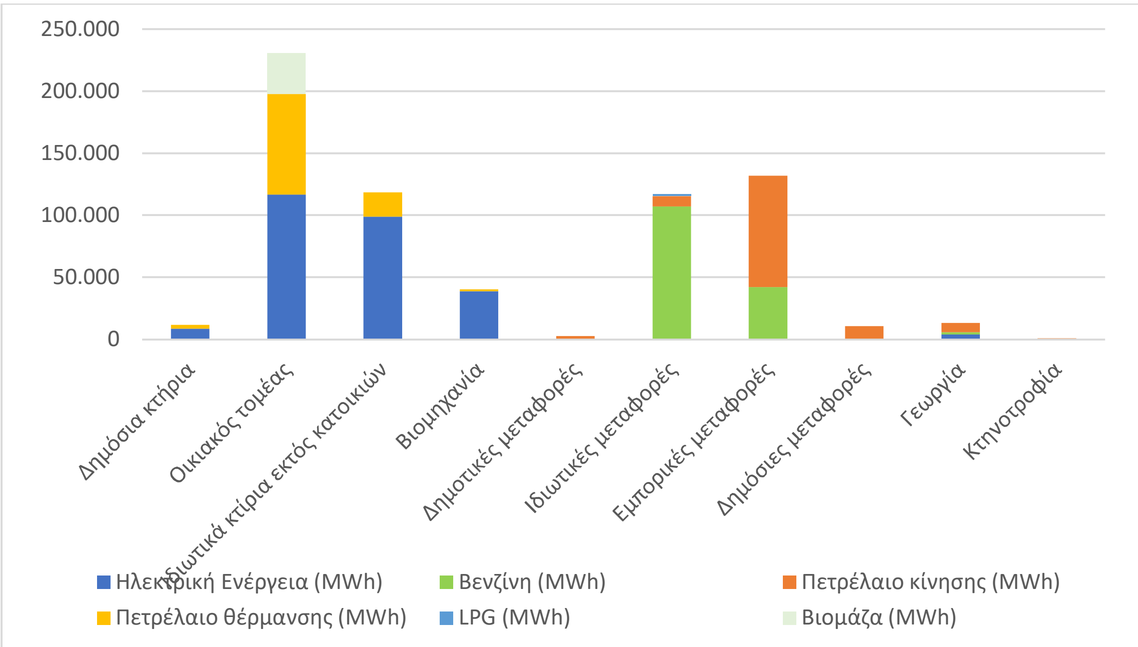
Shape 21 Final consumption Energy in the Municipality of Kalamata by sector (2019)



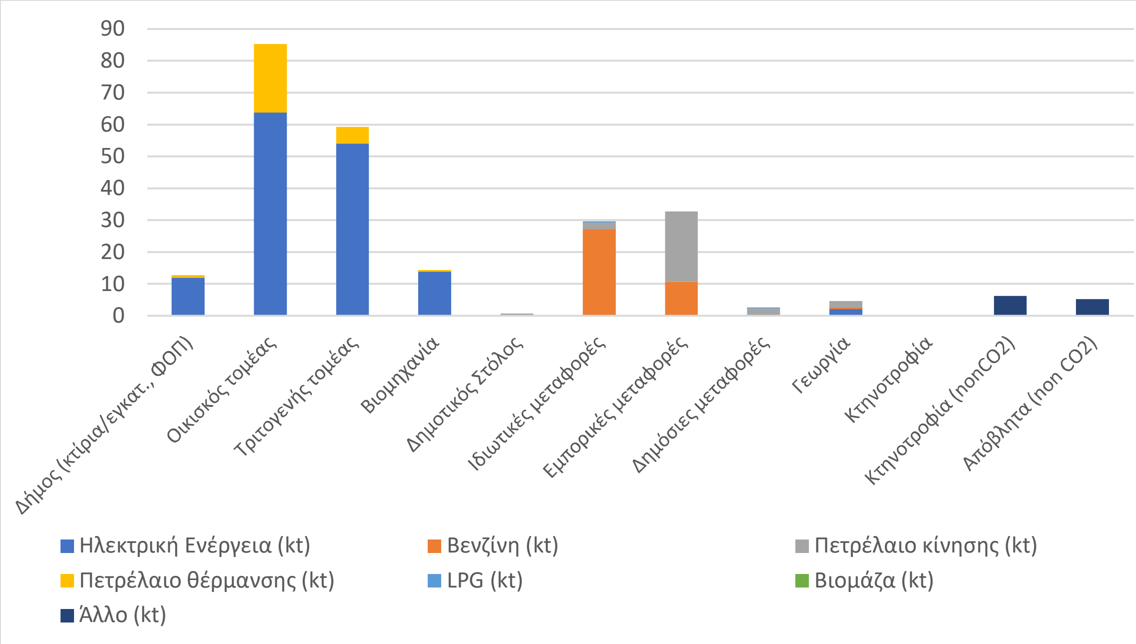
Shape 22 Emissions CO2 in the Municipality of Kalamata by sector (2019)



Shape 23 Final energy consumption by energy source (2019)



Shape 24 Final energy consumption by energy source and sector (2019)



Shape 25 Final emissions CO2 by energy source and sector (2019)

3. Assessment of climate change risks and

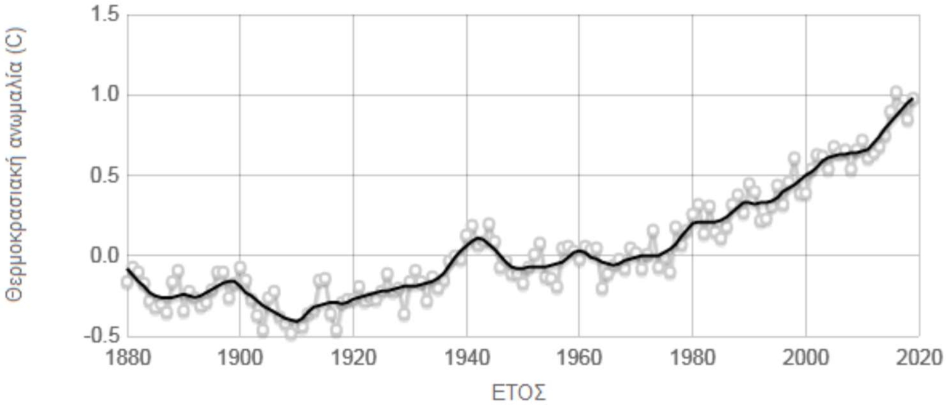
3.1 The Concept of Climate Change

The term climate change refers to a global phenomenon related to the change of climatic conditions on a global scale and in particular to changes in meteorological conditions that extend over a long period of time. Such changes include statistically significant variations in the average state of the climate, spanning decades or more of years. These changes in climate are not solely caused by natural processes but are often also due to human activities [21].

In the United Nations Framework Convention on Climate Change (UNFCC), climate change is defined in particular as change in climate caused directly or indirectly by human activities, distinguishing the term from climate variability that has natural causes. In recent decades, there has been a serious degradation of the environment due to the overconsumption of products, mainly of the primary sector, but also to the reckless overconsumption of natural resources. This has led to a growing imbalance between developed and developing nations. The aim of states, institutions and associations is to cooperate with each other for sustainable development at all geographical levels and the fight against inequality at international level. This vision has led to actions such as the establishment of a global movement calling for climate justice and equal sharing of environmental burdens [22].

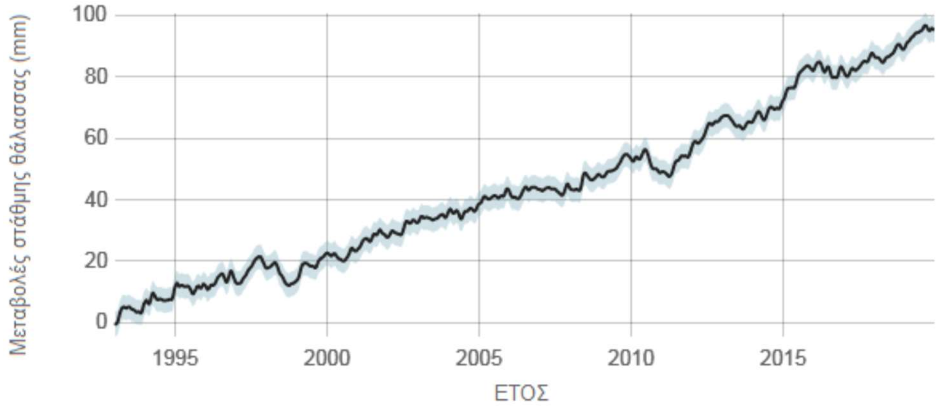
3.2 Climate Change and Impacts

People's standard of living has been significantly affected over the last twenty years by severe climate changes that have been observed worldwide. Indicatively, the following two diagrams show the rise in temperature and sea level respectively, at global level.



Source: climate.nasa.gov

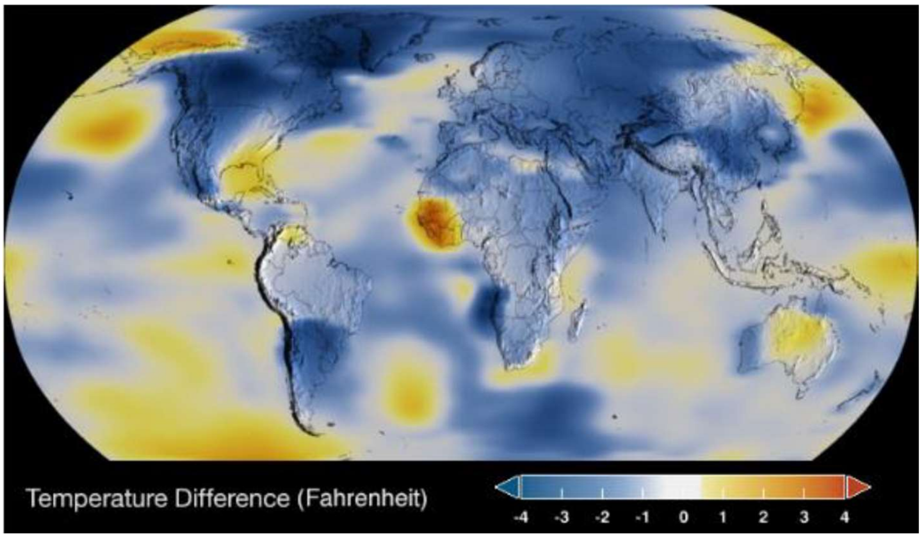
Image 5 Temperature anomaly



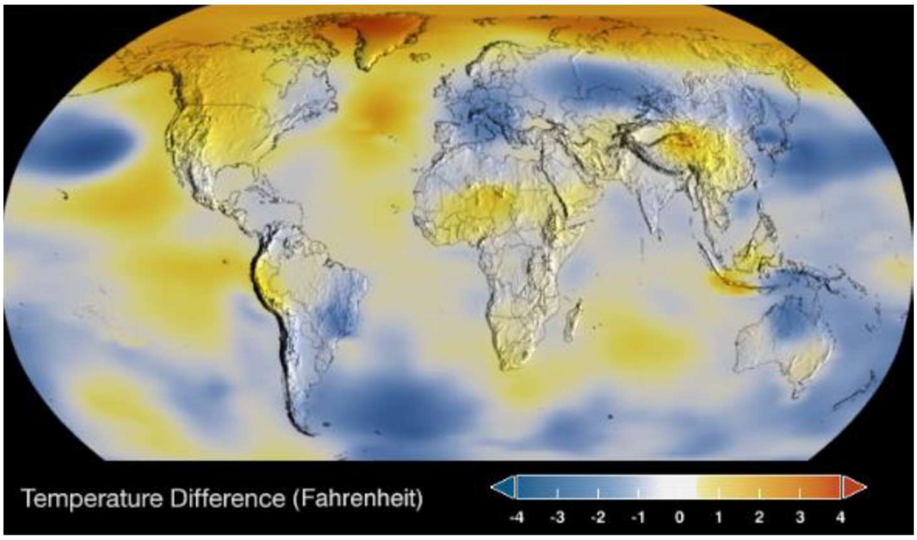
Source: climate.nasa.gov

Image 6 Sea level changes

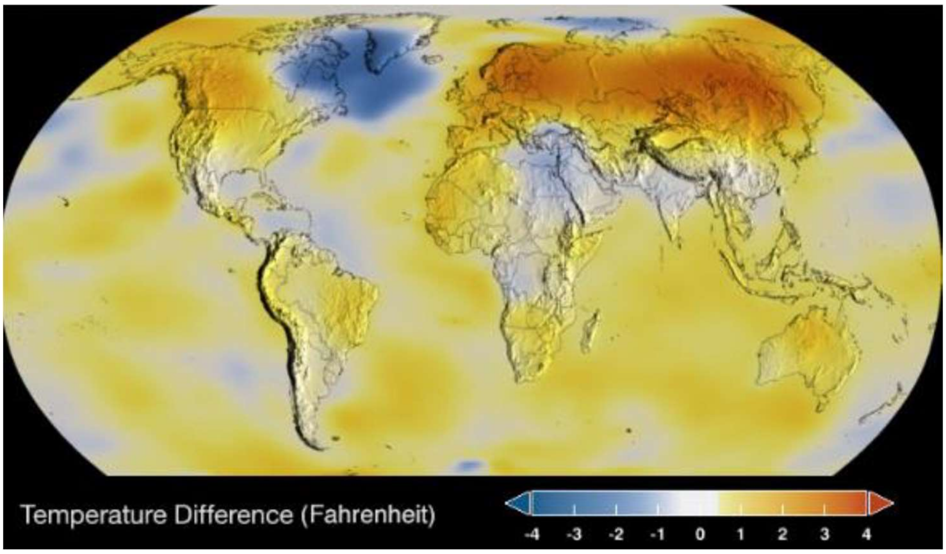
The following figures show the global temperature change from 1884 to 2019 [23].



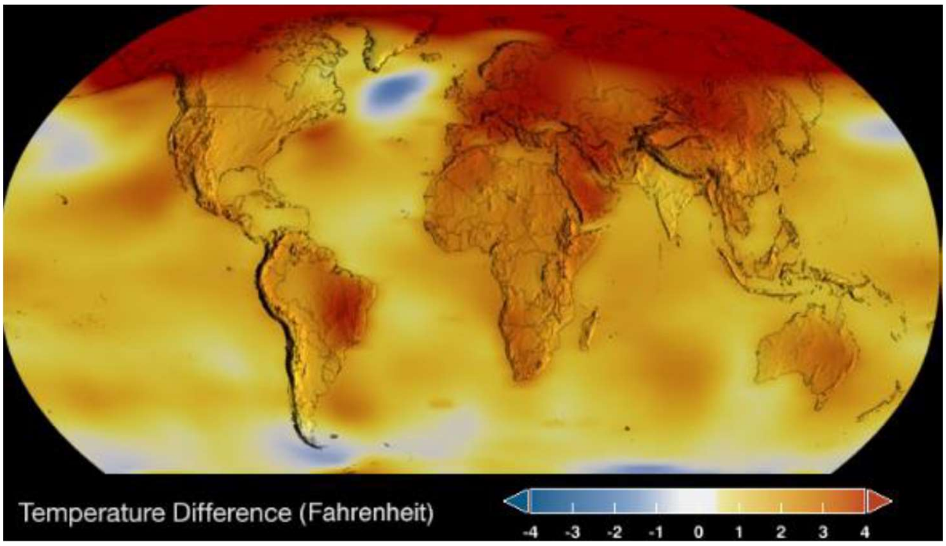
(a) 1884



(b) 1941



(c) 1992



(d) 2019

Source: climate.nasa.gov

Image 7 Changes in temperature (World map)

Since Greece is a Mediterranean country, particular importance is given to the climatic conditions of the Mediterranean, which, due to its geographical position and morphology, is characterized by a variety of complex weather and climatic phenomena. The Mediterranean, situated in a transitional zone between subtropical regions and mid-latitude regions, produces a wide climatic variation over multiple time scales, as well as a strong variation in precipitation in many regions [24]. Moreover, according to scientific assessments and forecasts, the Mediterranean has been identified as one of the most strongly affected regions by climate change [26]. One of the main concerns of researchers is the water cycle and its limits, given that many countries in the region use their water resources recklessly, a problem that is expected to worsen in the coming years. Very intense precipitation events are also taking place, while catastrophic floods pose a major threat to the region and especially to coastal zones. Following on from the above, other phenomena that take place may be overgrazing and the harvesting of firewood that put further pressure on the environment [21].

The Mediterranean region has experienced rapid climate change over the years and has experienced significant climate changes in the past. 20,000 years ago, the climate of the Mediterranean was much colder, with steppes stretching from the Caucasus region to southern Spain. In the northernmost regions of the Mediterranean basin, the temperature in the coldest month was 15°C lower than today. Also, the water available for vegetation was less. Also, the water resources that fed the flora were reduced. Looking at the region's most recent climate, there have been alternations between wet/dry and hot/cold periods over the past 2,000 years.
The effects of climate change are also observed by scientific predictions. In particular, a temperature rise of more than 3 degrees is forecast for southern countries between 1960-1990 and 2071-2100 [26].

According to a 2008 report by the European Investment Bank (EIB) for the Mediterranean region, climatologists expect during the 21st century:

- Temperature increase from 2.2 °C to 5.1 °C for southern European and Mediterranean countries between 1980-1999 and 2080-2099.
- Significant reduction in rainfall, ranging between -4 and -27 % for southern European and Mediterranean countries (while northern European countries will experience an increase of between 0 and 16 %).
- By 2100, sea levels could rise by up to 35 centimetres.
- Increase the number of days when the temperature will be above 30 °C. Similarly, a significant increase in extreme and dangerous events such as floods and floods is predicted. heatwaves.

In the Mediterranean region, 50% of the urban population lives below 10 metres above sea level, i.e. in areas vulnerable to rising sea levels. Also, the tourist destinations of these countries are equally vulnerable to rising temperatures [27].

The above climate changes will affect the natural environment of the Mediterranean in various ways, the main ones being [28]:

- Change in the water cycle given the increase in water evaporation and reduced rainfall. This significantly affects aquifers, which are vital for the sustainable development of an area.
- Deterioration of soil quality due to increased desertification phenomena.
- Many species will migrate to higher or more northern areas. Also, species that are even more dependent on climate may disappear altogether. Besides, The emergence of new species is also predicted. All the above will have a decisive impact on the fauna and flora of the Mediterranean.
- Risks to forest areas such as an increase in parasitisms as well as an increase in fires.

The above-mentioned risks are expected to exacerbate existing pressures on the environment and impair quality of life through changes in human occupations, such as tourism (water scarcity, heat waves), agriculture and fisheries (reduced production), coastal infrastructure (high waves, storms, sea level rise), energy sector (increased consumption, reduced water conditions for thermal and hydroelectric plants). In addition, especially for the energy sector, a significant increase in emissions is forecast in these regions, which will be even more pronounced than in other geographical areas. Finally, it is estimated that due to increased temperatures, there will be increased energy demand in these areas, in order to meet needs such as desalination, cooling of buildings, etc.

As shown above, the Southern and Eastern Mediterranean countries appear more vulnerable to climate change than the North. These countries are more exposed to accelerated desertification, drought and water scarcity and have economic structures that are more dependent on natural resources. Finally, the majority of these countries do not have such developed infrastructure, which creates considerable uncertainty for the implementation and achievement of the adaptation actions required [28, 24].

In the 21st century, problems linked to tourism, agriculture, fisheries, power generation, etc. are predicted to intensify. due to the increased water scarcity predicted to affect the Mediterranean region. Therefore, it is necessary to study and implement a set of adaptation actions to these phenomena in order to significantly reduce their economic consequences.

3.3 Climate Data and Forecasts in Greece

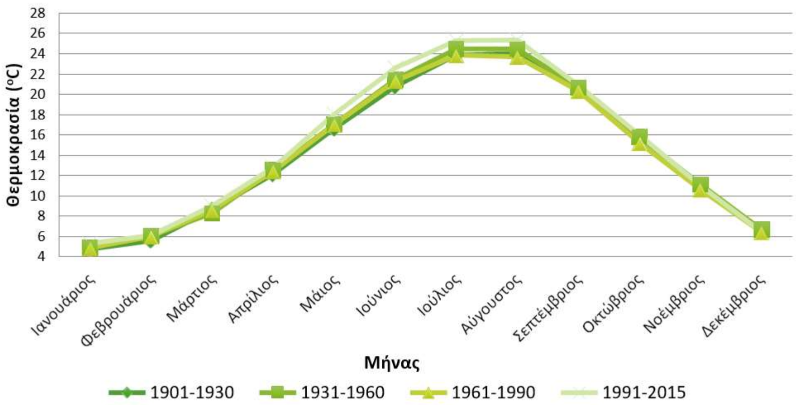
3.3.1 Climate Profile

The climate in Greece is characteristic of the Mediterranean climate: mild and rainy winter seasons, relatively hot and dry summers and, in general, extended periods of sunshine throughout the year. However, within the Greek territory various climatic types are observed, related to the geographical morphology of the area, but always within the framework of the temperate Mediterranean climate. This is due to the influence of topographic configuration (long mountain chains along the central part and other massifs, land and sea alternations) on atmospheric masses originating from the moisture sources of the central Mediterranean [29].

Climatologically, the year can be divided into two major seasons. From mid-October to late March, there is enough rainfall and relatively low temperatures. By contrast, the rest of the year saw significantly less rainfall and significantly higher temperatures. During the first, colder season, the coldest months are January and February. During these months temperatures between 0 °C and 5 °C are recorded in mountain areas. Coastal areas experience temperatures 5 degrees higher. During this period there is a lot of rainfall for the Greek climatic data, but usually the periods of cloudiness and rainfall are short, unlike in other regions of the planet [30].

On the contrary, during the warm season, the weather is characterized by stability with constant sunshine and minimal rainfall. There are, however, rare and brief intervals of rapid rain or thunderstorms mainly over the mainland. The maximum temperatures of the warm season range between 29 °C and 35 °C and occur from 20 July to 10 August. During the warm season, high temperatures are degraded by fresh sea breezes in the coastal areas of the country and by northern winds, blowing mainly in the Aegean. In general, the mountainous areas of the country are characterized by lower temperatures and more frequent snowfalls, while southern Greece is distinguished for its high temperatures as well as for the rare snowfalls [31].

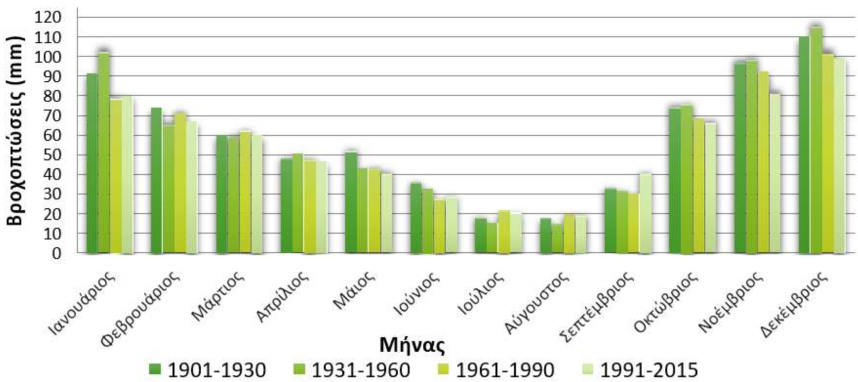
Regarding the relatively colder season, winters are mild on the plains with rare frost and snow. In recent years, extreme temperatures have occurred, i.e. very high summer and correspondingly very low winter temperatures, days with heavy rainfall, frost days, forest fires and days with increased thermal discomfort. As shown in the graph below, Greece's temperature was rising slowly but steadily until 2015. Also, since the beginning of the 20th century the average temperature of the country has increased by 2 degrees on the Celsius scale [32].



Source: Climate Change Knowledge Portal

Shape 26 Temperature changes in Greece by periods

The graph below shows the change of rainfall in Greece by time periods starting from the beginning of the 20th century until 2015. Although there is no clear pattern regarding these changes, we can conclude that on average rainfall has decreased, especially during the winter months. Regarding the summer months, there is an almost negligible increase, but this is probably due to extreme weather events, which, however, cause material damage. Therefore, this slight increase, instead of having positive effects, negatively affects the growth of the Greek economy.



Source: Climate Change Knowledge Portal

Shape 27 Rainfall changes in Greece by periods

3.3.2 Forecasts for the Peloponnese Region

The Bank of Greece study (CCISC) showed that changes in the frequency and intensity of extreme events will be one of the main impacts of climate change for Greece, with consequent negative effects on the vulnerability of societies and ecosystems through their exposure to environmental risks [33].

Under the estimations of even the most optimistic scenarios, a noticeable increase in the number of days when the maximum temperature will be above 35 °C is expected. Specifically, in the period 2071-2100 these days are predicted to be 35-40 more than in the current time period. In addition, an even more significant increase is predicted on days when the minimum temperature will not be lower than 20 °C (tropical nights). For the period 2071-2100 it is predicted that these days will have increased by 50 compared to current climate data. In contrast, the number of days with night frost is expected to decrease significantly, especially in Northern Greece (a decrease of up to 40 days). Moreover, the rise in temperature will result in an increase in the duration of the growing season by 15-35 days.

In particular, for the wider Study area, and more specifically for the Region of Peloponnese, a Regional Plan for Adaptation to Climate Change (PESPKA) has been prepared, during the elaboration of which simulations were carried out to determine the effects of climate change on the various climatic characteristics of the Region. To determine the climate changes expected to occur in the Peloponnese Region due to climate change, climate model simulations were used. A key factor in predicting climate change is the likely evolution of greenhouse gas concentrations. For this reason, in the context of the 5th report of the UN Intergovernmental Panel on Climate Change, scenarios of evolution of the world's population, economic activity, lifestyle, energy consumption, land use patterns, technology and climate policy were formulated. Estimates of future sentiment in this PESPA were made based on 3 of these scenarios. More specifically: RCP2.6 (severe mitigation scenario), RCP4.5 (intermediate scenario) and RCP8.5 (drastic increase in greenhouse gas emissions scenario) [34].

According to the results of climate models, the following conclusions are drawn:

- The average air temperature is expected to increase in the case of the three emission scenarios under study both in the near (2031-2060) and in the distant future (2071-2100), compared to the reference period (1970-2000). As expected, the increase in the average annual temperature is projected to be more pronounced in the case of the adverse emissions scenario (RCP8.5), as well as in the distant compared to the near future. Specifically in the extreme scenario, the temperature increase is expected to reach 1.7 ºC and 4.5 ºC for the near and distant future respectively.
- Precipitation precipitated during the year is expected to decrease in the future across the region in the case of all three emission scenarios with estimated reductions being more pronounced in the distant than in the near future, particularly in the case of RCP8.5 (reduction of 5% to 20% in the near future and 15% to 30% in the distant future). In addition, there are more pronounced decreases in the southern parts of the region. It is also noted that seasonally, the largest reduction in precipitation will occur during the summer. However, due to the fact that the rainfall during the summer in southern Greece and especially in the Peloponnese region is small, the reduction of precipitation in absolute numbers is small.

- Relative humidity is expected to decrease by a small percentage in both the near and distant future. The highest reduction values are recorded, as expected, in the case of the extreme scenario in which the relative humidity reduction for the distant future reaches 5%.

- Regarding the average wind speed, it is not expected to change based on all three Emission Scenarios. However, there is an increasing trend in the eastern parts of the Region and a decreasing trend in the west, with changes being more pronounced in the case of the RCP8.5 scenario. Seasonally, a change in average wind speed is expected. More specifically, in the winter period, in the near future, for the RCP2.6 and RCP4.5 scenarios, the wind speed is expected to show slight fluctuations. While for the RCP8.5 scenario reductions of up to 4% are expected. In the distant future the reductions become more significant. On the other hand, an increase in wind speed is expected during the summer.

- The average annual cloud cover fraction, based on the simulation results, would show small percentage reductions for the RCP2.6 scenario (2% - 4%). The decrease is greater in the RCP4.5 scenario and even greater for the RCP8.5 scenario with a decrease of 5%-10% in the near future and 10%-20% in the distant future. Looking at changes during winter, percentage reductions do not exceed 7% in the near future even for the RCP8.5 extreme scenario, while for the distant future the changes are still less than 5% for RCP2.6 and RCP4.5 scenarios, while for RCP8.5 scenarios the percentage reductions reach locally up to 15%. The percentage reduction of cloud cover during the summer is significantly greater, but its decrease in absolute numbers is not significant.

- The incoming short-wavelength radiation will show a relatively small increase in the Peloponnese Region for all three scenarios. In the near future, increases in the lowlands and coastal parts of the region do not exceed 1 Watt/m2 for any scenario, while in the mountains they are greater. In the distant future, increases for RCP2.6 and RCP4.5 scenarios are expected to be similar to changes in the near future; while for the RCP8.5 scenario they are estimated to be larger, especially in more mountainous areas. The increase in incoming radiation is smaller during the winter months and greater during the summer months with significant spatial variations (significantly higher values in the mountains of the Region).

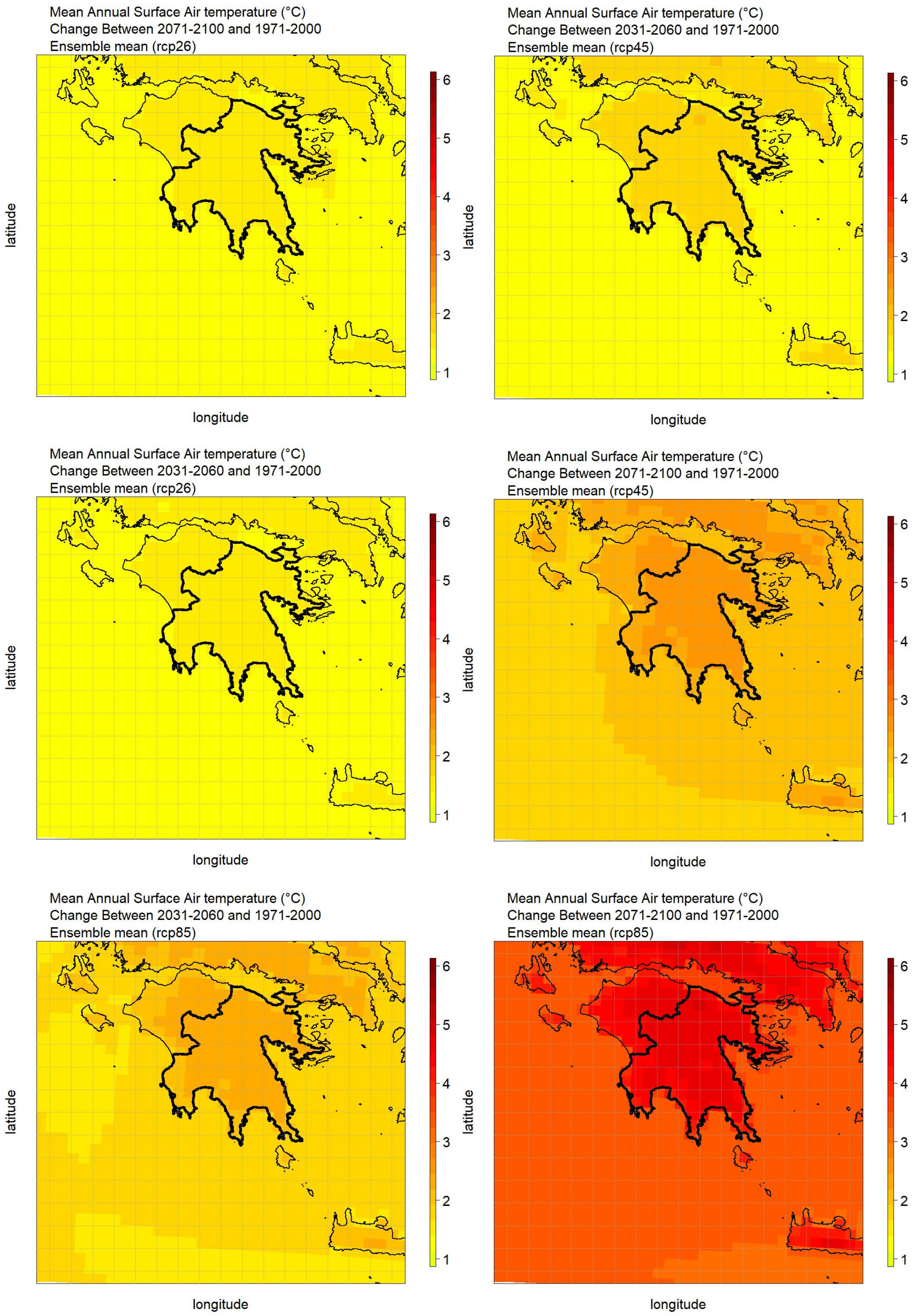
- As regards extreme weather events, minimum winter temperature values increase for all scenarios, while the average maximum summer temperature also increases more for all scenarios considered. On the number of days with night frost **(number of days with Tmin<0 °C),** Based on the results of the simulations, the number is expected to decrease in the future for all emission scenarios. The largest decreases are forecast in the mountainous parts and the smallest in coastal areas, where night frosts are almost absent in the current climate. A similar picture is presented by the spatial distribution of the change in the number of days that the ground is snowy **(ground snow cover = 100%).** Similarly to the number of days with night frost, the largest reductions in all emission scenarios are projected in mountain sections. In addition, the parameter of the growing season was examined, which for all emission scenarios shows increasing trends. The exception is the completely coastal sections where increases are small. Regarding days when the minimum temperature exceeds 20 ºC, their number is expected to increase for all emission scenarios with maximum increases in lowlands and coasts and minimum increases in mountain sections. An increase is also expected in the number of very hot nights during which the minimum temperature does not fall below the particularly high (for minimum temperature) value of 25 ºC. In the near future, increases for all emission scenarios are very small. In the distant future, however, there are particularly significant increases. There is also expected to be an increase during the summer season as well as in the number of days during which the maximum temperature exceeds 35 ºC, for all scenarios considered. As expected, the humidex index, i.e. the number of days that may cause discomfort to the population, is also increasing for all emission scenarios and the entire region. Another factor considered is the tendency to heat and cool. As expected from what has already been mentioned, there will be an increase in days with increased cooling needs, but heating needs during the winter period are decreasing.

- The number of days with a high fire risk for all emission scenarios is also increased. The largest increases occur in the mountainous parts of the Region. When considering the number of rainy days (daily rainfall > 1 mm), it follows that the number is expected to decrease for all emission scenarios. By contrast, the length of the maximum number of consecutive dry days per year is expected to increase for all scenarios considered, with a larger increase in the distant future. Another phenomenon caused by climate change is flash floods. When examining the course of the number of days when the amount of rain exceeds 20 mm, it is found that small fluctuations are expected for all scenarios for most of the region. Fluctuations, with the exception of some parts of the Region, are also expected in the maximum amount of precipitation precipitated in a short period of time (within three consecutive days). As regards the dryness index, changes are expected to be dramatic, except in mountainous and westernmost regions of the region, where there are milder changes and the climate will continue to be humid.

- Finally, regarding temperature and sea level, there is an increase in the average sea temperature without spatial variability. Logically, the largest increase occurs in the distant future and the extreme scenario. Sea level in the Eastern Mediterranean, in the case of the RCP45 scenario, is expected to rise in the near future between 12 cm and 16 cm, with the highest values occurring in the southeastern regions and the smallest in the Aegean Sea. In particular, for the maritime zone in the Attica region, the level is expected to rise by around 12 cm. In the case of the RCP85 scenario, the rise is expected to be more pronounced and will reach 20 cm in the southeastern areas, while in the Aegean in the maritime zone of the Attica region it will increase by about 15 cm.

Then, the future predictions for the main climatic phenomena in the Peloponnese Region are presented schematically and explained.

Regarding sea temperature, the increase, based on climate model simulations, is expected to continue in the future. Figure 8 shows the spatial distribution of sea surface temperature change in the sea area bordering the Peloponnese Region as well as air temperature at ground surface in FP. As is evident, sea surface temperature increases do not show spatial variability in the near future for scenarios RCP2.6, and RCP4.5 equals 1.3 ºC and for RCP8.5 equals 1.7 ºC. In the distant future the range of air temperature increase is significantly greater depending on the emission scenario and on average is 1.3 ºC for the RCP2.6 mild scenario, for the intermediate RCP4.5 scenario it is 2.0 ºC and for the RCP8.5 extreme scenario it is 3.4 ºC. Interestingly, the increase in surface temperature The increase in air temperature at the ground surface is less than the increase in air temperature, which is due to the higher heat capacity of the water. The seasonal variation in sea surface temperature increase is significantly less than that in air temperature.

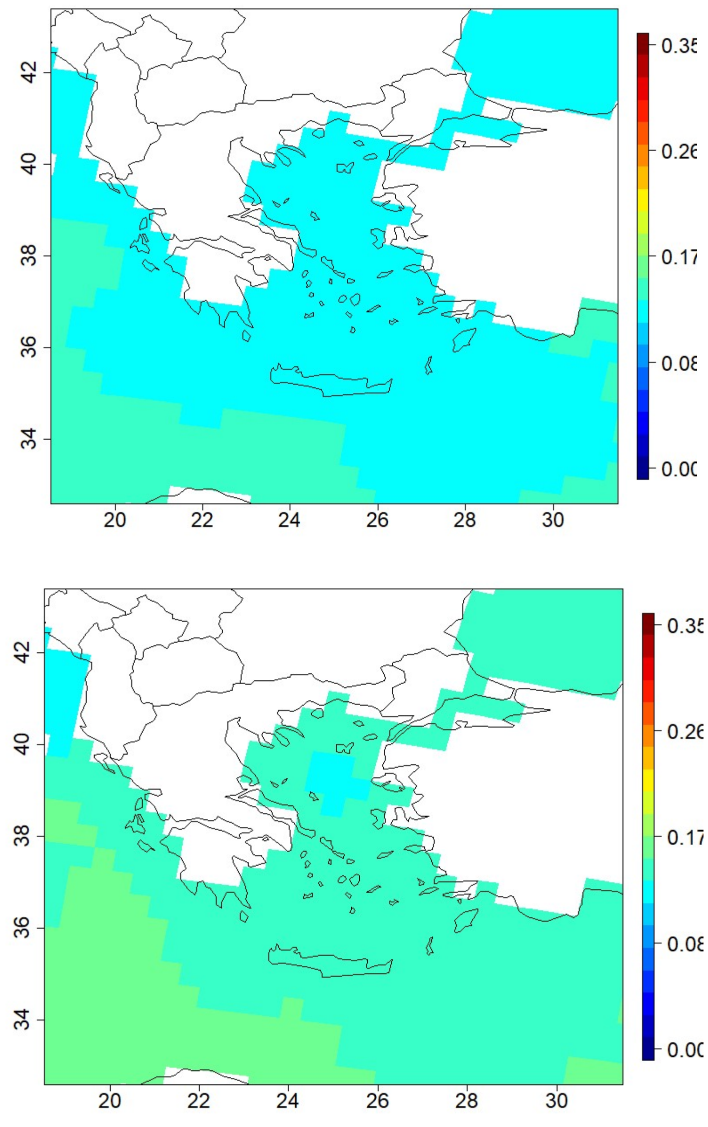


Source: PESPKA Peloponnese

Image 8 Change of sea surface temperature in the sea area bordering the Peloponnese Region as well as air temperature at ground surface according to RCP2.6 (top), RCP4.5 (average) and RCP8.5 (bottom) scenarios. Left-wing schemes refer to changes between the near future (2031-2060) and the reference period (1971-2000) and right-wing schemes refer to changes between the distant future (2071-2100) and the reference period (1971-2000)

Regarding sea level change, for the coastlines of the Peloponnese, Figure 9 shows the estimated time evolution of sea level changes in the scenarios RCP4.5 (green curve) and RCP8.5 (red curve) showing the continuous rise that will reach 30 cm at the end of the century for the RCP4.5 scenario and 40 cm for the RCP8.5 scenario.

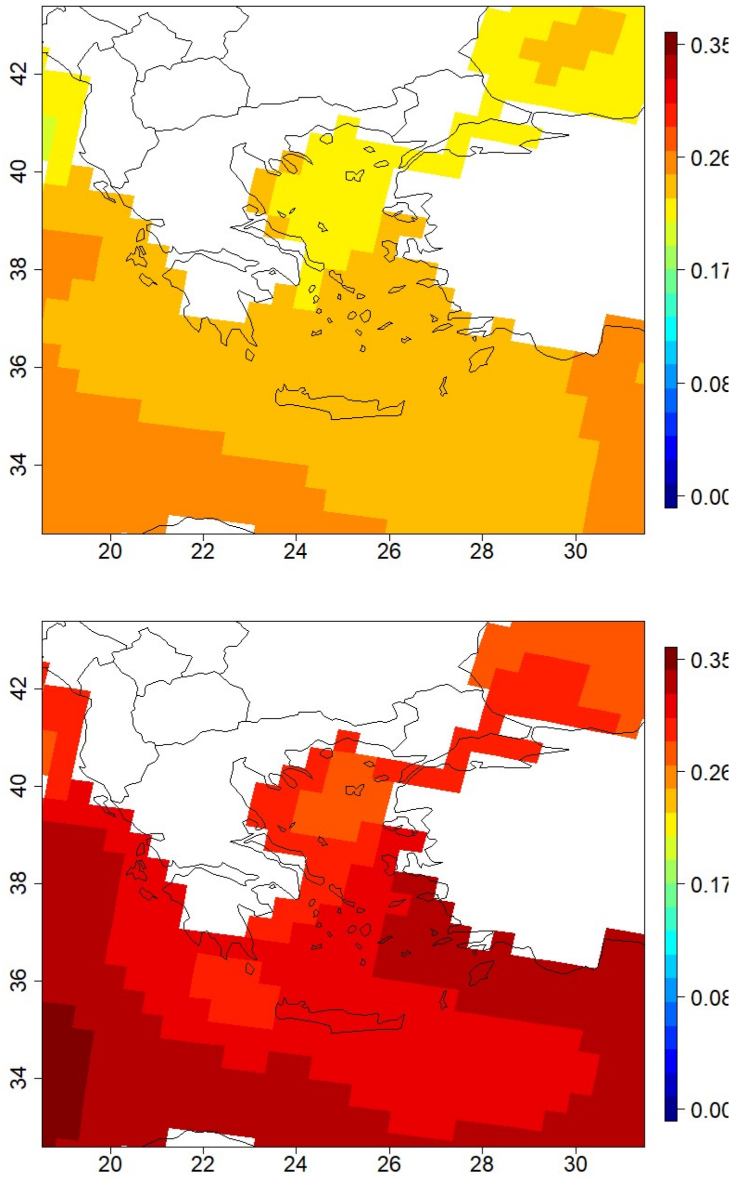
More specifically, the spatial distribution of the projected sea level change for the period 2031-2060 (near future) compared to the reference period 1971-2000 for the average low emission scenario RCP4.5 and the high emission scenario RCP85 based on the climate model MPI-ESM-MR in the Eastern Mediterranean is presented. The forecast simulations do not take into account changes in the level of the coastline due to geological movements.



Source: PESPKA Peloponnese

Image 9 Spatial distribution of projected sea level change for the period 2031-2060 (near future) compared to the reference period 1971-2000 for the RCP4.5 emission scenario (left) and the RCP85 emission scenario (right) based on the MPI-ESM-MR climate model.

As shown in Figure 10, based on the estimates of the MPI-ESM-MR climate model, sea level in the case of the RCP45 scenario is expected to rise in the near future between 10 cm and 15 cm with the highest values occurring in the southwestern and southeastern regions and the smallest in the Aegean Sea. In particular, for the maritime zone in the Peloponnese region, the level is expected to rise by around 12 cm. In the case of the RCP85 scenario, the rise is expected to be slightly more pronounced and will reach 18 cm in the southwestern Ionian Sea, while in the Aegean in the sea zone of the Peloponnese region it will increase by about 15 cm.



Source: PESPKA Peloponnese

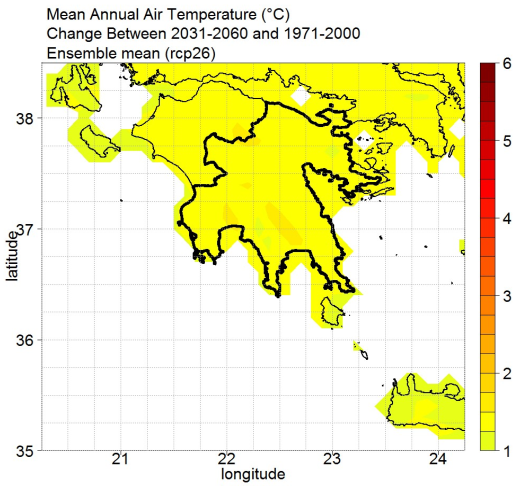
Image 10 Spatial distribution of projected sea level change for the period 2071-2100 (distant future) compared to the reference period 1971-2000 for the RCP4.5 emission scenario (left) and the RCP85 emission scenario (right) based on the MPI-ESM-MR climate model.

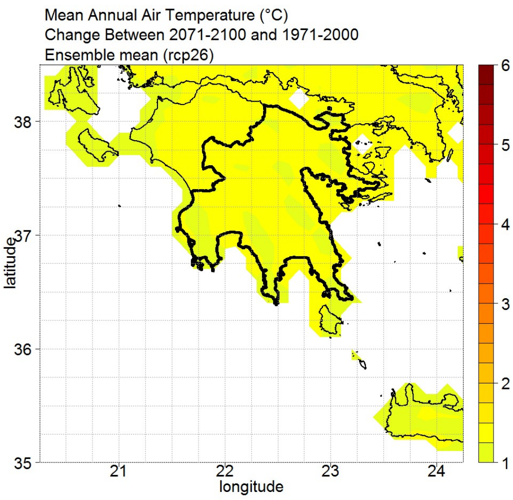
Figure 10 shows the corresponding changes between the period 2071-2100 (distant future) and the reference periods 1971-2000. As expected, the rise in the distant future will be greater compared to the near future. More specifically, based on the estimates of the MPI-ESM-MR model, the sea level in the seas bordering Greece is expected to rise between 20 cm and 26 cm, with the highest values occurring in the southwestern and southeastern sea areas and the smallest in the central Aegean. In particular, for the maritime zone in the Peloponnese Region, the level is expected to rise by about 22 cm. In the case of the RCP85 scenario, the rise is expected to be more pronounced and will reach 35 cm in the southwestern Ionian, 32 cm in the South Aegean, the Libyan Sea and the Ionian Sea, 28-30 cm in the maritime zone of the Peloponnese region, while the smallest increase of 26-28 cm is expected in the Northeast Aegean.

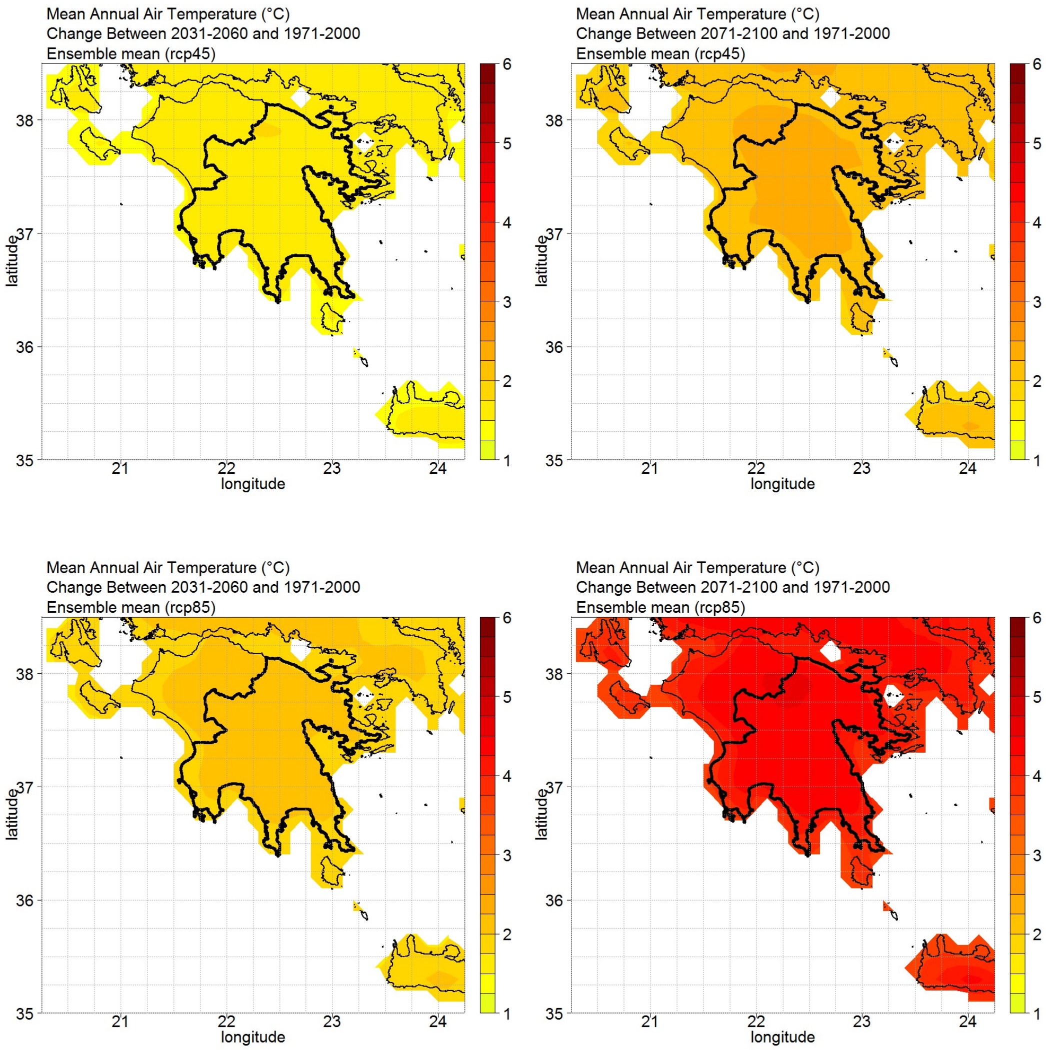
According to the climate model simulations used in PESPA Peloponnese**, the average air temperature is expected to increase in the case of all three emission scenarios under study** both in the near (2031-2060) and in the distant future (2071-2100) compared to the reference period 1970-2000. As expected, the increase in the average annual temperature is projected to be more pronounced in the case of the adverse RCP8 emissions scenario.5 compared to the mild RCP2.6 scenario, as well as in the distant compared to the near future.

More specifically, as shown in Figure 11, which shows the spatial distribution of the change in the average annual air temperature, uniform spatial increases are expected in the near future for all emission scenarios ranging between 1.4 ºC for the RCP2.6 mild scenario, and 1.7 ºC for the RCP8.5 severe scenario. In the distant future the range of air temperature increase is significantly greater depending on the emissions scenario and on average is 1.4 ºC for the RCP2.6 mild scenario, for the intermediate RCP4.5 emission scenario it is 2.2 ºC and for the RCP8.5 extreme scenario it is 4.5 ºC while locally the increase reaches 5 ºC.

In the images below it is evident that changes in average temperature are greatest during summer exceeding 5 ºC in the distant future for the RCP8.5 scenario, and smallest for winter so they do not exceed 3.5 ºC at the end of the century even for the extreme scenario RCP8.5.

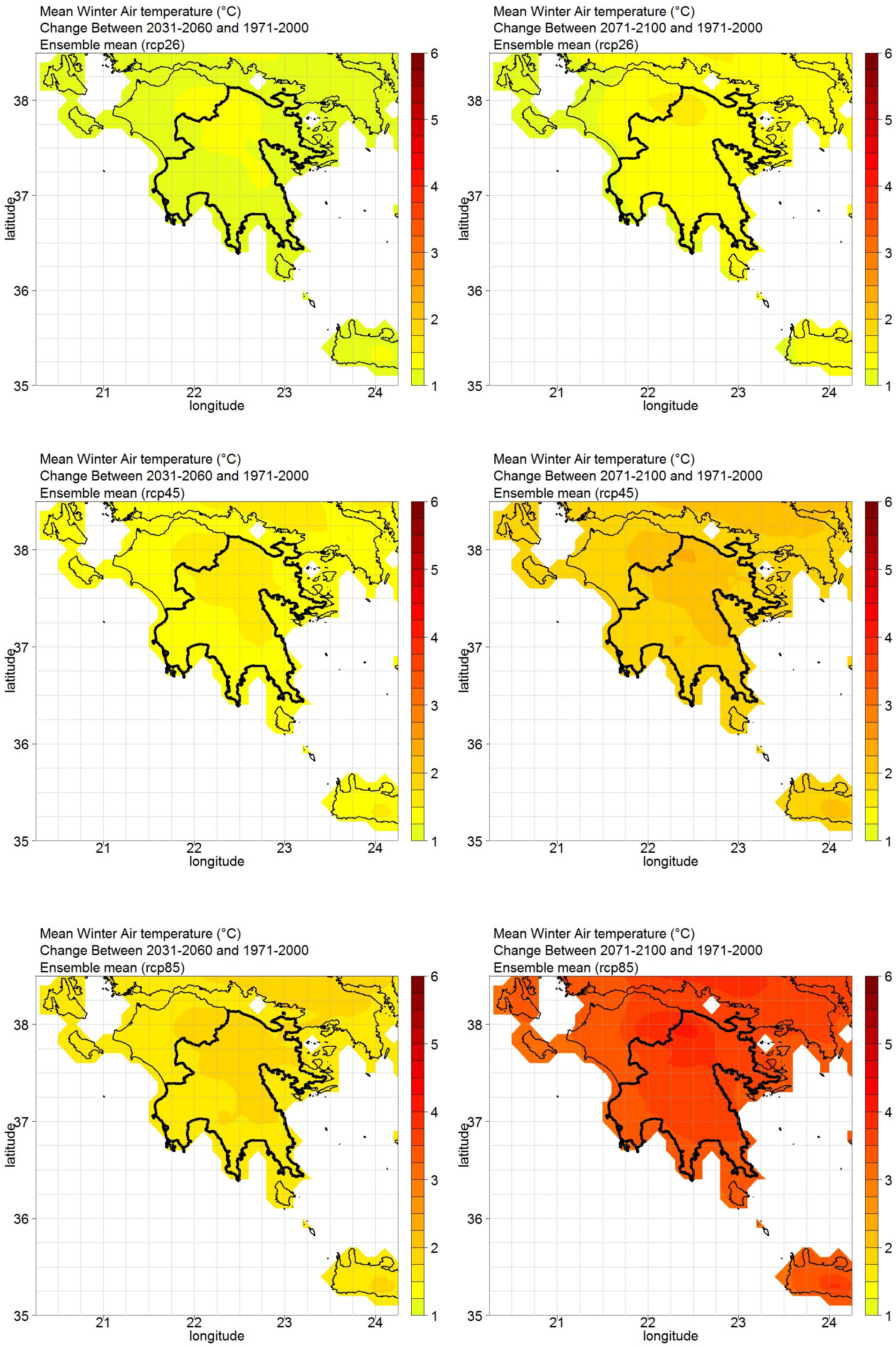






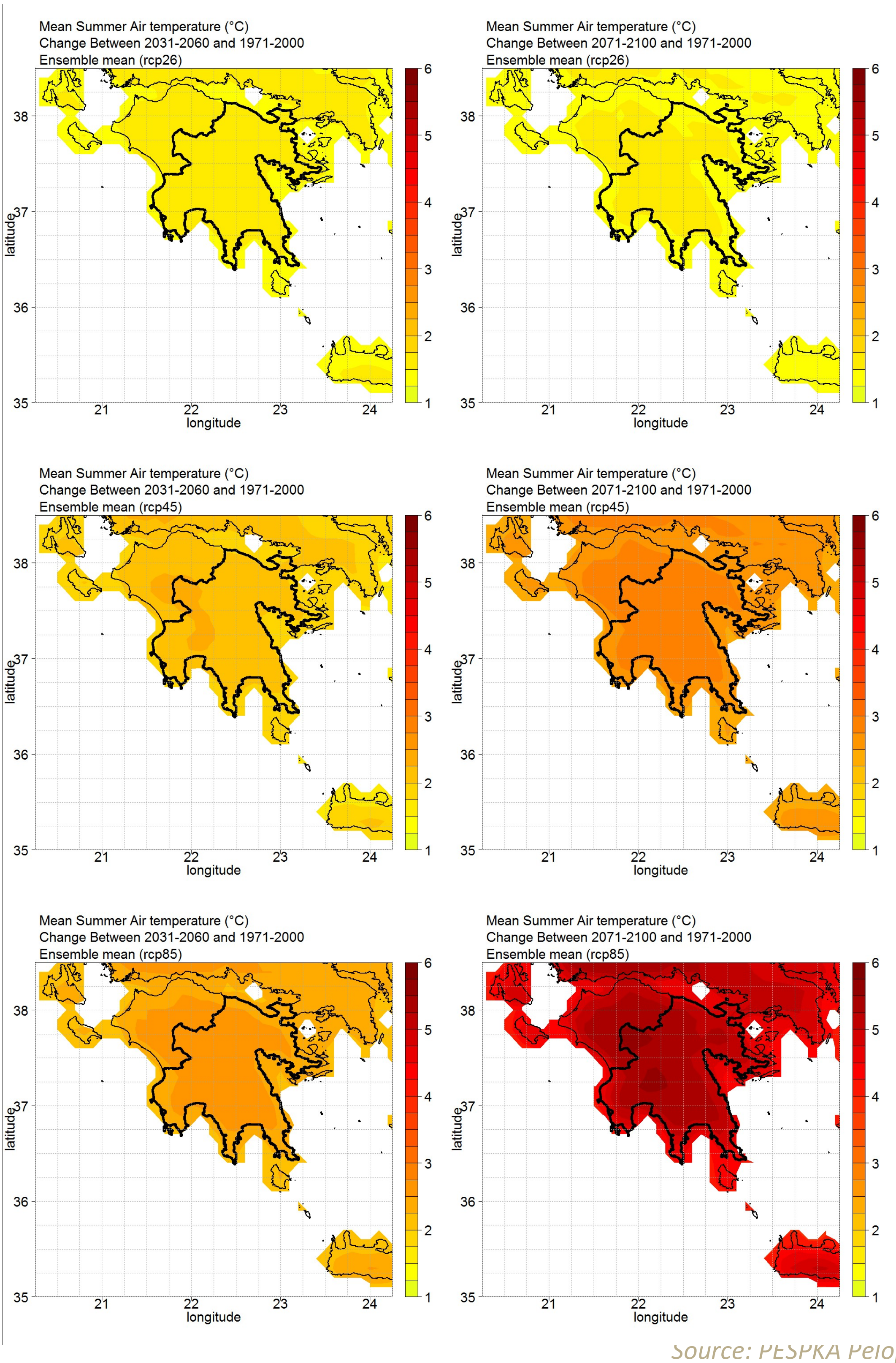
Source: PESPKA Peloponnese

Image 11: Changes in the average annual temperature in the Peloponnese Region according to RCP2.6 (top), RCP4.5 (average) and RCP8.5 (bottom) scenarios. Left-wing schemes refer to changes between the near future (2031-2060) and the reference period (1971-2000) and right-wing schemes refer to changes between the distant future (2071-2100) and the reference period (1971-2000).



Source: PESPKA Peloponnese

Image 12 Changes in average winter temperature in the Peloponnese Region according to RCP2.6 (top), RCP4.5 (average) and RCP8.5 (bottom) scenarios. Left-wing schemes refer to changes between the near future (2031-2060) and the reference period (1971-2000) and right-wing schemes refer to changes between the distant future (2071-2100) and the reference period (1971-2000).



Source: PESPKA Peloponnese

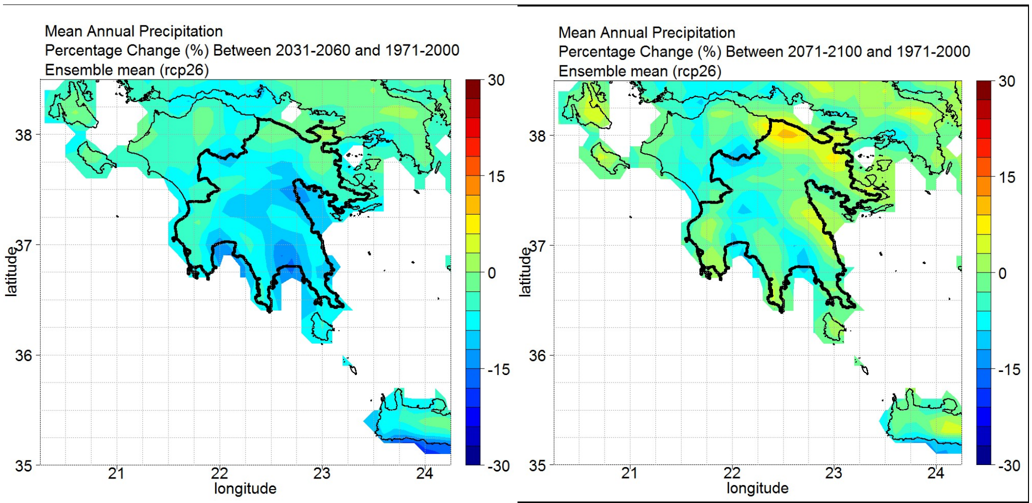
Image 13: Changes in average summer temperature in the Peloponnese Region according to RCP2.6 (top), RCP4.5 (average) and RCP8.5 (bottom) scenarios. Left-wing schemes refer to changes between the near future (2031-2060) and the reference period (1971-2000) and right-wing schemes refer to changes between the distant future (2071-2100) and the reference period (1971-2000).

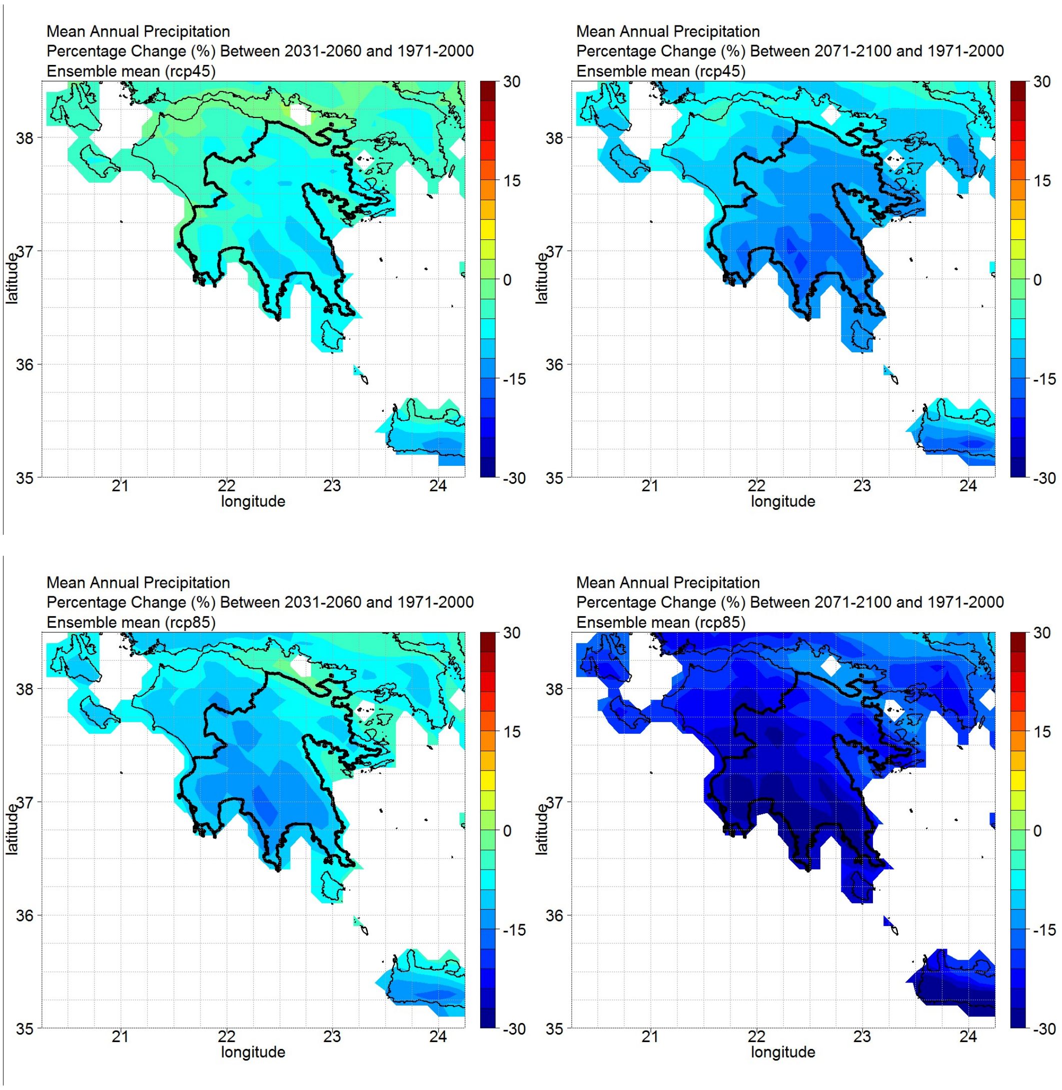
Based on the results of the climate simulations, precipitation precipitated during the year will decrease in the future in the entire Peloponnese region in the case of all three emission scenarios for which estimates of its change were made, with the estimated reductions being more pronounced in the distant compared to the near future, especially in the case of the RCP8.5 scenario. In addition, they are more pronounced in the southern parts of the region.

Especially in the near future, as shown in the maps in Figure 14, the average annual rainfall is expected to decrease from 0% to 15% in the case of the RCP2.6 scenario, from 5% to 12% for the RCP4.5 scenario and from 5% to 20% for the RCP8.5 scenario with the largest decreases expected in the regional units of Messinia and Laconia.

In the distant future and under the RCP2.6 scenario, precipitation fluctuations of up to 10% are expected, with increases observed mainly in coastal parts and decreases in mountainous areas. In the case of the RCP4.5 scenario, reductions of 10% to 20% are expected in the distant future, with the smallest values appearing on the boundaries of the Peloponnese region with the Region of Western Greece and the largest in the regional units of Messinia and Laconia and especially in the Taygetos mountain range. Finally, precipitation reduction is expected to be even more pronounced in the distant future in the case of the RCP8.5 scenario with reductions of 15% to 30%, with the largest decreases again in the regional units of Messinia and Laconia and the smallest in the northeast coast of the prefecture of Corinthia.

It is noted that the percentage decrease of precipitation during the summer is significantly greater, which is related to the decrease in the frequency of summer storms, however, as well as in the current climate the rainfall heights that fall during the summer season in southern Greece and especially in the Peloponnese region are small, the decrease in precipitation during the summer in absolute numbers is small.





Source: PESPKA Peloponnese

Image 14: Percentage changes of average annual rainfall in the Peloponnese Region according to RCP2.6 (top), RCP4.5 (average) and RCP8.5 (bottom) scenarios. Left-wing schemes refer to changes between the near future (2031-2060) and the reference period (1971-2000) and right-wing schemes refer to changes between the distant future (2071-2100) and the reference period (1971-2000).

3.4 Risk Assessment and Vulnerability Analysis

The assessment of the Municipality of Kalamata regarding the effects of climate change starts from the identification of the potential risks for the area, which are reflected in the table below, as well as their subcategories (indicated in less bold).

Table 26 Types of climatic risks and subcategories

Climate risks in the Municipality of Kalamata	Probability
Heat wave	√
Extreme cold	
Heavy precipitation	√
Heavy rainfall	√
Heavy snowfall	
Floods & Sea Level Rise	√
Sudden/surface flooding	√
River flooding	√
Coastal flooding (sea level rise)	√
Groundwater flooding	
Permanent flooding	
Drought & water scarcity	√
Storms	√
Strong winds	
Tornadoes	
Cyclones (hurricanes)	
Tropical storm	
Lightning/lightning	√
Movement of masses	√
Landslides	√
Avalanche	
Rockslide	
Precipitation	
Fires	√
Forest Fires	√
Chemical changes	√
Saltwater penetration	√
Ocean acidification	
Biological hazards	√
Waterborne diseases	√
Vector-borne diseases	
Insect infestation	√

Based on the Covenant Directives, a table is presented with a series of current and future parameters related to risks to better understand them. Such parameters are the significance of their effect, its change in the future, etc.

Table 27 Parameters of potentially occurring risks

Climate risks	Current risk		Future risks		
	Probability of danger	**Risk effect**	**Expected change in risk intensity**	**Expected change in risk frequency**	**Time horizon**
Heat wave	High	High	Augmentation	Augmentation	Medium term
Heavy precipitation	Middle	Middle	Unchanged	Augmentation	Medium term
Heavy rainfall	Middle	Middle	Unchanged	Augmentation	Medium term
Reduction of precipitated precipitation	Middle	Small	Unchanged	Augmentation	Medium term
Floods & Sea Level Rise	Small	High	Unchanged	Augmentation	Medium term
Sudden/surface flooding	Small	High	Unchanged	Augmentation	Medium term
River flooding	Middle	High	Augmentation	Augmentation	Medium term
Coastal flooding (sea level rise)	Middle	Middle	Augmentation	Augmentation	Long-term
Drought & water scarcity	Middle	Middle	Augmentation	Augmentation	Medium term
Storms	Low	Low	Unchanged	Augmentation	Medium term
Strong winds	Low	Low	Unchanged	Augmentation	Medium term
Lightning/lightning	Low	Low	Unchanged	Augmentation	Medium term
Movement of masses	Middle	Middle	Unchanged	Augmentation	Medium term
Landslides	Middle	Middle	Unchanged	Augmentation	Medium term
Fires	High	High	Augmentation	Augmentation	Short-term
Forest Fires	High	High	Augmentation	Augmentation	Short-term
Chemical changes	High	High	Augmentation	Augmentation	Short-term
Saltwater penetration	Middle	Middle	Unchanged	Augmentation	Long-term
Waterborne diseases	Middle	Middle	Unchanged	Unchanged	Medium term

After identifying the risks and assessing them according to their frequency and severity, it is important for the Municipality of Kalamata to evaluate which sectors of activity are vulnerable to the impact of climate change. The sectors affected by it are the following:

- Transport
- Public health
- Energy
- Water Resources
- Building Infrastructure
- Tourism
- Agriculture-Forestry
- Environment and Biodiversity
- Cultural Heritage

According to PESPKA Peloponnese:

VULNERABILITY IN THE TRANSPORT SECTOR: The transport sector can be affected by climate change and in particular by extreme weather events (mainly floods), intense changes in temperature and sea level rise due to the long coastline of the Region. Given the intensity of these phenomena in the FP, the sector's vulnerability is average.

HUMAN HEALTH VULNERABILITY: Climate change has a number of complex interconnections with health. The health of the population is particularly vulnerable to climate change. In particular, increased temperatures can have serious effects on human health while extreme weather events can even lead to deaths. Due to the above and in combination with the intensity of climate changes expected for the Region, the vulnerability of the sector for the Region is characterized as average.

VULNERABILITY IN ENERGY INFRASTRUCTURE: The energy sector is also vulnerable to climate change. In particular, the occurrences of extreme weather events and reduced water availability due to rising temperatures and reduced rainfall make the sector vulnerable to climate change. Due to the above and in combination with the fact that FP is the 2nd Region of the country in which electricity is produced, It makes the sector show moderate vulnerability in the distant future and low for the near future.

WATER RESOURCES VULNERABILITY: Water bodies have a direct correlation with climate change and specifically with the reduction of rainfall frequency and the increase in temperature leading to increased evaporation. Also, the occurrence of rainfall of high intensity and low frequency does not favor the intrusion of water into underground aquifers, aggravating the problem of water scarcity. In conclusion, the water resources reserves of the Region are expected to affected both qualitatively and quantitatively and therefore this sector is highly vulnerable.

VULNERABILITY IN THE BUILDING ENVIRONMENT: Since the energy demand of buildings is directly dependent on the climate, it is obvious that the building environment is affected by climate change and in particular by the increase and decrease of temperature as well as by extreme weather events that can cause damage to the built environment. Based on the above, in combination with the expected intensity of climate change in the Region, The vulnerability of the sector is characterized as average.

VULNERABILITY OF THE TOURISM SECTOR: The tourism sector is directly affected by climate change, this is because climate change affects the suitability of the climate for tourism. The increase in temperature and extreme phenomena (floods and fires) as well as coastal erosion or salinization phenomena (lack of drinking water) have the potential to greatly affect the tourist product. Based on climatic changes expected to occur in the FP: the sector's vulnerability is average.

VULNERABILITY OF BIODIVERSITY AND FOREST ECOSYSTEMS: The health and dynamic growth of biodiversity species depend directly on environmental factors such as temperature, solar radiation, available water and soil nutrients, while forests are directly affected by fires and the occurrence of diseases that can affect trees. Especially in matters of fires, PA is particularly sensitive. In addition, the increase in heavy rainfall also affects the sector under consideration due to the occurrence of soil erosion phenomena. Finally, the reduction of rainfall and the change in CO_2 concentration affects the growth rate of trees. Due to the above, the vulnerability of the sector for the Region is characterized by moderate to high, depending on the examined scenarios.

VULNERABILITY OF AGRICULTURE AND LIVESTOCK: Crop production and quality and the amount of irrigated water are directly affected by local climate variables. The agricultural sector is vulnerable mainly to climate changes resulting from frost and hail and secondarily to extreme rainfall, heat waves and finally floods, windstorms and snowfall. Short- and long-term forecasts show that Days with a risk of frost and hail are significantly reduced, especially in the affected areas so far. Correspondingly, as the days of snow cover are reduced, the risk arising from snowfall is expected to decrease even in mountainous and semi-mountainous areas. This risk affects livestock farming the most, especially non-stable. The vulnerability due to these phenomena is small. Regarding extreme rainfall and flood risk, no particular changes are expected. It is also not expected to change the risk currently posed by windstorms and strong gusts of wind. Therefore, vulnerability due to windstorms is low. However, vulnerability due to rising temperatures, in particular heatwaves and droughts, is expected to increase significantly.

As far as livestock farming is concerned, climatic conditions play a decisive role as they determine the energy and nutrient metabolism of farm animals. Animals can be affected by climate changes in different ways. In particular, they may be subjected to heat stress when the ambient temperature is higher or lower than the thermo-neutral zone (comfort) of the animal. In addition, vulnerability in the livestock sector is also increased by drought, which affects the general availability of water both for feed production and sufficiency in grassland and in the water necessary for the survival of animals. Finally, extreme weather events can cause losses in livestock and infrastructure. The vulnerability of the sector due to all the above is expected to be small.

VULNERABILITY IN THE FIELD OF CULTURAL CAPITAL: The changes that are going to occur in the frequency and intensity of extreme weather events, as well as the combined action of the above phenomena, are likely to affect elements of the environment that are part of cultural heritage, historical monuments that are exposed to the external environment and collections that are exhibited in museum spaces. In line with the above, in combination with the intensity of climate change expected for the Region, the vulnerability of the sector for the Peloponnese Region is characterized as low.

The following table lists the sectors that may be affected by each climatic impact and the way in which they are affected, based on the characteristics of the Municipality under study [34, 35].

Table 28 Sector Vulnerability Analysis and Risk Assessment

Climate Risks	Risk Probability	Risk effect	Expected change in risk intensity	Expected change in risk frequency	Time horizon
Heat wave	High	High	Augmentation	Augmentation	Medium term
Heavy precipitation	Small	Middle	Unchanged	Augmentation	Medium term
Heavy rainfall	Small	Middle	Unchanged	Augmentation	Medium term
Reduction of precipitated	Small	Small	Unchanged	Augmentation	Medium term
Hail	Middle	Middle	Unchanged	Augmentation	Medium term
Floods & Sea Level Rise	Small	High	Unchanged	Augmentation	Medium term
Sudden/surface flooding	Small	High	Unchanged	Augmentation	Medium term
River flooding	Middle	High	Augmentation	Augmentation	Medium term

The affected groups are presented in the following Table.

Table 29 Presentation of the most vulnerable social groups by climate risk

Climate risks	More vulnerable population groups
Heat wave	Elderly
	People with chronic diseases
	Children
Floods & Sea Level Rise	All population groups
Drought & water scarcity	Elderly
	People with chronic diseases
	Children
Mass Movement	All population groups
Fires	All population groups
Chemical changes	Elderly
	People with chronic diseases
	Children

Finally, the Table below assesses the adaptability of each affected sector of society.

Table 30 Adaptability of each sector

Sector affected	Relative climate risk	Current level of adaptability
Public health	Heat wave	Middle
	Floods and sea level rise	Middle
	Drought and water scarcity	First name
	Biological changes (diseases)	First name
	Fires	Middle
Energy	Floods and sea level rise	Middle
	Storms	Middle
	Fires	Middle
Transport	Fires	First name
	Floods and sea level rise	Low
	Mass Movement	Middle
Building Infrastructure	Floods and sea level rise	Middle
Tourism	Heavy precipitation	Low
	Floods and sea level rise	Middle
	Fires	Middle
	Heat wave	Middle
	Drought and water scarcity	First name
	Fires	First name
Agriculture - Forestry	Heavy precipitation	Low
	Drought and water scarcity	Low
	Floods and sea level rise	Low
	Fires	Low
	Heat wave	First name
	Drought and water scarcity	Middle
Environment and Biodiversity	Floods and sea level rise	Low
	Storms	Low
	Fires	Low
	Heat wave	Middle

Water Resources	Floods and sea level rise	Middle
Cultural Environment	Floods and sea level rise Fires	Middle Middle

4. Calculation of Greenhouse Gas Emissions for the year 2030

4.1 Baseline scenario (without additional measures)

Greenhouse gas emissions within the boundaries of the Municipality of Kalamata were calculated based on the same methodology applied for the calculation of emissions in the reference year 2019. In addition, data from the existing National Energy and Climate Plan (NECP) (Government Gazette B' 4893) [36] as well as the projected emission factor of 2030 of the energy generation mix were taken into account. as it will be included in the new, updated NECP 2023. Especially for transport, the penetration of electromobility was taken into account, according to the Climate Law as well as the conversion of vehicles into LPG vehicles.

Specifically, for the 2030 horizon, the expected changes in fuel and electricity consumption based on the NECP 2019 are described below for the country as a whole:

Table 31 Final consumption energy by the year 2030 in the sectors considered

Residential Sector			
[ktoe]	**2020**	**2030**	**%**
Electricity	1.719	1.748	1,7%

Tertiary sector			
[ktoe]	**2020**	**2030**	**%**
Petroleum and natural gas	322	326	1,2%
Electricity	1.541	1.539	-0,1%

Transport			
[ktoe]	**2020**	**2030**	**%**
Petroleum and natural gas	6.751	6.541	-3,1%
Biofuels	228	371	62,7%
Electricity	18	154	755,6%

Also, the provisions of the Climate Law (Government Gazette A' 105/27.05.2022) are taken into account, according to which:

Article 11

Ban on electricity production from solid fossil fuels

1. The production of electricity from solid fossil fuels shall be prohibited from 31 December 2028. Existing authorisations for the production of electricity from solid fossil fuels shall cease to be valid on that date.

2. By joint decision of the Minister of Environment and Energy and the Minister responsible for just development transition, which may be issued until 31 December 2025, the deadline of para. 1, taking into account capacity adequacy and security of supply;

according to the provisions of the National Energy and Climate Plan.

Article 17

Measures to reduce emissions from buildings

1. From 1 January 2025, the sale and installation of heating oil burners shall be prohibited. Anyone who sells or installs heating oil burners in breach of the first subparagraph shall be fined and the burner sealed. The amount of the fine is set at three times the selling price of the burner. Any penalties provided for by other laws shall not be affected by the application of this Agreement.

2. From 1 January 2030, only heating oil blended at least thirty percent (30%) by volume with renewable liquid fuels may be sold. Anyone who sells heating oil in breach of the first subparagraph shall be fined. The amount of the fine is set at three times the value of the fuel sold to the final consumer. Any sanctions provided for by other laws, in particular Law 3054/2002 (A' 230), shall not be affected by the application of the present. By 31 December 2025, the Ministry of Environment and Energy shall reassess the date of application of that measure referred to in the first subparagraph; and recommends to the Government Committee for Climate Neutrality the adoption of the decision of para. 6 of Article 33. If such a decision is adopted, the prohibition shall apply at least three (3) years after its publication.

Based on the above, the calculated emissions for 2030 are presented in the Table below:

Table 32: Greenhouse gas emissions up to the year 2030 in the sectors considered

Sector (tn_{CO2})	2019 Scope 1	2019 Scope 2	2019 Total	2030 Scope 1	2030 Scope 2	2030 Total
Buildings	**28.709**	**122.491**	**151.200**	**20.410**	**13.156**	**33.566**
Residential (Residential)	22.640	63.788	**86.428**	16.163	6.912	**23.075**
Public buildings	829,5	4.670	**5.499**	581	497	**1.078**
Private non-residential buildings (Tertiary sector)	5.239	54.035	**59.273**	3.667	5.747	**9.414**
Industry – Industrial Processes	419	21.164	**21.583**	294	2.255	**2.548**
Agriculture – Agriculture, Forestry, Land Use	8.762	2.135	**10.897**	8.637	227	**8.864**
Agriculture (energy)	2.294	2.135		2.179	227	
Livestock (Energy)	214			214		
Livestock farming ($nonCO_2$)	6.254			6.254		
Waste management	5.246		**5.246**	5.246		**5.246**
Transport	66.736		**66.736**	64.398	**4,76**	**64.403**
Private transfers	30.456			30.170	2,23	
Commercial transport	33.037			31.168	2,31	
Public Transport	2.590			2.457	0,18	
Municipal transport	653			604	0,05	
Total Municipality of Kalamata			**255.662**			**114.628**

It is noted that for 2030 without additional measures, scope 1 emissions were calculated based on the assumptions of the NECP and the Climate Law. On the contrary, emissions without measures in 2030 for scope 2 have been calculated on the basis of the electricity production factor of the national grid that considers 80% electricity production from RES under the revised NECP and the Climate Law. Therefore, According to the above, **the expected reduction of emissions without additional measures is about 55% for the year 2030.**

4.2 Scenario with Additional Measures

The Municipality of Kalamata, during the elaboration of the Sustainable Energy and Climate Action Plan (SDAEK) [37], had already committed to the adoption and implementation of measures and policies aimed at reducing energy consumption and CO_2 emissions. It is therefore called upon to play a dual role in achieving the target of reducing carbon dioxide emissions:

i. As an energy consumer, it is responsible for managing the energy consumption of municipal buildings, water supply / irrigation facilities and the municipal fleet, as they belong to its own jurisdiction, and therefore it is called upon to take actions to reduce these consumptions and increase their energy efficiency and
ii. It is responsible for coordinating and guiding citizens on benefits and funding opportunities for the implementation of such actions.

As presented in a previous chapter, the sectors responsible for the majority of emissions are the Residential Sector, Private and Commercial Transport and the Tertiary Sector.

Within the framework of the SDAEK, the proposed measures move in two directions: a) reduction of the consumption of the Municipality itself and b) reduction of consumption and carbon dioxide emissions from urban activities of citizens. The objective of the second direction is achieved through actions that inform and encourage citizens to adapt to their lifestyle choices that contribute to sustainability. The implementation of these actions is planned within a medium-term timeframe (until 2030) and is estimated to result in a significant reduction in emissions compared to the base year.

4.2.1 Proposed Actions and Measures

The actions and measures proposed under the SDAEK are listed below [37]. The energy saving results estimated in the framework of the SDAP were taken into account and adjusted based on the new emission inventory for the year 2019, while the greenhouse gas emission reductions were then calculated using the methodology applied for the preparation of the emission inventory.

According to SDAEK, the estimates of savings in each action were obtained taking into account that a percentage of citizens will implement each action and not all residents of the Municipality. Since the actions that the Municipality can undertake are varied, it is recommended to prioritize more important actions, in order to be able to proceed with the rest through the financial savings it will achieve.

Responsible for the implementation of these actions are both the municipal authorities and the residents of the Municipality, who can participate in the effort to reduce emissions by applying the proposed measures to their homes, transport and businesses.

4.2.1.1 Cross-sectoral measures

In addition to the actions in the areas under consideration, a series of horizontal measures are proposed which have an impact on more than one sector.

Establishment of the Department of Energy Saving

It is proposed to establish a Department to which the residents of the Municipality of Kalamata can turn for information on energy issues and which will provide legal and techno-economic advice on energy investments. This Department will be staffed by two people specialized in energy issues in order to promote EXEN actions.

Reduction of Organic Waste

The Municipality of Kalamata, through composting, has set a goal to reduce organic waste by 15% by 2030. More specifically, the residents of the Municipality should be informed about the separation of organic waste, which will then be stored in special composting bins for small domestic crops and in collection bins for their incineration in landfills. In order to achieve this goal, it is recommended to design a set of activities to inform citizens, such as publishing information material and conducting information seminars on how to reduce organic waste. It is also recommended to circulate advertising messages in local media as well as to inform students in schools, so that tomorrow's citizens know from an early age the right way to manage such waste. The cost of this action is included in the cost of the action to promote recycling, as reflected in the table below.

Table 33: Cross-sectoral actions

Actions	Energy Saving (MWh/year)	Energy Production from RES (MWh/year)	Emission Reduction (tn CO_2/year)
Establishment of the Department of Energy Saving	3.892,16		832,13
Reduction of Organic Waste			786,91
Total	**3.892,16**	**0**	**1.619,04**

4.2.1.2 Agriculture – Agriculture, Forestry and Land Use

The Agricultural Sector of the Municipality of Kalamata showed that for the year 2019 it consumed 14.012 MWh or else 2.15% of the total consumption with CO2 emissions reaching 11.071 tn or 4.2% of total emissions. The Municipality intends to organize information and awareness actions in order to orient farmers to participate in energy saving actions.

Installation of Electronic Water Abstraction Systems with Charging Cards

The second proposed action is the installation of electronic water abstraction systems with charging cards. These systems consist of a device that will automatically measure and charge the use of water to the consumer. The automatic electronic water abstraction with a card enables the Water Management Organization to sell with the card a specific amount of water to each consumer. Thus, a great economic benefit arises due to the non-waste of water. At the same time, the cost of installation and operation is considered relatively low if funding is sought from programs in order to partially cover it.

Modernisation of agricultural tractors

Research has shown an increase in the use of agricultural tractors, but this has not been accompanied by a corresponding increase in productivity in the primary sector. According to a study published by the Foundation for Economic and Industrial Research, entitled "Agricultural Machinery and Competitiveness of the Primary Sector", the average age of tractors in use in Greece exceeds 22 years, so the tractor fleet is considered old. It is also noted that the horsepower of the fleet has an average value, which leads to low vehicle efficiency and non-meeting the requirements of modern agriculture. In order to reduce fuel consumption as well as increase the efficiency of machinery, it is necessary to replace energy-consuming tractors with new ones of modern technology. This is an action that will bring economic benefit not only by saving energy to professional farmers but also by increasing the production of products.

Replacing Irrigation Methods with Drip Irrigation

It is then proposed to replace the present irrigation method with the drip method. The main feature of this method is that tubes are placed near the roots of the plant to supply water, which supply it with the exact required amount without significant losses. Subsequently, savings are noted both in the use of water and in the consumption of electricity. In fact, according to a study by the Institute of Agricultural and Cooperative Economy (INASSO) of the Panhellenic Confederation of Unions of Agricultural Cooperatives (PASEGES) entitled "Study for the Implementation of a Single Model of Irrigation Water Management in Greek Agriculture", it appears that water savings using drip irrigation can reach 30% compared to artificial rain or even 40% compared to surface irrigation.

Energy Upgrade of Private Pumps

Most of the installed pumps of the pumping stations are of old technology and have suffered damage over the years and the conditions of the surrounding area. A direct consequence of this is the reduction of their degree of efficiency, which often does not exceed 60%. However, if a pump is replaced with new technology and a drive is installed in it, the efficiency can reach and exceed 80% under nominal operating conditions [38].

Table 34 Agricultural Sector Actions

Actions	Energy Saving (MWh/year)	Energy Production	Emission Reduction (tn CO_2/year)

		from RES (MWh/ year)
Electronic water abstraction systems for irrigation with charging cards	134,61	7,68
Modernisation of agricultural tractors	77,67	20,63
Replacing irrigation methods with drip irrigation	54,63	3,18
Energy upgrade of private pumps	4,45	0,26
Total	**271,26**	**31,93**

4.2.1.3 Buildings

Energy Upgrade Interventions of Public Buildings

In this action, the following actions that contribute to energy saving were proposed. For the implementation of these actions, the services and schools with the highest energy consumption were selected.

- Installation of new air conditioners
- Installation of shades
- Use of Cold Paints on Roofs
- Replacing light bulbs with more efficient LEDs
- Automation Installation
- Double glazing
- Installation of thermostats
- Shell thermal insulation
- Maintenance of oil burners
- Replacing oil burners with gas burners
- Replacing oil burners with pellet burners
- Replacement of oil burners with new technology
- Replacing oil burners with heat pumps
- Supply of energy-efficient electrical appliances
- Installation of solar systems for hot water production in Sports Facilities

These measures are proposed to apply to at least half of the buildings under the jurisdiction of the Municipality with priority given to those with the highest energy needs.

In recent years, the Municipality has already proceeded with the plans for the implementation of energy upgrading of municipal buildings, focusing initially on the City Hall of Kalamata, in order to install a geothermal system to meet the heating and cooling needs of the building [39].

Installation of Photovoltaic Systems on the Roofs of Municipal Buildings with Net Metering

In order to penetrate renewable energy sources, it is proposed to install photovoltaic systems on the roofs of municipal buildings under the net-metering regime, an action that is considered economically viable. The energy produced can be used for the needs of buildings, while in case there is a surplus, it can be fed into the electricity distribution building network. In this case, the price of energy produced is balanced with the energy purchased at another time from the grid when there was insufficient self-production.

Energy Audit in Municipal Buildings and Pumping Stations

Another proposed action is to carry out energy audits in all municipal buildings and pumping stations. The purpose of such an audit is to record and analyze energy use, calculate the consumption base, highlight opportunities for energy saving and evaluate with techno-economic criteria the proposed measures to improve or replace existing equipment, identify savings measures on a case-by-case basis. The Energy Manager of the building or installation, knowing the consumption indicators as well as the base consumption of the building, will be able to effectively monitor the energy consumption of the building but also intervene accordingly if there is a noticeable increase. Also, the techno-economic evaluation of existing actions is considered very important for the implementation of new costed and targeted actions with a designed plan.

Energy Manager in Every Municipal Building

The duties undertaken by an Energy Manager of a municipal building or facility with significant consumption are listed below:

- Monitoring and recording of significant energy consumption
- Creation of energy consumption indicators
- Identify energy consumption opportunities
- Design of maintenance plan taking into account EXEN capabilities

The above tasks contribute to the effective monitoring of energy consumption of buildings and facilities as well as to the taking of all necessary measures for the implementation of EXEN actions.

Student Awareness Actions

Another important axis of actions, apart from energy upgrades in municipal buildings, is the conduct of awareness-raising actions, with a typical example being the organization of informative events for students. In particular, it is proposed to set up special groups that will present to students, through competitions and environmental activities, the benefits of energy saving and sustainable development in general. The Municipality recognizes the great importance of continuous education on climate change and its various impacts on the environment for students from an early age, so that they fully understand the importance of sustainable development and acquire environmental education. With the conduct of appropriate educational activities, they can even be a model for the elders, since they will have developed an environmentally sound behavior. Also, awareness programs will include competitions and online actions using social networks as well as meetings with team games that will highlight the benefits of sustainability. It is important to note that such information actions do not have any direct financial benefit to be considered viable, but can be financially supported by national and European funding funds beyond own resources. At the same time, the above actions will have benefits, which cannot be accurately estimated, since they are related to the effects of raising awareness among young children.

Information Actions for Users of Municipal Buildings for Behavior Improvement and Optimal Use of H/M Equipment.

The behaviour of users of municipal buildings is of paramount importance for reducing energy consumption as well as for the efficient use of heating-cooling equipment and other electronic devices. Therefore, it is proposed to carry out information actions for the permanent users of energy-intensive municipal buildings in order to adopt an energy-efficient behavior through which energy wastage will be avoided in terms of air conditioning, heating of buildings as well as the operation of other equipment. In addition, it is recommended to conduct an information campaign for all residents in order to adopt an energy saving spirit that will govern their daily lives and especially their living in their homes.

Installation of Metering Systems for Consumption Monitoring (BMS)

In order to maintain consumption data from each building or facility, it is proposed to install systems for recording and monitoring energy consumption in BMS (Building Management System) buildings. In this way, it is possible to automatically adjust the operation of the equipment according to the weather conditions, monitor the operation of the equipment in real time as well as the ability to retrieve past operating and consumption data if needed.

Energy Upgrade of Water Supply and Irrigation Network Pumping Stations

The modernisation of water supply and irrigation infrastructure is a key measure for energy savings and the cost of providing water services. It is therefore proposed to upgrade the energy efficiency of pumping stations and install pump regulation systems, which allow them to operate on demand. This intervention contributes to improving energy efficiency as well as saving both energy and water, while the costs are economically viable. In fact, a project has already been approved for the energy upgrade of the Biological Treatment of Kalamata, as well as for the installation of PV in its facilities.

Installation of SCADA water supply/irrigation network management system

The SCADA system is a monitoring system consisting of sensors that provide direct measurements as well as a network transmitting information to the control center. It is proposed to gradually install such a system in the irrigation and water supply network of the Municipality (DEYA of Kalamata has already installed telemetry systems in a large part of the network), in order to retrieve data concerning pump operations, water level level while at the same time any network failures can be detected. This will avoid unnecessary waste of both water and electricity. Investment in such a system is considered economically unviable and funding should therefore be sought.

Table 35 Actions in the Buildings and Facilities of the Municipality (category: Public Buildings)

Actions	Energy Saving (MWh/year)	Energy Production from RES (MWh/year)	Emission Reduction (tn CO_2/year)
Energy Upgrade Interventions of Municipal Buildings	1.998,18	337,64	239,86
Installation of photovoltaic systems on roofs of buildings in net-metering regime		189,86	11,08
Energy audit in municipal buildings and pumping stations	119,45		6,97
Energy manager in every municipal building	91,94		10,13
Student Awareness Actions	11,12		0,65
Information actions for users of municipal buildings for behavior improvement and optimal use of H/M equipment.	55,37		3,23
Installations of Consumption Monitoring Systems (BMS)	21,71		1,27
Energy Upgrade of Water Supply and Irrigation Network Pumping Stations	270,33		15,78
Installation of SCADA water supply/irrigation network management system	844,79		49,31
Total	**3.412,89**	**527,50**	**338,27**

4.2.1.4 Public Public Lighting

Energy consumption for lighting public spaces and streets in the Municipality of Kalamata constitutes a very small percentage of the energy needs of the Municipality. Specifically, in the reference year, 6,333 MWh of electricity were consumed, which correspond to 1.0% of the total energy consumed by the Municipality as well as 1.3% of the total produced carbon dioxide emissions within the boundaries of the examined Municipality. In order to achieve the emission reduction target, some energy saving actions are necessary, which are presented in detail below.

Replacing Energy Intensive Light Bulbs with Low Consumption LEDs

The network is equipped with energy-consuming lamps of old technology and so the Municipality, after a study, recently proceeded to their gradual replacement with low consumption LED lamps. LED bulbs outperform older bulbs because they have a much longer lifespan and better efficiency, since they provide the same luminous power while consuming much less energy. This action replaced 14,737 lighting points (simple lamps and luminaires with a lamp) by luminaires and LED lamps with increased energy efficiency, thus contributing to the reduction of air pollutant emissions [40].

Installation of Lighting Points with PV Frame

This action is not so much aimed at saving energy but mainly at familiarizing citizens with the concept of RES as well as improving the image of the Municipality. Specifically, it is proposed to install 20 lighting points, which have at the top of their pole a PV panel that produces the required energy for the operation of the lamp.

Installation of a Lighting Management System

The implementation of a remote lighting management system has multiple benefits both in energy saving and network maintenance work. This system is installed in the lighting network and performs two functions: On the one hand, it receives data on the lighting at the various points of the network and on the other hand, based on the needs of each point, it gives the appropriate control commands. One such example of control is the reduction of lighting in public areas and squares, at low traffic hours, with which significant energy savings can be achieved. The operation of this system requires wireless controllers in the lamps, communication nodes as well as a management software to coordinate the above equipment.

Table 36 Actions in the Municipal State Lighting

Actions	Energy Saving (MWh/year)	Energy Production from RES (MWh/year)	Emission Reduction (tn CO_2/year)
Replacing Energy Intensive Light Bulbs with Low Consumption LEDs	4.259,60		248,61
Installation of a Lighting Management System	484,42		28,27
Installation of Lighting Points with PV Frame		20,55	1,20
Total	**6.135,94**	**20,55**	**278,09**

4.2.1.5 Housing - Residential sector

During the reference year (2019) the energy consumed in the Municipality of Kalamata for the residential sector was distributed as follows: the highest consumption was recorded in electricity and amounted to 116.614.2MWh and the consumption of heating oil amounted to 80.860.05 MWh. Also, in the domestic sector, biomass in the form of wood is consumed, the consumption of which in 2019 reached 33.139.97 MWh. Therefore, the residential sector is responsible for 35% of the total energy consumption of the municipality as well as for 33.4% of total emissions, due to the high emission factor of electricity. It is therefore clear that the domestic sector is associated with very significant percentages of energy consumption and emissions produced, thus underlining the need for immediate proposal and implementation of actions. Citizens play a dominant role in the implementation of these actions, who through their choices will determine the percentage reduction and therefore the achievement of the target. At the same time, the Municipality will have a guiding and supporting role since it cannot intervene directly for the implementation of the actions.

Residential Energy Upgrade Interventions

The energy upgrade of homes aims to save energy in all sectors, reduce energy losses and increase the efficiency of lighting, heating and cooling systems. The actions recommended are the following:

- Installation of solar panels
- Maintenance of existing oil burners
- Replacement of oil burners with new technology
- Replacing oil burners with pellet burners
- Replacing oil burners with gas burners
- Replacing oil burners with heat pumps
- Construction of energy fireplaces
- Installation of double glazing
- Replacing energy bulbs with LED bulbs
- Replacement of old air conditioning units
- Replacing oil stoves with pellet stoves
- Application of shell thermal insulation
- Replacement of energy-consuming electrical appliances with new ones of better energy class
- Apply cold paints
- Installation of awnings in apartments and houses and horizontal shades on southern facades
- Installation of a photovoltaic system on the roof of old air conditioners

Adoption of Energy Rational Behavior-Compliance with Informal Rules

The information of citizens from the aforementioned workshops will not be limited to energy upgrade advice but also awareness for the adoption of energy rational behavior that does not require any financial expenditure. In this way, both financial and energy savings can be achieved. Some examples of such rational behaviors are presented below:

- During the summer months, it is recommended to ventilate the areas of the house during the morning hours characterized by cool temperature, lowering the awnings as well as closing the window shutters to avoid sunlight entering the house. Also, in the evening hours, which are again characterized by milder temperatures, it is recommended to use natural ventilation and not space air conditioners.
- On the contrary, during the winter months it is advisable during daylight hours to open the

curtains and window shutters in order to take advantage of the heat of the solar radiation as well as not to cover radiators with any kind of fabrics, covers or furniture.

- Cooling and heating of spaces with closed doors and windows.
- Regular maintenance of heating and cooling systems to maintain their coefficient of performance.
- Use of a fan at tolerably high temperatures.
- Turn off the devices instead of putting them into standby mode.
- Washing temperature at 40°C.
- Use washing machines and dishwashers only when full.
- Purchase of new electrical appliances with energy criteria (classes A ++, A +, A).
- Proper use of electric stove with simultaneous processes and utensils that fit correctly.
- Use of pressure cooker
- Avoid opening an oven door during its operation to prevent heat from escaping.
- Turn off the oven a few minutes before baking is complete.
- Place refrigerator away from heat-producing appliances and in a place with adequate ventilation for his back.

It is observed that the above actions are particularly costly and in fact burden almost exclusively on citizens, since they are associated with energy interventions in homes. Therefore, their achievement also depends to a large extent on the ability of residents to carry out the proposed actions. In order to achieve the greatest possible penetration of these interventions, the Greek state, in cooperation with financial institutions, provides loans and grants. This financial support reaches up to 70% of the required amount depending on the income of residents who wish to upgrade their homes. In this way, many households will gain an incentive to carry out energy-saving actions, which in the future will also save them money.

Table 37 Domestic Sector Actions

Actions	Energy Saving (MWh/year)	Energy Production from RES (MWh/year)	Emission Reduction (tn CO_2/year)
Residential Energy Upgrade Interventions	45.819,60	52.997,10	11.464,93
Adoption of Energy Rational Behavior - Compliance with informal rules	3.201,93		585,03
Total	**49.021,53**	**52.997,10**	**12.049,96**

4.2.1.6 Non-residential private buildings (tertiary sector)

Like the domestic sector, the tertiary sector is an important part of the energy consumption of the Municipality of Kalamata. Specifically, its energy needs for 2019 were 102,326.4 MWh of electricity and 1,545,557 MWh of heating oil, i.e. they constitute 18.8% of the total energy consumption of the Municipality and are responsible for 23.23% of carbon dioxide emissions.

Energy Upgrading Interventions for Tertiary Sector Buildings

After the information that entrepreneurs will have received about the ways and sustainability of the energy upgrade of their businesses, they will be able to choose which energy saving actions in lighting, heating-cooling as well as in increasing efficiency factors and reducing heat losses serve their business the most. Specifically, the actions proposed in the DAAP are the following:

- Application of double glazing
- Application of shell thermal insulation
- Maintenance of oil burners
- HVAC System Installation
- Replacing old technology boilers with more efficient LEDs
- Replacing oil boilers with gas boilers
- Replacement of old air conditioners with modern and more efficient new technology
- Replacing old appliances with new ones with energy efficient ones
- Installation of Automation in the lighting system
- Installation of thermostats
- Installation of external shading
- Apply cold paints
- Installation of PV systems on roofs with net-metering

Installation of Metering Systems for Consumption Monitoring (BMS)

As in municipal buildings, it is proposed to install metering systems to maintain consumption data in tertiary sector buildings. The BMS system recorders are installed in the individual equipment parts of each building in order to better monitor the most important energy cost centers, enabling the user to monitor the entire building via computer. Through the thorough and automated monitoring and recording of thermal and electricity consumption, energy savings and reduction of pollutants are achieved, while at the same time the investment of this action is economically viable.

10% Commitment Campaign

It is recommended that the Municipality launch a campaign to reduce the energy consumption of businesses operating within it by 10%. This action will be optional for businesses, but any business that achieves the goal will receive a special certificate from the Municipality proving its environmentally friendly operation. The supervision of this action will be done by providing annual electricity consumption tariffs to the competent services of the Municipality and will be checked if the target has been achieved.

Table 38 Actions in Private Buildings other than Residential (Tertiary Sector)

Actions	Energy Saving (MWh/year)	Energy Production from RES (MWh/year)	Emission Reduction (tn CO_2/year)
Energy Upgrade Interventions for Tertiary Sector Buildings	37.288,72	15.434,28	7.713,88
Installation of Metering Systems for Consumption Monitoring (BMS)	63,88		3,73
10% commitment campaign	566,79		103,56
Total	**37.919,40**	**15.434,28**	**7.821,17**

4.2.1.7 Transport

The Municipality of Kalamata has already developed the Plan for Sustainable Urban Mobility (SUMP), which explores the best way to sustainably meet the mobility needs of people and businesses, while contributing to the reduction of greenhouse gas emissions. The aim is to highlight the urban environment and natural wealth, ensuring excellent traffic connection while saving energy, using cleaner energy, rational management of the existing transport network, alternative ways of transportation, enhancing social transactions and creating a quality "atmosphere" in cities with less air and noise pollution. The actions included in SUMP lead to the reduction of energy consumption as well as to the facilitation of citizens' movements (optimization of parking system, optimization of conditions for movements of people with disabilities, etc.). As already mentioned, the estimates for greenhouse gas emissions for the year 2030 were initially made on the basis of data and forecasts on energy consumption from the existing National Energy and Climate Plan (NECP) (Government Gazette B' 4893) [36] and, in terms of the electricity generation mix (percentage of RES production), from the new, updated NECP 2023. In addition to the above, an increase in LPG was taken into account due to the planned conversion of some vehicles.

Subsequently, the reductions, in relation to the emissions of 2019, that will be brought about by the measures proposed in the SDAEK and concern projects that have been included in the programmatic planning of the Municipality, but have not yet been implemented, were calculated.

Municipal Transport

Eco-Driving Seminars for Municipal Fleet Drivers

According to the guidelines of the Center for Renewable Energy Sources (CRES), it is possible to reduce the fuel consumption of vehicles by up to 10% if a series of practices related to eco-driving are followed. For the effective implementation of these practices, it is recommended to reward drivers who achieve the lowest fuel consumption at the end of the year. The measurement of consumption will be done by installing a fuel consumption meter in all vehicles of the municipal fleet. The results of this action are immediate, so its NPV is positive [36].

The most important practices of eco-driving are summarised below [36]:

- Gear change at 2,000 to 2,500 engine speeds, since it is the most economical operating range (the analogous range for diesel engines is different and is in the range of 1,500 to 2,500 rpm).
- Use of the highest possible gear ratio, driving at a constant speed as well as avoiding unnecessary braking.
- Prediction of traffic conditions to avoid unnecessary braking and acceleration.
- Smooth deceleration with high gear ratio and release of the throttle foot lever as early as possible.
- Switching off the engine during short stops.
- Regular maintenance of tires and vehicle.
- Avoidance of transporting unnecessary loads.
- Prudent use of the air conditioner with a minimum temperature setting of 23 °C.
- Smooth deceleration when cornering without braking.
- Avoid using the vehicle for short distance journeys.
- Utilization of the vehicle's auxiliary equipment such as "cruise control", tachometer and "trip computer", as they help reduce consumption.
- Choosing the most efficient vehicle for the real daily needs of the driver.
- Design to find the route that requires the lowest fuel consumption.

Replacement of Old Diesel Vehicles of the Municipal Fleet with New Technology

Older technology vehicles have lower performance than more modern diesel vehicle models, so replacing old vehicles with newer ones can make a significant contribution to reducing emissions. In order to calculate the emission reductions from this project, it was assumed that about 20% of the Municipality's fleet will be replaced with new vehicles of newer technology. According to the SDAEK [36], however, this action, due to the high cost of new vehicles, is not considered sustainable and requires finding financial resources outside the budget of the Municipality.

Conversion of Municipal Fleet Vehicles to LPG/LNG

LPG offers many benefits, among which is saving up to 10% of fuel costs. LNG/LPG is a cleaner fuel than petrol and diesel, as it emits less CO2 emissions, while vehicles running on it consume less energy. Consequently, the conversion of old diesel cars to LPG contributes to the reduction of pollution of the urban environment and generally to its reduction greenhouse effect in relation to diesel vehicles and at the same time is considered economically viable as an action. To estimate the reductions of this measure, it was assumed that about 20% of the municipal fleet will be replaced with LNG/LPG vehicles.

Installation of a GPS System for the Calculation of the Optimal Route and the Monitoring of the Municipal Fleet

It is proposed to install GPS systems in vehicles of the municipal fleet such as garbage trucks and buses, so that they can follow the optimal routes in relation to the services provided. The routes will be registered in these systems and in this way fuel savings and control of the course of vehicles will be achieved in order to avoid unnecessary routes.

Implementation of a program for more frequent maintenance of municipal fleet vehicles

The maintenance of the degree of efficiency of the vehicle is directly related to the proper functioning of the engine as well as its other components, therefore regular inspection and maintenance of vehicles is a key factor in ensuring the performance of the vehicle and its constant fuel consumption, without increasing it due to reduced performance.

Replacement of Municipal Fleet Vehicles with Electric Vehicles

The measure of electromobility was proposed to the SDAEK, as electromobility is a technology that has been particularly highlighted in recent years. Electrification refers to the use of vehicles equipped with engines running on electric electricity instead of burning petroleum products (e.g. petrol or diesel). These motors are much more efficient and make minimal noise. Another advantage of vehicles equipped with such engines is that if the power generation mix is characterized by high penetration of renewables, then these vehicles produce minimal pollutants. Therefore, the replacement of part of the vehicles of the municipal fleet with electric ones is considered as an action that can offer significant benefits in the field of energy saving and emission reduction, especially in the coming years in which, according to the national planning, a significant increase in the use of RES is foreseen as well as the complete lignite phase-out of the country. This proposal is also consistent with the broader design of the NECP recommending the uptake of electric vehicles. Specifically, for the Municipality of Kalamata, it was estimated that about 20% of the total fleet will operate with electric mobility by 2030. It is noted that due to the high penetration of RES until then, the pollutants released will be particularly low.

Table 39: Actions in Municipal Transport

Actions	Energy Saving (MWh/year)	Energy Production from RES (MWh/year)	Emission Reduction (tn CO_2/year)
Eco-Driving Seminars for Municipal Fleet Drivers	257,58		60,45
Replacement of Old Diesel Municipal Fleet with New Technology	57,0		13,37
Conversion of municipal fleet vehicles to LPG/LNG	23,50		5,97
Installation of GPS system for calculating the optimal route and monitoring the municipal fleet	104,54		24,53

Implementation of a more frequent vehicle maintenance program	103,20		24,25
Replacement of vehicles with electric vehicles	58,30	6,71	14,45
Total	**604,12**	**6,71**	**143,02**

Public Transport

Buses:

Promoting Eco-Driving Through Brochures, Workshops and Seminars for Public Transport Drivers

The Municipality can organize workshops and seminars on ecological driving as well as distribute relevant printed material in order to inform Urban Transport drivers to adopt the techniques analyzed above and change their driving behavior. In this way, drivers will consume less energy for the same journeys, which will lead to a corresponding reduction in carbon dioxide emissions.

Replacement of Diesel Buses with New Technology

Since the Municipality cannot immediately replace urban transport vehicles, it is suggested to contact the competent authorities in order to present them with the advantages of the new vehicles. In this way, the competent authorities can be encouraged and gradually start replacing old buses with new ones of higher efficiency and lower consumption. To update the reductions, it was assumed that 1/3 of city buses will be replaced with new technology buses.

Replacement of Diesel Buses with CNG

The replacement of part of diesel buses by new ones that use natural gas as fuel is one of the most widespread actions already implemented in large urban centers of Greece. The use of natural gas offers significant savings in fuel costs compared to today's diesel cars, while contributing to the reduction of CO2 emissions and the creation of a more citizen-friendlyatmosphere within cities. To update the reductions, it was assumed that 1/3 of urban diesel buses will be replaced with buses using CNG.

Replacement of Diesel Buses with Electric

In order to promote electromobility, it is proposed to replace the diesel buses of the fleet with electric ones. Since the price of electricity is lower than that of oil, electromobility is a more economical way of transportation with low maintenance and transportation costs. At the same time, electric buses are environmentally friendly, as they do not emit air pollutants and are now equipped with larger capacity batteries, offering greater autonomy within the city network. However, the cost of replacing buses remains quite high and external funding will have to be sought. To update the reductions, it was assumed that 1/3 of city buses will be replaced with electric buses.

Implementation of a more frequent vehicle maintenance program

Public transport vehicles need to be regularly maintained in order to keep them in good condition, avoid possible breakdowns and allow the engine to run with a high degree of efficiency, which will help reduce fuel consumption.

Table 40 Public Transport Actions (Buses)

Actions	Energy Saving (MWh/year)	Energy Production from RES (MWh/year)	Emission Reduction (tn CO_2/year)
Promotion of eco-driving through brochures, workshops, seminars for public transport drivers	814,93		191,25
Replacement of diesel buses with new technology	39,20		9,16
Replacement of diesel buses with CNG	0,00		4,17
Replacing diesel buses with electric ones	737,23	133,18	195,23
Implementation of a more frequent vehicle maintenance program	195,79		45,95
Total	**1.787,15**	**133,18**	**445.76**

TAXI:

Eco-Driving Seminars for Individuals and Promotion of New Technologies

The Municipality will organize eco-driving seminars in which experienced speakers will participate. Informing drivers about eco-driving practices as well as encouraging as many as possible to adopt these practices through which energy savings (diesel and gasoline) can be achieved is the purpose of these seminars. In this context, it is recommended to distribute printed material on the advantages of ecological and economical driving, as well as the new automotive technologies prevailing in the market. At the same time, reference can be made to the financial incentives provided by the state for the promotion of these technologies, such as subsidies for the purchase of electric cars and reduced registration taxes for low-emission hybrid cars.

Replacement of Diesel TAXIS with New Technology

Similar to the above-mentioned action, a series of workshops etc. is being set up. to encourage citizens to replace old technology diesel vehicles with newer ones characterized by a higher degree of efficiency, and therefore by lower fuel consumption.

Convert TAXI to LPG/LNG

A fairly economical saving action is the conversion of conventional vehicles into LPG vehicles. The main advantages of this conversion are the reduced emissions, the lower price of LPG and the extension of the life of the engine, thanks to the clean combustion of LPG without leaving any residue. This measure has been calculated under the baseline scenario for 2030, where no additional measures are taken, and is therefore not presented separately in the Table below.

Replacement of TAXIS with Hybrid and Electric

It is recommended to replace taxis with hybrid and electric ones. This measure has been calculated under the baseline scenario, where no additional measures are taken, and is therefore not presented separately in the Table below.

Table 41 Public Transport Actions (TAXI)

Actions	Energy Saving (MWh/year)	Energy Production from RES MWh/year)	Emission Reduction (tn CO_2/year)
Eco-driving seminars for individuals and promotion of new technologies	75,26		17,50
Replacement of diesel cars with new technology	180,11		42,12
Total	**255,37**		**59,62**

Private Transfers

In contrast to these transport sectors, private transport is one of the most energy-intensive sectors of the local economy. Specifically, this sector consumes 107,177.2 MWh of gasoline, 8,111.10 MWh of diesel and 1,687 MWh of LPG. These energy consumptions lead to 12% of total emissions within the boundaries of the Municipality. As in other areas related to citizens, and not directly to the operation of the Municipality, the Municipality will have an advisory/supporting role since it cannot directly intervene in the behavior of drivers in private and commercial transport.

Eco-Driving Seminars for Individuals and Promotion of New Technologies

The Municipality will organize eco-driving seminars in which experienced speakers will participate. Informing drivers about eco-driving practices as well as encouraging as many as possible to adopt these practices through which energy savings (diesel and gasoline) can be achieved is the purpose of these seminars. In this context, it is recommended to distribute printed material to inform citizens about the advantages of ecological and economical driving, as well as the new automotive technologies prevailing in the market. At the same time, reference can be made to the financial incentives provided by the state for the promotion of these technologies, such as subsidies for the purchase of electric cars and reduced registration taxes for low-emission hybrid cars.

Replacement of Gasoline Cars with New Technology

Gasoline vehicles with new technology engines operate with a degree of better efficiency. This results in better combustion of gasoline and consequently fuel economy and reduction of pollutants.

Replacement of Diesel Cars with New Technology

Similar to the above-mentioned action, a series of workshops etc. is being set up. to encourage citizens to replace old technology diesel vehicles with newer ones characterized by a higher degree of efficiency, and therefore by lower fuel consumption.

Conversion of Vehicles to LPG/LNG

As in the case of taxis, this measure has already been assessed in the baseline reduction scenario, in which emissions are calculated assuming that no additional measures are taking place and is therefore not presented separately in the Table below.

Replacing Gasoline Cars with Hybrids

It is recommended to replace gasoline cars with hybrids. Hybrid cars base their operation on the combination of electric mobility with an internal combustion engine. In this way, vehicles can run on the electric motor as long as the throttle load is low and when there is a need for extra power, the internal combustion engine is activated. The battery of the electric motor is charged during braking with thermal energy converted through the generator into electricity. Hybrid models are an ideal solution for today's automotive needs, as they contribute to a cleaner environment without range limitations, offering lower fuel consumption compared to a petrol car of equivalent power. This measure has already been assessed in the reduction baseline scenario, in which emissions are calculated assuming that no additional measures take place and is therefore not presented separately in the Table below.

Use of Public Transport

In addition to the energy upgrade of citizens' vehicles and the change of their driving behavior, another action is recommended (also promoted through SUMP), which has no cost, both for the Municipality and for the citizens. This action is to increase the use of public transport by citizens, which will result in the reduced use of cars and thus contribute directly to the reduction of carbon dioxide emissions.

Use of Bikes and Bike Sharing

This action (also promoted through SUMP) includes the creation of paid bicycle rental stations in order to make them available to citizens according to their needs. More specifically, these bikes will be offered for rent with a pricing policy per minute of use, until the cyclist leaves it at one of the available stations of the network. It is part of the promotion of the alternative way of transportation and is proposed to cover nearby trips in which vehicles are used. Citizens will be able to get to work quickly or cover some other close distance, while at the same time it is an ideal solution for tourists and travellers. Specifically in the city of Kalamata, in the context of sustainable mobility, a network of bicycle paths-pedestrian paths of 9,700 meters in the urban fabric and 4,500 meters in the suburban area is created. Cyclists will be able to head to the central urban fabric from north to south, ending at the coastal part of the city, as well as from west to east, also to the coastal front [41]. In the coming years, it is planned to implement a suburban cycle path of 12,600 meters length that will connect the city of Kalamata with Ancient Thouria [42].

Car Sharing

This is a new service that offers drivers access to cars at any time, without requiring any form of ownership. Drivers-users benefit from exemption from maintenance, insurance and tax costs and can use the service at any time through their online registration with the company. After selecting the desired vehicle, the charge is based on the time of use and the kilometric distance traveled by the user with the car.

Table 42 Private Transport Actions

Actions	Energy Saving (MWh/year)	Energy Production from RES MWh/year)	Emission Reduction (tn CO_2/year)
Eco-driving seminars for individuals and promotion of new technologies	2.179,00		558,93
Replacement of gasoline cars with new technology	974,39		309,05
Replacement of diesel cars with new technology	1.020,59		238,69
Use of Public Transport	539,13		138,49
Use of bicycles and bike sharing	7.547,00		1.853,05
Car sharing	2.695,62		692,43
Total	**14.955,73**		**3.790,64**

Commercial Transport

Commercial transport is, like private transport, one of the most energy-intensive sectors of the local economy, with consumption of 42,058 MWh of gasoline and 89,869.80 MWh of diesel, which together constitute 19.5% of the energy consumption of the Municipality of Kalamata. These energy consumptions also lead to 13% of total emissions within the boundaries of the Municipality. As in other areas related to citizens, and not directly to the operation of the Municipality, the Municipality will have an advisory/supporting role since it cannot directly intervene in the behavior of drivers in private and commercial transport.

Eco-Driving Seminars for Individuals and Promotion of New Technologies

The Municipality will organize eco-driving seminars in which experienced speakers will participate. Informing drivers about eco-driving practices as well as encouraging as many as possible to adopt these practices through which energy savings (diesel and gasoline) can be achieved is the purpose of these seminars. In this context, it is recommended to distribute printed material to inform drivers about the advantages of ecological and economical driving, as well as the new automotive technologies prevailing in the market. At the same time, reference can be made to the financial incentives provided by the state for the promotion of these technologies, such as subsidies for the purchase of electric cars and reduced registration taxes for low-emission hybrid cars.

Table 43: Commercial Transport Actions

Actions	Energy Saving (MWh/year)	Energy Production from RES MWh/year)	Emission Reduction (tn CO_2/year)
Eco-driving seminars for individuals and promotion of new technologies	2.096,58		509,50
Total	2.096,58		509,50

4.2.1.8 *Waste Management Actions*

Pruning Collection and Use for Pellet Manufacturing instead of Uncontrolled Burning (25% of Prunings that burn uncontrollably)

The total amount of pruning from olive trees is estimated to be about 6,500 tons per year for the Municipality of Kalamata. This action concerns the collection of olive prunings that occur annually in the area and their transformation into biomass for energy production (pellet). The available biomass potential can be used to produce energy (heat and/or electricity) directly through combustion or indirectly after conversion through appropriate processes (e.g. pyrolysis, gasification, anaerobic digestion, etc.) gaseous, liquid and/or solid fuels. In particular, it can be used to meet energy needs (heating, cooling, electricity, etc.) and to produce liquid biofuels (bioethanol, biodiesel, etc.). The Municipality may submit a proposal, in cooperation with neighboring municipalities, for the funding of the action by European or national bodies, and at an initial stage the collection process will be carried out on a pilot level. Through this action, the Municipality will be able to gradually cover the heating needs of municipal and later other buildings while replacing oil burners. Since the combustion of pellets for heating is a clean form of energy with very low CO2 emissions, reducing the uncontrolled burning of prunings will contribute significantly to the reduction of emissions from these combustions.

Pruning Collection (15% of those burned uncontrollably) for Combustion in the Domestic Sector

In the same context as the previous action, it is recommended to collect pruning from olive trees in order to convert them into biomass and then burn them in the Domestic Sector. A percentage of 15% of pruning can contribute significantly to saving pollutants instead of their uncontrolled combustion, which would release large amounts of carbon dioxide.

Table 44 Waste Management Actions

Actions	Estimated emission reduction (tn CO2/year)
Collection of pruning and use for pellet manufacturing instead of uncontrolled burning (25 % of pruning)	746,10
Pruning collection (15%) for burning in the domestic sector	447,60
Total	1.193,70

4.2.1.9 Summary of Actions

The implementation of the above-mentioned actions results in a 10% reduction in emissions compared to the base year. This reduction is estimated at 24,917.94 tons of carbon dioxide.

The Table below aggregates the expected reductions from the measures foreseen by the SEAP.

Table 45 Summary of Emission Reductions of SDAEK Actions

Actions	Emission reduction 2030 (tCO2)	2030 emission reduction (tCO2) from net metering
4.2 Cross-sectoral measures	**1.619,04**	
Establishment of the Department of Energy Saving	832,13	
Reduction of organics by promoting residential and neighborhood bins	786,91	
4.3 Agriculture – Agriculture, Forestry, Land Use	**31,93**	
Electronic water abstraction system for irrigation with charging cards	7,86	
Modernisation of agricultural tractors	20,63	
Replacing irrigation methods with drip irrigation	3,18	

Actions	Emission reduction 2030 (tCO2)	2030 emission reduction (tCO2) from net metering
Energy upgrade of private pumps	0,26	
4.4. Buildings	**16.462,67**	**4.024,81**
4.4.1 Municipal buildings	**307,48**	**30,79**
Energy Upgrade Interventions of Municipal Buildings	220,15	19,71
Installation of photovoltaic systems on roofs of buildings in net-metering regime		11,08
Energy audit in municipal buildings and pumping stations	6,97	
Energy manager in every municipal building	10,13	
Student Awareness Actions	0,65	
Information actions for users of municipal buildings for behavior improvement and optimal use of H/M \equipment.	3,23	
Installation of Metering Systems for Consumption Monitoring (BMS)	1,27	
Energy Upgrade of Water Supply and Irrigation Network Pumping Stations	15,78	
Installation of SCADA water supply/irrigation network management system	49,31	
4.4.2 Public Lighting	**278,09**	
Replacing Energy Intensive Light Bulbs with Low Consumption LEDs	248,61	
Installation of a Lighting Management System	28,27	
Installation of Lighting Points with PV Frame	1,2	
4.4.3 Residential (Residential)	**8.956,76**	**3.093,19**
Residential Energy Upgrade Interventions	8.371,74	3.093,19
Adoption of Energy Rational Behavior-Compliance with Informal Rules	585,03	
4.4.4 Private Non-Residential Buildings (Tertiary Sector)	**6.920,34**	**900,83**
Energy Upgrading Interventions for Tertiary Sector Buildings	6.813,05	900,83

Actions	Emission reduction 2030 (tCO2)	2030 emission reduction (tCO2) from net metering
Installation of Metering Systems for Consumption Monitoring (BMS)	3,73	
10% commitment campaign	103,56	
4.5 Waste Management	**1.193,70**	
Collection of prunings and their use for pellet manufacturing instead of their uncontrolled burning (25% of prunings that burn uncontrollably)	746,06	
Pruning collection (15% of those burned uncontrollably) for burning in the Domestic sector	447,64	
4.6 Transport	**4.948,54**	
4.6.1 Municipal Transport	**143,02**	
Eco-Driving Seminars for Municipal Fleet Drivers	60,45	
Replacement of old diesel Municipal Fleet with New Technology	13,37	
Conversion of municipal fleet vehicles to LPG/LNG	5,97	
Installation of a GPS System for the calculation of the optimal route and the monitoring of the Municipal Fleet	24,53	
Implementation of a more frequent vehicle maintenance program	24,25	
Replacement of vehicles with electric vehicles	14,45	
4.6.2 Public transport[2]	**505,38**	
Promotion of eco-driving through brochures, workshops and seminars for public transport drivers (Includes taxis)	208,75	
Replacement of diesel buses with new technology	9,16	
Replacement of diesel buses with CNG	4,17	
Replacing diesel buses with electric ones	195,23	
Implementation of a more frequent vehicle maintenance program	45,95	
Replacement of diesel cars with new technology (for TAXI)	42,12	
4.6.3 Private Transfers	**3.790,64**	
Eco-Driving Seminars for Individuals and Promotion of New Technologies	558,93	
Replacement of gasoline cars with new technology	309,05	
Replacement of diesel cars with new technology	238,69	
Use of Public Transport	138,49	
Use of bicycles and bike sharing	1.853,05	
Car sharing	692,43	

[2] Emissions calculated in this category include emissions from buses and taxis

Actions	Emission reduction 2030 (tCO2)	2030 emission reduction (tCO2) from net metering
4.6.4 Freight transport	**509,50**	
Eco-driving seminars for individuals and promotion of new technologies	509,50	
Total SEAP policies	**24.255,88**	**4.024,81**

4.3 Scenario emissions with additional measures

The emissions of the Municipality of Kalamata for the year 2019 and for the year 2030 without and with additional measures are presented below based on the assumptions developed in previous paragraphs. Also, the measure of electricity production from RES with the net-metering regime has been calculated separately, since the deployment of RES was taken into account according to the forecast of the updated NECP. However, if these facilities are used for the needs of buildings or other facilities, then they should be taken into account.

The estimation of the contribution of each measure separately to the reduction of emissions is a useful tool for determining the additional measures that the Municipality of Kalamata will be called upon to adopt in order to achieve climate neutrality in 2030.

Table 46 Emissions of the Municipality of Kalamata for the reference scenario (2019) and 2030 (without and with additional measures)

kt CO_2 Sector	2019	No DAAP measures 2030	With SDAEK measures 2030
Buildings	**151.200**	**33.567**	**16.658**
Residential (Residential)	86.428	23.075	13.671
Public buildings	5.499	1.078	493
Private non-residential buildings (Tertiary sector)	59.273	9.414	2.494
Industry – Industrial processes	**21.583**	2.548	1.802
Agriculture – Agriculture, Forestry, Land Use	**10.897**	8.864	8.832
Agriculture (energy)			
Livestock (Energy)			
Livestock farming (nonCO_2)			
Waste management	**5.246**	5.246	3.627
Transport	**66.736**	64.403	59.454
Private transfers		30.172	26.381
Commercial transport		31.170	30.661
Public transport[3]		2.457	1.952
Municipal transport		604	461
Total Municipality of Kalamata	**255.662**	114.628	90.373

[3] Emissions calculated in this category include emissions from buses and taxis

Changes	**-55%**	86.348[4] **-64,6%** **-66,2%**[5]

[4] With net metering

Annexes

Annex A: Diesel in agriculture (2019)

Type of cultivation	Areas (acres)	Specific oil consumption (liters per acre)	Oil consumption (liters)
Olive groves	49.112	11,0	540.229
Nuts	562	3,6	2.024
Vineyards	603	13,0	7.840
Floricultural crops	27	10.415,0	283
Herbs	152	7,0	1.065
Citrus	816	17,5	14.275
Vegetables	1.072	30,0	32.172
Vegetables under cover	51	11,0	565
Maize	137	28,0	3.822
Other cereals	141	15,5	2.181
Edible legumes	14	8,7	120
Feed	6.909	16,0	110.549
Meloids	141	21,0	2.959
Stone	137	11,0	1.506
Other crops	406	11,0	4.467
Nurseries	22	5,5	122
Other	1.310	10,0	13.098
Total	61.612		737.277

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Climate City Contract

2030 Climate Neutrality Commitments

Climate Neutrality Commitments of KALAMATA

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1 Introduction

Explain your city's motivation to join the EU Mission "100 climate-neutral and smart cities by 2030" and highlight your city's present commitments to climate action. You may also want to include the aims of this document.

Your text
Kalamata is located at the south-western tip of mainland Greece, with obvious effects of climate change. Mild winters and cool summers were followed by rapid rainfall, floods, high winds, coastal erosion, prolonged heatwaves and drought. Phenomena that warn and dictate for the change of human behavior and the redefinition of the production model. Kalamata expressed its ambition to participate in the Mission of Cities, in order to prepare in a systemic way and turn the climate crisis into opportunities. An ambition based on initiatives and projects undertaken in recent years and converging with the vision of the Mission, such as the utilization of geothermal energy for the operation of the City Hall, the upgrading of municipal lighting and the infrastructure of mild transportation in the city center. Ambition based on the strategies for Sustainable Urban Development (SDS) and the Operational Program (MasterPlan) of interventions for urban space, Sustainable Urban Mobility (SUMP), the Energy and Climate Action Plan (SDAEK), for the installation of Electric Vehicle Charging Stations in the public space, the Marketing Plan for tourism and the study (Branding) of the identity and corporate presentation of the city, while today, with the support of the World Bank, the preparation of the strategy for the promotion of the coastal front of the city is in the phase of consultation with the social partners. An ambition that is also supported by the familiarization with terms and methods of tackling climate change, acquired from the participations of the Municipality of Kalamata, in networks of cities with a common goal, such as the Covenant of Mayors, Energy Cities, CIVITAS, Intelligent Cities Challenge, Major Cities of Europe, SUSTAINABLE CITY, ClimaNet. The 2012 CO2 emission inventory, through the Energy and Climate Action Plan, as well as the updated census data for the year 2019, covers the entire area of the Municipality which is identical to the area declared to the EOI in the phase of submission of the expression of interest and incorporates data from emission sources SCOP 1 and SCOP 2. The census highlighted the building stock, housing and facilities of the tertiary sector, with 59.14%, and the sector of private and freight transport, with a percentage of 26.10%, as the main sources of emissions in the Municipality of Kalamata. With the guidance of the transition team created by the Mayor, through a process of long consultation, online or in person, in which stakeholders and citizens from all professional classes of the city, members of Universities and Scientific Bodies, entrepreneurs and

members of the Public Administration participated, the Vision of the Municipality of Kalamata was formed, with the holistic and integrated view of the following axes of intervention:

1. **Transport – Urban Mobility**: focus on sustainable mobility – car-free residents/visitors, refuelling shops, car traffic/parking, Public Transport, etc.
2. **Buildings – Facilities**: energy saving in the building sector (houses & facilities), construction of non-energy-consuming modern houses/buildings, reuse of old & listed buildings, etc.
3. **Energy – Environment**: production/storage of clean energy, smart management of distribution & consumption networks, promotion of electromobility, protection from sea & air pollution, ensuring clean and sufficient drinking water, etc.
4. **Circular Economy & Waste Management**: reduction of household waste, awareness in product reuse, hazardous waste management, etc.
5. **Urban Planning & Urban Environment**: urban expansion of the city, redefinition of land use, development of smart/ecological areas, bioclimatic interventions in public space, etc.
6. **City Resilience & Related Infrastructure**: resilience in the areas of infrastructure, local economy, society, environment, health, etc.; protection projects against the effects of the climate crisis (e.g. flood protection & anti-corrosion works).
7. **Economy & Society for All**: improving agricultural production, innovation in manufacturing, climate-neutral tourism entrepreneurship, tackling energy poverty and social exclusion, etc.

In the second phase and after the inclusion of Kalamata in the Mission of Cities, working groups were created per thematic unit, in which participated the Coordinator, a member of a university institution, as well as an external collaborator with experience in the operation of the market, which transformed the political guidelines of the transition team into a proposal text, documented in the following transformation pathways (Impact Pathways):

1. Kalamata, city to live in
2. Kalamata, low emission transportation.
3. Kalamata, city to produce and create
4. Kalamata, a city that learns.

In the two-year course of communication and interaction, with every creative expression of the city, which began in September 2021, collaborations and strong commitments have been developed, with institutions and social groups of the city, academics and market executives, but also with all levels of government, at local, regional and national level, to support the city, both in shaping the content of the climate contract, and in the process of its implementation.

Collaborations, without limits and exclusions for anyone, in the spirit of which the implementation of the actions of the climate contract has been organized.

The proposed interventions give the city the opportunity to solve its operational problems in the crowded areas of the center and the beach, to support businesses in adapting to the new climate data, households and businesses, to become energy autonomous by utilizing clean energy sources and finally to create the appropriate urban environment and environmental conditions, so that Kalamata is a city to live in.

2 Goal: Climate neutrality by 2030

Articulate your 2030 climate neutrality ambition, as expressed and defined in your Cities Mission Expression of Interest (EoI). This should include your ambition and commitment to a 2030 horizon as a whole city, as well as describe any exclusion areas and summarise how these areas would be addressed beyond 2030. (A more detailed plan for exclusion areas should be included in the 2030 Climate Neutrality Action Plan.) Your 2030 ambition should be supported at a minimum by a Council decision, and it is recommended that it is also supported by a wider stakeholder group. We also recommend you to list other co-benefits you aim to achieve when working towards the climate neutrality goal, like well-being, health, equity, justice, financial savings.

Your text

Kalamata as the largest city in Southwestern Greece, and a hub of intermodal transport (Motorway, Airport, Port) gathers a large number of economic, cultural and other social activities, which give the city a leading role in undertaking initiatives aimed at climate neutrality and disseminating the objectives of the Mission of Cities, throughout the Peloponnese Region.

The **ambition** is to achieve climate neutrality by 2030 that is in full line with the achievement of the objectives of the Mission, and **is based on** the people and institutions of the city, partnerships with universities, companies and market executives, participation in networks of cities and international organizations, as well as the material and intellectual capital that has been created in the city. from its participation in actions and projects for Sustainable Urban Development, Sustainable Urban Mobility, Management of Energy Resources, promotion of electromobility, waste management and promotion of the gastronomic wealth of the region.

Interventions were designed that are interrelated and constitute the continuation and expansion of all the projects that the Municipality of Kalamata has entered in its budget and is currently implementing.

Interventions that extend throughout the area of the Municipality and in the following areas:

1. Built Environment

The city has been built on the basis of the street plan of 1905 and the urban planning studies on which its expansion was based. After the catastrophic earthquake of 1986, the reconstruction focused on residences and business premises, while since 2007 began a process of upgrading the aesthetics and functionality of public space, such as the pedestrianization of the northern part of Aristomenous Street, the renovation of the central square, the construction of bicycle paths, the southern sidewalk of the coastal road Navarinou, the widening of the sidewalks in the southern part of the central Aristomenous Street, the renovations in the Historical Centre.

Today, works are being carried out to convert the city's commercial center into a place for gentle travel, reducing the space available to cars, such as the renovation of 23rd March

Square and the surrounding areas, the pedestrianization of streets (Sfaktirias, Iatropoulou), the widening of the sidewalks of part of Navarinou Street, the renovation of Plastira Street.

The reduction of emissions from transport, as reflected in the 2019 census, prompts the creation of additional infrastructure that will enhance environmentally friendly travel. The Action Plan proposes interventions in the central sector of the city and the eastern city, with secured funding, while recording the great effort attempted, with the support of the World Bank, to highlight the coastal front as a source of life. There is also the opportunity to complete the city plan, with the completion of the construction of open roads, which will enhance micromobility.

The proposed infrastructure construction interventions aim to improve the aesthetic and functional image of urban space, so that citizens can move around with environmentally friendly means of transport (bicycles, skates, pedestrians, etc.), while entrepreneurs can invest and create, especially in the tourism sector, creating wealth for all.

2. In Mobility and Transport

The economic development of the city in recent years, increased the number of visitors, as well as the intense use of the car, for transportation, especially in the shopping center. Car that claims from pedestrian public space, making accessibility difficult.

The transformation of urban space in recent years has boosted the gentle movement of citizens either on foot, by bicycle or by scooter for younger ages, while the creation of infrastructure for the use of shared bicycles and other micromobility vehicles has begun.

Transport, according to the inventory, contributes 26% to emissions and the aim of the proposed interventions is to reduce vehicle kilometers and use environmentally friendly means of transport, which will utilize existing and planned infrastructure, as well as modern digital tools that favor smart travel.

At the same time, the freight transport system is organized and the replacement of internal combustion cars with other, electric or biofuel cars is promoted, while creating the necessary infrastructure.

3. In buildings and facilities

The building stock of houses and facilities of the tertiary sector has been constructed by 85%, before 2000, when there were no regulations and no substantial provision for energy savings, resulting in their operation today generating 59.14% of emissions, consuming 53.28% of total energy.

Extensive renovations and the replacement of heating oil energy by clean renewable energy sources (rooftop photovoltaics and geothermal) are the main directions of actions designed to improve the energy efficiency of homes, as well as tertiary sector facilities (hotels, shops, manufacturing units, schools, office and administration buildings, schools, etc.). The aim is, together with the implementation of smart energy management systems, to reduce the energy costs of households and businesses.

In the area West of Artemis Street, actions are being promoted to transform it into a climate-neutral area, which will consume the energy produced locally by photovoltaic systems. At the same time, a small local district heating and cooling network will be installed with the support of geothermal heat pumps. The same framework will be applied in the area of Kipoupoli, as a new and under reconstruction area of the city plan.

4. In Energy

The Municipality of Kalamata today uses energy from other areas, with local production from photovoltaics being at very low levels. The opportunity provided to Kalamata is to produce most of the energy it needs using every possible source.

In addition to self-production of energy from photovoltaics on the roof, clean energy production methods are proposed, utilizing the liquid waste of the biological treatment of Kalamata and the olive waste from the processing of the olives, the rich geothermal load of the area, the production of green hydrogen from sea water, the utilization of the energy of sea waves, but also any innovative idea that arises over time. At the same time, the management of energy storage and disposal is promoted, with modern digital tools based on Artificial Intelligence and big data analysis.

5. Circular Economy and waste

Where promotions are proposed to reduce the production of organic waste, with sorting methods at source, the promotion of home and neighborhood composting, the enhancement of recycling streams, but also the raising of awareness on issues of reuse of raw materials.

6. Industrial Processes and Product Uses (IPPU)

Where the certified production of climate-neutral products is proposed, with the replacement of equipment and changes in the steps of production processes, processing units.

7. Agriculture, Forestry and Land Use (AFOLU)

It is proposed to modernize the equipment of pumping stations and means of transport.

With the interventions, the city is changing and the wide participation of institutions and citizens recorded both their interest and willingness to participate in the great effort.

The common denominator for all is the quality of life created by the reduction of pollutants and noises, the reduction of traffic congestion and the ability to move in all areas and for all, with environmentally friendly means.

The environment is being created to invest in services, energy and mobility, create new jobs and adapt workers more quickly to the new skills required by cities' green and digital transformation.

Households are given the opportunity to upgrade their home, so that in addition to the financial benefit due to the reduction of their energy needs, they can create a higher standard of living, with conditions of safety, hygiene and comfort.

An environment is created for all, which encourages a change in the daily habits of citizens, with the aim of protecting the environment and saving natural resources.

3 Key priorities and strategic interventions

This is the core section of the Commitments document that should summarise **at least 3 or 4 systemic strategic priorities** that need to be implemented for your city to become climate neutral by 2030. These should be meaningful changes that will have a profound impact on reducing GHG emissions in your city, like decarbonising the heating system in the city or generating 100% energy from renewables. The individual commitments between your city and other stakeholders should address these key priorities and contribute to reaching them. The annexed 2030 Climate Neutrality Action Plan should describe the all interventions, including those to reach your priorities as well as all further actions, in detail and describe how your city plans to implement them.

Your text

The emission inventory for 2019, as shown in Part A of the Action Plan, shows that the main **sources** of emissions in the Municipality of Kalamata are **residences**, **tertiary** sector buildings, **private** transport and **commercial** transport, according to the table below:

n/a	Source of CO2 emissions	Total (tn)	%
1	Private buildings other than residential buildings	59.273,15	23,18%
2	Public buildings and facilities	5.498,93	2,15%
3	Houses	86.427,62	33,81%
4	Private transfers	30.455,58	11,91%
5	Commercial Transport	33.037,35	12,92%
6	Public Transport	2.590,25	1,01%
7	Municipal transport	652,83	0,26%
8	Waste	5.246,00	2,05%
9	Industrial Process and Product Use (IPPU)	21.582,93	8,44%
10	Agricultural, Forestry and Land Use (AFOLU)	10.897,29	4,26%
		255.661,93	**100,00%**

Based on emissions data, the Municipality of Kalamata identified four key priorities that need to be addressed in order to achieve the goal of climate neutrality by 2030:

1. **Changing** human **behavior**
2. **Low-emission** transportation.
3. Change the **production** model.
4. Setting up **a learning environment**

Systemic priority I: Changing human behaviour

The approach is to **change** the everyday life and habits of citizens**, shaping** the environment that will **inspire** them, whether it is **their public** or **personal** space.

In this context, interventions are proposed**,** shaping the public space that will **inspire** respect for the environment and promote another way of life, will be open to all and **inclusive**, will strengthen entrepreneurship and will **generate** wealth.

Interventions also in places where citizens spend several hours of the day, whether it is their **home**, their **children's** schools, or **recreation** and sports **areas, while creating the feeling that goods are not** inexhaustible **and require special management.**

At the heart of the interventions is everyone's personal space, their **home**, where through the **upgrade** of the building and the operating equipment, the household in the long run using energy from **photovoltaic** systems, will become energy **self-sufficient**, gaining economic benefit. At the same time, the promotion **of sorting** actions at source will **reduce** the volume of waste to be sent to the central treatment plant.

The interventions are transferred **to the public** space for a city **without garbage**, with green spaces, **without** degraded **neighborhoods, with soft mobility** infrastructure, with **schools** and sports **facilities, which** will operate **under climate neutrality rules and will** inspire **citizens to change their behavior.**

Systemic priority II: Low-emission mobility

Kalamata in recent years has an **upward** growth course, the result of which is the increase of professional **activity**, especially for catering and entertainment businesses in central parts of the city. The lack of hotel beds has **created** a wave of conversion of residential spaces into short-term rental (BnB) apartments, resulting in **visits** for tourism and leisure, to have **increased** rapidly in recent years.

At the same time**, the concentration** in the city of state **services**, banks, health care units, shops with a strong and **international** identity, as well as other activities that serve the daily needs of citizens, **increases** the number of **one-day** visits.

The common **denominator** for the majority of visitors is the need to use the **car**, both for the initial access to the city and for short trips within it, so there is an **intense** competition to find a **parking space**.

Public space is claimed **unequally** by cars at the expense of commuters, resulting in high traffic congestion, high noise and air pollutant levels and a dysfunctional and low aesthetic image of the city.

The emissions of the transport sector are **66.736,01 tn** corresponding to **26.10% of** the total emissions of the Municipality of Kalamata.

Interventions are proposed in favour **of soft** forms of transport and **against** cars, creating physical infrastructure (sidewalks, pedestrian streets, bicycle paths, etc.), promoting smart mobility by using digital applications and enhancing the role of public transport.

Market supply issues are regulated in order to reduce **unnecessary** movements of freight transport, the **controlled** parking **system is extended and a climate-neutral zone is defined for travel in the city center.**

Since the soft mobility proposals **reduce** the vehicle kilometres of high-emission vehicles, reducing emissions by around **45%,** without meeting the target, it is necessary to **replace vehicles** of all types with other **low-emission vehicles, whether** electric **or biofuel** . In this context, the installation of electric **vehicle charging** stations provided for by the relevant strategy is promoted and **depending on** the needs of electric vehicles.

The main objective is for citizens to **travel** only for what **is necessary** and not **unnecessarily**, avoiding their passenger vehicle and using environmentally friendly means.

Systemic priority III: Changing the production model

The **city**'s economy is mainly based on the **tertiary** sector, dominated by services, shops, catering and entertainment units and accommodation.

The production of high **quality** local **agricultural products (Kalamata olives, olive oil, vegetables, figs, wine, potatoes, etc.), has created a set** of processing and **marketing** units of agricultural products, where together **with the** handicrafts **and the large industry with the international cigarette trading mark KARELIA, constitute the secondary sector of the Municipality of Kalamata.**

In the agricultural sector, emissions have been recorded from the use of electricity for the operation of pumping stations, as well as from the use **of fossil fuels** to power **agricultural** vehicles.

In the transition to a society that **will use** only clean and green **energy, the challenge is for businesses and professionals to** reduce their energy **needs, both through energy saving actions and energy efficiency of their equipment, as well as by** changing their **production** processes. **Processes that will be monitored with digital applications and in real time.**

At the same time**, the need for independence from** fossil **fuels creates the prospects for the production of clean energy, utilizing every possible source, such as** photovoltaic **systems, in an area with rich solar potential (1440 Hour/year), geothermal load,** biomass **produced from pruning olive trees and waste from olive processing,** liquids biological waste, but also **hydrogen** from the sea.

Simultaneously with state supervision and funding, the **construction** of a natural gas network that **will supply** large consumers and apartment buildings has been approved and will begin immediately.

The goal is, apart from energy **saving** actions , to **produce** locally so much clean energy that the Municipality will be energy **self-sufficient** in the future.

An additional component for electricity is the **capacity** and the way it is **disposed** of through the transmission network, where it is proposed, in cooperation with private entities, to develop **artificial intelligence applications** that will interconnect each **energy** hub that will operate, either as **a producer** or as **a consumer**.

Systemic priority IV: Shaping a learning environment

The **success** of the implementation of the contract will be judged by the participation of properly **informed** and sensitized **citizens, who will function as part of** the city's ecosystem **that will create and** will be fed **back by the results it will produce.**

In this context, the OneStopShop **Citizens' Information Centre** will be created as a reception point, which, in cooperation with the Communication Office, will organize information events **and provide citizens with** specialized **information.**

In order to record the implementation data of the climate contract, the structure of the **Climate Change** Observatory will operate that will **evaluate** the progress of its implementation and will scientifically **record the** economic**,** environmental **and** social **impact of the implementation of the actions of the contract. Evaluation the results of which will** feed back **the** actions and will **also redefine** the corresponding political decisions of the competent collective bodies.

At the same time, Research and Innovation structures will use all data for scientific purposes, in the fields **of** energy, **transport**, **circular** economy and **production**.

4 Principles and process

Highlight the key principles that will guide your city as it implements its Climate City Contract, like accountability, transparency, or an open attitude to new approaches. The process should encompass principles like **co-creation, innovation, multi-actor and citizen engagement**, and should be **systemic and demand-driven in nature.** It should also be based on **monitoring** and **joint learning**. The Commitments Guidance document provides more specific guidance on how integrate these principles into your own process.

Your text

The two-year activity of each creative force of the city, under the guidance and coordination of the Municipality of Kalamata, was based on the following principles, the implementation of which permeates the entire process of drafting the climate contract.

1. Participation and Co-creation

Kalamata, through its participation in European programs, such as Beacon, but also in city networks, acquired **the expertise** to organize **participatory** processes and **co-formulate** proposals on the major issues of the city, such as the submission of the candidacy for claiming the title of European Capital of Culture for the year 2021.

Since the beginning of the process in September 2021, the participation of citizens and institutions of the city, academics, entrepreneurs and market executives, as well as representatives of all levels of government, has been organized in a long dialogue that took place either physically during the thematic workshops, or online, through mission.kalamata.gr platform. The widespread use of digital conferencing and remote conferencing applications (Zoom, Teams, ...), especially after the Covid-19 pandemic, has enabled many to participate in open thematic workshops. Academics, employees, representatives of institutions, participated remotely, overcoming obstacles, in the discussion and submitted their proposals.

The **drafting** of the application for inclusion in the Mission of Cities aiming at climate neutrality by 2030, as well as the **formulation** of the content of the Climate Contract, **emerged** through the above and broad participatory process.

In the implementation phase of the climate contract, the cooperative operation of the Citizens' Information Center and the Communication Office will support the participation in the actions of all citizens, especially those belonging to weak population groups. In this context, it has been proposed to continue the implementation of open workshops in the neighborhoods of the city where interventions are foreseen, such as the coastal front, the eastern center, the Nedontas Park and the area of Athinon Street.

2. Just Transition

The actions of the climate contract are inspired by the equal and inclusive treatment of all social groups in the city. In each action, the weaknesses and obstacles to their implementation were recorded, as well as proposals for their elimination. For example, the promotion of electromobility reduces jobs in the field of internal combustion engine mechanics and as a counterpart it is proposed to implement training programs and acquire new skills in the maintenance of electric vehicles. Similarly, the replacement of heating oil burners with heat pumps creates corresponding learning needs, but also business needs.

The recording of the economic and social impact, from the implementation of each proposed action, is designed to be done and evaluated by the structure of the Climate Change Observatory, as described in detail in the respective action, in order to scientifically detect the negative impacts that arise and propose solutions for each one.

3. Creating innovative approaches

Given that major changes require reversals, the analysis of each action records the spirit of innovation and diversity it introduces. At the same time, the establishment and operation of the structures of the Innovation Center, the Energy Research Institute, as well as the Center for Circular Economy, give the city's effort the scientific support for the elaboration and implementation of each innovative idea. For example, the implementation of the producer-consumer model in energy management, using artificial intelligence applications and big data processing, is an innovative proposal that will solve energy supply and demand issues at peak times.

4. Transparency and Accountability

The implementation of the climate contract, in addition to the administrative supervision it will have by the Development Organization of the Municipality of Kalamata, "SUSTAINABLE CITY", will be recorded by the Climate Change Observatory. The results of the data processing will result in the annual assessment of the climate contract, which will be discussed in the

City Council, for the adoption of appropriate adaptation policy decisions, whose meetings are open and broadcast by all digital media (TV, YouTube, Zoom,...)

The methodology and approach for the processes of drafting and implementing the climate contract are as follows:

I. Creating a strong mandate

The Municipality of Kalamata, for the preparation of the proposal for inclusion in the network of the Mission of Cities, as well as for the drafting and implementation of the content of **the Climate Contract, has formed** the **Transition Group** for Climate Neutrality, headed by the Mayor Mr. Athanasios Vasilopoulos.

The Transition Team includes executives of the Municipality, **representatives of institutions** and professional **groups of the city, business executives**, **academics** and external partners**. The structure of the group is as follows:**

1. The five-member Coordinating Team, headed by the Mayor.
2. The coordinators at the head of the following intervention axes:
   - Transport – Mobility
   - Buildings
   - Energy
   - Built and natural environment
   - Resilience
   - Waste and Circular Economy
   - Economy – Society
3. the 26 rapporteurs, as heads of the thematic units from each axis.

The transition team initially had **the mission** of implementing open **workshops**, in order to co-shape with city and civil society actors the **framework** of policies towards **achieving** the goal of climate neutrality, the work of which **was supported** by external partners, academics or market executives.

Through this route, a local **ecosystem** was created **per sector of intervention**, by political figures, economic operators, professional guilds, but also citizens, who with their continuous participation and the submission of their views **strengthen** the mandate for the **implementation** of the climate contract.

In each thematic unit **, project teams were created**, in which participated the Coordinator, a member of a university institution and an external collaborator with experience in the operation of the market, who **transformed** the political guidelines of the transition team into a proposal text.

The drafting **of the proposals, as well as** the procedures for **their implementation, had and will have the scientific** documentation of the professors **from the collaborating with the Municipality, University laboratories or Research Centers, according to table C-1.1. The** guidance **of University professors in** Mobility, **Energy** Production**, the Built Environment and Circular** Economy, has been decisive and in the same spirit there will be **participation** in the implementation of the actions of the climate contract, in order to achieve a reliable process of monitoring and evaluating the results.

At the same time, **by collaborating** with private sector economic operators, the necessary **know-how was** incorporated into the content of the contract **and the necessary** operational **capacity was ensured for the implementation of all planned actions of the climate contract.**

II. Portfolio Co-Design

After 2010, the Municipality of Kalamata**, implementing** strategies that emerged through a participatory process, began to implement ambitious **urban** development **and energy saving** projects . The rearrangement of the central **square** and the extensive **renovations** in the city center, the use of **geothermal** energy for the operation of the **cooling/heating** system of the new Town Hall, as well as the energy **upgrade** of the street lighting network, with self-financing and repayment from energy savings over a decade, are actions with a strong **economic,** environmental **and social** footprint, incorporating **innovative** ideas and certifying Kalamata's ability to implement sustainable development projects.

Today, in the field of urban **development, with participatory processes and the support** of the World Bank, **solutions** are designed **to highlight** the coastal **front of the city, followed by participatory** planning **for interventions in the** eastern **center and Nedontas Park.**

In mobility, **from the construction of soft mobility infrastructure, proposals were designed for** smart **mobility in the city, utilizing** digital **applications and the use of environmentally friendly means of transport, while to reduce CO2 emissions, movement with** low-emission **vehicles** is promoted.

In **the buildings, after the technical interventions in the shell, energy saving solutions are proposed, with the installation** of smart energy **management** and monitoring **systems in real time, while for their energy self-sufficiency solutions are promoted to exploit** the geothermal **and** solar **potential of the area.**

The **transition** away from **fossil** fuels and the **electrification** of society will create the need for **local** energy production from **renewable** sources, such as **photovoltaics,** geothermal**, biomass** from **pruning,** bioliquid waste and **hydrogen** from the sea.

Interventions in all emission sectors, where the next step is based on the old, but **incorporates** modern technology and every **innovative** and creative **thought, with new methods and collaborations, in order to** change **consumption habits of many years.**

Interventions that take into account, exploit and utilize European and National policies to tackle climate change, such as the European Green Deal, National Climate Law, and the National Energy and Climate Plan.

The Climate Contract of Kalamata is not a set of projects, but a set of transformation **paths** with **starting** point and **destination**, horizontally inspired by groups of interventions, whose **portfolios**, the actions of which are related and complement each other, either technically, regulatory, social, financial, etc. For example, the **change** in the consumption pattern is a **route** related to **energy**, mobility**, waste and** leading to the reduction of emissions, following a set of **technical,** regulatory **and** economic **interventions.**

In this process, systemic **barriers** are addressed with synergies **at all levels of governance. At** Regional level, with the participation of the Municipality in the **Monitoring Committee of the Operational Program of the Peloponnese Region and at national level, with the participation** of the **Municipality of Kalamata in the National Network of Cities ClimaNet**, with the participation of the six Greek cities of Apostoli, Athens, Thessaloniki, Ioannina, Trikala, Kozani, Kalamata and Limassol from Cyprus. The participations **seek** to resolve all systemic obstacles (regulatory, financial, etc.) to achieve the **goal** of climate neutrality.

III. Action

The Municipality of Kalamata in the last five years, has implemented climate projects, of the order of **120M**, (***Attachment File: Action2016-2021.doc***) and has already received funding from European and National resources, for interventions in the coming years, **over 35M**. Projects that have been integrated into the actions included in the climate contract portfolios. Projects of public interest, which create the **base**, but are **few** compared to the private investments required to achieve the objectives.

The proposed interventions require **the** participation **of citizens and investors, who, in order to feel** safe **and** secure**, require support from every level of government.**

IV. Learning-monitoring-evaluation environment

The Transition Team **for the coming years will have the role of** disseminating **to citizens**, the policies **that will be implemented, recording** comments and observations and **evaluating** the results.

The administrative and financial **management** of the actions for the implementation of the Climate Contract will be carried out by a **distinct** administrative structure, which will be integrated into the internal operation organization of the Development Organization of the Municipality of Kalamata, under the name "**SUSTAINABLE CITY".** The Development Organization AEIFOROS POLI has as its mission the support and provision of technical assistance to the Municipality of Kalamata, for the preparation of studies and for the implementation of each development action, so in this context, it will **supervise** the implementation of the Climate Contract.

In order to monitor the progress, the **values of the** indicators **described in the Action Plan will** be evaluated and the interventions will be **adjusted** in a time according to the guidelines of the Mission Team. In the full development and familiarization with how to implement the climate contract, integrating and utilizing the new digital products, the **goal** is to **monitor** be real-time.

In **collaboration** with **innovation bodies** (University or private), the city will be transformed into an open **laboratory** for the production of open data on the environment and city functions, the evaluation of which will contribute both to the **evaluation** of the achievement of the goal and to the **co-benefits** of citizens.

Particular emphasis will be given to the creation and scientific **documentation** of monitoring indicators, related to the **impact** on society and the indirect benefits of citizens, at **economic**, **environmental** and **social** level, as described separately in the Technical Fiches of the Climate Contract Actions. Actions planned to be carried out in cooperation with **Universities** and **Research** Centers. Of particular value is the recording of social impact, which enables to record the obstacles to participation of weak social groups in CCC actions. The intention is to ensure a just transition towards climate neutrality for all.

At the same time, the implementation of the actions will create learning needs for a large part **of the population,** which will be covered **in each case by the cooperation of the Municipality with the Universities. For example, the training of technicians in the maintenance of electric vehicles, but also of any new technological product, requires new knowledge that should be covered by all levels of education. Also the** environmental Terms for businesses and organizations, require the recording and evaluation of financial data with a green footprint, thus creating the need for green accounting of economic operators.

From the **collaborative** process, the need emerged, in addition to the **targeted information of citizens of various thematic groups and the** creation of **corresponding thematic monitoring groups**, at the stage of implementation of the actions, in **which representatives of the involved bodies will participate, such as in actions** to promote **travel by** mass **means** transport, representatives of public transport operators and TAXIS will participate.

V. Procedure for incorporating the terms of the Climate Contract.

The **monitoring** of the implementation of the **climate contract in its entirety will** be done **by a department of the** Development Organization and **is an immediate priority action, in order to create the right environment** for informing citizens, developing **partnerships** and attracting **investments** for the implementation of actions.

The expectation is, through the **establishment** of an annual **assessment of the** progress of the implementation of the climate contract, to emerge the possibilities to:

1. The contract should be a **living text** that will record and **evaluate** every factor of the **internal** and **external** environment, in order to accept the necessary **adjustments**.
2. The progress of its implementation and the results should be **open** and **available** to citizens.
3. Be open to any new **collaboration**, inclusive **for anyone. To this end, the Municipality is committed, through the process of monitoring the implementation of actions, to adjust its policies, creating new partnerships or incorporating new processes or products that will improve the result.**

5 Signatories

Include a list of stakeholders who have committed to help your city achieve its goal to reach climate neutrality by 2030. Detailed commitments and agreements between individuals or groups of stakeholders should be appended to this Commitments document. This list will likely increase over time.

Name of the institution	Sector/Area	Legal form	Name of the responsible person	Position of the responsible person
Ministry of Environment and Energy (MEEN)	Cross-sectoral	Central Government	Efthimios Bakogiannis	Secretary General for Spatial Planning and Urban Environment
Peloponnese Region	Cross-sectoral	B' degree local authorities	Panagiotis Nikas	Regional Governor
Network of Cities "ClimaNet"	Cross-sectoral	First Degree Local Authorities		Mayors
Network of Municipalities of Peloponnese Region	Cross-sectoral	First Degree Local Authorities		Mayors
University of Patras	Cross-sectoral	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Christos Bouras	Rector
Department of Transport Engineering of the National Technical University of Athens	Energy Transport Industry	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Eleni Vlahogianni	Professor
Electronic Sensors Laboratory of the School of Electrical and Computer Engineering, National Technical University of Athens	Energy Industry	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Evangelos Christoforou	Laboratory Director

Department of Geography & Regional Planning, School of Rural and Surveying and Geoinformatics Engineering, National Technical University of Athens	Energy Transport Industry Georgia	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Charalambos Ioannidis	Professor
Decision Systems & Management Laboratory, School of Electrical and Computer Engineering, National Technical University of Athens	Energy Transport Industry	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Ioannis Psarras	Laboratory Director
Laboratory of Atmospheric Physics, University of Patras	Energy Industry	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Andreas Kazantzidis	Professor
Circular Economy Workshop of the University of Piraeus	Waste Industry	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Konstantina Kottaridi	Laboratory Director
Department of Finance, University of Peloponnese	Energy Transport Industry	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Athanasios Katsis	Rector
Laboratory of Software Systems and Databases of the University of Peloponnese	Energy Transport Waste Industry	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Konstantinos Vasilakis	Laboratory Director
Laboratory of Wireless Communications and Information Processing, Aristotle University of Thessaloniki	Energy Transport Waste Industry Georgia	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Georgios Karagiannidis	Professor
Laboratory of Spatial Planning and Urban Development of the School of Architecture of the National Technical University of Athens	Built Environment	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Klampatsea Irene	Professor

Center for Renewable Energy Sources (K.A.P.E.)	Energy Waste Industry Georgia	Legal Entity under Public Law Research Organization (Universities, Research Centers, Institutes)	Dr. Lambros Pyrgiotis	Director
IQnovus - QUEST GROUP	Energy Transport Waste Industry Georgia	Private Entity	Antony Cassano	President & Managing Director
Public Power Corporation PPC S.A.	Energy Industry Georgia	Private Entity	Dimitris Apostolakos	Director
AMERESCO SUNEL ENERGY SA	Energy	Private Entity	Britta MacIntosh	
AVOKADO	Energy	Private Entity	Dr. Vasilios Nikolopoulos	CTO & co-founder
NOVOVILLE	Transport	Private Entity	Fotios Talantzis	Representative
WIND	Cross-sectoral	Private Entity	George Tsaprounis	Director
EUROBANK	Economics	Financial Institution	Papadimitriou Christos Grypaios	ESG Division Manager Senior Relationship Manager
NATIONAL BANK OF GREECE	Economics	Financial Institution	Penelope Charitou George Tzortzoglou	Representatives

Federation of Commercial Handicraft Enterprises of Messinia (OEBES)	Energy Transport Waste Industry Georgia	Association	Georgios Kaperonis	President
Kalamata Labour Centre (EKA)	Energy Transport Waste Industry Georgia	Association Club	Sotirios Tsonis	President
Ministry of Education (Regional Directorate of Primary and Secondary Education of Peloponnese)	Cross-sectoral	Education	Dimitrios Economopoulos	Regional Director
Ministry of Education (Directorate of Secondary Education) (Directorate of Primary Education)	Cross-sectoral	Education	Dr. Theofania Siouti Nikolaos Pefanis	Director Director

6 Contract with signatures

Express joint commitment / agreement for all stakeholders who sign this 2030 Climate Neutrality Commitments document.

Example: We, the undersigned, hereby commit to help make the City X climate neutral by 2030. We agree on the joint ambition and commitments, as formulated in the City X's Climate City Contract.

Date of signature	Name	Signature
15/9/2023	Athanasios Vassilopoulos	ATHANASIOS VASILOPOULOS 15/09/2023 15:44 Mayor Of City of KALAMATA

APPENDIX

Additional Signatories to the 2030 Climate Neutrality Commitments of KALAMATA

KALAMATA
Our mission: go zero!

KALAMATA 13/10/2023

NetZeroCities has received funding from the H2020 Research and Innovation Programme under the grant agreement n°101036519.

Additional Signatories

Include a list of stakeholders who have committed to help your city achieve its goal to reach climate neutrality by 2030. Detailed commitments and agreements between individuals or groups of stakeholders should be appended to this Commitments document. This list will likely increase over time.

Name of the institution	Sector/Area	Legal form	Name of the responsible person	Position of the responsible person
Network for Climate Neutrality of the Cities of Greece and Cyprus (“ClimaNet Network”)	Cross-sectoral	Non-profit association of First Degree Local authorities	Board of Directors	Mayors of the founding Municipalities
Technical Chamber of Greece - Regional department of Peloponnese - Prefectural Committee of Messinia	Energy Transport Waste Built Environment	Public Law Legal Entity with elected Administration	Vasileios Koutrafouris	Chairman of the Prefectural Committee
Chamber of Messinia	Cross-sectoral	Public Law Legal Entity with elected Administration	Evagelos Xygκoros	Chairman
MYTILINEOS – Energy & Metals	Energy	Private Entity	Dr Vasileios Nikolopoulos	Applied R&D, Technology and Digital Innovation, Head
Kalamata Mountaineering Association	Environment	Mountaineering Sports Association	Kostas Fykiris	Chairman of the Board