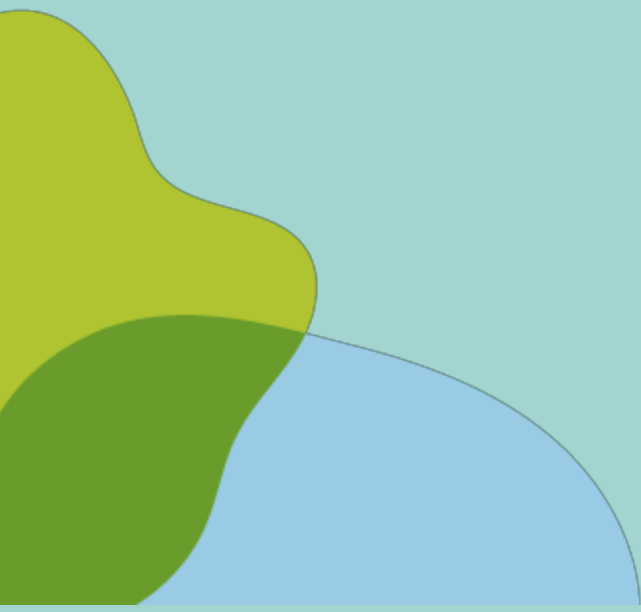


Climate City Contract

2030

Climate Neutrality Action Plan of the Municipality of Kozani

ΔΗΜΟΣ ΚΟΖΑΝΗΣ
Municipality of Kozani





Disclaimer

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Summary

An abstract **summarizes the content** of the 2030 Climate Neutrality Action Plan (Action Plan) that is developed jointly by local authorities, local businesses and other stakeholders.

Textual element

The present document describes the 2030 Climate Neutrality Action Plan of the Municipality of Kozani. The transition that the Municipality undergoes due to the reduction and termination of the lignite production and use for electricity generation in the local power plants, has a considerable negative impact on employment and economic prosperity. However, the transition is seen as a major opportunity for changing and restructuring the local economy through a diversification from the traditional one-dimensional dependence on mining-related activities towards an economy which generates employment opportunities in renewable energy, circular economy, smart technologies, manufacturing of renewable energy equipment, small and medium size food producing companies, precision farming etc. The development and implementation of the present Climate Neutrality Action Plan is highly valued and is considered to be a very strong policy framework and practical implementation toolkit for the development of a new narrative for the city of Kozani which will improve the quality of life and the health conditions of its citizens.

Kozani participates in the Covenant of Mayors initiative since 2012 and since then a thorough monitoring process of GHG emissions has been undertaken on an annual basis. A summary of the greenhouse baseline gas emissions inventory for the reference year 2020 is presented and a quantification of the various sources is briefly outlined. Due to a variety of targeted policies and actions undertaken by the Municipality, a significant reduction in the CO₂ emissions of the order of approximately 33% was accomplished between years 2010 and 2020. The major sources of CO₂ emissions are attributed to private buildings producing an approximate 45% of the total emissions. In addition, the tertiary sector is responsible for 28% of CO₂ emissions, whereas transport accounts for 23%.

The current climate neutrality action plan aims to accomplish the removal of the remaining CO₂ emissions (except an approximate of 20% of residual emissions); and to develop inventories, monitoring processes and emission reduction portfolios for the remaining GHG emissions. The proposed key priorities and strategic interventions are on energy efficiency optimization, renewable energy generation, sustainable urban mobility and transportation, waste management and circular economy, sustainable resource optimisation and governance.

A major challenge for Kozani is the replacement of the heat source which is utilised in its very successful district heating system. One of the most important and critical actions of the present climate neutrality plan is the replacement of lignite as the source of thermal power, through the gradual introduction of a range of available renewable energy sources. In addition, the reduction of thermal energy demand for heating is a major priority and this is planned to be accomplished through the implementation of an extensive deep retrofit and upgrade of the built environment, use of smart technologies and change in the behaviour of the residents.



A high penetration level of renewable energy sources in the local energy mix is planned driven by both public and private funding, which is expected to reduce and/or offset the electricity use in all sectors; and at the same time, it will provide the required power for sustainable mobility using electric vehicles. The climate neutrality plan also proposes measures that will optimise waste management and enhance the circular economy.

The introduction of targeted smart technology and digitisation applications in everyday life activities will reduce energy consumption, private car usage and it is anticipated to improve quality of life.

Research, development and adoption of new sustainable energy technologies including the introduction of hydrogen as an energy carrier is a priority of the local Higher Education and Research institutions.

A management structure and an operational plan that will promote and monitor the plan is proposed. Transparency, social participation, mobilisation of the youth, interaction among local authorities and stakeholders are key requirements for a successful outcome.

The preparation of the Action Plan has been a dynamic process which has been undertaken by a team of experts either employed in the MoK, or in other local stakeholders (UoWM, CLUBE, CERTH) or originated from the Aristotle University of Thessaloniki, supported by external financial advisors (FCNC) and expert advisors from abroad. The team members interacted and worked closely under a rigorous well - managed and intensive process with local authorities, businesses, professional associations, key stakeholders, youth organisations and schools who were actively participated and engaged in meetings, discussions, workshops, and various publicity activities. During this process, all the above players travelled a long distance and managed to co-create and acquire ownership of the present Action Plan finally committing themselves to enthusiastically adopt the common effort for a climate neutrality of Kozani by the year 2030 as the most significant challenge for the city and its citizens which is anticipated to offer significant improvements in the quality of life.

A governance system is proposed that will focus on the continuous monitoring, appropriate adaptations and successful implementation of the plan through strong engagement of all stakeholders and especially of the Kozani's citizens.



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Abbreviations and acronyms

The list of abbreviations and acronyms **identifies the abbreviations** (a shortened form of a word used in place of the full word) **and acronyms** (a word formed from the first letters of each of the words in a phrase or name) used in the Action Plan.

Abbreviations and acronyms	Definition
AFOLU	Agricultural, Forestry and Land Use
BECCS	Bioenergy Production Stations with Carbon Capture and Storage System
BEI	Baseline Energy Inventory
CAP	Climate Action Plan
CCC	Climate City Contract
DAC	Direct Air Capture
DH	District Heating
EFE	Local Emissions Factor for Electricity
EU	European Union
GHG	Green House Gases
IPPU	Industrial Process and Product Use
JTDP	Just Transition Development Plan
MoK	Municipality of Kozani
NEEFE	National or European Emissions Factor for Electricity
NECP	National Energy and Climate Plan
PPC	Public Power Corporation
PV	Photovoltaics
RES	Renewable Energy Sources
SECAP	Sustainable Energy and Climate Action Plan
SUMP	Sustainable Urban Mobility Plan
YPEN	Hellenic Ministry of Environment and Energy



Introduction

The introduction should outline the local policy context in which the Action Plan is being developed and describe the gap it is addressing in broad terms.

Introduction - textual element

The Municipality of Kozani (MoK) is a pioneering local authority in environmental and energy management issues and has demonstrated a strong will to dynamically move forward in the field of Renewable Energy Sources (RES) and energy saving policies. By recognising the fact that:

- limiting the pollutants that contribute to the greenhouse effect ensures a cleaner living environment, contributes to improving the quality of life of citizens and creates conditions for economic and cultural development
- saving energy in buildings and in transport guarantees direct financial benefits for the citizens and the release of financial resources for the Municipality
- the promotion of RES contributes to the independence from conventional energy sources.

In 2011 the Municipality of Kozani highlighted environmental awareness as a central priority of its policies by joining the "Covenant of Mayors for Sustainable Energy and Climate" which is the main European movement in which local and regional authorities participate voluntarily committing to undertake initiatives at the level of local communities with the aim of increasing energy efficiency and the use of RES which will lead to the reduction release of pollutants responsible for the greenhouse effect.

The Municipality of Kozani has developed pioneering energy and environmental applications for the country, such as a central district heating system, a waste management and recycling system, a program for installing PV systems in all schools, an energy efficiency programme for replacing all municipal lighting with LED etc. There is also significant activity in a variety of energy saving activities, bioclimatic applications, educational activities etc.

The organisational framework that emerged as a result of the planning and implementation of the measures foreseen in the Sustainable Energy and Climate Action Plan (SECAP), is estimated to have facilitated the more effective use of financial tools and the inclusion of the proposed measures in various financial aid programs, in order to implement targeted actions and projects in line with the central environmental and energy policy of the municipality.

The climate crisis remains the defining challenge of our time and climate change is a serious concern with profound implications for our planet. Kozani acknowledges that cities play a key role in responding to the climate crisis and in achieving climate neutrality.

The Municipality of Kozani has the potential and the Mayor as well as the Municipal Council have the ambition to accelerate the transition of the city to climate neutrality by 2030.



The decision of the Greek Government for decarbonization and for decommissioning of the locally based lignite mines and power plants by 2023 with a simultaneous transition to a greener energy and economy aligns with Kozani's vision for climate neutrality and joins the rapidly growing global community that acknowledges this climate emergency.

The region of Western Macedonia region has a population of total 270,000 people. Its economy is dominated by the lignite mining industry directly employing approximately 5200 people, while many more companies relate their operation on this activity. The Greek Government, in order to be aligned with the global CO₂ mitigation efforts, has entered the lignite phase-out and it is planned to complete it for all operating units, as reflected in the Greek National Energy and Climate Plan (NECP, 2019). Only one lignite-fired powerplant will continue to operate, the Ptolemaida V unit, which is currently in commissioning phase and will burn lignite at the latest until 2028. By 2023 80% of total lignite PPs installed capacity will be decommissioned. An estimated total number of about 16,000 jobs could potentially be affected directly and indirectly by the mines closure.

In order to address the severe socio-economic implications of the rapid lignite phase-out, the Greek Government announced a **Master Plan for the Just Development Transition (JDTP)** in support of the **Regional Operational Program 2021-2027 and the Smart Specialization Strategy for Western Macedonia**.

More financing tools have been recently become available from: a) the **Regional Operational Program 2021-27** and the **Smart Specialization Strategy for WM**, b) the **Green Fund**, c) the **Just Transition Fund (ERDF)**, d) an **InvestEU dedicated scheme**, and e) the **public sector loan facility by the EIB**¹. The development and implementation of the current Climate Action Plan is greatly aligned with the objectives of the aforementioned programs and will be significantly benefitted by the availability of appropriate funding which is specifically targeted to the region of Western Macedonia.

Just Transition Development Plan (JDTP): Kozani, Florina and the Municipality of Megalopolis in Arcadia, belong to the EU regions with the greatest dependence on fossil fuels. These areas face the consequences of the long-term one-dimensional dependence on lignite activity, in contrast and to the detriment of all others, but also the stagnation of previous years in preparing a new, balanced and sustainable development model.

The "Just Transition Development Plan of lignite areas" is based on **five development pillars**, which are as follows: **Clean energy, Industry and trade, Smart agricultural production, Sustainable tourism, Technology and education**. It includes enhanced investment incentives to attract investments, as well as specific land uses for the tens of thousands of acres of land of lignite fields which will be released. The total amount of funding, including the necessary leverage of private resources, is estimated to exceed five (5) billion euros, originated from EU and national resources, with the main vehicle being the new independent Operational Program for the Just Transition of the new NSRF 2021-2027.

¹ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism/just-transition-funding-sources_en



[https://www.sdram.gr/sites/default/files/consultation/Master Plan Public Consultation ENG.pdf](https://www.sdram.gr/sites/default/files/consultation/Master_Plan_Public_Consultation_ENG.pdf)

The NSRF (National Strategic Reference Framework) for the next programming period 2021-2027 has a separate Thematic Objective dedicated to supporting the transition to a low carbon economy in all sectors (TO4). This TO has included programs related to RUE in public buildings such as Operational Program (OP) "Competitiveness, Entrepreneurship and Innovation" (EPANEK), OP "Transport Infrastructure, Environment and Sustainable Development" (YMEPERAA) and the 13 Regional Operational Programs (ROP).

This is the most appropriate time for Kozani to act and maintain its leading role in the emerging green energy sector, as it did for decades produce more than 70% of the country's total electric power, but from fossil fuels (lignite). However, the national policy for a transition to low-carbon economy has a strong negative social impact associated with job losses and income reduction for the area. Facing this challenge, Kozani is determined to take advantage of the move towards a greener future, by utilising the local expertise, the infrastructures and the newly available funding opportunities for the creation new and greener jobs and offering new developmental opportunities for Western Macedonia.

The management of the transition to a climate-neutral community is seen as both a major challenge and an opportunity to build a better future for the city and its citizens considering the associated benefits for citizens such as improved environment quality, healthier lifestyle, more and better jobs.

Citizens will play a pivotal role in driving systemic transformation towards climate neutrality in a participatory process as users, producers, consumers, owners or political actors, together with local stakeholders from academia, the energy sector, mobility, buildings, ICT, agriculture, forestry etc.

Kozani aims to act as a leading city and a paradigm which can inspire the rest of the Greek cities and beyond: if Kozani can do it, other cities can do it as well!

The Mayor and the Municipal council of the city recognize the need to adapt to the national and European plans towards climate neutrality; and, to this end, the Mission team of Kozani has been established to work and guide the city towards this goal. The initial task of the Mission team of Kozani was to respond to the call of the European Mission and was accepted to join the "100 climate neutral and smart cities". According to the Mayor:

"Kozani is going to make a leap into the future, with the help of the Mission of Kozani".

The Mission of Kozani team has been engaged in *networking* with local, regional and national stakeholders using their experience in implementing large scale projects to facilitate decision making and integration and create synergies with policy frameworks.

Kozani believes that the co-creation approach for the transformation of the city 'with the citizens and for the citizens' is the best way forward and a series of citizen engagement



initiatives and events have been organized based on a long-term plan for the participatory process.

Partnerships have been established with other cities, with regions, with the research and business community and other stakeholders, as well as with the wider financial sector, public and private, also through the stakeholder engagement workshops.

These latter, in the form of “Living Labs”, have been held in the last quarter of 2021, focusing on the thematic areas considered as the most important for the city’s Climate Neutrality and Smartness challenge, notably:

- Urban transformation
- Renewable Energy generation
- Management of resources
- Circular economy
- Digital Transformation
- Mobility and transport

Accompanied by the transversal themes of:

- Sustainable entrepreneurship
- Agriculture
- Financing opportunities
- Social resilience

Kozani established a Citizen’s Climate Board to process the results of the citizens’ and stakeholders’ engagement events and relate the ideas to the climate-neutral transformation plan of the city.

The successful work that took place in the first phase of the Mission set the foundations for further activities and awareness raising campaigns with the citizens and for the citizens to co-develop the climate city contract, that will enable the desired transformation. Intensive one-to-one meetings and workshops with key stakeholders were organised to capture and finalise their requirements that are now in the centre of the aforementioned process.

Summarising all the above, it is apparent that the Municipality of Kozani follows a detailed plan to develop an ambitious and at the same time realistic climate city contract, uses the best available practices and expertise that can be mobilised, adopts a participatory approach, putting its citizens and stakeholders in the centre, and strongly commits to become climate neutral by 2030.

The plan for climate neutrality builds on a number of existing strategies and takes into account the benefits in terms of CO₂ emission reductions attributed to these strategies.

The present document of the Climate Action Plan describes in detail the roadmap and all the associated required steps in terms of portfolios of actions and the governance that are crucial



in order to accomplish the set climate neutrality targets. A quantification of the CO₂ emissions that are mitigated through each particular action is carried out at an annual basis in combination with the level of the necessary financial investment is presented.

The evolution of CO₂ emissions, primary energy consumption and investment funding that are associated to the particular actions of the plan are presented until year 2030. The plan is expected to accomplish a total reduction of 80% of CO₂ emissions between 2020 and 2030 and a proposal for addressing the residual emissions is outlined.

The present document is part of the City Climate Contract of Kozani, it was developed in parallel and is directly interlinked with the required Investment Plan and the Commitments documents which are part of the current submission.

The whole effort was substantially enhanced through the intensive and productive collaborative process that was carried out with the NZC Advisors team which was allocated; and, their substantial guidance and support is highly appreciated.



Work Process

This section should list the working steps carried out, for example along the NZC Climate Transition Map, or related steps planned as well as outline timeline and milestones for future iterations for the continuous development of the Action Plan.

Work Process - combination of textual and visual elements

The Municipality of Kozani after its successful selection among the “100 climate neutral and smart cities by 2030” of the relevant EU Mission, has highly prioritised the preparation of its climate city contract and has taken a number of solid actions.

A project management office (PMO) was established and has been led by the Cluster of Bioeconomy and Environment (CluBE) of Western Macedonia. Core members of the PMO are the Mayor’s team, UoWM (the University of Western Macedonia), AUTH (the Aristotle University of Thessaloniki), CERTH (the Center for Research and Technology Hellas) and the company FCNC (financial consultants). Figure 1 below shows the structure of the PMO and all interactions linked to it.

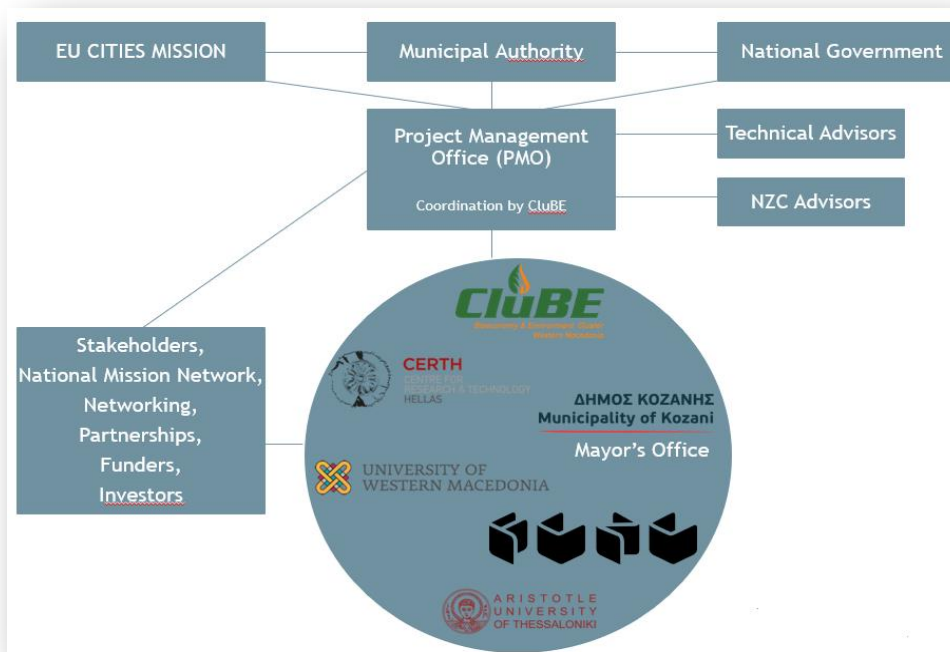


Figure 1: Project Management Office (PMO) Structure

The PMO is responsible for the coordination of the whole process and has internal rules that promote a participatory approach and facilitate the co-development of the climate city contract. As shown in Figure 2, the project has a clear breakdown structure and all partners have specified roles and active contribution.

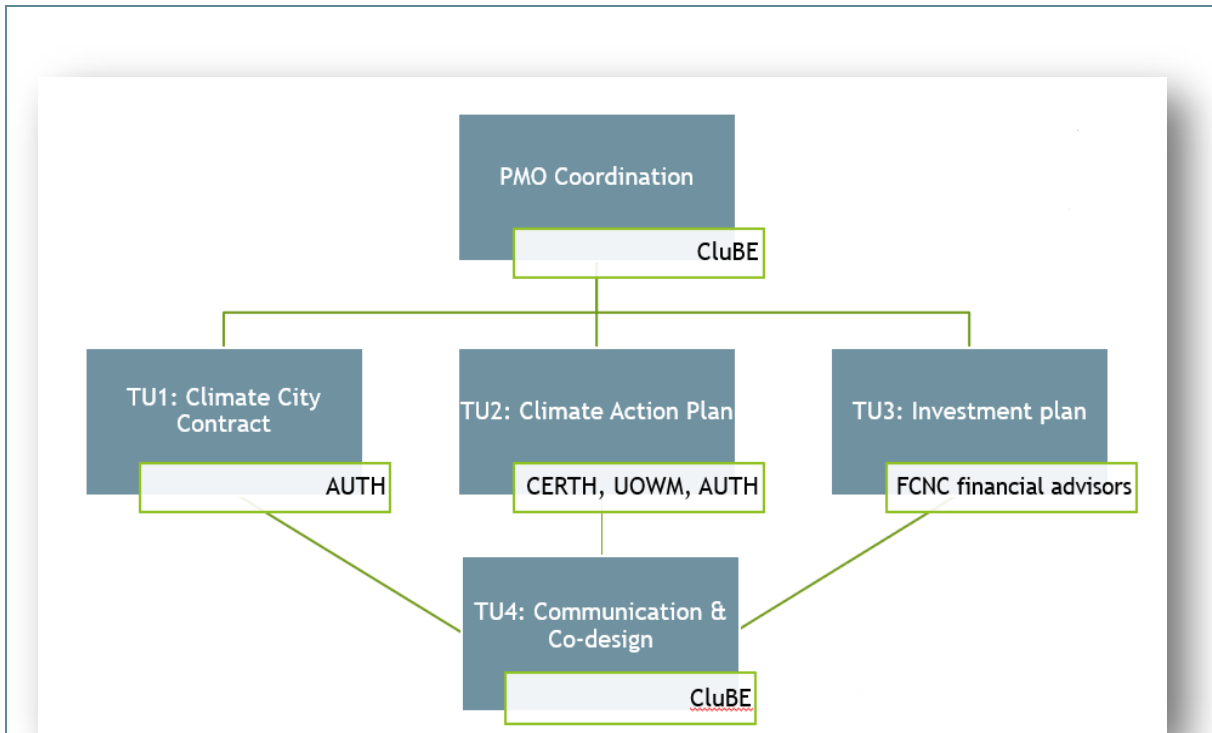


Figure 2: Project Breakdown Structure

The whole team has as a central pillar of its operation the climate transition map and has already organized one-on-one meetings and workshops with key stakeholders and citizens to capture their requirements, build a strong mandate and co-create the portfolio that will enable the desired change.

The project’s KPIs have been defined to facilitate continuous monitoring and a scientific review strategy has been established and adopted to assure that that the project’s goal will finally be met.

The collaborative work has been initiated in 2021 and intensive interaction between the core members followed in order to map and define the details of the current state of the system components that are anticipated to influence the evolution of the climate action plan. The baseline emissions inventory was accurately defined and validated. The submission of Kozani’s SECAP for 2020 was accepted and formed the basis for the development of portfolios of actions in the energy field that would contribute to the Climate Action Plan’s objectives. The core partners worked on the Mobility and Transport portfolios and also the strategic planning related to Waste and Cyclic economy. A continuous process of interactions with stakeholders was followed and various publications were made to the public and to targeted audiences.

Figure 3 illustrates the major steps that were followed for the preparation and the submission of the Climate City Contract.



Figure 3: Evolution of the development of the Climate City Contract



Part A

**Current State
of Climate Action**



Part A – Current State of Climate Action

Part A “Current State of Climate Action” describes the point of departure of the city towards climate neutrality, including commitments and strategies of key local businesses, and informs the subsequent modules and the outlined pathways to accelerated climate action.

Module A-1 Greenhouse Gas Emissions Baseline Inventory

Module A-1 “Greenhouse Gas Emissions Baseline Inventory” should detail and describe the city’s latest GHG inventory to establish the emission baseline and to establish the emissions gap to 2030 climate neutrality according to the inventory specifications defined in the Cities Mission’s *Info Kit for Cities* and the process outlined in the Action Plan Guidance.

A-1.1: Final energy use by source sectors				
Base year	2020			
Unit	MWh/year			
	Scope 1	Scope 2	Scope 3	Total
Buildings				
District Heating	394,910.29	-	Not applicable	394,910.29
Electricity	-	371,567.59		371,567.59
Oil	144,612.98	-		144,612.98
Transport				
Diesel	167,268.91	-	Recommended by 2030	167,268.91
Petrol	102,218.97	-		102,218.97
Biodiesel	8,003.30	-		8,003.30
Electricity	-	*		-
Waste				
(Fuel type/ energy used)	**	Not applicable	***	-
Industrial Process and Product Use (IPPU)				
Electricity	****	Not applicable	Not applicable	-
Agricultural, Forestry and Land Use (AFOLU)				
Electricity	****	Not applicable	Not applicable	-

Notes:



* The Scope 2 emissions due to the use of electricity in transport is negligible due to the very small percentage of electric vehicles (currently less than 5%).

** No waste is managed/sent to landfill within the Municipality boundary.

*** The amount of energy that is used in order to manage waste processing is included under the Buildings and Transport sectors.

**** There are no significant industrial processes within the Municipality boundary. The small industries in Kozani mainly use grid supplied electric energy for machinery, etc. In addition, the agricultural sector primarily uses grid supplied electric energy for pumping and irrigation purposes. Agriculture also uses Diesel for agricultural machinery. Thus, the corresponding energy consumption has been included in Buildings (scope 2) and Transport sectors.

A-1.2: Emission factors applied

* Primary energy calculation is based on the national Regulation for the Energy Performance of Buildings (KENAK - Government Gazette B' 407/09.04.2010) and the Technical Guidelines of the Technical Chamber of Greece (TOTEI 20701-1/2017). KENAK is also used for the CO₂ emissions calculation of the local DH system.

** CO₂ emissions are calculated using the method of IPCC (IPCC 2006, IPCC Guidelines for national greenhouse gas inventories, Prepared by the National Greenhouse Gas Inventories Programme, IGES, Japan.) updated by the JRC (Bastos, Joana; Lo Vullo, Eleonora; Muntean, Marilena; Duerr, Marlene; Kona, Albana; Bertoldi, Paolo (2020): GHG Emission Factors for Electricity Consumption. European Commission, Joint Research Centre [Dataset] PID: <http://data.europa.eu/89h/919df040-0252-4e4e-ad82-c054896e1641>)

Primary energy/energy source *	Carbon Dioxide (CO ₂) **	Methane (CH ₄)	Nitrous Oxide (N ₂ O)	F-gases (hydrofluorocarbons and perfluorocarbons)	Sulphur hexafluoride (SF ₆)	Nitrogen trifluoride (NF ₃)
Electricity	0.775					
Natural gas	0.202					
Diesel oil	0.267					
Petrol	0.249					
LPG	0.227					
Locally produced District Heating	0.347					



A-1.3: Activity by source sectors			
Base year	2020		
	Scope 1	Scope 2	Scope 3
Buildings			
Public buildings – Electricity		x	
Public buildings - District Heating	x		
Public buildings- Oil	x		
Private buildings – electricity		x	
Private buildings – District Heating	x		
Private buildings - Oil	x		
Transport			
Municipal fleet - Petrol	x		
Municipal fleet – Oil	x		
Municipal fleet - Biofuel	x		
Municipal fleet - Electricity		x	
Public transportation – Petrol	x		
Public transportation – Oil	x		
Public transportation - Biofuel	x		
Public transportation - Electricity		x	
Private transportation – Petrol	x		
Private transportation – Oil	x		
Private transportation - Biofuel	x		
Private transportation - Electricity		x	
Waste			
(Activity)	x		x
Industrial Process and Product Use (IPPU)			
Electricity		x	



Agricultural, Forestry and Land Use (AFOLU)			
Electricity		x	
Lighting			
Public lighting		x	
Lighting of streets and squares		x	
Tertiary Sector			
Electricity		x	
District Heating	x		
Oil	x		



A-1.4: GHG emissions by source sectors				
Base year	2020			
Unit	metric tonnes of CO ₂ equivalent/year			
	Scope 1	Scope 2	Scope 3	Total
Buildings (electricity)	-	86,017.87	Not applicable	86,017.87
Buildings (heat)	117,947.07	-		117,947.07
Transport	63,739.38	*	Recommended by 2030	63,739.38
Waste	**	Not applicable		3,375.00***
Industrial Process and Product Use (IPPU)	****	Not applicable	Not applicable	-
Agricultural, Forestry and Land Use (AFOLU)	****	Not applicable	Not applicable	-
Total	181,686.45	86,017.87	3,375.00	271,079.33

Notes:

* Negligible due to the very small percentage of electric vehicles (currently less than 5%).

** No waste is managed/sent to landfill within the Municipality boundary.

*** Estimation of emissions in tonnes of CO₂ equivalent/year from solid waste disposal sites (corresponds to 0.1350 tonnes CH₄/year). There is an ongoing measurement campaign for the estimation of emissions from wastewater handling. Since the results need to be evaluated and further processing, they are not included here. However, they will be monitored, assessed and discussed in future reports.

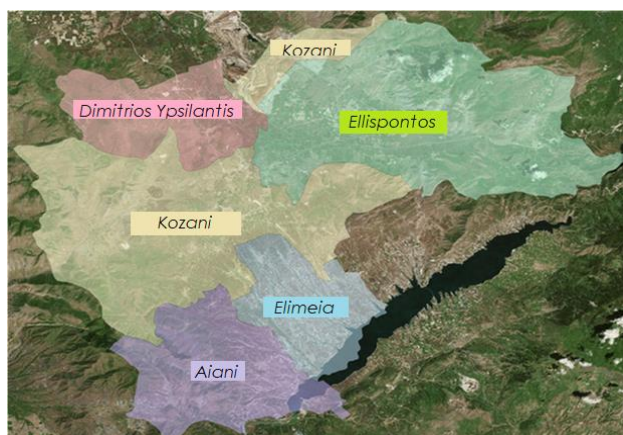
**** There are no significant industrial processes within the Municipality boundary. The small industries in Kozani mainly use grid supplied electric energy for machinery, etc. Also, the agriculture sector primarily uses grid supplied electric energy for pumping and irrigation purposes. Agriculture also uses Diesel for agricultural machinery. Thus, the CO₂ attributed to AFOLU and IPPU is included in Buildings (scope 2) and Transport sectors.



A-1.5: Graphics and charts



(a)



(b)

**Figure 4: a. Western Macedonia and Municipality of Kozani location in Greece
b. Municipal Units of the Municipality of Kozani**

Table 1: Population of the Municipal Units of Kozani

Municipal Unit	Population
Kozani	53,880
Aiani	3,429
Dimitrios Ypsilantis	2,335
Elimeia	5,910
Ellispontos	5,834
Total	71,388



Table 2: Primary energy consumption and CO₂ emissions per sector for the year 2010
(Source : SECAP of Kozani)

Source sector	Energy consumption [MWh]	Primary energy consumption [MWh]	Emissions [tn CO ₂ /year]
Buildings			
Municipal buildings (electricity)	1,954.00	5,666.60	1,514.35
Municipal buildings (District Heating)	9,576.98	6,703.89	3,323.21
Municipal buildings (heating oil)	3,768.29	4,145.12	1,006.13
Residential buildings (electricity)	89,902.69	260,717.80	69,674.58
Residential buildings (District Heating)	213,814.12	149,669.88	74,193.50
Residential buildings (heating oil)	144,119.88	158,531.87	38,480.01
Lighting			
Public lighting	3,367.40	9,765.45	2,609.73
Lighting of streets & squares	4,458.33	12,929.15	3,455.20
Transportation			
Municipal fleet (petrol)	430.50	473.55	107.19
Municipal fleet (diesel)	2,448.39	2,693.23	653.72
Municipal fleet (biodiesel)	128.86	128.86	0.00
Public transport (petrol)	0.00	0.00	0.00
Public transport (diesel)	13,605.90	14,966.49	3,632.78
Public transport (biodiesel)	716.10	716.10	0.00
Private transport (petrol)	95,726.00	105,298.60	23,835.77
Private transport (diesel)	140,360.60	154,396.66	37,476.28
Private transport (biodiesel)	7,387.40	7,387.40	0.00
Tertiary sector			
Tertiary sector buildings (electricity)	73,173.83	212,204.11	56,709.72
Tertiary sector buildings (District Heating)	40,726.50	28,508.55	14,132.10
Tertiary sector buildings (heating oil)	152,288.40	167,517.24	40,661.00
Agriculture			
Agriculture (electricity)	14,309.76	41,498.30	11,090.06
Industry			
Industry (electricity)	15,247.25	44,217.03	11,816.62
Total	1,027,511.17	1,388,135.87	394,371.97
Total per capita	14.39	19.44	5.52



Table 3: Primary energy consumption and CO₂ emissions per sector for the year 2020

Source sector	Energy consumption [MWh]	Primary energy consumption [MWh]	Emissions [tn CO ₂ /year]
Buildings			
Municipal buildings (electricity)	3,192.40	9,257.96	1,251.42
Municipal buildings (District Heating)	6,451.96	4,516.37	2,238.83
Municipal buildings (heating oil)	2,206.15	2,426.77	589.04
Residential buildings (electricity)	90,776.50	263,251.85	35,584.39
Residential buildings (District Heating)	194,457.90	136,120.53	67,476.89
Residential buildings (heating oil)	60,942.37	67,036.61	16,271.61
Lighting			
Public lighting			
Lighting of streets & squares	4,092.90	11,869.41	1,604.42
Transportation			
Municipal fleet (petrol)	175.25	192.77	43.64
Municipal fleet (diesel)	2,458.18	2,704.00	656.33
Municipal fleet (biodiesel)	129.38	129.38	0.00
Public transport (petrol)	0.00	0.00	0.00
Public transport (diesel)	13,605.90	14,966.49	3,632.78
Public transport (biodiesel)	716.10	716.10	0.00
Private transport (petrol)	92,751.09	102,026.20	23,095.02
Private transport (diesel)	135,998.56	149,598.42	36,311.62
Private transport (biodiesel)	7,157.82	7,157.82	0.00
Tertiary sector			
Tertiary sector buildings (electricity)	87,680.48	254,273.39	34,370.75
Tertiary sector buildings (District Heating)	37,880.40	26,516.28	13,144.50
Tertiary sector buildings (heating oil)	68,262.92	75,089.21	18,226.20
Agriculture			
Agriculture (electricity)	10,524.20	30,520.18	4,125.49
Industry			
Industry (electricity)	10,397.21	30,151.91	4,075.71
Total	829,857.67	1,188,521.64	262,698.64
Total per capita	11.62	16.65	3.68

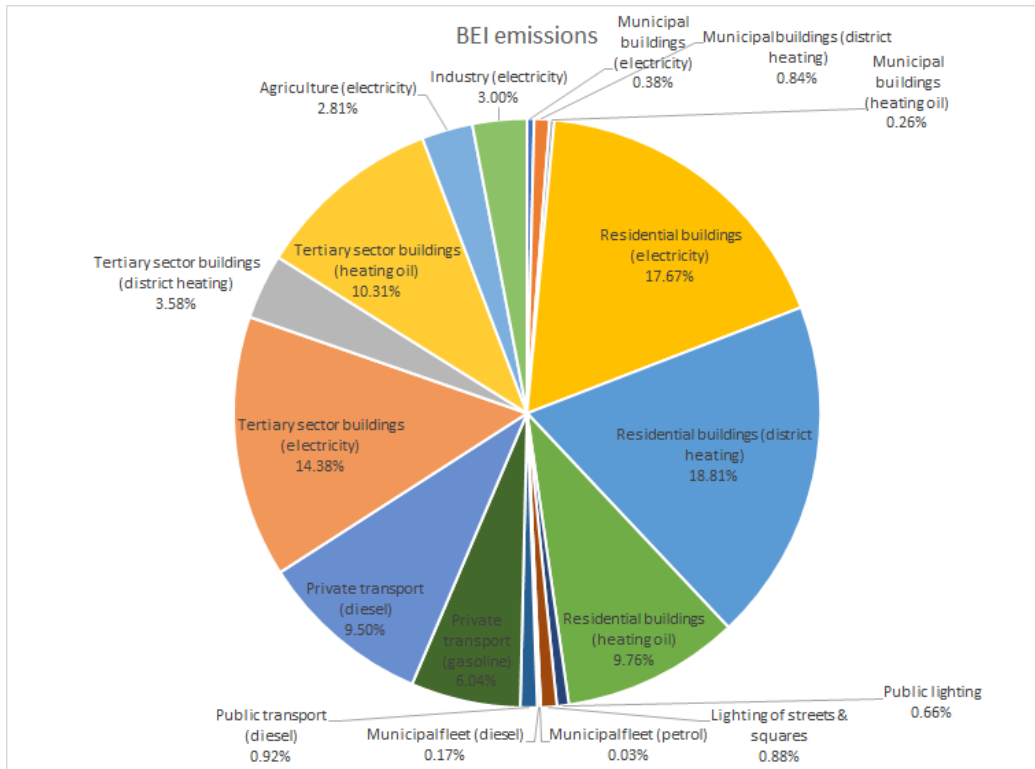


Figure 5: Contribution of each sector to the total CO₂ emissions from the Municipality of Kozani for the year 2010

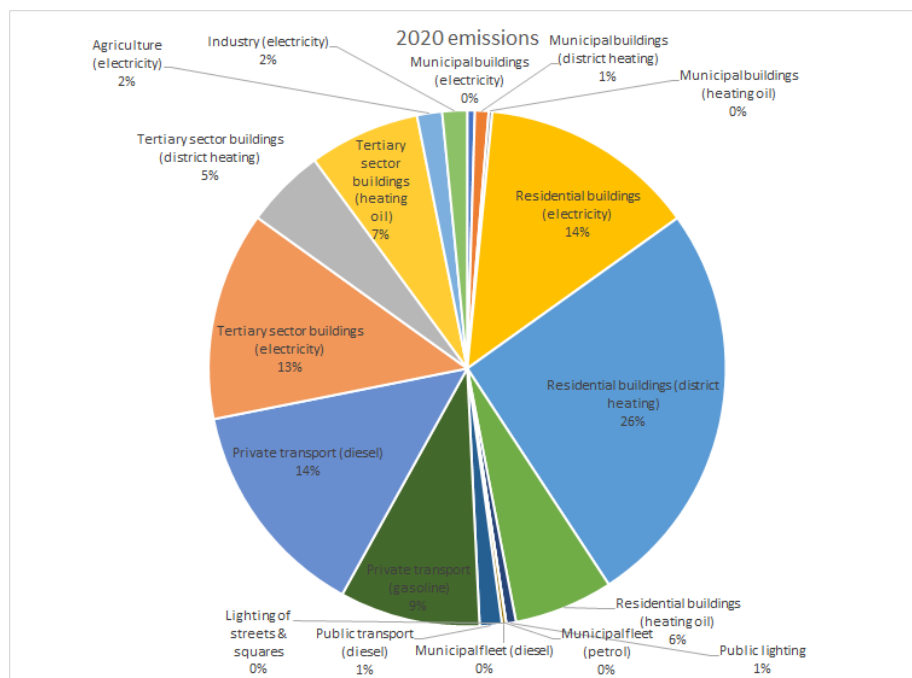


Figure 6: Contribution of each sector to the total CO₂ emissions from the Municipality of Kozani for the year 2020

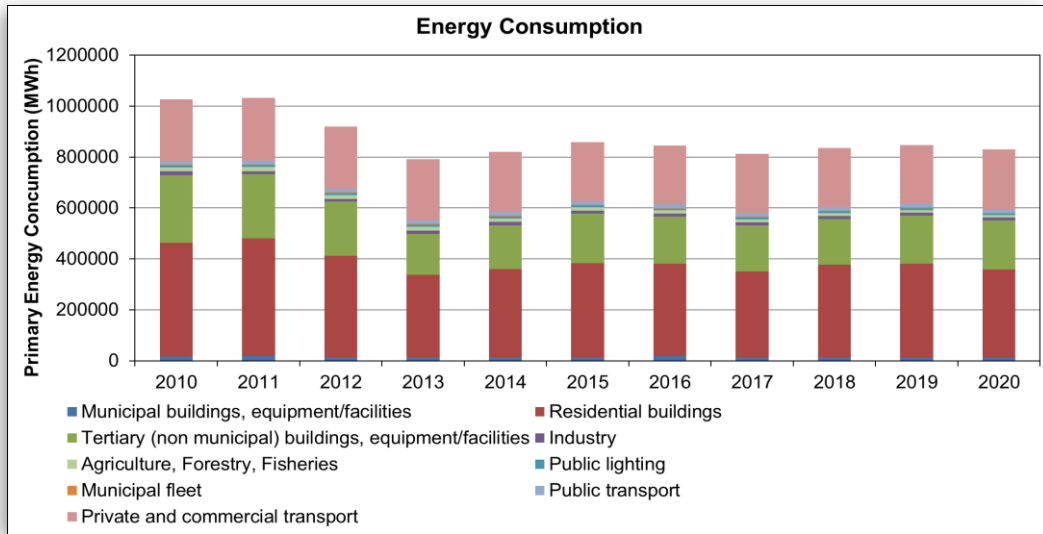


Figure 7: Evolution of primary energy consumption for each sector between 2010 and 2020

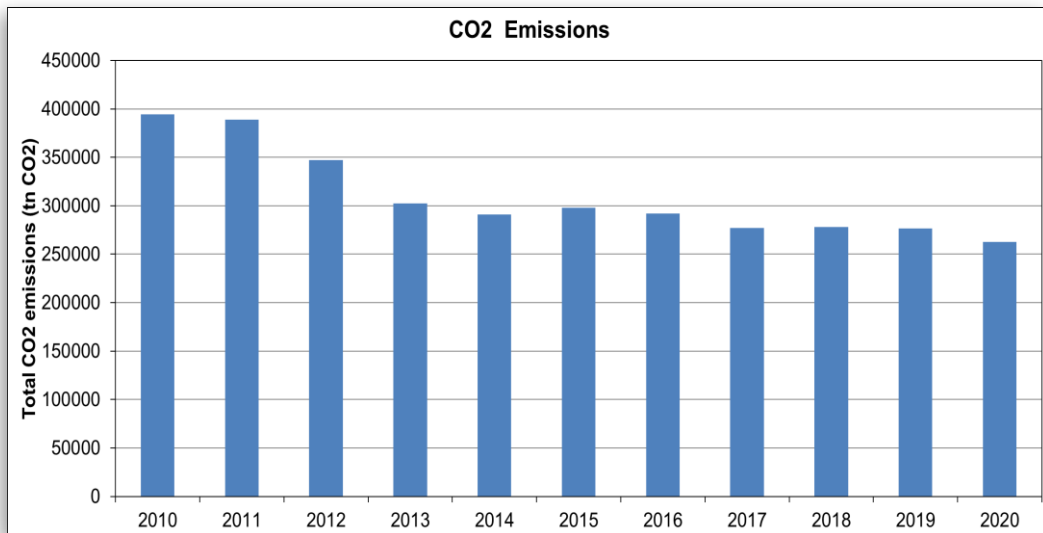


Figure 8: Evolution of CO₂ emissions between 2010 and 2020

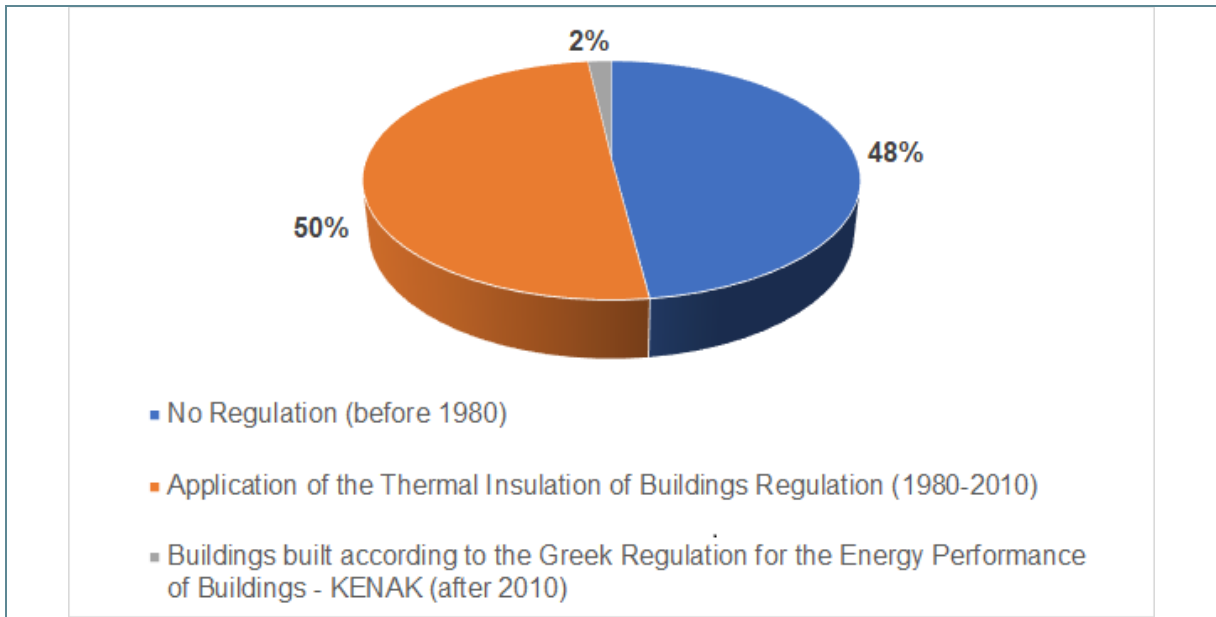


Figure 9. Thermal insulation adequacy of buildings of the Municipality of Kozani based on their year of construction.

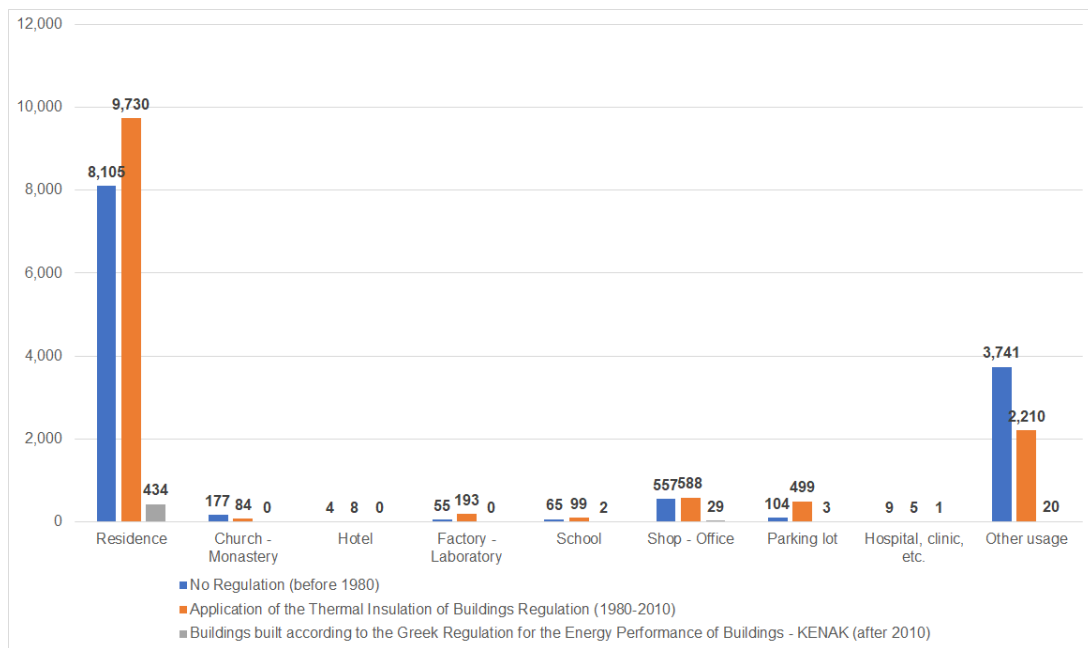


Figure 10: Buildings in the Municipality of Kozani according to their type and age

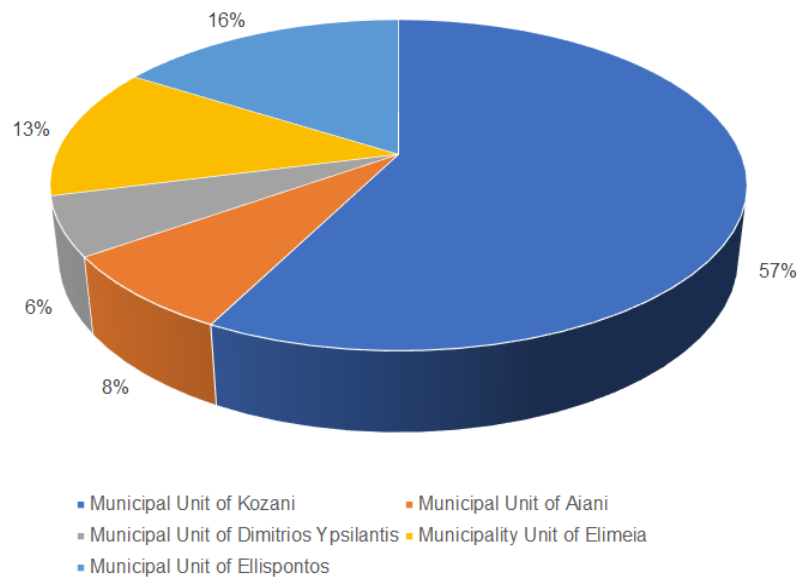


Figure 11: Distribution of the residences of the MoK by Municipal Unit

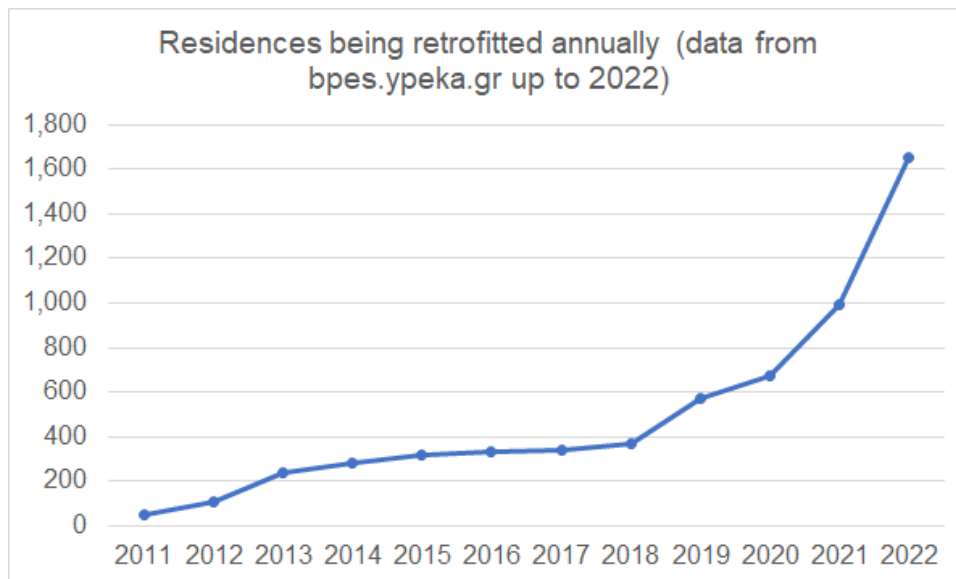


Figure 12: Cumulative number of buildings retrofitted through the implementation of national energy savings programs in MoK (2011 – 2022)

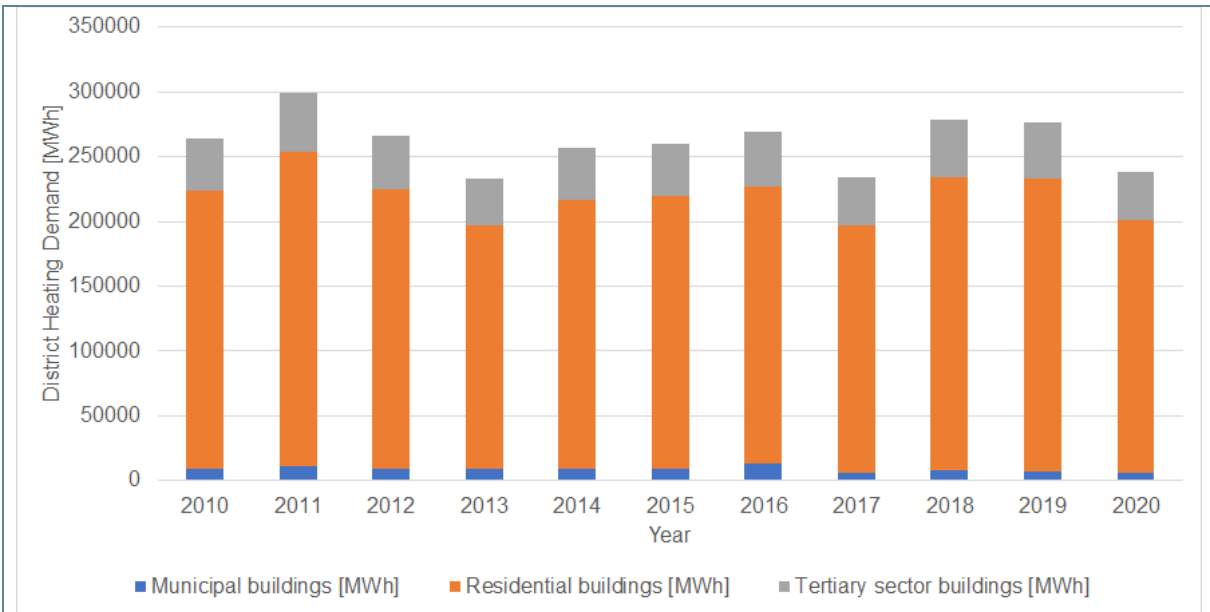


Figure 13: Evolution of District Heating consumption from buildings in MoK between 2010 and 2020

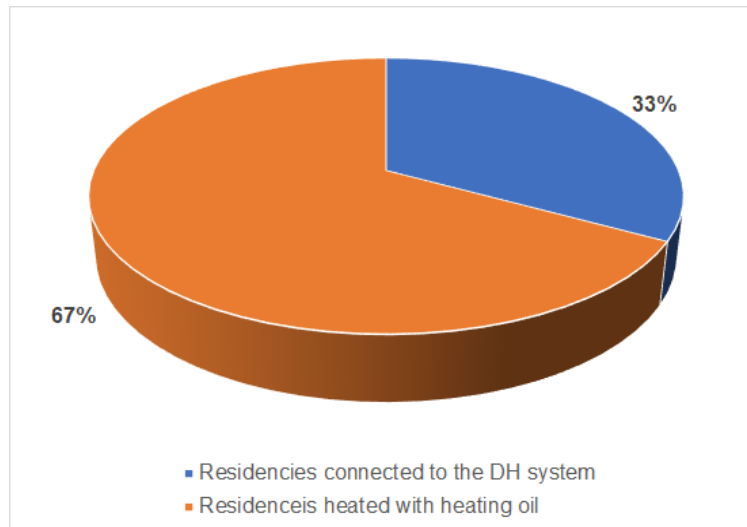


Figure 14: Distribution of residences based on their heating energy source

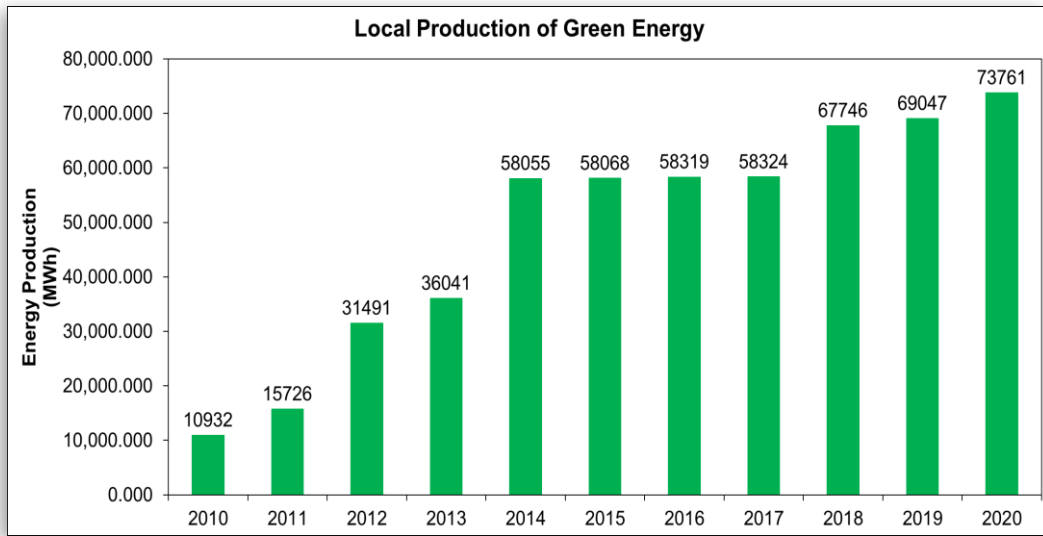


Figure 15: Time-evolution of green energy production between 2010 and 2020

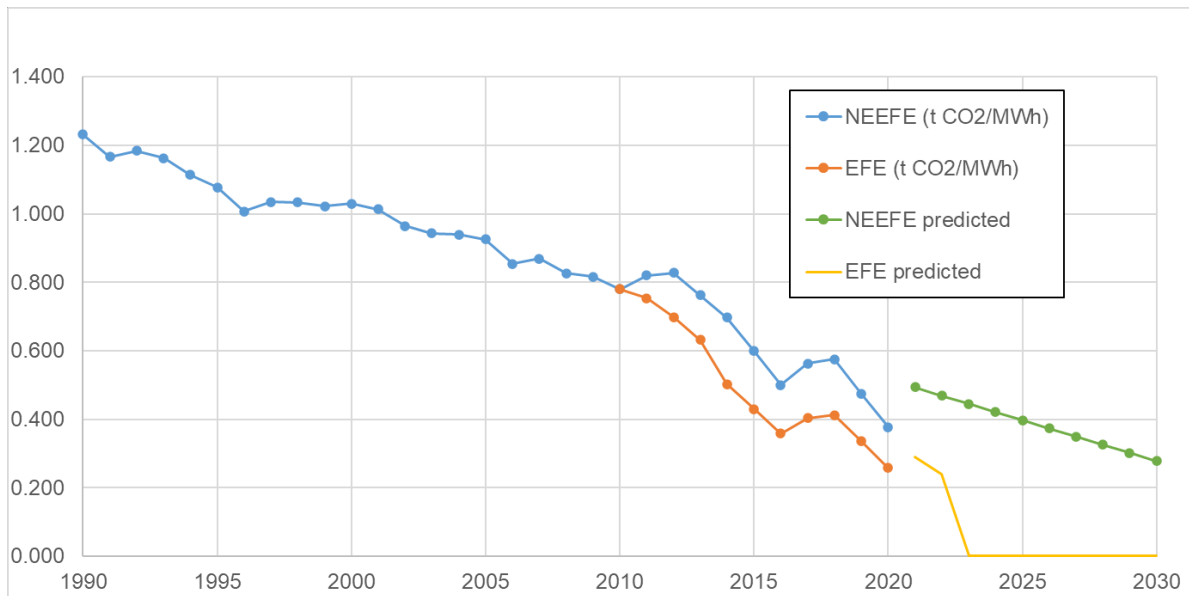


Figure 16: Time-evolution of NEEFE, EFE and predictions based on the existing data (*JRC <http://data.europa.eu/89h/jrc-com-ef-comw-ef-2017>)



A-1.6: Description and assessment of GHG baseline inventory

The Municipality of Kozani belongs to the Region of Western Macedonia which was established in 2011 with the Law 3852/2010 "Kallikratis" Program (Government Gazette A' 87/07.06.2010) through the merging of the pre-existing Municipalities of Aiani, Dimitrios Ypsilantis, Elimia, Ellispontos and Kozani. The municipality of Kozani has as its natural borders the mountain range of Vermio from the East, Mount Burinos from the West, Mount Siniaciko and the heights of Komanos to the north and the artificial Lake Polyphytos to the south.

The capital of the MoK is the city of Kozani, its largest city, which is also the administrative centre of the Region of Western Macedonia. The historical headquarters of the MoK is Aiani, which is built near the site of the ancient city of the same name. The total area of the Municipality amounts to 1,071 km² while its permanent population is 71,388 inhabitants according to the 2011 census.

The Baseline Emissions Inventory (BEI) according to the SECAP of MoK, attributes energy consumption and CO₂ emissions to the following sectors: a) buildings, b) lighting, v) transportation, d) tertiary sector, e) agriculture and f) industry. A summary of the primary energy consumption and emissions per sector is presented in Figures 5 and 6 above.

Figure 5 presents the total CO₂ emissions from the Municipality of Kozani for the year 2010 and Figure 6 presents the emissions for the year 2020 (baseline year for SECAP). The total energy consumption for the Municipality of Kozani in the year 2010 was calculated to be equal to **1,027,511.17MWh** and the corresponding emissions were estimated at **394,371.97 tonnes CO₂**. In year 2020 the energy consumption was reduced to **829.857,67MWh** and the estimated emissions were equivalently reduced to **262,698.64 tonnes CO₂**. Summary of energy consumption data attributed to each activity within the boundaries of the Municipality is presented in detail in Tables 2 and 3 above.

The private sector plays a major role in energy consumption and CO₂ emissions. Especially in the building sector, the estimated energy consumption by the private sector is to a very large extent much greater than the corresponding consumptions by the Municipal sector.

If the overall data of Tables 2 and 3 are divided by the population size, then the Municipality of Kozani with 71,388 inhabitants (ELSTAT, 2011) shows energy consumption per inhabitant equal to **14.39 MWh/inhabitant** and emissions equal to **5.52 tnCO₂/inhabitant per year**. In 2020 those values were reduced to **11.62 MWh / inhabitant** and **3.68 tonnes CO₂ / inhabitant per year**.



YEAR	TOTAL ANNUAL ENERGY CONSUMPTION	TOTAL ANNUAL CO ₂ EMISSIONS
2010	1,027,511 MWh	394,371 tones CO ₂
2020	829,857 MWh	262,698 tones CO ₂

YEAR	ANNUAL ENERGY CONSUMPTION PER CAPITA	ANNUAL CO ₂ EMISSIONS PER CAPITA
2010	14.39 MWh	5.52 tones CO ₂
2020	11.62 MWh	3.68 tones CO ₂

Figure 17: Primary energy consumption between 2010 and 2020

Figure 7 illustrates the time evolution of primary energy consumption between 2010 and 2020 and the contribution of each sector, while Figure 8 shows the corresponding CO₂ emissions.

It is clear that the major energy consumer and source of CO₂ emissions is the buildings sector and mainly the private residences. Buildings in MoK were mainly built either during the period 1980-2010 where the Thermal Insulation of Buildings Regulation was applied; or, before 1980 there were no obligations to insulate buildings. However, in 2010 the Regulation for the Energy Performance of Buildings (known as KENAK) has been introduced where new buildings not only have to be insulated but also to account for their energy efficiency.

While only a small number of buildings was built after 2010 in MoK, since 2011 the Ministry of Environment and Energy has implemented a number of energy savings programs for residences. The purpose of these programs has been to retrofit existing buildings to achieve high energy efficiency (low energy consumption and low emissions). A total of 18,269 residences exists in the Municipality of Kozani. Their distribution in the five Municipal Units is described in Figure 11.

Although these energy savings programs had a small impact in the first years of their implementation in the Municipality of Kozani, however since 2020 a significant number of buildings were retrofitted, 657 residences in 2022 out of 1651 in total, which accounts for about 9% of the total households in MoK.

The energy consumption for the residencies consists of their electric energy consumption (~20%) and their heating energy consumption (~80%). The city of Kozani and the communities of Nea Haravgi and ZEP use at a very high percentage (~99%), heating energy provided by the Municipal District Heating Company. The District Heating system distributes thermal energy which is produced by the locally based powerplant of St Demetrios which belongs to the Public Power Corporation (PPC) and utilizes lignite. However, in areas which do not have access to the District Heating system, the main fuel is diesel oil. Biomass fuels such as wood and pellets are also used at a much lower percentage.



The current situation is unsustainable as the costs for the lignite-associated CO₂ emissions are extremely high and also the St Demetrios powerplant will cease its operation in 2025 according to the National Energy and Environment Plan. Consequently, an urgent action is required in order to find alternative source of thermal energy. This is a major challenge for the Municipality of Kozani, but it is seen as a major opportunity because a centrally managed action of reducing the carbon footprint of the District Heating system in Kozani would have a major impact leading to a drastic reduction of the emissions related to heating and will help to accomplish the 100% target set by MoK. On the other hand, residences, the major energy consumer need to be shielded against energy losses. This can be achieved through an appropriately designed, funded and implemented energy retrofiting plan. These actions should be prioritised in the residences of MoK that are not connected to the District Heating system since their impact is even higher.

At the same time, numerous new renewable energy installations, as it is depicted in Figure 15, mainly photovoltaics, connect to the electrical system and contribute towards the reduction of the local emissions coefficient of electricity (Figure 16). NEEFE is the national emission factor for electricity based on data from the CoM Default Emission Factors for the Member States of the European Union - Version 2017, (JRC: <http://data.europa.eu/89h/jrc-com-ef-comw-ef-2017>). EFE is the local emissions factor for electricity and is calculated based on the current local (MoK limits) green energy production (data obtained by the RAE the Regulatory Authority for Energy).

The emissions gap, defined as the amount and type of emissions to be addressed by the Action Plan, is composed of the emissions baseline minus the residual emissions being offset minus the emission reductions already planned. The emission reductions planned in existing action planning and strategies equals 37,913.96 tonnes CO₂ or about 14% of the baseline emissions. The total emissions gap to be addressed by this Action Plan is 217,670.88 tonnes CO₂. Residual emissions in this Action Plan amount of about 6%. These emissions can not be reduced through actions and have to be offset. Planting trees is important in fighting the climate change. The Municipality of Kozani planted about 3205 trees within its administrative boundaries which are estimated to capture 5,000 to 10,000 tonnes of CO₂ annually.

While this inventory focuses on the CO₂ emissions, other pollutants are planned to be accurately quantified, assessed, and addressed with appropriate actions through the dynamic implementation of the Climate Action Plan. The more significant GHG that are going to be quantified and assessed are Methane (CH₄) and Nitrous Oxide (N₂O). A thorough Inventory will be developed as a priority action and monitoring, and assessment will be included in future progress reports during the implementation of this plan.

Methane contributes to climate change due to its positive radiative forcing effect and is considered to be the second most significant greenhouse gas after CO₂. The major emitting sources are enteric fermentation, landfilling of wastes, coal extraction and leakage from the coal, gas and oil distribution system. Emissions from landfilled waste in Kozani are very limited and they are calculated to about 0.1350 tonnes CH₄ for the baseline year 2020. They are accounted as their equivalent in CO₂ (approximately 3,375 tonnes CO_{2,eq}) which is added to



the total CO₂ emissions and they are proposed to be addressed with actions of this plan. In addition, Methane emissions from wastewater handling for 2020 are currently estimated to be about 8,380 tonnes of CH₄. Emissions from agriculture have not been calculated at this stage. However, it is planned to carry out a detailed study on the livestock numbers and their contribution to CH₄ production. Coal extraction has been drastically reduced in the region of Western Macedonia during the last decade. Moreover, no coal-mining activity is currently present within the boundaries of the Municipality of Kozani that could contribute to CH₄ emissions. There is also no coal, gas or oil distribution network within the boundaries of MoK as the major source of heating is DH, oil carried by small tank trucks and wood.

Nitrous oxide (N₂O) contributes to climate change due to its positive radiative forcing effect, and the gas has a relatively high global warming potential. The agriculture sector dominates emissions of N₂O while other important sources are road transport, combustion sources and waste processes. There are no previous studies on the N₂O production within MoK. There is an estimation for the emissions from wastewater handling for 2020 according to which 1,105 tonnes N₂O are emitted annually. DEYAK and MoK plan further actions to reduce this contribution to the GHG emissions. Appropriate studies on the contribution of transportation and land use are planned to be carried out in order to provide the data required to assess N₂O contribution to the emissions inventory of Kozani.

Despite of their high Global Warming Potentials hydrofluorocarbons, perfluorocarbons, Sulphur hexafluoride (SF₆) and Nitrogen trifluoride (NF₃) also known as the F-gases, are expected to have a significantly smaller contribution to the GHG emissions in Kozani, due to the limited existing activities that contribute towards their formation. However, they will be included when appropriate studies will be conducted during the implementation of the Climate Action Plan.



Module A-2 Current Policies and Strategies Assessment

Module A-2 “Current Policies and Strategies” should list relevant policies, strategies, initiatives or regulation from local, regional and national level, relevant to the city’s climate neutrality transition.

A-2.1: List of relevant policies, strategies & regulations					
Type (regulation/ policy/ strategy/ action plan)	Level (local, regional, national, EU)	Name & Title (Name of policy/ strategy/ plans)	Description (Description of policy/ strategy/ plans)	Relevance (Describe relevance/ impact on climate neutrality ambition)	Need for action (list any suggested action in relation – to be further picked in Module C-1)
Strategy	EU	European Green Deal	A strategy to transform the EU into a modern, resource-efficient and competitive economy by 2050	Includes guidelines to effectively reduce GHG emissions by 2050, while ensuring economic growth decoupled from resource use	
Strategy	EU	Biodiversity Strategy for 2030: Bringing nature back into our lives	The biodiversity strategy aims to put Europe’s biodiversity on the path to recovery by 2030 for the benefit of people, climate and the planet.	Through concrete commitments and actions, the plan is for EU countries to put in place effective restoration measures to restore degraded ecosystems, in particular those with the most potential to capture and store carbon and to prevent and reduce the impact of natural disasters.	
Action plan	National	Action Plan for addressing energy poverty	A plan to address energy poverty	Includes economic, social and technical measures to protect energy consumers to address energy poverty	-
Action plan	National	Just Transition Development Plan (JTDP)	A road map for the restructuring of the production pattern of the transition regions (Kozani, Florina and the Municipality of Megalopolis in Arcadia)	Includes actions related to clean energy, industry and commerce, smart agricultural production, sustainable tourism as well as technology and education	-
Action plan	National	National Energy and Climate Plan (NECP)	The national road map for the achievement of the European Energy and Climate Goals by the year 2030.	Presents and analyses priorities and policy measures in a wide range of development and economic activities	



				for the benefit of Greek society	
Action plan	National	National Waste Management Plan	The plan defines the policy, strategies, axes as well as the qualitative and quantitative objectives of waste management and their individual streams, while setting the axes of actions and re-measures to achieve the objectives set by both national and EU legislation for waste management	Sets goals compatible with goals of EU directives. for sorting at source, which are also the objectives of the circular economy package directives, and in particular the achievement of increasing the preparation for re-use and recycling of Municipal Solid Waste (MSW) to at least 55% by weight by 2025 and 60% by weight by 2030	-
Law	National	Promotion of electric mobility	A Law that sets the framework for electric mobility	Sets the regulatory framework for electric mobility and the development of recharging infrastructures	-
Strategy	National	National Technology Promotion Strategy – Applications of Hydrogen and Renewable Gases	A road map for the inclusion of Hydrogen and Renewable Gases	Sets targets for the inclusion of Hydrogen and other Renewable Gases and energy production based on them for the next 30 years	
Strategy	National	The Just Transition Mechanism	The Just Transition Mechanism is a key tool to ensure that the transition towards a climate-neutral economy happens in a fair way, leaving no one behind	It provides targeted support to help mobilise around €55 billion over the period 2021-2027 in the most affected regions, to alleviate the socio-economic impact of the transition	-
Action plan	National	Greece 2.0	The plan aspires to lead the economy, institutions and society, towards a more extroverted, competitive and green economic model, matched with a more efficient, less bureaucratic, digitalised state, a more growth-friendly tax system, a dramatically reduced informal economy, and a strong, resilient and	Proposes reforms and investments based on Green transition, Digital Transformation, employment, skills & social cohesion and private investments & transformation of the economy	-



			inclusive social safety net		
Strategy	National	Greek Digital Strategy	A strategy that outlines the principles and framework that the government will use to facilitate the digitization of Greek's society and economy	The plan consists of 450 projects supported by the EU Recovery Fund, to speed up the digitization of the public and private sectors and boost Greece's digital readiness	-
Action plan	National	Circular Economy Action Plan	A four-year road map (2021-2025) to make the country's economy sustainable and at the same time competitive	The actions cover the entire value chain of basic products, which are time compatible with the corresponding initiatives of the European Commission for the period 2021-2025, and have default implementers	-
Action plan	National	Action Plan for Green Public Procurement	The overall objective of the policy is to promote environmental protection and advance sustainable development in the society. The specific aims of this policy are to ingrate environmental considerations at all levels of public procurement programs both products, services and work.	According to the approach adopted, Green Public Procurement is at the crossroads of the National Strategy for Public Procurement, the National Strategy for the Circular Economy and the National Action Plan for energy saving-energy upgrading of public buildings.	
Action plan	Regional	Regional Plan for Adaptation to Climate Change (PESPKA) of Western Macedonia	This regional action plan assesses the expected impacts of the Climate Change in Western Macedonia and thus in Kozani	The plan proposes several adaptation actions related to water resources, built environment, infrastructures, agriculture & livestock, land & riparian zones, biodiversity & ecosystems, forestry, anergy, mining industry, fisheries & aquaculture, culture, health, tourism and insurance sector	-
Strategy	Regional	A Road Map for a Managed Transition of Coal-Dependent	A Road Map for a Managed Transition of Coal-Dependent	Proposes a transition pathway consisting of a quickly shifting set of	-



		Regions in Western Macedonia	Regions in Western Macedonia	economics within the global energy sector, where cleaner energy and digital technologies are eroding the commercial viability of coal. In most instances, this is occurring regardless of low-carbon energy policies being in place	
Action plan	Local	Sustainable Energy and Climate Action Plan (SECAP)	Plan to reduce energy consumption and pollution on the boundaries of MOK while addressing climate change	Includes actions to mitigate the CO ₂ emissions and adapt to climate change	A steering committee consisting of the MoK and stakeholders monitors and evaluates the actions
Action plan	Local	Sustainable Urban Mobility Plan (SUMP) of the Municipality of Kozani	Plan to reduce energy consumption and pollution related to transportation while ensuring functionality of the transportation system	Includes actions to mitigate the CO ₂ emissions	The changes on the fleet used in MoK and the citizens' behaviour need to be monitored and their effect on emissions must be evaluated
Action plan	Local	Circular Economy Strategic Action Plan of the Municipality of Kozani	Plan to map the sustainable interventions to promote the Circular Economy and the synthesis of circular applications, which will bring economic, social and environmental benefits	Includes actions to mitigate GHG emissions, environmental actions, actions to maintain and increase employment and actions for the green entrepreneurship	The implementation of the actions should be monitored, and their results should be quantified
Action plan	Local	Local Waste Management Plan 2021-2025 of the Municipality of Kozani			The implementation of the actions should be monitored, and their results should be quantified
Strategy	Local	Digital Transformation Strategy "Kozani-Smart City" of the Municipality of Kozani	A plan for the digitization of Kozani	Digital solutions can be used to address environmental and climate issues	The implementation of the actions should be monitored, and their results should be quantified



A-2.2: Description & assessment of policies

The CO₂ emissions in the City of Kozani have been reduced by approximately over 30% between 2010 – 2020, as compared to the baseline year of 2010. The largest reduction appears in the residential and tertiary sector.

This is a result of the City's policies so far, coupled with a number of external reasons, such as the economic crisis in the country which caused a general reduction in energy consumption, the decommissioning of lignite power plants and national initiatives (Save Energy at Home) supporting energy retrofitting for public and private buildings. The local policies are aligned to the national and European legislative and regulatory framework. However, the apparent negative consequences of the gradual reduced participation of lignite in the national energy mix and the corresponding downsizing of the local mining activities during the last decade, had a considerable impact on the local economy causing high unemployment rates. This impact was magnified by the current urgency to decarbonise the power generation, and has alerted the municipality authorities to undertake early action towards a more sustainable development plan and a transformation to an economy that could utilise the existing expertise and infrastructure on power generation, towards renewable energy and energy savings activities. For this reason, some of the initiatives were pioneering for the country.

To achieve decarbonisation and deliver the EGD's goals at the lowest possible cost, it is necessary to break the silos in which energy generating and consuming sectors currently operate; bringing together the electricity and heating sectors on the energy supply side and linking them with major energy consumption sectors on the demand side. The recent technological developments (e.g., novel heat generation technologies, rapid innovation on storage devices, digitalisation, demand response schemes, building integrated energy systems, decreasing prices of RE generation systems, integrated digital twin solutions) in parallel with the EU's ambitious new growth strategy that places energy efficiency, sector coupling and renewability at the forefront of sustainable development (reflected in relevant initiatives, strategic documents and financial frameworks such as the REPower EU, Clean Energy Package, the Fit for 55, the 2021-2027 long-term Horizon Europe budget, NextGenerationEU), can set off large-scale demonstrations offering a great opportunity to make the integration of RES production and storage, while coupling multi-vector carriers a win-win scenario towards achieving climate neutrality and equitable economic recovery.

A major asset of the municipality is the presence of the local University of Western Macedonia, which was founded during the last decade, and which provides higher education degrees related on energy, environment, information technology, management, regional development etc; and the University Departments carry out research and development work on the above subjects interacting with the national and European academic network and transferring knowledge and best practices locally. In addition, two more important institutions for the area of innovation are the following: i) CERTH, the Centre for Research and Technology Hellas, which develops breakthrough innovations through its Research Institutions in the fields of energy, transport, ICT, etc and ii) CLUBE, the Cluster of Bioeconomy and Environment of Western Macedonia, which includes as its members an important number of key stakeholders



of the Region including all Regional Municipalities and secures their interaction, mainly through planning and implementing innovative projects and policies, especially at EU level.

Local strategies

In addition, the following local and regional strategies of the Municipality of Kozani, contribute to gradually carbon neutrality of Kozani namely:

- The Sustainable Energy and Climate Action Plan (SECAP) of the Municipality of Kozani,
- Circular Economy Strategic Action Plan of the Municipality of Kozani,
- Local Waste Management Plan 2021-2025 of the Municipality of Kozani,
- Digital Transformation Strategy "Kozani-Smart City" of the Municipality of Kozani (2020),
- The Business Plan for the Sustainable Urban Development Strategy 2017 – 2023,
- The Sustainable Urban Mobility Plan (SUMP) of the Municipality of Kozani (2019),
- Municipality's Gender Equality Plan.
- Moreover, pilot's inclusive character is in line with Municipality's Gender Equality Plan, as well as other initiatives with similar provisions (i.e., New European Bauhaus).

The development and implementation of the above local strategies over the previous years, has been a major asset for Kozani which cultivated the conditions for the next major step which is the climate neutrality by 2030. All of the aforementioned local strategies, each at different level, were taken into account and contributed towards the development of the CAP. On the other hand, the very demanding requirements of the CAP imposes considerable pressure for the amendment and refinement of the local strategies and the setting of more ambitious targets. The most important influence on the CAP was originated by the SECAP. The rigorous development and evolution of the SECAP during the past decade allowed a very good understanding of the various contributors of GHG emissions; and also a detailed planning of actions that could reduce them. The process of developing the CAP inevitably focused on the particulars of each individual strategy in order to achieve the best possible alignment and compliance and at the same time identified issues that can be amended in the individual strategies in order to enhance their impact on the targets of the CAP.



Figure 18: CCC's alignment with local and regional strategies

National policies

- National Energy and Climate Plan (NECP) (<https://ypen.gov.gr/energeia/esek/>) - The National Energy and Climate Plan (NECP) constitutes for the Greek Government a Strategic Plan for Climate and Energy issues and presents a detailed road map for the achievement of comparable Energy and Climate Goals by the year 2030
- Action Plan for addressing energy poverty (<https://ypen.gov.gr/energeia/dimosievmeno-schedio-drasis-gia-tin-katapolemisi-tis-energeiakis-endeias-sdee/>) - The purpose of the Action Plan for addressing energy poverty is to map and analyse the characteristics of the most vulnerable households in order to understand better and design more efficient policy measures to achieve the goals set by NECP.
- Just Development Transition Plan (<https://www.sdam.gr/home-page>) - With the aim of the just transition of its lignite areas, Western Macedonia and Megalopolis, the Government set a new operational programme in 2020.
- National Climate Law – From 2022 the National Climate Law no. 4936 regulates the transition to climate neutrality and adaptation to climate change, emergency provisions to address the energy crisis and protect the environment (<https://www.taxheaven.gr/law/4936/2022>)

From the above strategies, the NECP plays a significant role in the development of the CAP as it quantifies in detail the nationally set targets for the evolution of the energy mix and also the spatial distribution and allocation of energy facilities. However, the most significant national policy that will influence and benefit the CAP is the Just Development Transition Fund that has a paramount local focus in the distribution of funds for actions that coincide or align with those of CAP.

National initiatives

Cooperation Memorandum for the European Mission "100 Climate Neutral Cities by 2030" was signed by 21 Greek Municipalities with the Ministry of Environment and Energy. The purpose of the Memorandum of Cooperation is to accelerate the transition of cities to climate neutrality



and their digital transformation, while simultaneously recovering from the coronavirus pandemic.

Local initiatives

Kozani's City Council declared Climate Neutrality in July 2021, setting the goal to reach net-zero by 2030. (<https://climateneutral2030.cityofkozani.gov.gr/en/declaration/>)

EU initiatives

Kozani is also member of Green City Accord, endorsing the commitment to reach the goals of European Green Deal and the delivery of the Sustainable Development Goals.



A-2.3: Emissions gap

	Baseline emissions (percentage)		Residual emissions / offsetting ¹		Baseline emissions reduction target ²		Emissions reductions in existing strategies ³		Emissions gap (to be addressed by action plan) ⁴	
	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)
Buildings	125,688.25	46.37	51.12	0.02	125,637.13	46.35	9,134.32	3.37	116,502.81	42.98
Transport	63,739.38	23.51	12,201.54	4.50	51,537.84	19.01	2,675.80	0.99	48,862.05	18.02
Waste	3,375.00	1.25	1,146.90	0.42	2,228.10	0.82	-	0.00	2,228.10	0.82
Industrial Process and Product Use (IPPU)	4,327.54	1.60	2,208.01	0.81	2,119.53	0.78	2,119.53	0.78	-	0.00
Agricultural, Forestry and Land Use (AFOLU)	4,380.40	1.62	0.00	0.00	4,380.40	1.62	3,056.72	1.13	1,323.68	0.49
Public Lighting	1,703.55	0.63	0.00	0.00	1,703.55	0.63	795.66	0.29	907.89	0.33
Tertiary	67,865.20	25.04	113.08	0.04	67,978.28	25.08	20,131.93	7.43	47,846.35	17.65
Total	271,079.33	100.00	15,720.65	5.80	255,584.84	94.28	37,913.96	13.99	217,670.88	80.30

¹ Residual emissions consist of those emissions which can't be reduced through climate action and are being offset. Residual emission may amount to a maximum of 20 % as stated by the Mission Info Kit.

² Baseline reduction target = Baseline emissions – residual emissions.

³ Emission reductions planned for in existing action planning and strategies should be quantified per sector.

⁴ Emissions gap = Baseline emission reduction target – Emissions reduction in existing strategies.



Module A-3 Systemic Barriers and Opportunities to 2030 Climate Neutrality

Module A-3 “Systemic Barriers to 2030 Climate Neutrality” should document the results of the stakeholder, systems and ecosystem mapping and identification of systemic barriers and opportunities.

A-3.1: Systems & stakeholder mapping

System description	Stakeholders involved	Network	Influence	Interest
Road network	Regional Authority of Western Macedonia Municipality of Kozani	Local Authorities	Both Authorities have the responsibility for road network (planning and operation)	Since it is the responsibility of Local Authorities to provide a reliable road network that will allow reductions of GHG emissions, their interest is significant
District heating network and operation	Municipal Enterprise for Water Supply, and Sewerage of Kozani (DEYAK) Public Power Corporation (PPC)	Municipal Company Energy Company	DEYAK is a Municipal Company that manages the District Heating network and its operation, thus has a high influence in planning the roadmap to a cleaner district heating system PPC power plants produce the main heat supply to power the DH system so has a crucial influence	Since DH system is currently powered by lignite and oil it is of vital importance for DEYAK to move towards green energy and reduce CO ₂ emissions and cost PPC is moving towards green energy and the lignite-based power plants in West Macedonia will soon stop their operation, thus it is of great interest for PPC to get involved in actions that will reduce its CO ₂ emissions and cost
Water Supply and Sewerage network	Municipal Enterprise for Water Supply, and Sewerage of Kozani (DEYAK)	Municipal Company	DEYAK is responsible for managing the water supply and sewerage network in Kozani	Since DEYAK is responsible for managing the water supply there is a strong interest to get involved in the action plan implementation
Waste collection network	DIADYMA S.A.	Regional Company	DIADYMA is responsible for waste management and their impact to environment	Since DIADYMA is responsible for waste management there is a strong interest to get involved in the action plan implementation
EV charging stations	Municipality of Kozani	Local Authorities	MoK plans the network and the locations of the public available EV charging spots	MoK is planning actions to reduce GHG emissions from



System description	Stakeholders involved	Network	Influence	Interest
	Hellenic Electricity Distribution Network Operator (HEDNO S.A.)	Energy Company	HEDNO as a manager of the complete electric network in Greece has the responsibility to examine and approve the proposed stations	transport thus it is strongly interested in developing a wide EV charging stations network to facilitate EV vehicle charging in Kozani HEDNO is interested in approving feasible solutions for charging EVs in order to avoid problems of an unstructured network development
Public Lighting	Municipality of Kozani	Local Authorities	MoK plans the network extension and upgrade of the public lighting system	MoK pursues actions to reduce energy consumption and since public lighting is an electric energy consuming sector it is of high interest for MoK
Educational network for upskilling and reskilling	Ministry of Education University of Western Macedonia Centre for Research and Technology Hellas (CERTH) Regional Directorate of Primary and Secondary Education School Committees of Primary and Secondary Education Greek Public Employment Service (DYPA) Cluster of Bioeconomy and Environment of Western Macedonia (CluBE)	National Authorities Educational and research Institution Research Institution, nonprofit Regional Authority Local Association Public Employment organisation Nonprofit organization	The Ministry of Education may provide educational material and guidelines to develop appropriate school courses on green energy and environmental issues which could be implemented by the Primary and Secondary Education Directorate School Committees can get involved in organizing actions of awareness The University of Western Macedonia has a strong background in energy and climate subjects and could very easy get involved in planning and implementing short courses, tutorials for upskilling and reskilling technical personnel to new technologies and the upcoming technical challenges DYPA is able to inform and guide the work force in Kozani towards new and upgraded skills CluBE has already implemented numerous seminars and awareness events	The main interest of these stakeholders is to provide modern educational services to the citizens which have to obtain new or upgrade their current skills



System description	Stakeholders involved	Network	Influence	Interest
Renewable Energy installations	<p>Hellenic Ministry of Environment and Energy (YPEN)</p> <p>Regional Authority of Western Macedonia</p> <p>Municipality of Kozani</p> <p>Association of Photovoltaic Investors of Western Macedonia Region</p> <p>Energy Community of Kozani Municipality</p>	<p>National Authorities</p> <p>Local Authorities</p> <p>Local Authorities</p> <p>Local Association</p> <p>Local Association</p>	<p>YPEN and the local authorities must facilitate and support renewable energy installations by acceleration of the licensing procedures (given that the legislation is followed)</p> <p>Energy Communities and the Photovoltaic investors of Western Macedonia are responsible for the operation of their power plants and they must be able to upgrade and expand their infrastructure while following current legislation</p>	<p>The Ministry and the local authorities support new installations since they are the basis for a cleaner national energy mix and furthermore a cleaner environment</p>
Funding organisations	<p>Hellenic Ministry of Environment and Energy (YPEN)</p> <p>Just Development Transition Plan (JDTP)</p> <p>Special Service for the Management of the Operational Program of the Region of Western Macedonia (EYD OP PDM)</p> <p>Funds - European Central Bank, European Investment Bank (EIB), European Bank for Reconstruction and Development (EBRD), World Bank</p> <p>Hellenic Association of Banks</p> <p>West Macedonia Development Company (ANKO S.A.)</p>	<p>National Authorities</p> <p>National Organisation</p> <p>Regional Authorities</p> <p>International Bank associations</p> <p>Hellenic Bank Associations</p> <p>Development company</p>	<p>YPEN and the funding organisations and mechanisms can lever funds to facilitate and support investments in renewable energy installations, energy upgrading of buildings and vehicles</p> <p>ANKO is an experienced organization with many years of knowledge, experience and presence in European and national networks, business support structures and funding mechanisms</p>	<p>The availability of funds and the interest of these organisations to fund investments in Kozani towards the implementation of the action of this plan is significant, aligned with the decarbonization process of the Region of Western Macedonia.</p>
Public transportations	<p>Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.)</p> <p>TAXI Owners Association of Kozani</p>	<p>Local Associations</p>	<p>The associations of Bus and TAXI owners are private and their investments on new environmental friendly vehicles is of crucial importance to reduce the emissions of the transportations sector</p>	<p>These local associations are highly interested in investing and also having support from the local authorities in order to upgrade their fleet with new and more efficient vehicles</p>



System description	Stakeholders involved	Network	Influence	Interest
Municipal buildings	<p>Municipality of Kozani</p> <p>Regional Directorate of Primary and Secondary Education</p> <p>School Committees of Primary and Secondary Education</p> <p>Association of Certified Contractors (SPEDE)</p>	<p>Local Authorities</p> <p>Regional Authority</p> <p>Local Association</p> <p>Professional Organizations</p>	<p>MoK and the Regional Directorate of schools are responsible for the operation and retrofitting of the Municipal buildings and the schools, respectively</p> <p>The School Committees can also be involved in schools' operation</p> <p>SPEDE is a professional organization the members of which are experienced in public projects</p>	<p>MoK targets to reduce its GHG emissions and municipal buildings have a significant share</p> <p>Stakeholders related to Schools are strongly interested in reducing energy costs and improving the quality of the built environment and the health conditions for the students and the teaching staff</p> <p>SPEDE members' main professional interest is public projects and they are experienced in constructions and retrofitting of buildings</p>
Private buildings	<p>Property Owners Association of Kozani</p>	<p>Local Association</p>	<p>Property owners of Kozani is an association of individuals who own large numbers of apartments in Kozani and they are responsible of their good condition and operation</p>	<p>Improved quality of buildings offers better living conditions and lower operating cost thus rendering properties more commercially attractive thus the interest for the owners is significant</p>
Tertiary sector buildings	<p>Technical Chamber of Greece, Regional Department of Western Macedonia</p> <p>Chamber of Commerce and Industry of Western Macedonia</p> <p>Chamber of Commerce and Industry of Western Macedonia</p> <p>Commercial Association of Kozani</p> <p>Geotechnical Chamber of Greece (branch of Western Macedonia)</p> <p>Association of Coffee and Pastry Shop Owners (HERMIS)</p>	<p>Professional Organizations</p>	<p>Professional Organizations can influence and inform their members to get involved and apply the action plan of the Municipality</p>	<p>For a business (no matter the size) a lower operating cost means more profit</p>
Alliances	<p>Network of Energy Producing Municipalities (NEPROM)</p>	<p>Local Authorities</p> <p>Local Authorities</p>	<p>Strong alliances with other local authorities may lead to wider acceptance due to actions of information and</p>	<p>All local authorities tend to adopt action plans in order to adapt to climate change and reduce their GHG emissions</p>



System description	Stakeholders involved	Network	Influence	Interest
	Regional Union of Municipalities of Western Macedonia (PED) Go Alive NGO Municipal Organization of Sports, Culture and Youth	Youth Organisation Cultural	awareness as well as more effective leverage of funds Go Alive NGO and the Municipal Organization of Sports, Culture and Youth are addressed to young citizens of Kozani	and strong alliances will help them all to achieve this target Youth organizations can effectively involve young people to the projects of this Action Plan
Energy infrastructures	Public Gas Corporation of Greece (DEPA) Hellenic Petroleum (HELPE) Advent Technologies S.A. Enel Green Power S.p.A.	Energy companies Manufacturer	Energy companies and manufacturers are able to construct large scale energy infrastructures	The new landscape due to energy transition evolving in the area will make Kozani attractive to energy companies and manufacturers to invest in constructing large scale energy infrastructures



A-3.2: Description of systemic barriers

The development of the Climate neutrality action plan and its successful implementation has to overcome a variety of systemic barriers and obstacles that are outlined below. Some of the issues that are outlined were raised during the interaction with various stakeholders and citizens.

A major issue is that although the social and economic pressures from the requirement for a transition to an economy of low carbon dependence are substantially increasing at a very fast pace, while the transformation of the local economy is occurring at a slow pace. The major categories of systemic barriers are listed below accompanied by a brief explanation:

Legislation / regulatory framework

- Land uses for Renewable Energy. Currently there is no clear planning or a land use framework to define the zones for the development of renewable energy installations; as a result, there are conflicts with other land uses such as agriculture, causing local frictions and increasing resistance to new installations of wind farms and photovoltaics. Consequently, there is an urgent need for the development of a land use framework especially for renewable energy installations both on a national and on a regional level, as this will facilitate the transition process towards a cleaner energy mix. To this end, by decision of the Regional Council of Western Macedonia, an integrated Special Spatial Plan for renewable energy sources is being prepared, which is expected to be put to Public Consultation in October 2023. It concerns a plan that will document the capacity of Western of Macedonia to welcome investments in the RES sector.
- Licensing procedures of Renewable Energy projects. At the moment the procedure is slow and there are uncertainties, especially in the final stage. According to the recent bill passed in the Greek Parliament, it is foreseen, among other things, that there is a drastic acceleration of the licensing procedures and specifically, a reduction of the average time for licensing new RES projects to 14 months from the current 5 years, as well as the development of electricity storage projects with installed power of at least 3.5 GW by 2030, throughout the country
- Treatment of energy communities. The new law 5037/2023 passed by the Greek Parliament in March 2023, improves the situation and defines an attractive framework for the operation of Energy Communities, introducing two distinct types of Energy Communities: Renewable Energy Communities (RECs) and Citizens' Energy Communities (E.K.P.), while at the same time differentiating energy netting (net metering) and virtual energy netting (virtual - net metering), thus modernizing the operating framework of the Energy Communities.
- Regulatory framework for the operation of the District Heating (DH) network of Kozani. The situation with the DH should be modified to ensure the continuous and uninterrupted supply of thermal energy to the DH system (regardless of source). According to the current regulatory system, the powerplants are selected to participate in the daily electricity generation schedule independently of whether they support local



DH or not. As a result, at an increasing number of occasions, when the PPC St Demetrios plant was not required to operate for electricity generation, there was no sufficient heating power for Kozani leading to the use of very high quantities of oil which was used as an emergency measure.

- Special treatment and simplification of licensing procedures (e.g. local urban plans and interventions, urban regeneration, energy upgrades, integration of RES in buildings, development of green roofs, location of charging stations, etc.) in cities that wish to become climate neutral. In this direction, the network of Greek cities that have committed themselves to become climate neutral can raise the relevant issues and produce solid proposals to the Greek government in order to address all relevant issues that hindering their efforts.

Bureaucracy:

- Complexity of legislation for the implementation of new investment plans and development of new projects
- Bureaucratic procedures
Slow justice system

The problem of Bureaucracy remains perennial in Greece and difficult to deal with. In any case, it is expected that a simpler and more functional system for processing administrative procedures is instituted in the Public Administration, through the reformation and updating of the legislative framework for the National Policy of Administrative Procedures, which is jointly advanced by the Ministries of Interior and Digital Governance. Regarding the municipalities in particular, they will provide the services that fall under their responsibilities, through the new platform of "myDimos.Live.gov.gr" remotely and by tel-conferences.

Funding:

- Limitations of available resources
- Limitation of existing funding schemes
- Flexibility in relation to the financing of the DH system,
- Requirement for additional financial support e.g., for deep retrofitting of buildings, installation of renewable energy systems in buildings etc

Structure of the local economy

- High level of one-dimensional dependence on lignite power production activities.
- Limited investment in other industrial activities
Local economy mostly dependent on trade and services
- Collapse of the local lignite power generation, causing a significant reduction in the municipality's economic activities

The long-term dependence of Western Macedonia on lignite has created conditions of technological and economic lock in at a regional level, as more than 34% of the Gross Value Added (GVA) in the region derives from lignite activities, while around 10% of local employment is directly or indirectly related to lignite production. Western Macedonia will be



called upon not only to redefine and adjust its production model, but also to immediately create a completely new and productive environment in conditions of zero lignite dependence focusing on the development of new activities.

In order to address the socio-economic implications of the rapid lignite phase-out, the Greek Government announced a Master Plan for the Just Development Transition (JDTP) for the period 2023-2029 which is based on five key development pillars for Western Macedonia:

- Clean energy development
- Industry manufacturing activities and trade
- Smart agricultural production
- Sustainable tourism
- Research, innovation, technology and education

The implementation of the Master Plan measures is expected to mobilise €5 bn for Western Macedonia for the period 2023-2029. In order to ensure that the lignite phase-out will not negatively affect the regional economy, Kozani can build on its strengths and competitive advantages, including the high concentration of specialized human resources, its industrial culture, energy infrastructure, an agriculture sector with high potential, existing academic and research structures, its strategic geographic position in South-Eastern Europe and design and associate all its developmental efforts under the strategic goals of the City Climate Contract. The proposed actions are anticipated to boost the employment and the economic activity of the city and the region.

Social background:

- High unemployment and staff shortages as a result of the recent economic crisis.
- Serious structural problems with a very high unemployment rate especially among young people.
- Limited career development opportunities for educated people
- Limited industrial activities (beyond PPC).

Integrated and coherent policy measures that combine training with work employment subsidy are important in order to ensure a fair transition with limited negative impacts on the income of local population. The combination of employment programs with reskilling/upskilling will enable local workers to be absorbed quickly by the labor market and will contribute to attracting new investment. The funding of these specific actions is eligible through the Just Transition Development Plan of Western Macedonia with a total amount of €175 m, for the period 2023-2029.

Demographic problem

A critical challenge for the long term development of Kozani which also indirectly influences the successful implementation of the CAP, is the demographic problem which impacts mainly the small remote communities of the MoK. Population decreases, a problem obvious not only in the Municipality but dramatically affecting the whole region.

- Slow rehabilitation of the mines that could provide useful lands. These lands could be used for agriculture purposes and other business activities.



- The support to the University of Western Macedonia needs to be enhanced as the limited recruitment of academic and research staff in critical areas is an issue. This has the consequence of a limited capacity to develop and support new technologies

The above-mentioned issues along with the departure of highly educated and trained people due to limited opportunities leads to a decreased number of scientific personnel available at the region.

Greater support for public services and infrastructures (such as health and care infrastructure, urban transport etc) is also required in order to incentivise inhabitants, especially young people, to remain in the area and also to maintain social life and cohesion in small communities outside the urban core of the city. In this direction, the new wing of the Kozani General Hospital, approximately 5,500 square meters, is expected to be completed within the next 3 years, upgrading the services provided to the citizens of the wider area on many levels.

Town morphology / existing infrastructures:

The municipality consists of an urban centre (Kozani) and a number of small local communities, located around the city with very different characteristics covering a large geographical area. This leads to:

- The requirement for different types of policies and actions
- Existence of very narrow streets
- Limited parking spaces
- High concentration of inhabitants around the city centre
- Difficulty in developing bicycle routes, limited green spaces
- Limited capacity of the electrical grid for the support of new renewable energy installations
- Lack of industrial parks and infrastructures to host new industrial activities

Mobility:

Electric mobility develops slowly in Greece. This is mainly due to

- The high prices of electric vehicles
- The technology, which is still under development.
- The lack of an extended network of electric chargers.
- The difficulties arising due to the topography and morphology of Kozani
- The limited parking spaces (required to completely charge an electric vehicle).

At the same time, the Greek Government and local authorities have decided to promote electric mobility since it offers an appealing alternative to conventional internal combustion based automobility.

Social engagement:

The engagement and active participation of citizens in similar actions is traditionally rather limited. The climate action plan is determined to implement innovative ways in order to enhance participation and convey the ownership of the decision-making process to the



citizens, especially targeting the younger generation and exploiting the capabilities offered by smart technology and digitisation. The Municipality has realized this situation and plans to establish an innovative participatory model that places the citizens in the epicentre of the action plan.

In Western Macedonia, several actions and interventions have been undertaken related to the transition process, mainly concerning studies from various stakeholders, but also integrated projects on a municipal or regional level. The interventions of the local stakeholders such as the regional authorities, municipalities, academia and business community, chambers and trade unions, so far show a widespread skepticism towards the accelerated and time-pressing process of delignification. However, there is an increasing understanding in the local community of the necessity for lignite phase-out, while ensuring that the local population and economy do not face hardship from the transition process. It is becoming increasingly clear that the energy transition is not just about choosing the best technical solutions to decarbonize the energy system but relies heavily on human habits and behaviors as well as societal transformation and should ensure that no region or worker is left behind (“Just Transition”), especially for Western Macedonia where the transition is accompanied by a generalized reconstruction of the current economic paradigm.

Other

- Large number of old buildings: The vast majority of buildings have been built before 2010 and lack modern insulation and heating system technologies, resulting in high energy losses and deep retrofitting needs.
- Challenging climatic conditions: The Municipality of Kozani is located in the northwestern part of Greece and has an average altitude of around 700m resulting in one of the coldest weather conditions in Greece. Therefore, more energy is required to assure the buildings’ sufficient heating causing increased GHG emissions.

A-3.3: Description or visualisation of participatory model for the city climate neutrality – textual and visual elements

The Municipality of Kozani is in the process of founding a Developmental Corporation which, under its supervision, will focus on the creation and implementation of participatory models for climate neutrality, and ensure the active participation of citizens and stakeholders.

The ecosystem of the climate stakeholders of Kozani includes all parts of the quadruple helix: academia and research, local authorities, enterprises and - of course - the local society. The Municipality, as well as the Cluster of Bioeconomy of Western Macedonia (CluBE), which is a multi-actor platform for cooperation, are uniquely placed to cultivate cooperation between these groups as well as with other cities.

Citizens will play a pivotal role in driving systemic transformation towards climate neutrality in a participatory process as users, producers, consumers, owners, or political actors, together



with local stakeholders from academia, the energy sector, mobility, buildings, ICT, agriculture, and forestry.

The Development Corporation will implement an interactive participatory framework that can confront levels of power to encourage diversity and participation in decision-making from bottom-up initiatives.

The participatory models which are utilised for the development and execution of the climate action plan are based on the principle of inclusion, making the maximum effort to actively engage people from all demographic groups, without discrimination for income brackets, and especially focusing on vulnerable demographics that can often be underrepresented, such as the elderly, the unemployed, low-income citizens, minorities, and other groups. The most significant asset of the Municipality is its youth; consequently, its mobilisation and engagement are key levers for the successful outcome of the whole process. The educational community is very enthusiastic to link and enrich its conventional curriculum content and delivery modes to the City's vision for climate neutrality through structured programmes and targeted activities starting from early childhood to University level students.

Kozani agrees that the co-creation approach for the transformation of the city 'with the citizens and for the citizens' is the best way forward and a series of citizen engagement events have been organised based on a long-term plan for the participatory process.

The co-design processes also include open workshops (Living Labs) and the results will be put into consultation with the Citizens' Climate Board facilitating a participatory planning. In addition, student community engagement, which was utilised since the start of the ambition for Kozani's climate neutrality, has been pursued through school contests on climate-neutrality and digitalisation. More specifically, citizens have been given the opportunity to evaluate the proposals and at the same time make their own proposals and suggestions.

All participatory processes will be subjected to a system of design, testing and redesign based on participant feedback, so that improvements can be made on the participatory models and potential issues can be ironed out during the process.

An important aspect of the engagement plan is the thorough explanation and the persuasion of the citizens about the benefits that are anticipated from the successful implementation of the various components of the action plan.



Part B

Pathways towards Climate Neutrality by 2030



Part B – Pathways towards Climate Neutrality by 2030

Part B represents the core of the Action Plan, shaped by local authorities, local businesses and stakeholders, comprising of the most essential elements: scenarios, strategic objectives, impacts, action portfolios and indicators for monitoring, evaluation and learning.

Module B-1 Climate Neutrality Scenarios and Impact Pathways

Module B-1 “Climate Neutrality Scenarios and Impact Pathways” should list impact pathways, early and late outcomes and direct and indirect impacts (co-benefits) according to and adapted from the NZC Theory of Change and the AP Guidance – clustered by fields of action.



B-1.1: Impact Pathways

Fields of action	Systemic levers/ Entry points	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions)	Indirect impacts (co-benefits)
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ENERGY

Renewable Energy Generation	Technology/Infrastructure - Improved efficiency and cost reduction of PV systems				
	Technology/Infrastructure - Existence of strong electrical grid in the region	36 MWp of photovoltaics and 3 GW of wind power will be installed (private investment)	7 MWp PV plant will be installed by the Municipality of Kozani		New infrastructures depend on investments that will create new jobs and may alleviate the unemployment in Western Macedonia related to energy sector
	Technology/Infrastructure - Availability of land	A total green energy production of 225 GWh will be produced by private Renewable Energy systems	145 MWp of photovoltaics and 12.4 GW of wind power will be installed (private investment)	CO ₂ emissions will be reduced by 417,508 tonnes annually	Emissions will be significantly reduced
	Finance and funding - Availability of national funding initiatives		A total green energy production of 899 GWh will be produced by private Renewable Energy systems		The energy cost will be reduced
	Social innovation - Significant growth of energy communities				Cleaner environment Better health conditions for the citizens.



'Greening' of District Heating	<p>Technology/Infrastructure</p> <ul style="list-style-type: none"> - New CHP plant using natural gas 				
	<p>Technology/Infrastructure</p> <ul style="list-style-type: none"> - Use of electric boilers to exploit PV electricity 				
	<p>Technology/Infrastructure</p> <ul style="list-style-type: none"> - More efficient and economical heat pumps 	<p>Critical assessment of available technologies and gradual 'greening' of the District Heating system</p>	<p>While initially the energy cost may be slightly increased, later economic benefits will appear</p> <p>A reduced emission coefficient will have a direct impact on reducing CO₂ emissions</p>		<p>The city will become a paradigm of a pioneering evolution towards 'real zero' 'green' energy heating</p>
	<p>Technology/Infrastructure</p> <ul style="list-style-type: none"> - Heat from solar thermal park 				
	<p>Technology/Infrastructure</p> <ul style="list-style-type: none"> - Development of natural gas transmission line 				
	<p>Finance and funding - Available funding for connection to the new DH hub</p>	<p>The Kozani DH system will be connected to the new DH hub and it will start using natural gas</p>	<p>The necessary equipment (electric boilers and heat pumps) will be acquired and installed for a partial electrification (40%) of the Kozani DH system</p>	<p>CO₂ Emissions will be significantly reduced (83,305.21 tonnes by 2030)</p>	<p>Air quality will be improved</p> <p>Better health conditions for the citizens</p> <p>Reduction of CO₂ penalties for DEYAK</p>



	<p>Governance and policy - Change of governance of DH companies of Western Macedonia</p>	<p>A unified company will be created</p>	<p>The cost for the consumers will be reduced</p>		<p>A larger scale investment could be attracted</p>
Energy Efficient Buildings	<p>Governance and policy</p> <p>Finance and funding - Development of local innovative investment projects</p>	<p>Approximately 1370 residencies will be upgraded</p>	<p>About 4795 residencies will be upgraded</p> <p>All buildings of the Municipal Authority will be retrofitted</p>	<p>CO₂ emissions will be reduced by 60,000 tonnes</p> <p>The total primary energy consumption will be reduced by 168 GWh</p>	<p>Significant energy cost reduction for the inhabitants</p> <p>More comfortable and healthy living</p> <p>Energy upgrading of buildings demand specialized workers and engineers, thus an increased demand for personnel</p> <p>Increased revenue for local businesses who deal with the supply of building materials and equipment</p>
Smart Energy systems	<p>Technology/Infrastructure - Smart devices and systems become more efficient and cheaper</p>	<p>An increasing number of citizens will choose to adopt smart energy system solutions</p>	<p>Reduced primary energy consumption and CO₂ emissions</p>		<p>Emissions will be significantly reduced.</p> <p>The energy cost will be reduced.</p> <p>Cleaner environment.</p>



	<p>Learning & capabilities - More people become aware of using smart technologies</p>				<p>Better health conditions for the citizens.</p>
	<p>Finance and funding - Smart energy systems can be funded in combination with other energy saving measures</p>				



MOBILITY AND TRANSPORT

<p>Introduction of alternative fuel in transportations</p>	<p>Technology/Infrastructure - Penetration of new vehicle technologies</p>	<p>Penetration of vehicles fuelled by CNG and LPG. Replacement of 6 conventional private vehicles with vehicles fuelled by CNG/LPG.</p>	<p>Replacement of conventional vehicles with CNG/LPG fuelled will rise to 31 private cars and 2 trucks/buses.</p>		
	<p>Finance and funding - Availability of national funding for replacement of conventional vehicles</p>	<p>Replacement of municipal vehicles with EV using RES. E-mobility penetration to municipal fleet by replacing 3 cars and 5 heavy vehicles with EVs.</p>	<p>5 more municipal cars will be replaced by EVs, as well as 8 heavy vehicles will replace the obsolete vehicles of the municipal fleet.</p>		<p>Further penetration of RES in mobility system</p>
	<p>Governance and policy - E-mobility programs of the Municipality</p>	<p>Replacement of 9 private cars and 4 trucks/buses</p>	<p>Additional 76 private cars will replace conventional ones as well as additional 9 heavy duty will be replaced by EVs</p>	<p>Significant reduction to CO₂ emissions are expected for this field of action that will reach 12,200.1 tonnes of CO₂ annually. These CO₂ emissions account to approximately the reduction of equivalent 47,665 MWh.</p>	<p>Renewing of obsolete municipal with more efficient vehicles</p>
	<p>Technology/Infrastructure - Installed charging stations for EVs in businesses</p>	<p>Installation of additional charging stations. 2 charging stations will be installed in strategically locations of the municipality (parking areas of municipal EVs)</p>	<p>12 more charging stations will be installed</p>		<p>Budget saving from the reduction of fuel needs due to the use of more efficient vehicles</p>
	<p>Governance and policy - Article 17 of Law 4710/2020, where Municipalities must prepare an Electric Vehicle Charging Plan</p>	<p>Creation of zones with low emissions of air pollutants and noise with priority on the use of electric vehicles. A study will be conducted for the formation of these zones.</p>	<p>The formation of the zone of low emissions of air pollutants and noise with priority on the use of electric vehicles will cover an area of approximately 0.445km².</p>		<p>Use of new and more environmentally cleaner vehicle technologies</p>
	<p>Technology/Infrastructure - Infrastructures for the production of green hydrogen</p>	<p>Replacement of heavy vehicles with vehicles fuelled with hydrogen. Installation of infrastructure for the production of green hydrogen</p>	<p>As a consequence of green energy production, 5 heavy vehicles fuelled by hydrogen will be introduced into Kozani's fleet.</p>		<p>Lower air pollutants</p>
	<p>Public transport upgrade (bus on demand, park and ride)</p>				



Upgrade of Public Transportation Systems and Urban Logistics		Promotion of park & ride initiative. This includes the study about location of stations				
	Governance and policy - Available studies for Public Transportation	Reorganization of public transportation within the city. This concerns the study for formation of a public transportation route. The Municipality will streamline public transportation services, ensuring better coverage and frequency.	A number of stations (4) that will serve for park & ride purposes will be established.			Introduction of smart systems to mobility
	Technology/Infrastructure - Existence of Public transportation system that serves a percentage of the population		Development of information system for bus on demand actions as well as an establishment of bus line that implements this system			Familiarization of citizens will alternative and more environmental means of transportation
	Technology/Infrastructure - Public transportation infrastructures for storage of Vehicles	Bus on demand will be used for the public transportations. A study for the formation of bus lines will be conducted.	The formation of a line for bus on demand public transportations will be ready.	Based on these actions the reduction of CO ₂ is estimated at 3,486.9t which refer to an energy reduction of 13,429.5 MWh		Decongestion of city traffic Lower of air pollutants Improved air quality
	Finance and funding - Participation of public transportation sectors in financing national/continental programs	Utilization of a taxi system for collective movements with itineraries responsive to demand is under study. This will include shared rides or pooled services.	A platform will be developed for taxis in order to assist to collective movements.			Enhanced accessibility to public transportation
	Governance and policy - Legal traffic regulations for loading and unloading of goods/products as well as signalling	Establishment of urban supply chain centres will be conducted.	A number of areas (2) will be formed in order be used as small supply centres and an intelligent supply management system (eg. For loading & unloading freight) will be developed			Increased efficiency of transportations
		A two wheeled electric vehicle will be purchased for municipal transportation of personnel.	Additional 2 two wheeled vehicles will be purchased.			Relief measure for economically vulnerable residents
						Transportation of people or goods more efficient with less emissions



Walkability & Cycling Strategy	<p>Governance and policy - Available studies for formation of routes and streets in order to create a cycling network</p>	<p>Inspection of areas for formation of cycling routes</p>			<p>Promotion of physical activity, leading to improved health and well-being</p>
	<p>Technology/Infrastructure - City's distances are not aversive for walkability and cycling promotion</p>	<p>Examination of public spaces in order to install shared transportation stations</p>	<p>A station for shared transportation system will be installed (this will contain e-bikes along with the sharing platform and racks)</p>		<p>alternatives to private vehicles, thereby reducing congestion on roads and improving traffic flow</p>
	<p>Governance and policy - Legal traffic regulations for formation of cycling network</p>	<p>Preliminary study to create green school routes along with pedestrianization of strategic selected areas</p>	<p>A number of nodes (14) will be ready with developed crossings</p>	<p>The actions will lead to the reduction of 11,054.5 tCO₂ which is in terms of equivalent energy of 44,204 MWh</p>	<p>Introduction of sustainable modes of transportation</p>
	<p>Governance and policy - Available street and route areas for creation of green routes</p>	<p>Studies in order to enhance infrastructures' accessibility</p>	<p>The green route will be ready for citizens and visitors in order move easily to city's attractions</p>		<p>Economic Benefits</p>
	<p>Technology/Infrastructure - Available street and route areas for creation of green routes</p>	<p>Development of 2 nodes with enhanced crossings</p>			<p>Fostering of social interactions and community engagement</p>
	<p>Governance and policy - Participation of the Municipality to mobility programs and actions</p>	<p>Preliminary study in order to establish green routes</p>			<p>Further promotion of RES usage</p> <p>Promotion of transportation for groups that don't have the funds to acquire a vehicle</p>



Introduction of IT technologies to mobility	Finance and funding - Available funding for IT technologies	Data collection for the development of smart controlled parking and smart signals systems	Smart controlled parking system developed and smart signals ready for citizens	These actions will contribute to CO ₂ reduction by 7,237.8t equivalent to 28,941.9 MWh energy savings	Increased efficiency of transportations Lower air pollutants Budget savings from fuel reduction Real-time monitoring of traffic conditions Improved Safety of transportations
	Learning & capabilities - Experience in using smart technologies	Establishment of a smart stop station coupled with telematics system	Additional 4 smart stops stations will be created		Seamless integration and coordination of various transportation modes, including public transit, cycling, walking, and shared mobility services
	Technology/Infrastructure - Constant enhancement in the efficiency of smart devices and systems	Collection of data and promotion of IT systems for mobility (crowd-sensing tools, car-pooling systems and the idea of an airbnb type for parking spaces)	Development of a car-pooling system Development of a platform for "Airbnb" type of parking system. This concerns the creation of online platform of homeowners who are willing to provide their unused parking spaces.		Enhanced overall user experience by providing personalized and real-time information Data-Driven Decision Making and Planning
	Learning & capabilities - More people engage to smart technologies				Improving accessibility and inclusivity in transportation systems Citizen engagement



Infrastructure Upgrades & Mobility Measures		A number (600) signs will be installed that will reduce speed limit of vehicles			
		Road network will be reorganized and the streets of the city will be characterized as a) "Free Avenue", b) "Main arterial road", c) "Secondary arterial road", d) "local distributor road" and e) "Local street" and the reorganization will take place based on this hierarchy.			Reducing the risk of accidents
	Governance and policy - The Municipality will use its vast experience in this type of actions		Light traffic areas will be expanded to approximately 4,500m ²		Enhance accessibility for active transportation
	Finance and funding - Funding can be achieved via National and Regional programs	An area of approximately 105 km ² will be characterized as light-traffic	Additional 10 nodes of intersections (formation of roundabouts) will be upgraded as well as 25 more spot nodes will be improved		Reducing of congestion and improvement of overall traffic management
	Governance and policy - There are already available studies for infrastructure upgrade	Formation of approximately 200m of one way street	Horizontal and vertical signalling will be installed at streets length of approximately 46,000m	The interventions will contribute to CO ₂ reduction by 7,406.3 equivalent to 29,615.7 MWh energy savings	More efficient transportation
	Technology/Infrastructure - The Municipality has available spaces/areas that can be upgraded	Upgrade of 4 nodes of intersections (formation of roundabouts) as well as 5 spot nodes will be improved	Formation of a peripheral ring-road to decongest city centre		Encouragement of walking and cycling
		Preliminary study and data collection for reinforcement of signalling, ring-road establishment, areas with reduced vehicle traffic and upgrading public spaces	Creation of a reduced vehicle traffic area within the city centre		Reduction of noise and pollution
		Boxing of 5 legal parking spaces and creation of parklets	Additional boxing of 20 legal parking spaces and creation of parklets		Promotion of vibrant community spaces
		Replacement of road paving materials on 15km of streets of the Municipality			Enhancement of road safety
					Prevention of congestion
				Creation of additional green spaces	
				Improvement of driving quality	



Incentives and Citizen Engagement	<p>Learning and capabilities - Already existing training programs</p>	Development of awareness raising strategy (education actions/events, seminars, speeches, presentations, etc.) for the following ages: a) 8 to 18, b) 18 to 25, c) 26 to 50 and d) 50+ will be provided twice per year	Awareness raising campaigns will continue for this period		Lower air pollutants	
	<p>Democracy/participation - Citizens with strong sense of engagement in community activities</p>				Fostering environmental friendly behaviour	
	<p>Democracy/participation Available organizations that promote collaboration and partnership</p>	Learning seminars for eco-driving addressed to: a) municipal fleet drivers, b) bus drivers, c) taxi drivers, d) professionals drivers and e) citizens	Learning seminars will be also be provided	Rewards to businesses for adopting active travel	A reduction of 4,994.3 tCO ₂ is estimated for these actions accounting to equivalent 19,970.9 MWh.	Raising public awareness against climate change
	<p>Finance and funding - Available municipal budget for implementing supportive policies & incentives</p>	Financial incentives to businesses that are friendly to active travel will be given twice per year as well as reduction of municipal fees	Municipal fee reductions for businesses that operate in an environmental friendly manner twice per year			Fostering social interactions
	<p>Learning and capabilities - Training programs for pupils and students</p>			Municipal police engagement		Supporting local businesses
	<p>Governance and policy - Existing union of professional drivers (Taxi, Buses, etc)</p>	Systematic police inspections to prevent violations				Strengthened community engagement



WASTE AND CIRCULAR ECONOMY

<p>Sorting at Source enhancement & Recycling</p>	<p>Technology/Infrastructure - Already existing actions for sorting at source</p>				<p>Alignment with the principles of sustainable development</p>
	<p>Technology/Infrastructure - Governance and policy - Operation of Waste Management Enterprise of Western Macedonia (DIADYMA SA) which is the Waste Management Agency (FODSA) of the Region of Western Macedonia</p>	<p>Establishment of 3 green spots for enabling sorting at source</p>	<p>Establishment of 9 more green spots for enabling sorting at source, 2 of these spots will be mobile</p>		<p>Reducing the use of raw materials, saving natural resources through recycling</p>
	<p>Introduction of pay as you throw program</p>	<p>Studies for creation a creative re-use centre</p>	<p>Continue of pay as you throw program</p>	<p>Direct emissions reduction are expected to be 1,620.6t CO₂</p>	<p>Promotion of circular economy principles</p>
	<p>Phase 1 of establishing the Circular Economy Park: preparation of studies and services for the infrastructure and configurations of all the park's sectors</p>	<p>Phase 2 of Circular Economy Park: This includes the sector of energy & recycling</p>	<p>Establishment of one creative re-use centre</p>		<p>Job creation Promotion of prioritization in waste management and in particular the promotion of reuse and recycling with sorting at source</p>
	<p>Technology/Infrastructure -Existing infrastructure for sorting at source in most of the neighbourhoods of the Municipality</p>				<p>Recovery of higher purity materials as a result of separate collection</p>
<p>Technology/Infrastructure - Available areas for installing infrastructures</p>				<p>promoting the initiatives of Social and Solidarity Economy in the field of the environment</p> <p>raising awareness among citizens with their direct participation and environmental education</p>	



Certification and Green Procurements	Governance and policy – Green procurement measures policies					Minimize costs by increasing materials, recycling waste and eliminating practices that impose regulatory penalties
	Governance and policy – Existence of several municipal services			Certification of the Municipality in Green Procedures - Circular Economy		Reduction of sources of pollution and waste
	Technology/Infrastructure - Waste handling activities	Preparation of the Municipality for certification (data collection, organizing municipal services, determination of the appropriate indexes)		Certification of other economic entities in Circular Economy traits		Engagement of other economic sectors
	Democracy/participation - Governance and policy Stakeholder engagement	Training of the municipal employees on Green Public Contracts		Establishment of mandatory criteria for green public procurement	This actions will lead to the reduction of 270 tCO ₂	Saving of Municipal resources
	Learning and capabilities - Capacity Building and Training of municipal servants			Development of an information application for selection criteria for choosing the appropriate Green Public Contracts		Sustainable and more efficient use of natural resources
	Finance and funding - Circular Economy Business Support					Enhanced Reputation of the profile of the Municipality
				Attraction of investments and stimulate the growth of green industries		
				Prioritize resource efficiency and optimize their use		



Awareness Raising for Waste Treatment	<p>Citizens with strong sense of engagement in community activities</p> <p>Available organizations that promote collaboration and partnership and can provide training</p> <p>Available municipal budget for implementing supportive policies & incentives</p> <p>Already available demonstration activities and pilot projects</p> <p>Established collaborative platforms</p>	<p>Awareness raising campaigns concerning Recycling, Waste Handling and Circular Economy will be categorized as: a) Educational Activities in Schools and b) Information Actions for agencies and citizens twice per year</p>	<p>Campaigns will continue and they are expected to engage more citizens</p>	<p>A reduction of 337.5 tCO₂ is expected as a result of these actions.</p>	<p>Waste Reduction</p> <p>Resource Conservation</p> <p>Reducing the use of raw materials, saving natural resources through recycling</p> <p>Lifestyle changes in the behaviour concerning waste</p> <p>Fostering environmental behaviour</p> <p>Circular economy concepts fosters a culture of innovation and entrepreneurship</p> <p>Community Engagement and Social Cohesion</p>



GREEN INFRASTRUCTURE

<p>Green infrastructure & nature-based solutions</p>	<p>Technology/Infrastructure - Agricultural industry's leading farm machinery manufacturers introduce new efficient vehicles and machinery</p>				
	<p>Learning and capabilities - Existing experience in using smart technologies and smart management systems</p> <p>Technology/Infrastructure - Enhanced efficiency smart devices and systems</p> <p>Finance and funding - Available municipal budget for implementing supportive policies & incentives</p>	<p>An irrigation smart management system will be installed and operating for one third of MoK's irrigated lands</p> <p>About 5% of new energy efficient machinery will be used in farming</p>	<p>An irrigation smart management system will be installed and operating for all of MoK's irrigated lands</p> <p>About 15% of new energy efficient machinery will be used in farming</p> <p>5 Smart trees with Smart Benches will be installed</p>	<p>The actions are estimated to reduce the CO₂ emissions by 1,323.68 tonnes</p> <p>These CO₂ emissions account to an approximate primary energy reduction of 7,583.78MWh</p>	<p>Irrigation management system will have a strong impact on water resources conservation</p> <p>Farmers' engagement</p> <p>Fostering environmental behaviour</p> <p>Reduced cost of agricultural products</p>



SMART CITY

<p>Smart city</p>	<p>Governance & policy</p>	<p>Reduced waiting time, requests pilling and in person visits to Municipal Services</p>	<p>Increased mobility</p>	<p>Fulfilling remotely the citizens request will contribute to minimize commuting and thus reducing CO₂ emissions</p>	<p>Improvement of the municipality – citizens interaction Improvement of the quality of life and the creation of a measurable benefit for the citizens and businesses of the Municipality without an administrative burden on the executives of the Municipality</p>
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B-1.2: Description of impact pathways – textual and visual elements

Fields of action

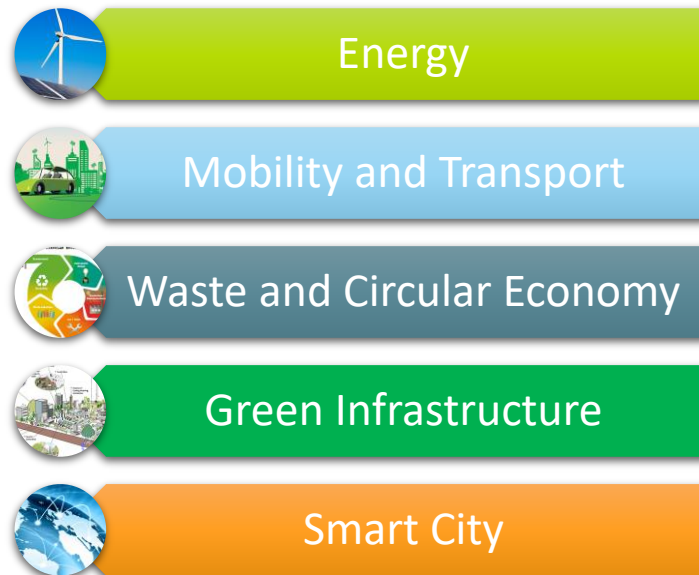


Figure 19: Fields of action of the Climate Action Plan of Kozani

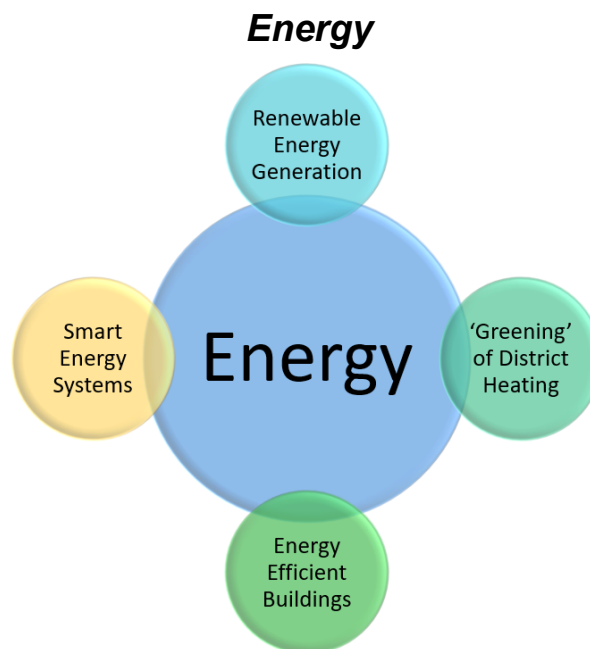


Figure 20: Portfolios of actions related to Energy

The Municipality of Kozani is endowed with natural capital to take advantage of renewable energy opportunities: excellent solar resources, good wind sites, and substantial land and water bodies available for solar and wind generation. It has the potential worth investigating



for: pumped storage, power blocks in power plants that could be reconfigured to run on heat generated by renewable electricity with the aid of thermal storage, the possibility of large-scale stationary storage in batteries, and the production in future of green gas to be utilized in power blocks or otherwise.

The Municipality of Kozani and Western Macedonia in general, could be a flourishing and innovative centre of economic growth and employment, leveraging its comparative advantage and social capital to the full, as an alternative energy transition pathway. Benefits would not be for the region and for Greece alone; rather for neighbouring countries in the Balkans, by becoming a centre for alternative energy and for energy storage services. This would also enable much higher penetration rates of variable renewables in Greece and the Balkans. Such an energy transition, preserving the energy identity and energy employment of Western Macedonia, can be expected to greatly facilitate the social acceptability of an overall energy transition of the region.

The Municipality of Kozani has a long-standing involvement, expertise, and successes in the general field 'Energy' and this is considered to be the most important priority area that will contribute to the accomplishment of climate neutrality.

In order to refine the plan and visualise the impact pathways, it has been decided to divide the Energy field of action into four separate particular Energy portfolios:

- 1. Renewable Energy Generation**
- 2. 'Greening' of District Heating**
- 3. Energy Efficient Buildings**
- 4. Smart Energy Systems**

Renewable Energy Generation

The portfolio includes a number of important actions which will have a significant effect on the accomplishment of the targets of the climate action plan. Some of these are listed below:

- A 7MW Photovoltaic Power Plant is under preparation by the Energy Community of the Municipality of Kozani which will produce enough 'green' electric power that will cover the requirements of the Municipality.
- A continuous effort is underway for upgrading of the Public Lighting through the introduction of LED lights and smart lighting management in order to significantly reduce electric energy consumption.
- Currently there has been an enormous progress and growing interest on the planning, licensing, installation and operation of large scale renewable energy systems in the MoK, thus leading to an increasingly green energy mix. The installations are in their majority photovoltaic parks and wind farms. The attractive elements that contributed to this development is the availability of land and the existence of an established electric power transmission grid due to the thermal power plants of the region. A considerable number of these installations belong to energy communities. In the development of the Climate Neutrality Action Plan only small scale installations have been taken into account and a rather conservative assumption has been made that only 10% of the current applications for the development of renewable energy systems will be



materialised until 2030. Even this safe assumption is sufficient to drive the local **emission factor for electricity** at a level which is much lower than the national one approaching **almost zero** during the period of 2026-2030.

- The climate action plan involves the introduction of a large number of PV and thermal solar systems to existing buildings which will lead to reduced energy consumption and CO₂ emissions.

'Greening' of District Heating

The District Heating of Kozani is an important asset for Kozani. However, currently it is powered by heat produced by the lignite-fired power plant Agios Dimitrios of PPC and also by oil burners in order to cover peak demand.

The climate action plan aims towards providing "clean" energy to the citizens through the gradual 'greening' of the power source initially using natural gas and at a later stage through the electrification of the system with electricity which is provided by renewable sources. The electrification process will take place by using electric boilers and/or heat pumps.

Certain stakeholders of the MoK have already been involved in technical and financial discussions and others have undertaken feasibility studies.

The MoK participates in the **NEUTRON** project as the Lead partner, under the action entitled 'Accelerating cities' transition to net zero emissions by 2030' – 'NetZeroCities'. Under the NEUTRON pilot, the participating partners develop and showcase the methodology to support the transition via the definition of existing innovative technologies, such as the Green Heat Module (GHM); they implement this methodology in sectoral pilots, including energy production from RES and energy-from-waste (EfW), Digital Twins, Building Information Modeling, and accelerate a just transition while focus on energy decarbonization of district heating, smart buildings, just transition, and circular economy in building sector, as well as to any other economic activity, including industry and agriculture.

Energy Efficient Buildings

Figure 21 graphically illustrates the actions that are included in the plan for upgrading public and private buildings for improved energy efficiency.

- The deep energy retrofit of private residences is the most significant action both in terms of GHG emission reductions and associated costs; and, it is expected to have a major impact reducing energy demand, CO₂ emissions and effectively reduce energy costs for the citizens. This action is the result of successful national initiatives which need to intensify and develop further at local level through appropriate resourcing. The adoption of bioclimatic principles on architectural design and regulations will be of major importance. The engagement of citizens is of paramount importance.
- Deep Energy Retrofit of Municipal Buildings
- Deep Retrofit of School Buildings
- Deep Energy Retrofit of the Sports Facilities of the Municipality of Kozani



- Deep Energy Retrofit of Tertiary Sector Buildings

The CAP proposes the development of a local funding scheme to accelerate the energy upgrade of existing buildings by offering financial incentives to individual home owners.

The MoK participates in the **ProLight** project (Progressive lighthouse districts serving as green district Gate towards Leadership in Sustainability, HORIZON-CL4-2021-RESILIENCE-02) with 16 participants. The envisaged actions of the ProLight project are representative for innovative refurbishment with large potential of immediate replication of other residential buildings from the municipalities and the social housing involved.

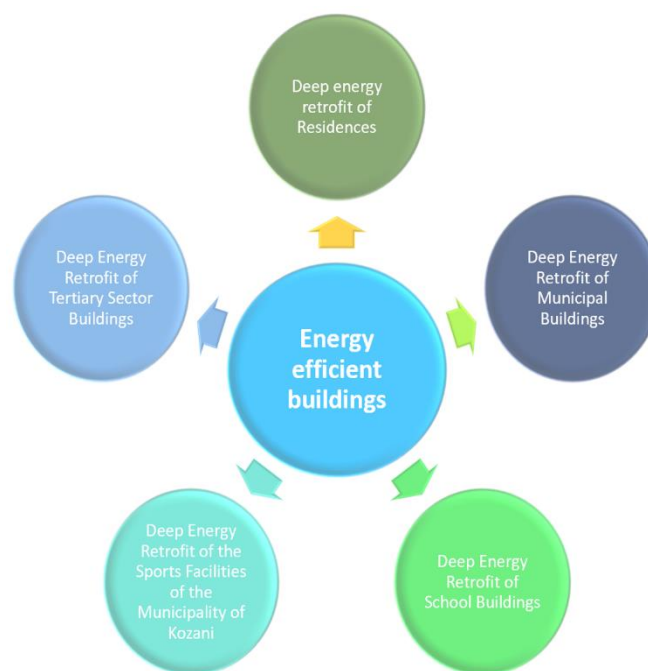


Figure 21: Energy efficient buildings

Smart Energy Systems

Smart technology will be fully exploited "Smart Building" and Energy Management System for the monitoring and management of one or more facilities (buildings) which mainly aims at energy management, with the target of saving resources and reducing the costs and expenses of managing the Municipality's facilities, as well as the possibility for monitoring and upgrading the living conditions inside the buildings, by using digital twin - 3D models.

Pilot Projects

In addition to the well-defined actions of the Climate Neutrality Action Plan, a number of pilot projects are under consideration in order to test the feasibility of innovative technologies at large scale. A list of pilot project can be outlined as follows:



Production of energy for electricity and heating purposes through renewable and other alternative sources, such as:

- Using solar energy (with thermal storage) and/or biomass and/or natural gas/green gas in the power plants currently fired by lignite (in order to save power plant jobs and reduce emissions).
- Large solar photovoltaic parks for the electrolytic production of green hydrogen (and other renewable gases) for attracting gas/ heat consuming industry, for export, and for energy storage.
- Large scale photovoltaic parks, due to the availability of brownfields in the area and the ease of connection to the transmission grid.
- Wind parks.
- District heating units using natural gas or combinations of alternative energy sources that do not include lignite.
- Production of heat for industrial and agricultural processes.
- Promotion of Hydrogen technologies through the development of a «H2 Innovation Hub» to be implemented by CERTH in the former industrial zone of Aeval in Ptolemaida. The H2-HUB will test H2 production (alkaline and PEM electrolyzers), H2 utilization for power and heat (fuel cells) and H2 use in transportation (refuelling of H2 vehicles through HRS).

Energy storage projects, such as:

- Conversion of lignite plants to thermal plants using RES with molten salts storage.
- Combinations of RES and pumped hydro-energy storage (PHS) stations.
- Development of pumped-storage plants in coal mines.
- Battery storage.
- Green gas storage (hydrogen, etc.).

The MoK participates in:

- The **STARDUST** project (HOLISTIC AND INTEGRATED URBAN MODEL FOR SMART CITIES, H2020-SCC-2017). The objective of STARDUST project is to pave the way towards the transformation of the carbon supplied cities into Smart, high efficient, intelligent and citizen oriented cities, developing urban technical green solutions and innovative business models, integrating the domains of buildings, mobility and efficient energy through ICT, testing and validating these solutions, enabling their fast roll out in the market.
- The **TIPS4PED** project (Turning cities Planning actionS for Positive Energy Districts into success, HORIZON-MISS-2023-CIT-01). TIPS4PED will design, develop, and test in a relevant environment the effectiveness and the techno-economic viability of a Digital Twin based Platform, to support municipalities in the implementation of Positive Energy Districts. The TIPS4PED Platform will be able to support municipalities in the decision-making delivering a series of evidence-based results, increasing the environmental sustainability of cities, and reducing operational costs. The project will adopt a people-centric approach, which aims at engage, train and empower citizens and potential stakeholders.
- The **REFORMERS** project (Regional Ecosystems FOR Multiple-Energy Resilient Systems, HORIZON-CL5-2023-D3-01). The REFORMERS project aims to develop, implement an exploit an energy renewable energy valley in the Boekelermeer in the



Netherlands, that serves as a living lab for testing and validating technologies, business models, stakeholder ecosystems, including industrial partners, DSO, the municipality, and residents, and user acceptance in real-life circumstances, in a peri-urban and industrial environment.

- The **EHHUR** project (EYES HEARTS HANDS Urban Revolution, HORIZON-MISS-2021-NEB-01). The EYES HEARTS HANDS Urban Revolution (EHHUR) project will develop and test a co-designed methodological structure to support cities in their built environment transformation by using already existing good practices and complementing them with the New European Bauhaus and EU Missions principles. 7 Lighthouse demonstrators will be involved across EU and Associated countries (DK, EL, BE, PT, TK, HR, IT). EHHUR will tackle socio-economic and cultural challenges through relevant case studies facing social segregation, vulnerable residents (experiencing energy poverty), coal transition, depopulated and degraded historic centres.

Mobility and Transport

Transport is a vital sector towards climate neutrality of Municipality of Kozani. Decisive policies, smart investments and changes in demand can trigger a vital shift towards cleaner transport modes and reduce the sector's impact on the environment, climate and our health. Transport connects people, cultures, cities, countries, and continents. It is one of the main pillars of modern societies and economies, allowing producers to sell their products across the world and travellers to discover new places. Transport networks also ensure access to key public services, such as education and health, contributing to a better quality of life. Connecting to transport helps boost the economy in remote areas, creating jobs and spreading wealth.

As demand has increased, so has the overall energy efficiency of new passenger cars, vans and trucks, planes, and ships, but not at the same pace as total transport emissions. The sheer volume of transport activity has impacted our GHG emissions and demands on all types of transport are expected to increase.

The city of Kozani is well-positioned to transform its mobility landscape and embrace sustainable transportation solutions. With a range of strengths at its disposal, the city can strategically navigate the pathways to achieve a greener and more efficient mobility system. Some of the Municipality's strengths are:

- Existence of a pedestrian area where all special land uses, public and professional, commercial and recreational uses are included
- The total length of sidewalks constitutes 16% of the total road network of the area
- Implementation of a controlled parking system with vending machines
- Detection of black spots
- Fair pricing
- Minibus operation
- There is no through traffic within the city
- Existence of a Sustainable Urban Mobility Plan (SUBM) and participatory planning of the local community



A number of opportunities may arise for mobility and transportation within the Municipality of Kozani and these include:

- The local community realizes the need to switch to walking
- Introduction of an electric shared bicycle system
- A large part of the road sections were identified without parking
- Parking seems to decrease and zero depending on the distance of the studied streets from the city centre.
- Shift to gentle means of transport
- No through traffic
- Introduction of electrification
- Interconnection of urban transport
- The local community realizes the need to switch to cleaner means of transportation

Kozani has already implemented the following projects:

- Municipal fleet maintenance
- Green initiative – eMotion
- Information Events for New Vehicle Technologies
- Operation of two routes with the minibuses of the Municipality of Kozani
- Configuration of surrounding green spaces
- Amendment of the approved city plan for the regeneration of the city center of Kozani
- Elaboration of a Sustainable Urban Mobility Plan
- Urban infrastructure renewals

Municipality of Kozani aims to become climate-neutral by 2030. This cannot be achieved without a sustainable mobility system, **based on cleaner and more active transport modes, cleaner fuels and, where possible, reducing the need for mobility.**

Thus, Kozani will take advantage of future actions to be implemented in the “Transport and Mobility” field in order to reduce further GHG emissions and move effectively to climate neutrality.

Mobility and Transport consists of **six(6) main portfolios** that can lead to further reduction of CO₂ emissions until 2030.

1. *Introduction of alternative fuel in transportations*
2. *Upgrade of Public Transportation Systems and Urban Logistics*
3. *Walkability & Cycling Strategy*
4. *Introduction of IT technologies to Mobility*
5. *Infrastructures Upgrades & Mobility Measures*
6. *Incentives and Citizen Engagement*

The MoK participates in the project **JUST STREETS** (Mobility justice for all: framing safer, healthier and happier streets, HORIZON-MISS-2022-CIT-01). JUST STREETS is the project



proposal from a team of 30 partners from 17 countries, including 12 cities representing more than 4,5m citizens. It aims to transform cities' car-centered mobility narratives that take for granted that streets are for motorized traffic only, promoting walking, cycling and other active modes of mobility.

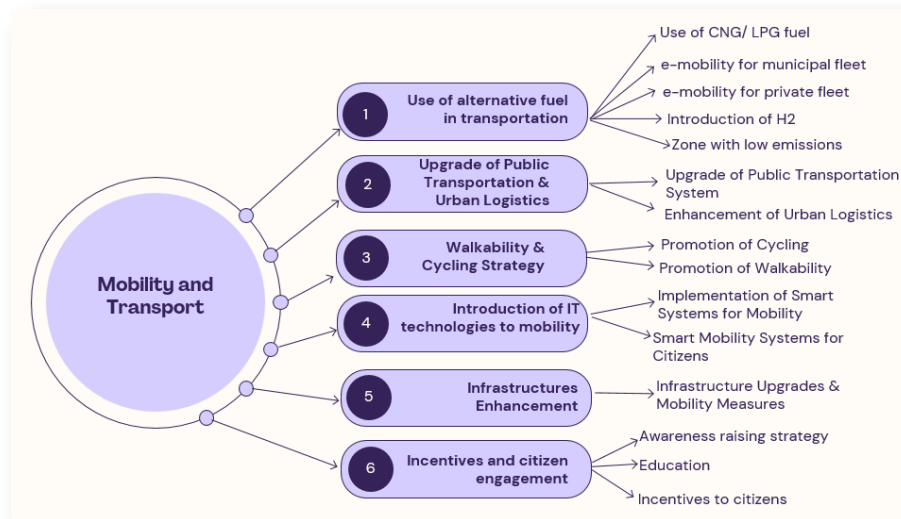


Figure 22: Mobility and Transport portfolios

Waste and Circular Economy

The Municipality of Kozani places particular emphasis on the promotion and implementation of actions towards the reuse and recycling of part of the MSW. It should be noted that the Municipality of Kozani, unlike most municipalities in the country, implements a program of Sorting at Source and recycling four streams of recyclable waste, with the result that the collected materials that are taken to DIADYMA SA facilities for processing have less residue than loads collected from the blue bin network. The Recyclable Materials (RA) collected from the recycling bins of the four streams have a purity that exceeds 95%.

From the micro-sorting at RECYCLABLE MATERIALS SORTING CENTER per material stream, packaging materials are again basically obtained which are also utilized in the correct stream.

Already in the Municipality, in addition to recyclable materials (paper, plastic, glass, metals), separate collection programs of various waste streams such as bio-waste, frying oil, lamps, batteries, bulky and green are operating.

The Municipality of Kozani is responsible for the collection of the mixed solid waste of the entire Municipality as well as the Recyclable Materials (RA) within the city of Kozani. DIADYMA is responsible for the collection of household waste bins outside the urban center of Kozani as well as the bins of bio-waste, green waste, bulky waste and frying oil.



All the mixed and recyclable waste collected by the Municipality is transferred to the Local Waste Management Unit (WMU) of Kozani, while the organic waste and bio-waste collected by DIADYMA SA are sent directly to the Waste Treatment Unit (WTU) of Kozani.

Kozani participates in the following projects/actions:

- **SYMBI** project concerning the Industrial Symbiosis for Regional Sustainable Development and Circular Economy based on Resource Efficiency
- **In2UCO** project: INTEGRATED INNOVATIVE PILOT MANAGEMENT OF FRYING OILS WITH THE PARTICIPATION OF CITIZENS & STUDENTS
- **NOMAD** project: NOVEL ORGANIC RECOVERY USING MOBILE ADVANCED TECHNOLOGY
- **LIFE-IP CEI-GREECE** project: CIRCULAR ECONOMY IMPLEMENTATION IN GREECE
- **SYMBIOSIS** project: SYMBIOTIC NETWORKS OF BIO-WASTE SUSTAINABLE MANAGEMENT
- Energy Communities of Kozani

Kozani moves to optimization of the waste management and recycling collection network including the introduction of new streams for sorting at source and scalability by 2030 and further development of Smart Waste Management (IoT) systems (i.e., full installation of sensors on bins and waste collection vehicle fleet). Six separate streams (a seventh is implementing at the moment) are already installed in the largest part of the Municipality. Kozani is trying continuously to increase Sorting at Source and recycling through installation of Green points.

Regarding **circular economy**, the **vision of the Municipality of Kozani** is:

- *To be a pioneer municipality in the adoption of circular economy practices in Greece as well as in their promotion in social and economic level, by shaping new circular economy patterns and governance practices at the local Government level*
- *To utilize the circular economy practices and the related funding to create new jobs that will offset part of the de-lignification losses*
- *To act as a catalyst for the circular economy throughout Northern Greece, with particular emphasis on the development of innovation structures and practices that will create long-term comparative advantages for the Municipality and its residents*

Thus, Kozani will take advantage of future actions to be implemented in the “Waste & Circular economy field in order to reduce further GHG emissions and move effectively to climate neutrality.

Waste & Circular economy consists of **three(3) main portfolios** that can lead to further reduction of CO₂ emissions until 2030.



- **Sorting at Source enhancement and Recycling**
- **Certification and Green Procurements**
- **Awareness raising**

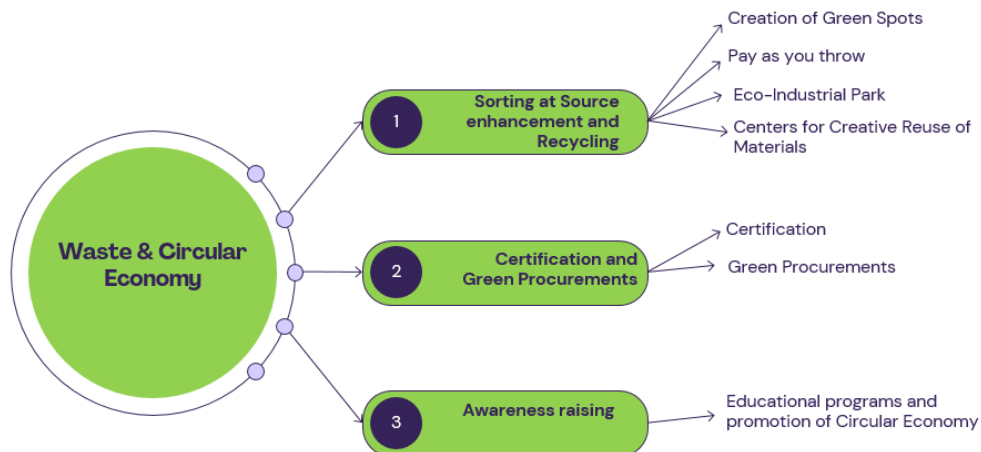


Figure 23: Waste and Circular Economy

Cross-sectional initiatives

Digitisation

Digitisation can leverage human and social capital, entrepreneurship, knowledge, intelligence and creativity. Moreover, it can change the way of doing things and working effectively through collaboration, networking, and participation. Western Macedonia and the Municipality of Kozani in particular, is in dire need of modernizing its production base to become attractive for entrepreneurs and young highly skilled people, while at the same time addressing the needs of an aging and unevenly distributed population.

Digitisation runs horizontally across all impact pathways and is considered to be a highly important constituent for the accomplishment of the climate neutrality.

The initial phase of the implementation of the plan is about governance and more precisely on the organizations' competence to define their needs clearly and be able to integrate the solutions into their wider operations. Equally important is the organizations' ability to support the use and continuous demand for data and the upgrade of digital tools. The second phase concerns the supply and operation of the necessary systems that could revolve around functions and utilities such as: smart governance, smart economy, smart mobility, smart environment, smart energy, smart living, etc.



In parallel, developing citizens' digital skills is of paramount importance to ensure access to education, human resources management, in an inclusive society that enhances creativity and fosters innovation.

It has to be mentioned that the CAP proposes a number of digital actions which are planned for the later stages of the plan's implementation. In this way, smart technologies will have become more robust and easier to use and also the level of familiarisation of the citizens will improve through targeted learning initiatives. It is well-understood that digital tools without a strong community and trust process just adds an extra layer of complexity and can become a barrier. It is quite apparent that all the proposed digital tools are not in an urgent need at the beginning and can be strategically added without creating additional complexity and barriers. Whether all the proposed platforms are required or not will be dynamically assessed as the implementation of the plan evolves and maybe it is quite likely that tools that are more familiar to everyone can be exploited especially in the beginning.

Despite the above reservation, the development and implementation of particular digital tools can have significant co-benefits to remote small communities as they can improve access to services locally without the need to travel to the urban centre of the MoK. The same is the case for particular disadvantaged social groups where the use of digital tools can facilitate access to services, reduce the sense of isolation and improve the chances of inclusion.

Open Mall

The Municipality of Kozani, in cooperation with the Commercial Association of Kozani and the participation of businesses, proceeds to the development of a Municipal Open Trade Center called "Open Mall". The action concerns the implementation of targeted interventions to upgrade the functionality and aesthetics of the intervention area which is located in the city center with the adoption and use of smart applications. The portfolio includes a number of actions which will be implemented by the Municipality and actions that will be implemented by the Commercial Association.

Among others, the actions include upgrade of public lighting, planting of trees, upgrade of parking spaces, improvement of accessibility, installation of urban furniture made from environmentally friendly materials, acquisition of modern mini-buses that will offer free access to citizens, smart parking spaces, smart crossings etc.

In addition, through the use of smart systems, it is expected to reduce the city's operating costs, harmonize with European guidelines for sustainable mobility and waste management. The Open Mall project is in line with the principles of environmental protection. More specifically, the proposed interventions contribute to the limitation of air pollutant emissions and/or the reduction of greenhouse gas emissions, the rational management of municipal waste, as well as the proper energy management and energy savings. The reduction of traffic congestion, the reduction of travel time to the city center and traffic on the main streets of the city during peak hours as well as the immediate reduction of the energy footprint of roadside



electric lighting are some of the proposed interventions that move towards environmental protection and resource efficiency. Improving energy efficiency both in public buildings and in the private sector (businesses) will lead to a reduction in energy consumption and consequently to a reduction in emissions to the atmosphere. In addition, improving air quality means limiting the exposure of the population to pollutants.



Figure 24: Open Mall of Kozani

Green Hydrogen

An Innovation Hub for green hydrogen and energy storage in Western Macedonia (H2-HUB) funding of 18 million euros has already been secured. It will include a hydrogen cluster based at the National Centre for Research and Technological Development (CERTH) in **Ptolemais**, an electronic hydrogen technologies application platform and a Centre for Hydrogen Studies at the University of Western Macedonia. The infrastructure will be complemented by a hydrogen technology park consisting of a 1 MW photovoltaic park, two electrolytes to produce 60 kg of green hydrogen per day which will initially be used in two municipal heavy-duty refuse trucks and two smaller personnel and supply vehicles.

The project entitled “H2 Innovation Hub” has been included in the Just Transition Development Plan (SDAM) of the Region of Western Macedonia (“Territorial Plan for Fair Transition of Western Macedonia” - Priority 2: Energy Transition-Climate Neutrality, Renewable Energy Sources (RES) Promotion, 2nd consultation, June 2021) acting as an Innovation Zone, with the coordination of research institution CERTH/CPERI located in Ptolemaida.

Furthermore, the Public Power Corporation (PPC) and Motor Oil have introduced it **Hellenic Hydrogen**, for the development of hydrogen applications, with the first objective of developing a “Hydrogen Valley” in Western Macedonia which will include the development of a 100 MW



electrolysis plant to produce approximately 11,789 tonnes of renewable hydrogen using wind and solar energy.

The development of the Climate Neutrality Action Plan

In order to estimate the influence of each intervention on CO₂ emissions, an *in-house computational model* by the University of Western Macedonia that it calculates the emission reduction caused by each selected action and accumulates all the individual reductions in order to estimate the total combined effect. A detailed time evolution of all the actions that are introduced has been carefully decided and their effect on GHG emissions has been estimated using either measured data from previous experience or values that are found in the scientific literature are utilised. This process is not very straightforward as the emission coefficients proposed sometimes vary significantly. In these cases, a more conservative approach has been followed in order to remain on the conservative side of the calculations.

The computational model contains historical data related to past energy and energy savings interventions in the Municipality of Kozani and has also been used in order to perform parametric studies on the influence on GHG emissions of various parameters that are related to factors such as the type of interventions, their prioritisation, their intensity, the individual emission factors, the time-evolution of implementing various actions of the plan etc. The above sensitivity analysis studies proved to be extremely useful for quantitative and qualitative decisions related to the development of the climate action plan.

In parallel, economic aspects of each intervention have been included in the model and the effect of changes on the particulars of individual actions on the total cost requirement was estimated. Furthermore, sensitivity analyses were carried out for the development of a hierarchy interventions in terms of resulting CO₂ emissions reduction per unit of investment cost; or otherwise 'value for money' or each intervention.

The model is under continuous development and refinement, and it is planned to be used during the implementation of the action plan as this will be a dynamic process. In addition, the model will be used to monitor progress in GHG emissions reduction in combination with other tools that are used to support the implementation of other plans of the Municipality, e.g., the SECAP.



Impact of Climate neutrality action plan on CO₂ emissions

Based on the current state of the climate action plan, the evolution of CO₂ emission reductions between 2023 and 2030 were calculated in detail based on the contribution of each individual action and field of action. The forecast of the emission reductions is presented in Figure 25. In addition, Table 4 presents numerical data of the emissions reduction for each action and field of action.

Table 4: Cumulative emissions reduction in tonnes CO₂.

FIELDS OF ACTION	#	ACTION	Cumulative emissions reduction [tnCO ₂]															
			30/6/2023	31/12/2023	30/6/2024	31/12/2024	30/6/2025	31/12/2025	30/6/2026	31/12/2026	30/6/2027	31/12/2027	30/6/2028	31/12/2028	30/6/2029	31/12/2029	30/6/2030	31/12/2030
ENERGY	1	Covering district heating thermal needs with green energy					4,590.66	4,590.66	4,590.66	4,590.66	44,116.27	44,116.27	44,116.27	44,116.27	83,305.21	83,305.21	83,305.21	83,305.21
	2	7MW photovoltaic power plant by the Energy Community of MOK					2,704.03	2,704.03	2,704.03	2,704.03	2,704.03	2,704.03	2,704.03	2,704.03	2,704.03	2,704.03	2,704.03	2,704.03
	3	Deep energy retrofit of residences	12,485.63	12,485.63	53,938.66	53,938.66	57,545.19	57,545.19	61,995.09	61,995.09	58,923.90	58,923.90	62,737.48	62,737.48	56,097.42	56,097.42	58,923.65	58,923.65
	4	Deep energy retrofit of Municipal buildings (incl. RE installations)	288.16	288.16	648.71	648.71	648.71	648.71	714.09	714.09	891.28	891.28	1,684.59	1,684.59	1,684.59	1,684.59	1,684.59	11,251.99
	5	Building integrated renewable energy systems			49.12	98.24	147.35	196.47	245.59	294.71	343.82	392.94	442.06	491.18	540.29	589.41	638.53	687.65
	6	Public lighting	0.00	0.00	0.00	0.00	66.47	66.47	907.89	907.89	907.89	907.89	907.89	907.89	907.89	907.89	907.89	907.89
	7	Deep energy retrofit of the tertiary sector buildings			534.05	1,068.09	1,602.14	2,136.18	2,670.23	3,204.28	3,738.32	4,272.37	4,806.42	5,340.46	5,874.51	6,408.55	6,942.60	7,476.65
MOBILITY & TRANSPORT	8	Mobility	21.12	42.24	427.03	837.17	2,090.20	4,425.91	9,900.63	15,756.30	17,311.46	21,612.15	22,530.92	24,241.94	26,442.08	29,652.96	35,456.06	48,862.05
WASTE & CIRCULAR ECONOMY	9	Waste & Circular Economy	0.00	0.00	4.36	6.35	84.91	126.99	375.01	451.40	576.03	782.25	823.09	890.34	1,004.30	1,203.38	1,562.10	2,228.10
GREEN INFRASTRUCTURE	10	Agriculture/Forestry	82.73	165.46	248.19	330.92	413.65	496.38	579.11	661.84	744.57	827.30	910.03	992.76	1,075.49	1,158.22	1,240.95	1,323.68
SMART CITY	11	ICT																
	12	Electronic Governance																
	13	Smart Energy Systems																
		Cumulative emissions reduction [tnCO ₂]	12,877.64	12,981.49	55,850.11	56,928.13	69,893.30	72,937.00	84,682.33	91,280.29	130,257.58	135,430.38	141,662.77	144,106.94	179,635.80	183,711.65	193,365.60	217,670.88
		Total emissions (2020) [tnCO ₂]	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33	271,079.33
		Total emissions [tnCO ₂]	258,201.70	258,097.85	215,229.22	214,151.20	201,186.03	198,142.33	186,397.00	179,799.05	140,821.75	135,648.95	129,416.57	126,972.40	91,443.53	87,367.68	77,713.74	53,408.45
		Emissions reduction [%]	4.75%	4.79%	20.60%	21.00%	25.78%	26.91%	31.24%	33.67%	48.05%	49.96%	52.26%	53.16%	66.27%	67.77%	71.33%	80.30%

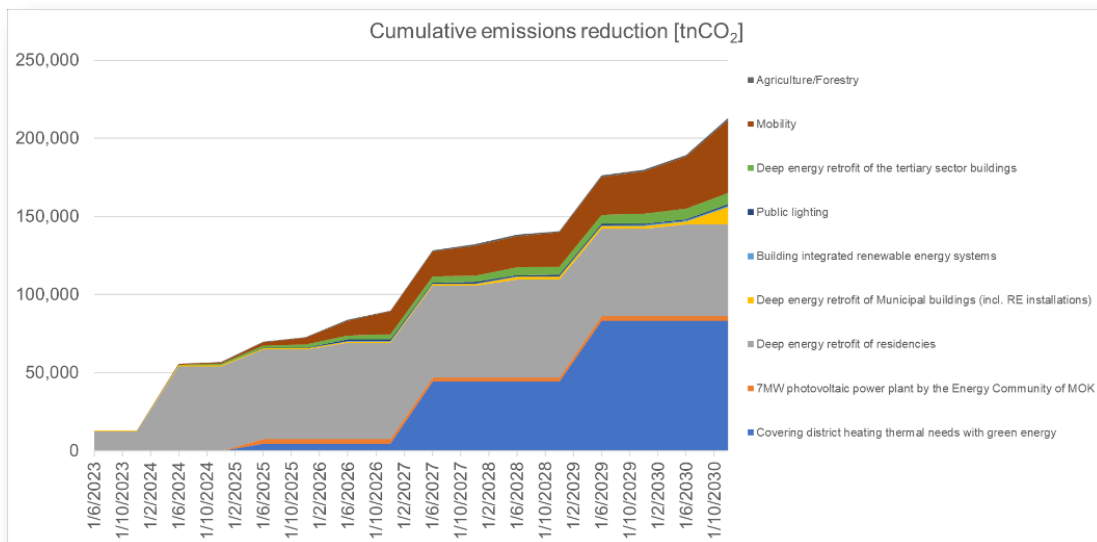


Figure 25: Cumulative emissions reduction (2023-2030).



Figure 26 presents the percentage contribution of each proposed interventions in the total emission reductions in year 2030. The private building sector along with the ‘greening’ of the District Heating have the strongest impact on reducing CO₂ emissions. Mobility actions also have a very important role. In 2030 the CO₂ emissions will be reduced by **80.3%** of the baseline emissions of 2020 (Fig. 27).

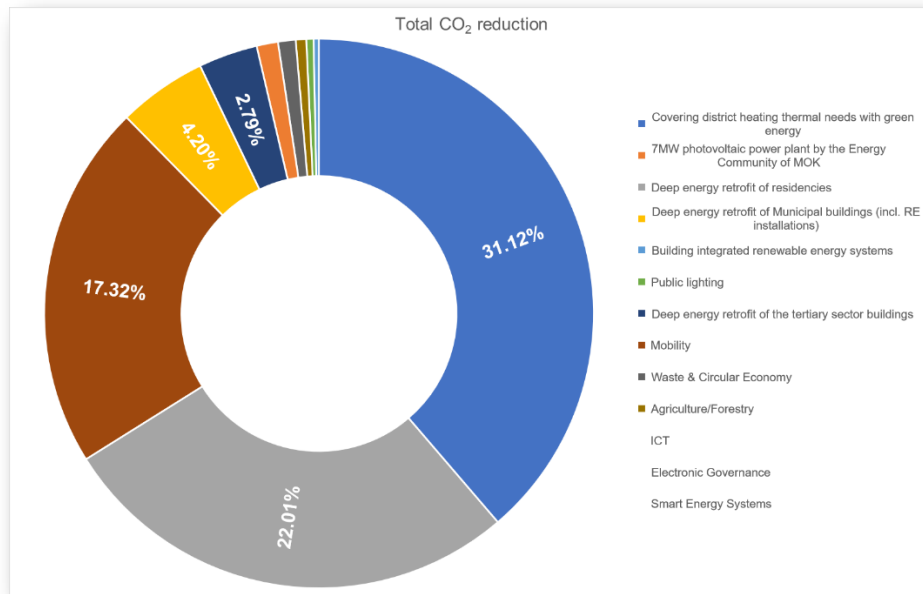


Figure 26: Percentage contribution of each proposed intervention in the total emission reductions in year 2030

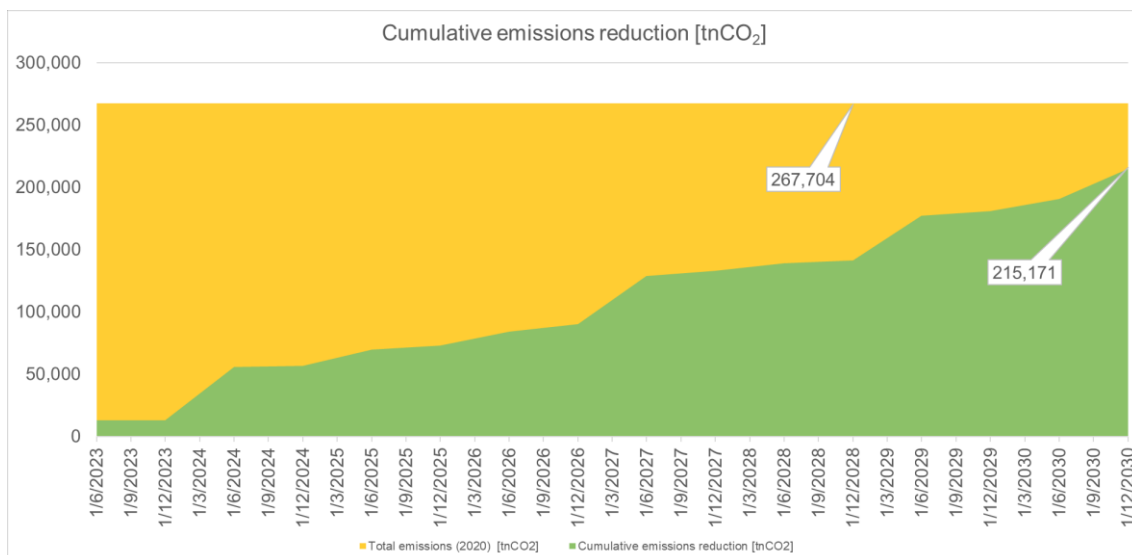


Figure 27: The effect of the proposed interventions in reducing the baseline emissions



Impact of Climate neutrality action plan on energy savings and green energy production

Table 5 presents quantitative data of the energy savings and the green energy production for each action and field of action.

Table 5: Total effect of the proposed action on energy savings, green energy production and emissions reduction

FIELDS OF ACTION	#	ACTION	Energy savings [MWh/year]	Green energy production [MWh/year]	Energy savings and green energy production [MWh/year]	Emissions reduction [tnCO ₂ /year]
ENERGY	1	Covering district heating thermal needs with green energy			0.00	83,305.21
	2	7MW photovoltaic power plant by the Energy Community of MOK		10,500.00	10,500.00	2,704.03
	3	Deep energy retrofit of residencies	848,567.60		848,567.60	58,923.65
	4	Deep energy retrofit of Municipal buildings (incl. RE installations)	45,170.18	444,825.00	489,995.18	11,251.99
	5	Building integrated renewable energy systems	2,670.20	94,327.87	96,998.08	687.65
	6	Public lighting	5,813.61	0.00	5,813.61	907.89
	7	Deep energy retrofit of the tertiary sector buildings	17,774.84	0.00	17,774.84	7,476.65
MOBILITY & TRANSPORT	8	Mobility			0.00	48,862.05
WASTE & CIRCULAR	9	Waste & Circular Economy	0.00	0.00	0.00	2,228.10
GREEN INFRASTRUCTURE	10	Green Infrastructure	5,008.42	0.00	5,008.42	1,323.68
SMART CITY	11	ICT	0.00	0.00	0.00	0.00
	12	Electronic Governance			0.00	0.00
	13	Smart Energy Systems			0.00	0.00
ENERGY	14	Renewable Energy Systems		1,003,090.99	1,003,090.99	417,508.06
Total			925,004.86	549,652.87	1,474,657.73	217,670.88
In the year 2020			Energy consumption [MWh/year]			Emissions [tn CO₂/year]
			1,188,521.64			271,079.33
Residuals			263,516.79			53,408.45
Reduction Percentage			77.83%			80.30%

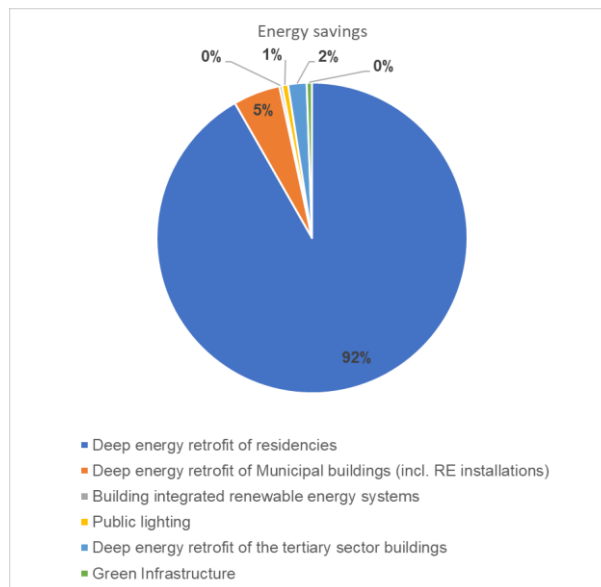


Figure 28: Percentage of each proposed intervention in primary energy savings

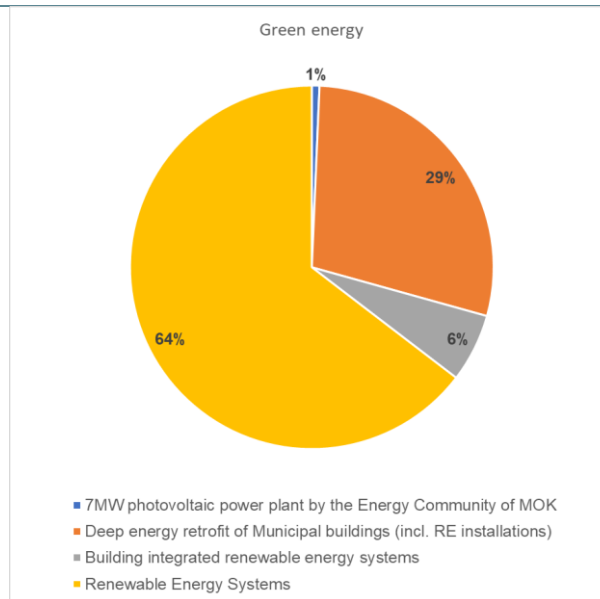


Figure 29: Percentage of each proposed intervention in green energy production

Figure 28 shows the percentage participation of the proposed interventions in the energy savings for year 2030.

The building sector interventions have a tremendous share in energy savings of MoK. Consequently, it is highly important to develop a local funding initiative which will strongly support this intervention. In addition, the most important challenge for the successful outcome of the climate action plan is the engagement of citizens in undertaking the renovation of their houses and flats. Inevitably this requires strong financial incentives as it is addressed in the associated Investment Plan.

Among the green energy actions proposed, Figure 29 shows that the renewable energy projects that are under planning and preparation to be installed through private funding, occupy the largest share in terms of installed capacity (approximately 64%). Renewable energy installations on Municipal buildings are also very important (29%) and installation on private buildings roofs have a share of approximately 6%.



Module B-2 Climate Neutrality Portfolio Design

Module B-2 “Climate Neutrality Portfolio Design” should contain a project description for **each intervention planned**, including interventions by local businesses and industry, according to the template B-2.1, including actions those interventions targeted at enhancing carbon sinks to address residual emissions. Narrative analysis and comments can be provided in B-2.2. A summary of how residual emissions are addressed, should be provided in B-2.3.

B-2.1: Description of action portfolios - textual or visual

Fields of action	Portfolio description	
	List of actions	Descriptions

ENERGY

Renewable Energy Generation	7MW Photovoltaic Power Plant by the Energy Community of the Municipality of Kozani	The PV will produce green electric energy enough to cover the needs of MoK
	Energy Upgrading of the Public Lighting	Introduction of LED lights and smart lighting management in order to significantly reduce electric energy consumption
	Renewable Energy Systems	Large RES systems are planned to be installed in MoK, thus leading to a green energy mix
	Building integrated Renewable Energy Systems	The introduction of a large number of PV systems and thermal solar systems to existing buildings will lead to reduced emissions
‘Greening’ of District Heating	Covering District Heating Thermal Needs with Green Energy	Currently the DH system in Kozani is powered by heat produced by the lignite-fired power plant Agios Dimitrios of PPC and oil burners; in order to provide “clean” energy to the citizens the DH system power source will be replaced by a cleaner and more efficient one
Energy Efficient Buildings	Deep energy retrofit of Residences	Energy upgrade of residences is expected to reduce energy demand, CO ₂ emissions and effectively reduce energy costs for the citizens. The adoption of bioclimatic principles on architectural design and regulations will be of major importance
	Deep Energy Retrofit of Municipal Buildings	Energy upgrade of Municipal buildings is expected to reduce energy demand, CO ₂ emissions and reduce energy costs
	Deep Energy Retrofit of School Buildings	Energy upgrade of schools is expected to reduce energy demand, CO ₂ emissions, reduce energy costs and in conjunction with information actions it will have a major impact on citizens behaviour
	Deep Energy Retrofit of the Sports Facilities of the Municipality of Kozani	Energy upgrade of sports facilities is expected to reduce energy demand/costs and CO ₂ emissions
	Deep Energy Retrofit of Tertiary Sector Buildings	Energy upgrade of the tertiary sector buildings is expected to effectively reduce energy demand, operating costs and CO ₂ emissions



Smart Energy systems	Smart Energy Management	"Smart Building" and Energy Management System for the monitoring and management of one or more facilities (buildings) which mainly aims at energy management, with the target of saving resources and reducing the costs and expenses of managing the Municipality's facilities, as well as the possibility for monitoring and upgrading the living conditions inside the buildings, by using digital twin - 3D models.
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MOBILITY AND TRANSPORT

Introduction of alternative fuel technologies in transportation	Penetration of vehicles fuelled by CNG and LPG	This action concerns the penetration of CNG/LPG for private vehicles. This action is about the replacement of approximately of 2% of the conventional vehicles which can lead to the reduction of significant amounts of CO ₂ emissions
	Replacement of municipal vehicles with EV with RES installation of charging stations and GPS management	E-mobility will be promoted which will be fuelled by RES. These actions refers to both the private and the municipal vehicle, as well as the establishment of charging stations.
	Replacement of private vehicles with EVs using RES	EVs are selected as an option to replace obsolete private cars. This will help in the penetration of EVs fuelled by RES.
	Replacement of heavy duty vehicles with hydrogen technology	This action focuses on the promotion of hydrogen technologies that can replace municipal and private heavy-duty vehicles.
	Zone with low emissions of air pollutants with priority on the use of EVs	The establishment of low-emission and low-noise zones, with a focus on prioritizing electric vehicles (EVs), represents a groundbreaking approach to creating a sustainable and environmentally friendly urban landscape.
Upgrade of Public Transportation Systems and Urban Logistics	Upgrade of Public Transportation System	This field contains actions that will help in the enhancement of public transportation as well as the reduction of CO ₂ emissions. The actions refer to reorganization of public transportation routes within the city, promotion of the idea of park & ride, creation of public transport bus lines (mini-bus/on-demand) and utilization of a taxi system for collective movements with itineraries responsive to demand.
	Enhancements of Urban Logistics	This action concerns business/municipal services dealing with freight transportation. Therefore, this action includes (better planning of refuse collection and development of an intelligent supply management system.
Walkability & Cycling Strategy	Promotion of Walkability	Walkability strategy includes a number of measures that concern infrastructure upgrade and modifications in order to prevent citizens from using private vehicles. Walkability measures concern pedestrianization and Development of infrastructure to enhance accessibility (widening points, local outskirts, reduction of lane width, disabled ramps, etc.), creation of green routes.
	Promotion of Cycling	Similar to walkability promotion, cycling strategy concerns a package of measures including infrastructure changes and formations that aim to promote cycling. Cycling promotion includes creation of new cycling routes and related facilities (e.g. parking spaces-bike racks, sharing systems)
Introduction of IT	Implementation of Smart Systems for Mobility	The introduction of Intelligent Transportation Systems (ITS) marks a paradigm shift in transportation, providing efficient, sustainable, and eco-friendly mobility solutions. Smart



technologies to Mobility		mobility systems have the potential to improve transportation efficiency, alleviate traffic congestion, and make substantial contributions to decarbonization efforts and the mitigation of CO ₂ emissions.
	Smart Mobility Systems for Citizens	The implementation of IT mobility systems represents a transformative step in reshaping the way citizens fulfill their daily travel requirements. These innovative solutions provide sustainable transportation options that play a vital role in decarbonization efforts and the reduction of CO ₂ emissions. By adopting a comprehensive approach that encompasses various actions tailored for citizens and pave the way towards a greener and more sustainable future.
Infrastructures Enhancement	Infrastructure Upgrades & Mobility Measures	This field of actions concerns measures that can assist to traffic conditions. These include upgrading intersections to enhance road safety, eg. small roundabouts, creation of a peripheral ring road to prevent congestion, reduced vehicle traffic and replacement of road paving materials on selected streets of the Municipality.
Incentives and citizen engagement	Awareness raising strategy	Awareness raising concerns the organization of events in schools as well as to groups of entrepreneurs or relate professionals in order to learn about mobility actions for CO ₂ emissions mitigation. This can help citizens to adopt environmental behaviour concerning transportations.
	Education	A number of actions concerning education e.g. from eco-driving seminars to workshops and educational activities for new alternative fuelled vehicle and their optimal use. These actions can be used for the promotion of alternative fuel penetration to transportations.
	Incentives to citizens	This action include incentives in order to motivate citizens as well as business to adopt more environmentally friendly means of transportation. Penalty measures are also included as these decisions (of municipal authorities, etc) when implemented may prevent the intensive use of vehicles and can reduce CO ₂ emissions.



WASTE AND CIRCULAR ECONOMY

Sorting at Source enhancement & Recycling	Creation of Green Spots	These are programs where recycling collection is brought directly to communities or neighbourhoods, instead of individuals needing to transport their recyclables to a central location. This can help increase recycling rates and reduce transportation emissions from individuals traveling to and from recycling centres.
	Pay as you throw	"Pay as you throw" program is a waste management system where households pay for the amount of waste they produce. This system aims to reduce waste and encourage recycling, which in turn can lead to a reduction in CO ₂ emissions.
	Eco-Industrial Park	An Eco-Industrial Park is one of the good practices of industrial symbiosis, i.e. a process by which the waste or products of one industrial (or industrial process) become the raw materials for another. The application of this concept allows the use of materials in a more sustainable way and contributes to the creation of a circular economy.
	Centers for Creative Reuse of Materials	The implementation of Creative Reuse Center in a municipality can potentially reduce CO ₂ emissions by extending the lifespan of products and reducing waste.
Certification and Green Procurements	Certification	The Municipality of Kozani will proceed in certification in the implementation of Circular Economy and Industrial Symbiosis procedures and, it will promote the aforementioned action to other economic operators of the region.
	Green Procurements	This action concerns the training of the municipal employees on Green Public Contracts. This action is expected to contribute to the achievement of circular economy in the field of public contracts and procurement of the municipality. The Municipality also aims to the development of an information application for selection criteria for choosing the appropriate Green Public Contracts/Circular Public Contracts.
Awareness Raising	Educational programs and promotion of Circular Economy	The current action is about the educational programs concerning awareness raise activities & encouragement in the participation of citizens in the traits of Circular Economy. Raising awareness campaign are interrelated concepts that must be developed together because through information comes awareness and through awareness citizens become more receptive to being informed and ultimately to actively participating.
	Kozani Water Supply Networks Upgrade	The action concerns projects and supplies aimed at the general upgrading of the water supply networks of the Municipality of Kozani. The sub-project is a supply and includes the installation of smart meters for continuous monitoring and control of the consumption of the internal water supply network of the city of Kozani, namely: 1) Study and design of the overall wireless communication system for the proper communication of the water meters through a LoRaWAN network with a central server at a Central Control Point of DEYAK. 2) Installation of automatic water meter counting system consisting of 4,635 smart water meters and communication and electronic equipment and software.



GREEN INFRASTRUCTURE

Green infrastructure & nature-based solutions	Agriculture/Forestry	Energy upgrade of agricultural vehicles and equipment, effective management of irrigation system and appropriately designed training and informational actions are expected to significantly reduce energy costs, energy demand and consequently GHG emissions.
	Smart parks (solar trees, etc)	The Solar Tree with the Smart Bench is an energy-independent, urban, multi-functional rest station, with modern technological benefits and information gathering. The proposed solar tree is essentially a new, technologically developed solution to meet the modern needs of cities as well as to understand citizens' behaviours and desires. In addition, it offers the possibility of quantitative and qualitative evaluation of environmental data to strengthen the planning of actions to improve urban living.



SMART CITY

Smart City	Digital organization and management platform for workflows, processes, cases and documents.	The specialized Document Management Information System offers a complete and secure solution to everyday problems arising from the management and archiving of large amounts of information. It is a complete digital document management and workflow capture solution with support for digital signatures. It works in a fully online environment as it is a (web-based) application, based on Open-Source Software, with customizations, adjustments and extensions thereof, to fully cover the needs of the end user.
	Smart City Guide	The scope of the project concerns the development of a city guide in which local businesses will be presented, with an integrated Loyalty Platform which will be configured appropriately for use by stores and citizens. The aim is to support local entrepreneurship through interaction services, strengthening loyalty and rewarding customers of the stores.
	Application of the Municipality's Electronic Appointments	Online application, through which a citizen can make an appointment with a specific municipality Service for a specific day and time, in order to be served without crowding into waiting lines. The citizen can monitor the course of the appointment and be updated in real time via SMS time for when it will be served.
	Smart city platform	The Smart City Platform is the central point of collection, control and management of all the data that will be collected from the individual subsystems that the Municipality has and will develop in the future. The offered Platform is an open, cloud-based platform that enables the interconnection and communication of individual smart city solutions and applications.



B-2.2: Individual action outlines

Individual action outlines

ENERGY



7MW Photovoltaic Power Plant by the Energy Community of the Municipality of Kozani

Action outline	Action name	<i>7MW Photovoltaic Power Plant by the Energy Community of the Municipality of Kozani</i>
	Action type	Technical interventions
	Action description	The 7MW solar park of the Municipality of Kozani is under tendering procedure and is expected to produce 10,500 MWh/year of green energy and contributing to the CO ₂ emissions' reduction by 2,704 tonnes annually. The park will cover 100% of Municipality's electricity needs (public lighting, buildings etc) through the virtual net metering scheme.
Reference to impact pathway	Portfolio	Renewable Energy Generation
	Systemic lever	Technology/Infrastructure
	Outcome (according to module B-1.1)	Green energy generation that will completely cover the Municipality's electricity needs will help to reach CO ₂ emissions' reduction to 100%
Implementation	Responsible bodies/person for implementation	Energy Community of Municipality of Kozani
	Action scale & addressed entities	Municipal buildings, agriculture (water supply system) and public lighting system
	Involved stakeholders	Municipality of Kozani, Municipal Enterprise for Water Supply, and Sewerage of Kozani (DEYAK), Municipal Organization of Sports, Culture and Youth, DIADYMA S.A., Municipal Library of Kozani, Kozani Industrial Park Management Company (VIOPAK S.A.), School Committees of Primary and Secondary Education
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	10,500.00 MWh/year
	Removed/substituted energy, volume or fuel type	10,500.00 MWh/year
	GHG emissions reduction estimate (total) per emission source sector	2,704 tonnes CO ₂



Total costs and costs by CO ₂ e unit	6,249,600.00 €
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Energy Upgrading of the Public Lighting		
Action outline	Action name	Energy Upgrading of the Public Lighting
	Action type	Technical interventions
	Action description	<p>The action concerns the supply and installation of an electronic remote management system with the ability to adjust the light intensity as well as the installation of LED technology lighting. The street lighting sector is the second largest consumer of electricity after pumping stations. Most of the electric lighting network includes lighting fixtures and lamps, most of which are of old technology with significantly higher energy consumption than modern ones.</p> <p>With the supply and installation of more energy-efficient equipment in the street lighting of the Municipality of Kozani, the ultimate goal is to save resources, reduce operating and maintenance costs and improve the lighting quality of the local authorities. The purpose of replacing the lamps with conventional lamps is to use LED line technology lamps which give white lighting (without the use of filters), highlight architectural elements of the cities, with the main characteristics of high efficiency, low energy consumption and long life, resulting in minimal maintenance required. The purpose of installing an electronic management system with the ability to adjust light flow is the ability to respond to all management needs, with the ultimate goal of a more rational management of financial resources and improving the quality of the service provided to citizens. With the help of the above interventions, 5,813.60MWh can be saved and correspondingly the production of 907.89 tonnes CO₂/year can be avoided.</p>
Reference to impact pathway	Portfolio	Renewable Energy Generation
	Systemic lever	Technology/Infrastructure
	Outcome (according to module B-1.1)	Reduction of CO ₂ emissions and energy consumption Reduced energy costs
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Municipal Lighting
	Involved stakeholders	Municipality of Kozani
	Comments on implementation	



Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	5,813.61 MWh/year
	GHG emissions reduction estimate (total) per emission source sector	907.89 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	8,457,475.80 €



Renewable Energy Systems		
Action outline	Action name	Renewable Energy Systems
	Action type	Technical interventions
	Action description	<p>The Municipality of Kozani is characterized as an energy municipality. It has a number of electrical power generation units, both conventional and renewable. The development strategy of the Municipality of Kozani is characterized by the objective of developing the Municipality as an important service provider for the citizen, which manages its daily problems, while achieving its sustainable development, taking into account the unstable and fluid socio-economic environment that has been formed due to the general economic crisis which the country passes through. The main strategic objectives of the above strategy are the quality of life, ensuring the sustainable management of the environment, the completion of urban and social infrastructure projects, social welfare and care, in combination with the balanced economic development of the region. In this context, its strategic planning is determined by combined interventions in the axes of quality of life and environment, energy saving, social policy - education - culture - sports and local economy-employment as well as in the internal structure and organization of the municipality. Specifically, the interventions in the field of energy production at the local level concern the utilization of Renewable Energy Systems with specific measures such as the promotion of RES in municipal holdings and uses with a demonstrative-informative nature and support of Renewable Energy Systems investments in both the public and private sectors. The table below lists information about the Renewable Energy Systems projects that have received a production permit.</p>



Reference to impact pathway	Portfolio	Renewable Energy Generation
	Systemic lever	Technology/Infrastructure
	Outcome (according to module B-1.1)	Green energy generation Will help to reach the 100% reduction of CO ₂ emissions
Implementation	Responsible bodies/person for implementation	Municipality of Kozani, Association of Photovoltaic Investors of Western Macedonia Region, Citizens of Kozani
	Action scale & addressed entities	All electric energy consuming sectors
	Involved stakeholders	Association of Photovoltaic Investors of Western Macedonia Region, Municipality of Kozani, Citizens of Kozani
	Comments on implementation	Given the limited capacity of the existing network and the rate of new facilities into the system, it is estimated that by 2030 all of the above applications will progress to the final operating license and 10% of the projects will have been completed and will provide the benefits presented below.
Impact & cost	Generated renewable energy (if applicable)	1,003,090.99 MWh/year
	Removed/substituted energy, volume or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	417,508.06 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	166,235,382.00 €



Building Integrated Renewable Energy Systems

Action outline	Action name	Building Integrated Renewable Energy Systems
	Action type	Technical interventions
	Action description	Residences in the Municipality of Kozani account for 57% of the CO ₂ emissions. The residential buildings have also a large free area on their roofs which can be appropriate to install photovoltaics and/or thermal solar systems. National legislation and the national energy efficiency upgrade programs promote renewable energy installations on building. The municipality will also promote renewable energy installations (small photovoltaics and thermal solar installations) in order to increase green energy production by the residential buildings.
Reference to impact pathway	Portfolio	Renewable Energy Generation
	Systemic lever	Technology/Infrastructure, democracy/participation
	Outcome (according to module B-1.1)	Green energy generation Will help to reach the target of CO ₂ emissions reduction
Implementation	Responsible bodies/person for implementation	Citizens of Kozani, Municipality of Kozani
	Action scale & addressed entities	Residential buildings Citizens of Kozani
	Involved stakeholders	Citizens of Kozani, Municipality of Kozani, Property Owners Association of Kozani
	Comments on implementation	It is assumed that with the appropriate motivation, policies and funding at least 32% of the residential buildings (5,846 buildings in total) will install RES
Impact & cost	Generated renewable energy (if applicable)	96,998.08 MWh/year
	Removed/substituted energy, volume or fuel type	2,670.20 MWh/year
	GHG emissions reduction estimate (total) per emission source sector	687.65 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	126,257,820.00 €



Covering District Heating Thermal Needs with Green Energy

Action outline	Action name	Covering district heating thermal needs with green energy
	Action type	Technical interventions
	Action description	<p>The plan includes three stages of improving the District Heating emissions of the Municipality of Kozani. The reference in terms of CO₂ emissions is the average value of the three years 2018-2020, i.e. 91,813.17 tn CO₂.</p> <ul style="list-style-type: none"> • Until the year 2024, the situation remains as it is, with the supplied heat coming from the AIS Agios Dimitrios and the oil boilers of DEYAK. The CO₂ emission factor is 0.347 tn CO₂/MWh. • In the years 2025 and 2026, the model that will be utilized is heat production of 95% from the Agios Dimitrios power plant with lignite combustion as today and 5% from electric boilers which will be supplied with green electricity (via PPA). The cost of the electric boilers is taken over by PPC SA. In this case district heating CO₂ emissions drop to 87,222,508 tn CO₂ (4,590,658 tn CO₂ reduction compared to the reference). The emission factor is set at 0.330 tn CO₂/MWh. • In the years 2027 and 2028 the supplied heat will come from the following mixture: <ol style="list-style-type: none"> 1. 45% Ptolemaida Unit V (lignite combustion) 2. 45% Cogeneration of Heat and Electricity (CHP fired with natural gas) at the facilities of the former Kardia power plant 3. 6% Thermal solar installation (production of hot water from the sun) 4. 4% Electric boiler (electricity from green energy source through PPA) <p>The solar thermal installation will have a thermal power of 15MW, it will be built by DEYAK and the cost is expected to be 30,000,000.00 €.</p> <p>The cogeneration unit at Kardia power station is financed by PPC SA (at a cost of 99,200,000.00 €).</p>



		<p>The cost of interconnecting District Heating with the new scheme that will provide it with thermal energy is 55,000,000.00 € and is divided into the cost of interconnecting pipelines (42,000,000.00 €), construction of a new District Heating pumping station and renovations (12,000,000.00 €) and accompanying projects (1,000,000.00 €).</p> <p>The benefit of this combination will be a drop in emissions compared to the reference by 44,116,272 tn CO₂, as its emissions drop to 47,696,894 tn CO₂. The emission factor of district heating drops to 0.180 tn CO₂/MWh.</p> <p>As the plan so far contains a small percentage of green energy and the Municipality is planning with a horizon of drastically limiting CO₂ emissions over 80%, it was proposed to DEYAK and the proposal was judged to be realistic in the years 2029 and 2030 the share of 45% of thermal energy from burning lignite to be replaced by the simultaneous increase of the participation of cogeneration to 60% and the introduction of thermal energy production from a system of heat pumps (heat pumps) with a participation of 30%. The heat pumps will be supplied with green electricity (probably via PPA). The remaining required thermal load continues to be provided by 6% Solar thermal installation and 4% Electric boiler.</p> <p>The cost of heat pumps with a total thermal power of 30MW is estimated at 39,000,000.00 € (1,300,000 €/MWth). The benefit of this combination will be a drop in emissions compared to the reference by 83,305,207 tn CO₂, as its emissions drop to 8,507,959 tn CO₂. The emission factor of district heating drops to 0.032 tn CO₂/MWh.</p>
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		<p>Cumulative emissions reduction of District Heating [inCO₂]</p>
		Figure 30: Emissions reduction for DH
Reference to impact pathway	Portfolio	“Greening” of District Heating
	Systemic lever	Technology/Infrastructure
	Outcome (according to module B-1.1)	Green energy will cover almost completely the district heating demand of Kozani, reducing CO ₂ emissions to over 80% (estimated reduction 90.7%)
Implementation	Responsible bodies/person for implementation	Municipal Enterprise for Water Supply, and Sewerage of Kozani (DEYAK)
	Action scale & addressed entities	Buildings
	Involved stakeholders	Municipal Enterprise for Water Supply, and Sewerage of Kozani (DEYAK), Public Power Corporation (PPC)
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	83,305.21 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	124,000,000.00 €



Deep Energy Retrofit of Residences		
Action outline	Action name	Deep Energy Retrofit of Residences
	Action type	Technical interventions
	Action description	<p>About 48% of the buildings in Kozani were built before 1980 and the first thermal insulation regulation. There are, in total 18269 residences in the Municipality of Kozani which account for 57% of the CO₂ emissions. While a number of buildings has already been retrofitted with various energy retrofitting programs funded by the Ministry of Energy and Environment, the Municipality of Kozani plans to implement a novel local deep retrofitting program of residential buildings in order to increase energy saving and reduce energy losses. 50% of the residencies are expected to be upgraded (an annual increase rate of 8.5% is expected).</p> <p>Figure 31: Increase of residencies to be upgraded annually</p>
Reference to impact pathway	Portfolio	Energy Efficient Buildings
	Systemic lever	Technology/Infrastructure, governance & policy, democracy/participation, finance & funding, learning & capabilities
	Outcome (according to module B-1.1)	Reduction of CO ₂ emissions and energy consumption Reduced energy costs Upgraded buildings will improve indoor air quality and comfort
Implementation	Responsible bodies/person for implementation	Citizens of Kozani, Municipality of Kozani
	Action scale & addressed entities	Residential buildings Citizens of Kozani
	Involved stakeholders	Citizens of Kozani, Municipality of Kozani, Property Owners Association of Kozani
	Comments on implementation	It is assumed that with the appropriate motivation, policies and funding at least 20% of the residential buildings will be retrofitted
Impact & cost	Generated renewable energy (if applicable)	-



	Removed/substituted energy, volume or fuel type	122,575.47 MWh/year
	GHG emissions reduction estimate (total) per emission source sector	58,923.65 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	145,000,698.00 €



Deep Energy Retrofit of Municipal buildings

Action outline	Action name	Deep energy retrofit of Municipal buildings
	Action type	Technical interventions
	Action description	The Municipality of Kozani has already implemented a large number of retrofit actions on municipal buildings. The Municipal Authority, wanting to be a model for the citizens but also in practice to upgrade the energy of its buildings in order to achieve reduced energy consumption, lower carbon dioxide emissions and substantially reduce the impact on the environment, has set the goal of energy upgrading of all buildings. The actions include upgrades of thermal insulation, windows and doors frames, air sealing, upgrades on lighting systems, installation of green roofs actions on raising awareness of the users and installation of heat pumps.
Reference to impact pathway	Portfolio	Energy Efficient Buildings
	Systemic lever	Technology/Infrastructure
	Outcome (according to module B-1.1)	Reduction of CO ₂ emissions and energy consumption Reduced energy costs Upgraded buildings will improve indoor air quality and comfort
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Municipal buildings
	Involved stakeholders	Municipality of Kozani
	Comments on implementation	
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	21,033.20 MWh/year
	GHG emissions reduction estimate (total) per emission source sector	5,291.07 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	20,186,036.00 €



Deep energy retrofit of School buildings

Action outline	Action name	Deep energy retrofit of School buildings
	Action type	Technical interventions
	Action description	The Municipality of Kozani in cooperation with the School Committees of Primary and Secondary Education has already implemented a significant number of retrofit actions and installation of Renewable Energy systems on schools. Schools have a major impact on students and students are the main population zone to build and increased awareness on environmental subjects. Growing up, students with a strong environmental consciousness will help to improve the impact of human actions to the climate. So the actions will not only drastically improve energy consumption, reduce emissions and costs but will have a long term impact on the behaviour of the next generations. The Municipality of Kozani set the target to completely upgrade all schools through actions that include upgrades on thermal insulation, windows and doors frames, air sealing, upgrades on lighting systems, actions on raising awareness of the users, installation of heat pumps and thermal solar systems.
Reference to impact pathway	Portfolio	Energy Efficient Buildings
	Systemic lever	Technology/Infrastructure, democracy/participation, learning & capabilities
	Outcome (according to module B-1.1)	Reduction of CO ₂ emissions and energy consumption Green energy generation that will help reach the target of 100% CO ₂ emissions reduction Reduced energy costs Upgraded buildings will improve indoor air quality and comfort
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Schools Citizens of Kozani



	Involved stakeholders	Municipality of Kozani, School Committees of Primary and Secondary Education
	Comments on implementation	
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	13,493.22 MWh/year
	GHG emissions reduction estimate (total) per emission source sector	3,113.76 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	28,855,288.00 €



Deep energy retrofit of the sports facilities of the Municipality of Kozani		
Action outline	Action name	Deep energy retrofit of the sports facilities of the Municipality of Kozani
	Action type	Technical interventions
	Action description	<p>So far, the actions of the Municipality of Kozani have included the Municipal Sports Center, the Indoor Gym of Lefkovrysi and the Liapio Athletic Center of Kozani. The Municipality of Kozani in cooperation with the Municipal Organization of Sports plans to completely upgrade the energy efficiency of all its sports facilities. This action will not only drastically improve energy consumption, emissions and costs but will have a long term impact on the indoor air quality and comfort for the users. The actions include upgrades on thermal insulation, windows and doors frames, air sealing, upgrades on lighting systems and the lighting controls and the installation of thermal solar systems.</p> <p>Figure 32: Municipal buildings to be upgraded annually</p>
Reference to impact pathway	Portfolio	Energy Efficient Buildings
	Systemic lever	Technology/Infrastructure
	Outcome (according to module B-1.1)	<p>Reduction of CO₂ emissions and energy consumption</p> <p>Green energy generation that will help reach the target of 100% CO₂ emissions reduction</p> <p>Reduced energy costs</p> <p>Upgraded buildings will improve indoor air quality and comfort</p>
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Sports facilities Citizens of Kozani
	Involved stakeholders	Municipality of Kozani, Municipal Organization of Sports
	Comments on implementation	



Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	3,880.46 MWh/year
	GHG emissions reduction estimate (total) per emission source sector	1,012.30 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	18,673,672.00 €



Deep energy retrofit of the Tertiary Sector Buildings

Action outline	Action name	Deep Energy Retrofit of the Tertiary Sector Buildings
	Action type	Technical interventions
	Action description	<p>This sector contributes with high emissions of CO₂ (about 26%). In order to bring the tertiary sector into line with the National Legislation regarding the energy efficiency of buildings and the heating/cooling and lighting systems, professionals need to be informed about the savings measures and the benefits of implementing them. Thus, the Municipality of Kozani, through a series of information and awareness-raising activities, must inform citizens about the ways to reduce CO₂ emissions replacing conventional lamps with more efficient LED technology, installing presence sensors, replacing old air conditioners with new more efficient and insulating their buildings. In this way, significant energy savings can be achieved.</p>
Reference to impact pathway	Portfolio	Energy Efficient Buildings
	Systemic lever	Technology/Infrastructure, governance & policy, democracy/participation, finance & funding, learning & capabilities
	Outcome (according to module B-1.1)	Green energy generation Will help to reach the 100% reduction of CO ₂ emissions
Implementation	Responsible bodies/person for implementation	SME's owners, Municipality of Kozani
	Action scale & addressed entities	Tertiary sector buildings
	Involved stakeholders	SME's owners, Municipality of Kozani, Property Owners Association of Kozani
	Comments on implementation	It is assumed that with the appropriate motivation, policies and funding at least 20% of the residential buildings will be retrofitted
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	1,269.63 MWh/year



	GHG emissions reduction estimate (total) per emission source sector	7,476.65 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	15,325,772.00 €



Smart Energy Management		
Action outline	Action name	Smart Energy Management
	Action type	Technical interventions
	Action description	<p>Buildings' energy consumption in the EU represents about 30% of total EU energy consumption and between 25 and 40% in OECD countries (OECD, 2003). Developing countries have a less efficient building stock where it is even more important to improve on building energy efficiency. In the EU-25, in 2003 total CO₂ emissions amounted to 3.8 Gtonnes of which 479 Mtonnes were household emissions (12%) (EU, 2005). The specific system monitoring and controls the functions of the building, allowing a smooth operation and efficient functioning of the building, through an innovating software combined with sensors and actuators. The software will consist of a web application as well as an application for smartphones and tablets (Android, iOS). Through both the user will be able, at any time and moment, wherever he is, to:</p> <ul style="list-style-type: none"> • Check the operation of electrical devices (opening/closing) • Schedule the operation of electrical appliances • Monitor power and electricity consumption for each of its electrical devices • Monitor temperature and humidity in the rooms and adjusts the heating accordingly • Create device groups to control multiple devices simultaneously • Controls devices via floorplans • Shares any devices he wants with other users • Sets operating rules for devices in an << If-This-Then-That >> format • "chats" with his devices through Facebook Messenger • Give voice commands to devices using Amazon Echo • Remotely turns on/off devices such as lights and other loads controlled by the electrical panel • Monitors detailed power and energy consumption charts of all the devices it controls • Creates operating schedules • It uses Wi-Fi protocol • It offers security using SSL/TLS



		The platform concerns the supply of an integrated energy consumption management system in public infrastructures and buildings. It will incorporate a holistic approach to the management of energy data and additional information that will be collected, processed, and analysed by the energy management information system. The proposed solution will support the complete parameterization of the platform (e.g. users and their roles, management of energy measurement sensors in the central panel and in selected points of the public infrastructure), making it a complete package for energy management in infrastructure and building facilities.
Reference to impact pathway	Portfolio	Smart Energy systems
	Systemic lever	Technology/Infrastructure
	Outcome	Building Energy management system for the municipality of Kozani will contribute to minimum energy consumption and CO ₂ emissions reduction for the electricity consumption
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Buildings
	Involved stakeholders	Municipality of Kozani, Public Power Corporation (PPC)
	Comments on implementation	It is assumed that with the appropriate motivation, policies and funding an amount of 35 buildings could be fitted with EMS
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	Energy efficiency delivers a number of environmental benefits. It notably reduces GHG emissions, both direct emissions from fossil fuel combustion or consumption, and indirect emissions reductions from electricity generation. Buildings' energy consumption in the EU represents about 30% of total EU energy consumption and between 25 and 40% in OECD countries (OECD, 2003).



		Developing countries have a less efficient building stock where it is even more important to improve on building energy efficiency. In the EU-25, in 2003 total CO ₂ emissions amounted to 3.8 Gtones of which 479 Mtones were household emissions (12%) (EU, 2005).
	Total costs and costs by CO ₂ e unit	609.126 € - Installation on 35 buildings



Individual action outlines

MOBILITY AND TRANSPORT



Penetration of vehicles fuelled by CNG and LPG

Action outline	Action name	Penetration of vehicles fuelled by CNG and LPG
	Action type	Introduction of alternative fuel in transportations
	Action description	<p>The transportation sector plays a significant role in global carbon emissions, making it crucial to explore alternative fuels and technologies that can help reduce environmental impacts. One promising solution is the use of vehicles powered by liquefied natural gas (LNG) or compressed natural gas (CNG). These clean-burning fuels offer several benefits over conventional gasoline or diesel vehicles, ranging from reduced emissions to enhanced fuel efficiency.</p> <p>LNG and CNG vehicles emit fewer greenhouse gases compared to their gasoline or diesel counterparts. Natural gas combustion produces lower levels of carbon dioxide (CO₂) and virtually eliminates particulate matter emissions. When considering the entire fuel life cycle, including extraction, processing, and transportation, natural gas still exhibits lower overall emissions compared to conventional fuels. This makes LNG and CNG vehicles an effective strategy for mitigating climate change and improving air quality in urban areas.</p> <p>In addition to lower CO₂ emissions, LNG and CNG vehicles significantly reduce the release of pollutants that contribute to poor air quality. Compared to diesel engines, natural gas engines produce significantly fewer nitrogen oxides (NO_x), sulfur oxides (SO_x), and particulate matter. By transitioning to LNG or CNG vehicles, the municipality can experience cleaner and healthier urban environments, with fewer</p>



		<p>respiratory and cardiovascular health issues caused by air pollution.</p> <p>The technology for LNG and CNG vehicles is well-established and continuously improving. Many vehicle manufacturers offer a range of natural gas-powered models, including sedans, buses, trucks, and even heavy-duty vehicles. Additionally, the infrastructure to support LNG and CNG vehicles, including refuelling stations, is expanding. The growing network of refuelling stations enables increased adoption and provides convenience and accessibility for vehicle owners. Apart from that it is expected that an additional 2% percentage of biodiesel will be introduced in the fuel mixture by 2030.</p> <p>This particular action focuses on replacing conventional vehicles with LNG and CNG fuelled ones. This action focuses on the private vehicles owners. It is expected that by the end of 2030, 415 conventional passenger cars and 20 trucks or buses will be replaced by vehicles fuelled with CNG or LNG. The following graph presents the progress of the replacement of the aforementioned vehicles until 2030. The cost of this action is expected to be 10,300,000 euros by the end of 2030.</p>
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		<p>Figure 33: Replacement of private vehicles</p>
Reference to impact pathway	Portfolio	Use of alternative fuel in transportation
	Systemic lever	Technology / Infrastructure - Governance & policy
	Outcome (according to module B-1.1)	Budget saving from the reduction of fuel needs due to the use of more efficient vehicles, Use of new and more environmentally cleaner vehicle technologies, Lower air pollutants
Implementation	Responsible bodies/person for implementation	Private vehicle owners of Kozani, Municipality of Kozani
	Action scale & addressed entities	Private vehicle fleet owners, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), TAXI Owners Association of Kozani
	Involved stakeholders	Regional Authority of Western Macedonia, Municipality of Kozani, Hellenic Ministry of Environment and Energy (YPEN), Just Development Transition Plan (JDTP), Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), TAXI Owners Association of Kozani, Citizens of Kozani
	Comments on implementation	-



Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	16,557,6 MWh
	GHG emissions reduction estimate (total) per emission source sector	4,420,9 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	10.300.000 €

*Actions included in this package:

1. Penetration of vehicles using CNG and LPG
2. Penetration of additional biodiesel by 2%



Replacement of municipal vehicles with EV with RES installation of charging stations and GPS management

Action outline	Action name	Replacement of municipal vehicles with EV with RES and installation of charging stations
	Action type	Introduction of alternative fuel in transportations
	Action description	<p>As the world strives to combat climate change and reduce greenhouse gas emissions, the transition from conventional vehicles to electric vehicles (EVs) presents a pivotal opportunity.</p> <p>One of the most compelling advantages of EVs is their ability to dramatically reduce CO₂ emissions. Unlike conventional vehicles that rely on internal combustion engines powered by fossil fuels, EVs operate on electricity, producing zero tailpipe emissions. By adopting EVs on a large scale, we can make substantial progress in decarbonizing the transportation sector, which is a significant contributor to global CO₂ emissions. This shift plays a crucial role in mitigating climate change and protecting our planet for future generations.</p> <p>Conventional municipal vehicles, particularly those powered by diesel engines, contribute to air pollution, leading to adverse health effects for residents. Electric vehicles produce zero exhaust emissions, eliminating harmful pollutants such as nitrogen oxides (NO_x), particulate matter (PM), and sulfur dioxide (SO₂).</p> <p>While the upfront cost of electric vehicles may be higher than their conventional counterparts, EVs offer potential long-term cost savings through reduced operational expenses. Electric vehicles have lower maintenance requirements, as they have fewer moving parts and do not require oil</p>



changes or complex engine servicing. Additionally, the cost of electricity for charging EVs is typically lower compared to conventional fuel prices, resulting in reduced fueling expenses for municipal fleets over time.

Finally, by adopting electric vehicles the Municipality of Kozani can demonstrate environmental leadership and a commitment to sustainability. Such actions inspire public confidence, encourage community engagement, and foster a sense of civic pride. Thus the Municipality can become role model, influencing other sectors and community members to embrace electric mobility and support the transition to a low-carbon future.

Based on the aforementioned Municipality Kozani plans to replace all of its municipal passenger cars (32) and 51% of the municipal trucks and buses with EVs. A time schedule is presented on the following graph.

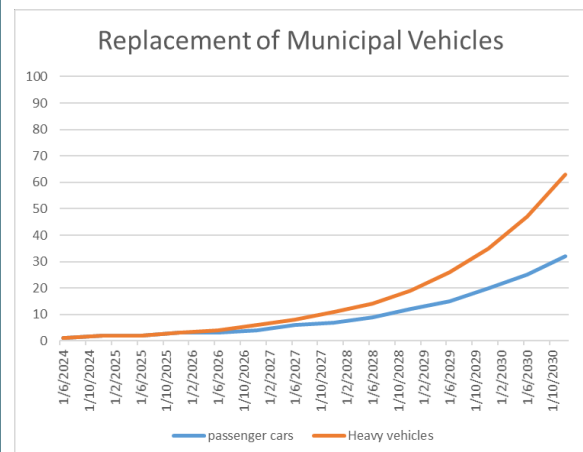
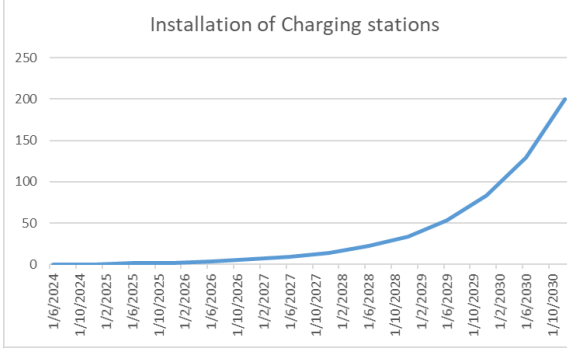


Figure 34: Replacement of Municipal vehicles

Moreover, in order to promote e-mobility the Municipality will progressively install 200 charging stations in numerous



		<p>locations as well as in areas where municipal services park their fleets until 2030.</p>  <p>Figure 35: Installation of charging stations</p> <p>Finally, the municipal vehicles will be supported by a GPS system (telematics systems), for better control of municipal fleet. This is a forward-thinking approach that offers multiple benefits for sustainable urban transportation. By leveraging real-time data and advanced monitoring capabilities, the Municipality can optimize fleet operations, reduce fuel consumption, and significantly contribute to decarbonization and the mitigation of CO₂ emissions. This system will be developed and implemented by the end of 2025.</p>
Reference to impact pathway	Portfolio	Use of alternative fuel in transportation
	Systemic lever	Technology / Infrastructure
	Outcome (according to module B-1.1)	Further penetration of RES in mobility system, Renewing of the obsolete municipal fleet with more efficient vehicles, Budget saving from the reduction of fuel needs due to the use of more efficient vehicles, Use of new and more environmentally cleaner vehicle technologies, Lower air pollutants



Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Municipal vehicle fleet
	Involved stakeholders	Municipality of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	1,999.7 MWh
	GHG emissions reduction estimate (total) per emission source sector	499.6 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	20,390,000 €

*Actions included in this package:

1. Replacement of municipal vehicles with EV with RES
2. Additional charging stations for electric vehicles
3. Introduction of GPS systems for better control of municipal fleet



Replacement of private vehicles with EV using RES

Action outline	Action name	Replacement of municipal vehicles with EV using RES
	Action type	Introduction of alternative fuel in transportations
	Action description	<p>As cities and municipalities seek to reduce their carbon footprint and combat climate change, transitioning municipal fleets from conventional vehicles to electric vehicles (EVs) emerges as a promising solution. The electrification of municipal vehicles brings numerous benefits, with a key focus on decarbonization and the mitigation of CO₂ emissions.</p> <p>One of the most significant advantages of EVs is their ability to produce zero tailpipe emissions. By replacing conventional municipal vehicles, such as buses, garbage trucks, and service vehicles, with electric alternatives, local governments can make substantial progress in reducing CO₂ emissions. As EVs do not rely on fossil fuels and use electricity as their primary energy source, they contribute to a significant decrease in greenhouse gas emissions and help combat climate change.</p> <p>The rise of EVs aligns seamlessly with the integration of renewable energy sources. By coupling EV adoption with renewable energy, we a powerful combination is realised that accelerates the transition to a sustainable energy ecosystem. Moreover, EVs mitigate the release of harmful pollutants like nitrogen oxides (NOx) and particulate matter (PM).</p> <p>EVs are inherently more energy-efficient than internal combustion engine vehicles. Electric drivetrains convert a higher percentage of energy from the grid to power at the wheels, reducing energy waste. Additionally, EVs feature regenerative braking systems that capture and store energy during deceleration, further improving overall efficiency. By optimizing energy usage, EVs contribute to a more sustainable transportation system, aligning with the goals of resource conservation and environmental stewardship.</p>



Finally, the rapid development of EV technology has led to improvements in battery performance, driving range, and charging infrastructure. As battery costs decline and charging networks expand, the economic viability of EVs continues to improve. While the upfront cost of EVs may still be higher than conventional vehicles, the total cost of ownership, including fuel and maintenance expenses, tends to be lower over the vehicle's lifetime. By transitioning to EVs, individuals and businesses can achieve long-term cost savings while making a positive environmental impact.

This action foresees the replacement of 10% of private vehicles (passenger cars and heavy-duty vehicles such as trucks) of Kozani by the end of 2030. This accounts to 2,487 vehicles. Apart from that an additional 4.8% reduction of the private vehicles is also expected to take place by the end of 2030 due to the population shrinkage of the Municipality. This fact is based on the progressive reduction of private vehicles provided by the Hellenic Statistical Authority based on data of the period 2010-2020. The following graphs illustrate the replacement of private vehicles and the shrinkage of the aforementioned fleet of Kozani.

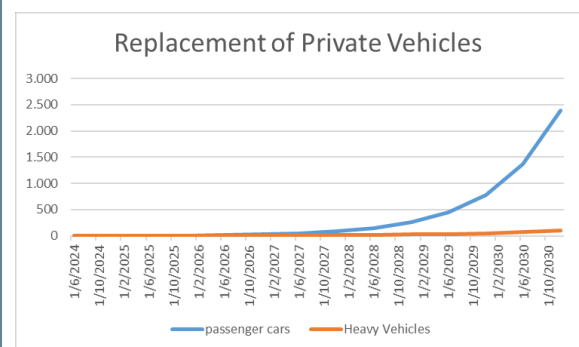


Figure 36: Replacement of private vehicles



		<p>Figure 37: Expected reduction of private vehicles</p>
Reference to impact pathway	Portfolio	Use of alternative fuel in transportation
	Systemic lever	Technology / Infrastructure- Participation/Democracy
	Outcome (according to module B-1.1)	Further penetration of RES in mobility system, Budget saving from the reduction of fuel needs due to the use of more efficient vehicles, Use of new and more environmentally cleaner vehicle technologies, Lower air pollutants
Implementation	Responsible bodies/person for implementation	Private vehicle owners of Kozani, Municipality of Kozani
	Action scale & addressed entities	Private vehicle owners of Kozani, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), TAXI Owners Association of Kozani
	Involved stakeholders	Regional Authority of Western Macedonia, Municipality of Kozani, Hellenic Ministry of Environment and Energy (YPEN), Just Development Transition Plan (JDTP), Kozani Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), TAXI Owners Association of Kozani, Citizens of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-



	Removed/substituted energy, volume or fuel type	22,479.7 MWh
	GHG emissions reduction estimate (total) per emission source sector	5,621.5 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	98,545,000 €

*Actions included in this package:

1. Replacement of private vehicles with EV with RES
2. Reduction of total vehicle fleet by 5% until 2030



Replacement of heavy-duty vehicles with hydrogen technology

Action outline	Action name	Replacement of municipal vehicles with EV using RES
	Action type	Introduction of alternative fuel in transportations
	Action description	<p>The replacement of conventional heavy vehicles with hydrogen-powered alternatives, can unlock a range of benefits, with a key focus on decarbonisation and the significant mitigation of CO₂ emissions. Hydrogen technology offers a pathway to zero-emission transportation. Hydrogen-powered heavy vehicles, such as trucks, buses, and freight vehicles, emit only water vapour when operating. By replacing conventional diesel or gasoline engines with hydrogen fuel cells can significantly reduce CO₂ emissions from the transportation sector. This transition plays a crucial role in decarbonizing heavy-duty transportation, which is a major contributor to global CO₂ emissions.</p> <p>Hydrogen-powered improve air quality and create cleaner and healthier environments in urban areas along transportation corridors.</p> <p>Hydrogen fuel offers high energy density, providing extended driving ranges for heavy vehicles without compromising performance. Hydrogen-powered trucks and buses can travel long distances and carry heavy loads, making them suitable for freight transportation and public transit. This efficiency and range enable the adoption of hydrogen technology in heavy vehicles without compromising operational capabilities, offering a viable solution for long-haul and intensive-use applications.</p> <p>The production of hydrogen can be achieved through renewable energy sources such as solar power. This solution reduces reliance on fossil fuels and facilitates the decarbonisation of the entire hydrogen value chain.</p> <p>Moreover, the adoption of hydrogen technology in heavy vehicles drives technological advancements and infrastructure development. As the demand for hydrogen-powered vehicles increases,</p>



		<p>manufacturers invest in research and development, leading to improved efficiency, performance, and affordability of hydrogen fuel cell systems. Furthermore, the expansion of hydrogen refueling infrastructure supports the widespread adoption of hydrogen-powered heavy vehicles, ensuring accessibility and convenience for vehicle operators. This action focuses on the replacement of 50 private heavy duty vehicles (trucks & buses) of Kozani by the end of 2030. The following graph presents the progressive replacement of private heavy vehicles in the Municipality of Kozani.</p> <div data-bbox="831 824 1396 1160" data-label="Figure"> <table border="1"> <caption>Penetration of Heavy Vehicles with Hydrogen Technology</caption> <thead> <tr> <th>Date</th> <th>Penetration (%)</th> </tr> </thead> <tbody> <tr><td>1/6/2024</td><td>0</td></tr> <tr><td>1/10/2024</td><td>0</td></tr> <tr><td>1/2/2025</td><td>0</td></tr> <tr><td>1/6/2025</td><td>0</td></tr> <tr><td>1/10/2025</td><td>0</td></tr> <tr><td>1/2/2026</td><td>0</td></tr> <tr><td>1/6/2026</td><td>0</td></tr> <tr><td>1/10/2026</td><td>0</td></tr> <tr><td>1/2/2027</td><td>0</td></tr> <tr><td>1/6/2027</td><td>0</td></tr> <tr><td>1/10/2027</td><td>0</td></tr> <tr><td>1/2/2028</td><td>0</td></tr> <tr><td>1/6/2028</td><td>0</td></tr> <tr><td>1/10/2028</td><td>0</td></tr> <tr><td>1/2/2029</td><td>0</td></tr> <tr><td>1/6/2029</td><td>0</td></tr> <tr><td>1/10/2029</td><td>0</td></tr> <tr><td>1/2/2030</td><td>0</td></tr> <tr><td>1/6/2030</td><td>0</td></tr> <tr><td>1/10/2030</td><td>65</td></tr> </tbody> </table> </div>	Date	Penetration (%)	1/6/2024	0	1/10/2024	0	1/2/2025	0	1/6/2025	0	1/10/2025	0	1/2/2026	0	1/6/2026	0	1/10/2026	0	1/2/2027	0	1/6/2027	0	1/10/2027	0	1/2/2028	0	1/6/2028	0	1/10/2028	0	1/2/2029	0	1/6/2029	0	1/10/2029	0	1/2/2030	0	1/6/2030	0	1/10/2030	65
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Reference to impact pathway	Portfolio	Use of alternative fuel in transportation																																										
	Systemic lever	Technology / Infrastructure																																										
	Outcome (according to module B-1.1)	Budget saving from the reduction of fuel needs due to the use of more efficient vehicles, Use of new and more environmentally cleaner vehicle technologies, Lower air pollutants																																										
Implementation	Responsible bodies/person for implementation	Private vehicle fleet owners, Municipality of Kozani																																										
	Action scale & addressed entities	Private vehicle fleet owners, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.)																																										
	Involved stakeholders	Regional Authority of Western Macedonia, Municipality of Kozani, Hellenic Ministry of Environment and Energy (YPEN), Just Development Transition Plan (JDTP),																																										



		Kozani Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), Citizens of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	324.7 MWh
	GHG emissions reduction estimate (total) per emission source sector	81.2 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	22,500,000 €

*Actions included in this package: Replacement of heavy duty vehicles with hydrogen technology



Zone with low emissions of air pollutants with priority on the use of EVs

Action outline	Action name	Creation of zones with low emissions of air pollutants and noise with priority on the use of electric vehicles
	Action type	Introduction of alternative fuel in transportations
	Action description	<p>Establishing zones with low emissions of air pollutants and noise, while prioritizing the use of electric vehicles (EVs), presents a transformative solution towards a greener and more sustainable urban environment. These zones provide numerous benefits, with a key focus on decarbonisation and the significant mitigation of CO₂ emissions. By promoting the adoption of EVs within these zones, cities can achieve substantial reductions in transportation-related CO₂ emissions, making a substantial impact on climate change mitigation.</p> <p>In addition to air pollution, conventional vehicles also contribute to noise pollution in urban areas. By prioritizing the use of EVs within low emission zones, noise levels can be significantly reduced. Electric vehicles operate quietly compared to their combustion engine counterparts, resulting in less noise pollution. This creates a more peaceful and enjoyable urban environment for residents, enhancing quality of life and promoting well-being.</p> <p>The establishment of low emission zones requires careful urban planning and design. It encourages the development of pedestrian-friendly infrastructure, including wider sidewalks, dedicated bike lanes, and improved public transportation networks. By prioritizing EV usage, the Municipality can create a sustainable transportation ecosystem, fostering walkability, cycling, and the use of clean public transport. These measures not only reduce emissions but also enhance urban livability and promote healthier lifestyles.</p> <p>The establishment of low emission zones with a focus on EVs fosters technological advancements and innovation. By embracing low emission zones, the</p>



		Municipality positions itself at the forefront of the clean transportation revolution. The Municipality of Kozani will proceed in the establishment of zones with low emissions of air pollutants and noise with priority on the use of electric vehicles. The introduction of low-emission zones bans all vehicles that do not meet an environmental standard (engine-related restrictions). The main environmental limitation measures are as follows: a) restrictions depending on the vehicle's engine, b) noise restrictions and c) low emission zones. This zone expands to 0.445 km ² . This actions will be finalized in mid 2026.
Reference to impact pathway	Portfolio	Use of alternative fuel in transportation
	Systemic lever	Technology / Infrastructure
	Outcome (according to module B-1.1)	Lower air pollutants, Further promotion of RES usage
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Private vehicle fleet owners
	Involved stakeholders	Municipality of Kozani, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), Citizens of Kozani, TAXI Owners Association of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	2,850.6 MWh



	GHG emissions reduction estimate (total) per emission source sector	712.9 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	330,000 €

*Actions included in this package:

1. Creation of zones with low emissions of air pollutants and noise with priority on the use of electric vehicles



Upgrade of Public Transportation System

Action outline	Action name	Upgrade of Public Transportation System																																										
	Action type	Upgrade of Public Transportation Systems and Urban Logistics																																										
	Action description	<p>Upgrading the public transportation system by incorporating the following actions as park & ride, reorganizing of public transportation routes, introducing bus on demand system, and utilizing taxi systems for collective movements, presents a transformative opportunity. This action offers numerous benefits, with a key focus on decarbonisation and significant mitigation of CO₂ emissions.</p> <ol style="list-style-type: none"> 1. Park & Ride: Implementing park & ride facilities provides commuters with an efficient and environmentally friendly alternative to driving their cars into congested urban areas. By establishing conveniently located parking facilities near public transportation hubs, individuals can park their vehicles and switch to buses, trains, or other modes of public transportation for the remainder of their journey. This reduces the number of private vehicles on the road, leading to reduced traffic congestion, improved air quality, and lower CO₂ emissions. The Municipality will establish 4 stations, on each entrance of the city. The following graph presents a schedule the establishment of the aforementioned stations. <div data-bbox="831 1576 1382 1901" data-label="Figure"> <table border="1"> <caption>Established Stations for Park & Ride</caption> <thead> <tr> <th>Quarter</th> <th>Number of Stations</th> </tr> </thead> <tbody> <tr><td>01/06/2024</td><td>0</td></tr> <tr><td>01/10/2024</td><td>0</td></tr> <tr><td>01/02/2025</td><td>0</td></tr> <tr><td>01/06/2025</td><td>0</td></tr> <tr><td>01/10/2025</td><td>0</td></tr> <tr><td>01/02/2026</td><td>0</td></tr> <tr><td>01/06/2026</td><td>0</td></tr> <tr><td>01/10/2026</td><td>0</td></tr> <tr><td>01/02/2027</td><td>0</td></tr> <tr><td>01/06/2027</td><td>0</td></tr> <tr><td>01/10/2027</td><td>0</td></tr> <tr><td>01/02/2028</td><td>1</td></tr> <tr><td>01/06/2028</td><td>2</td></tr> <tr><td>01/10/2028</td><td>3</td></tr> <tr><td>01/02/2029</td><td>4</td></tr> <tr><td>01/06/2029</td><td>4</td></tr> <tr><td>01/10/2029</td><td>4</td></tr> <tr><td>01/02/2030</td><td>4</td></tr> <tr><td>01/06/2030</td><td>4</td></tr> <tr><td>01/10/2030</td><td>4</td></tr> </tbody> </table> </div>	Quarter	Number of Stations	01/06/2024	0	01/10/2024	0	01/02/2025	0	01/06/2025	0	01/10/2025	0	01/02/2026	0	01/06/2026	0	01/10/2026	0	01/02/2027	0	01/06/2027	0	01/10/2027	0	01/02/2028	1	01/06/2028	2	01/10/2028	3	01/02/2029	4	01/06/2029	4	01/10/2029	4	01/02/2030	4	01/06/2030	4	01/10/2030	4
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Figure 39: Established stations for park & ride



		<p>2. <u>Reorganization of Public Transportation Routes:</u> Reorganizing public transportation routes to optimize efficiency and accessibility can have a significant impact on reducing carbon emissions. By analyzing travel patterns and adjusting routes accordingly, Kozani can streamline public transportation services, ensuring better coverage and frequency. This encourages more people to choose public transportation as their preferred mode of travel, reducing the overall number of private vehicles on the road and resulting in lower CO₂ emissions. This includes the Reorganization of Public Transportation routes within the city as well as a feasibility study for the reorganization of Public Transportation.</p> <p>3. <u>Introducing Bus On-Demand Systems:</u> These systems complement with the reorganization of public transportation routes by providing flexible and demand-responsive services to underserved areas. This system utilizes real-time data and advanced technology to dynamically adjust bus routes and schedules based on passenger demand. By ensuring that buses are operating at or near capacity, the bus on demand system optimizes efficiency, reduces the number of empty or underutilized buses on the road, and minimizes unnecessary carbon emissions associated with low occupancy rates. This includes the establishment of municipal transport bus line as well as information system.</p> <p>4. <u>Utilization of a Taxi System for Collective Movements:</u> Implementing a taxi system for collective movements, such as shared rides or pooled services, promotes efficiency and reduces the number of individual vehicles on the road. By encouraging passengers traveling in similar directions to share a single taxi, Kozani can optimize transportation capacity, minimize congestion, and lower CO₂ emissions. This is a key measure to increase collective travel and reduce</p>
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		dependence on the car. Its implementation will be realized in cooperation with the local taxi association. This action is based on the creation of platform that will help in managing collective moment. This action will be finalized by the first semester of 2026.
Reference to impact pathway	Portfolio	Upgrade of Public Transportation & Urban Logistics
	Systemic lever	Technology / Infrastructure - Governance & policy
	Outcome (according to module B-1.1)	Introduction of smart systems to mobility, Familiarization of citizens will alternative and more environmental means of transportation, Decongestion of city traffic, Lower of air pollutants, Improved air quality, Enhanced accessibility to public transportation, Increased efficiency of transportations, Relief measure for economically vulnerable residents, Transportation of people or goods more efficient with less emissions
Implementation	Responsible bodies/person for implementation	Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), TAXI Owners Association of Kozani, Municipality of Kozani
	Action scale & addressed entities	Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), Citizens of Kozani, TAXI Owners Association of Kozani
	Involved stakeholders	Municipality of Kozani, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), Citizens of Kozani, TAXI Owners Association of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	6,898.4 MWh



	GHG emissions reduction estimate (total) per emission source sector	4,225.15 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	776,000 €

*Actions included in this package:

1. Park and Ride
2. Reorganization of Public Transportation routes within the city
3. Creation of public transport bus lines (mini-bus/on-demand)
4. Utilization of a taxi system for collective movements with itineraries responsive to demand



Enhancement of Urban Logistics		
Action outline	Action name	Enhancement of Municipal Logistics
	Action type	Upgrade of Public Transportation Systems and Urban Logistics
	Action description	<p>Upgrading Municipality's logistics planning is a crucial step towards achieving sustainable and efficient urban transportation. These include:</p> <ol style="list-style-type: none"> <u>Creation of Small Urban Supply Chain Centers:</u> The establishment of small urban supply chain centers strategically located within The Municipality offers multiple advantages. These centers serve as consolidation points where goods from various suppliers are collected, sorted, and redistributed using eco-friendly transportation modes. In the context of the optimization of the urban supply chain, it is considered appropriate to establish a specific schedule for loading and unloading, which should be observed by all parties. In this way, the traffic of loading and unloading vehicles is avoided, which are usually more voluminous and can create traffic and parking problems, during peak hours when a large number of residents move. With the specific schedule, loading and unloading will take place during the periods of the day when there are no significant traffic loads of other vehicles. At the same time, it is foreseen to define specific parking places for the loading and unloading vehicles so that they are not forced to park illegally and obstruct the traffic. The specific positions are reserved exclusively for these types of vehicles only during the opening hours. These spaces will be able to be contracted via a telematics system. Thus, an intelligent supply management system which includes loading and unloading schedules, and optimal routes will be developed. In addition, loading and unloading places will be developed in areas of commercial interest. The observance of loading and unloading time-schedules is connected to the jurisdiction of Municipal actions of the



		<p>Municipality and Traffic Police. The supply management system will be developed realized by mid 2026. Moreover, in Kozani 5 areas are identified in order the centres to be established within the Municipality starting from mid-2026 until late 2028.</p> <p>2. <u>Use of Municipal Electric Two-Wheeled Vehicles:</u> electric bicycles or scooters, for appropriate tasks within the municipality can significantly contribute to decarbonisation efforts. These vehicles provide an efficient and environmentally friendly alternative for tasks that do not involve heavy freight or large distances. By opting for electric two-wheelers instead of conventional gasoline-powered vehicles, municipal servants can reduce local air pollution, noise levels, and greenhouse gas emissions. This include the purchase of 5 two-wheeled electric vehicles that will be used by the municipal servants. The adoption of electric two-wheeled vehicles in municipal logistics offers the opportunity to integrate renewable energy sources into the transportation system. Charging stations for electric vehicles can be powered by solar panels or other renewable energy technologies, reducing reliance on fossil fuels and further lowering the carbon footprint. This integration supports the decarbonization of the transportation sector and contributes to the overall mitigation of CO₂ emissions. This will be realized by the end of 2029.</p> <p>This action showcases a commitment to sustainability and inspire other stakeholders, including businesses and residents.</p>
Reference to impact pathway	Portfolio	Upgrade of Public Transportation & Urban Logistics
	Systemic lever	Technology / Infrastructure - Governance & policy
	Outcome (according to module B-1.1)	Introduction of smart systems to mobility, Decongestion of city traffic, Lower of air pollutants, Improved air quality, Increased



		efficiency of transportations , Transportation of people or goods more efficient with less emissions
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Citizens of Kozani
	Involved stakeholders	Municipality of Kozani, Municipal Police
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	6,531.1 MWh
	GHG emissions reduction estimate (total) per emission source sector	1,743.8 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	1,145,000 €

*Actions included in this package:

1. Creation of small urban supply chain centers
2. Use of municipal electric two wheeled vehicles when appropriate (without carrying freight etc)
3. Development of an intelligent supply management system (eg establishment of loading and unloading schedules, optimal routes, etc.)



Promotion of Cycling

Action outline	Action name	Alternative Transportation
	Action type	Walkability & Cycling Strategy
	Action description	<p>The creation of new cycling routes and the development of cycling-friendly facilities are key components of a successful cycling strategy. By investing in dedicated cycling infrastructure, such as protected bike lanes and shared paths, municipalities Kozani provides a safe and convenient environment for cyclists. This encourages more people to choose cycling as a mode of transportation, reducing the number of car trips and leading to a significant reduction in CO₂ emissions. Additionally, providing ample parking spaces with bike racks promotes cycling accessibility and encourages individuals to use bicycles for short-distance trips instead of cars. Installing a smart bike sharing system enhances the accessibility and convenience of cycling as a transportation option. These systems provide a network of shared bicycles available for short-term use, allowing individuals to easily access and return bikes at designated stations. By integrating technology, such as mobile apps and real-time bike availability updates, smart bike sharing systems make cycling more user-friendly and encourage its adoption as a viable mode of transportation. Increased bike sharing usage translates into reduced car usage, resulting in lower CO₂ emissions and improved air quality. Moreover, promoting cycling as a mode of transportation brings numerous health and well-being benefits. This holistic approach to transportation not only benefits individuals but also contributes to the overall well-being of the community. Finally, the cycling strategy promotes community connectivity and vibrancy. Cycling-friendly infrastructure</p>



		creates a sense of place, connecting neighborhoods, business districts, and recreational areas. This connectivity enhances social interactions, supports local businesses, and stimulates economic activity. This action includes the creation of 19.1 km of cycling routes as well as the installation of 10 stations for bike sharing including facilities such as bike racks, charging stations, electric bikes, electronic platform (sharing system), etc. Stations will be installed from 2026 until 2030 and the routes will be realized from 2028-2030.
Reference to impact pathway	Portfolio	Walkability & Cycling Strategy
	Systemic lever	Technology / Infrastructure - Social innovation- Participation / democracy
	Outcome (according to module B-1.1)	Promotion of physical activity, leading to improved health and well-being, Alternatives to private vehicles, thereby reducing congestion on roads and improving traffic flow, Introduction of sustainable modes of transportation, Economic Benefits, Fostering of social interactions and community engagement, Further promotion of RES usage, Promotion of transportation for groups that don't have the funds to acquire a vehicle
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Citizens of Kozani
	Involved stakeholders	Municipality of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	21,775.5 MWh



	GHG emissions reduction estimate (total) per emission source sector	5,445.6 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	2,510,600 €

*Actions included in this package:

1. Creation of new cycling routes and related facilities (e.g. parking spaces-bike racks)
2. Installation of smart shared transportation systems (bike sharing system, car-sharing, e-scooters, etc.)



Promotion of Walkability		
Action outline	Action name	Alternative Transportation
	Action type	Walkability & Cycling Strategy
	Action description	<p>Promoting walkability within cities not only enhances the livability and well-being of residents but also contributes to sustainable development and environmental conservation. This action includes:</p> <ol style="list-style-type: none"> 1. School Green Routes: Creating dedicated pedestrian-friendly pavement and street formations in front of school complexes encourages students and their families to walk to school instead of relying on private vehicles (formation of green school routes). By prioritizing safety and accessibility, these measures promote active transportation, reduce traffic congestion around schools, and significantly lower CO₂ emissions. Furthermore, this action fosters a healthier lifestyle for children and enhances their overall well-being. The formation of school green routes rings is a measure that can create favorable traffic and urban planning conditions for children for safe and comfortable movement to and from school complexes. Therefore, the intensity of the measures needs to have an escalation in order to bring the desired results. This kind of escalation in the case of student movements begins with the interventions on the roads within the school rings and intensifies with the more drastic interventions on the roads around the perimeter of the school complexes. In particular, for the case of school facilities in the Municipality of Kozani, it is proposed to develop rings on the streets located within a radius of 250m from the buildings under consideration. The Municipality of Kozani, identified 39 school complexes in order to proceed to this measure. This include the formation of approximately 0.07km² by the end of 2030.

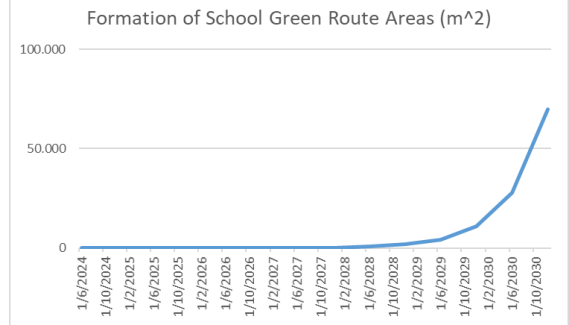


Figure 40: Formation of school green route areas

2. **Pedestrianization:** This involves designating certain areas within the city as car-free zones or limiting vehicle access. This action promotes walkability by creating pedestrian-friendly environments, enabling residents and visitors to navigate urban spaces safely and comfortably. The measure includes the pedestrianization of approximately 0,03km² by the end of 2030.

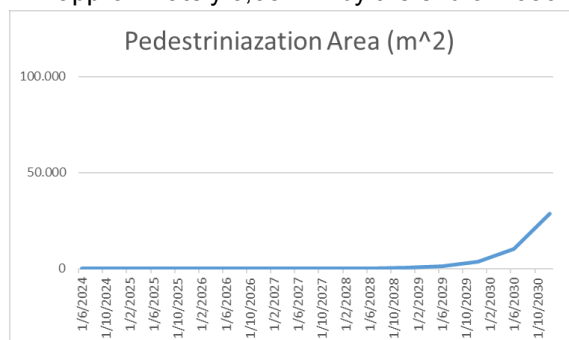


Figure 41: Pedestrization

3. **Infrastructure Development to Enhance Accessibility:** Investing in infrastructure to enhance accessibility plays a vital role in promoting walkability. Actions such as widening points, reducing lane width to prioritize pedestrians, installing disabled ramps, and improving the connectivity of local outskirts enable individuals of all abilities to navigate urban spaces more easily. By creating inclusive environments that cater to pedestrians, communities foster a culture of walking and reduce the



need for motorized transportation, resulting in a significant reduction in CO₂ emissions and a more sustainable urban ecosystem. This measure focuses on the enhancing an area of approximately 0.07 km² by the end of 2030.

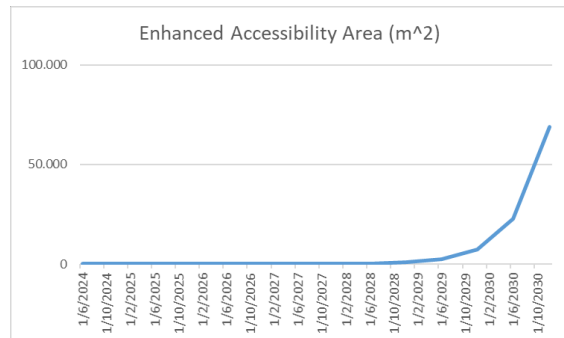


Figure 42. Enhanced accessibility area.

4. **Pedestrian Crossings:** Developing crossings that prioritize pedestrian safety and convenience further promotes walkability. Actions such as densification of pedestrian crossings, elevated crossings, and the implementation of smart crossings improve the flow of pedestrian traffic and enhance safety. By facilitating the movement of pedestrians and ensuring efficient crossing opportunities, these actions encourage more people to choose walking as their preferred mode of transportation. This measure includes the formation of 14 nodes until 2030.
5. **Creation of Green Routes Connecting City Attractions:** Establishing green routes that connect the city's attractions creates an interconnected network of walkable paths. These routes, often lined with green spaces and parks, encourage residents and tourists to explore the city on foot. By providing attractive, safe, and accessible walking options, these green routes not only enhance the walkability of the city but also contribute to the overall reduction in carbon emissions. Green routes are planned by taking under consideration the following conditions: a) safe crossing arrangements for pedestrians, b) motor



		traffic mitigation provisions, c) change/reduce speed limits, d) improvement of infrastructure for the disabled, e) effective and comprehensive pedestrian information sign system, f) urban equipment upgrade (lighting, benches, etc.). The study is expected to be concluded by mid 2026 and the action will be finalized by 2030.
Reference to impact pathway	Portfolio	Walkability & Cycling Strategy
	Systemic lever	Technology / Infrastructure - Social innovation- Participation / democracy
	Outcome (according to module B-1.1)	Promotion of physical activity, leading to improved health and well-being, Alternatives to private vehicles, thereby reducing congestion on roads and improving traffic flow, Introduction of sustainable modes of transportation, Economic Benefits, Fostering of social interactions and community engagement, Further promotion of RES usage, Promotion of transportation for groups that don't have the funds to acquire a vehicle
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Citizens of Kozani
	Involved stakeholders	Municipality of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	22,428.6 MWh
	GHG emissions reduction estimate (total) per emission source sector	5,608.9 tCO ₂



	Total costs and costs by CO ₂ e unit	4,448,415 €
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*Actions included in this package:

1. Pavement and street formations in front of the entrances of school complexes
2. Pedestrianizations
3. Development of infrastructure to enhance accessibility (widening points, local outskirts, reduction of lane width, disabled ramps, etc.)
4. Development of crossings (eg. Densification, elevated crossings, smart crossings)
5. Creation of green routes connecting the city's attractions



Implementation of Smart Systems for Mobility

Action outline	Action name	Implementation of Smart Systems for Mobility
	Action type	Introduction of IT technologies to mobility
	Action description	<p>Introducing Intelligent Transportation Systems (ITS) revolutionizes the way people move, offering efficient, sustainable, and environmentally friendly transportation solutions. Smart Systems for Mobility can enhance mobility, reduce traffic congestion, and significantly contribute to decarbonization and the mitigation of CO₂ emissions. Kozani plans the following actions:</p> <ol style="list-style-type: none"> 1. <u>Smart Controlled Parking System (e-parking):</u> The introduction of a smart controlled parking system revolutionizes parking management within the municipality. By utilizing technology such as sensors and real-time data, this system guides drivers to available parking spaces, reducing the time spent searching for parking spots and minimizing traffic congestion caused by circling vehicles. Additionally, the system can offer incentives for off-peak parking or electric vehicle charging, encouraging the use of sustainable transportation options. By optimizing parking efficiency and reducing unnecessary vehicle movements, this measure helps to decarbonize transportation and mitigate CO₂ emissions. This system will be developed by the end of 2026. 2. <u>Smart Mobility Management System with Smart Signals:</u> This system integrates real-time data from various sources, including traffic sensors, vehicle detectors, and public transportation schedules. By analyzing this data, Kozani can optimize traffic signal timings, reducing traffic congestion and improving traffic flow. Smart signals can prioritize buses, emergency vehicles, and pedestrians, ensuring a more efficient and safe transportation network. By minimizing idling



		<p>time and stop-and-go traffic, the system reduces fuel consumption and associated emissions. This will be developed by the end of 2027.</p> <p>3. <u>Installation of Smart Stops with Telematics System:</u> This enhances the user experience and promotes sustainable transportation. Real-time information about bus arrivals, routes, and delays is displayed at the smart stops, allowing passengers to plan their journeys more efficiently and reduce wait times. Furthermore, the telematics system enables operators to optimize bus schedules based on demand, ensuring more efficient service and reducing unnecessary trips. By improving the reliability and attractiveness of public transportation, this action package encourages modal shift from private vehicles to greener alternatives, resulting in reduced carbon emissions and a cleaner urban environment. The Municipality plans to install these stops to 25 stations/locations of the city progressively, starting from late 2025 until 2030.</p> <div data-bbox="831 1198 1396 1541"> <table border="1"> <caption>Total Stops/Stations</caption> <thead> <tr> <th>Date</th> <th>Total Stops/Stations</th> </tr> </thead> <tbody> <tr><td>1/6/2024</td><td>0</td></tr> <tr><td>1/10/2024</td><td>0</td></tr> <tr><td>1/2/2025</td><td>0</td></tr> <tr><td>1/6/2025</td><td>0</td></tr> <tr><td>1/10/2025</td><td>1</td></tr> <tr><td>1/2/2026</td><td>2</td></tr> <tr><td>1/6/2026</td><td>2</td></tr> <tr><td>1/10/2026</td><td>3</td></tr> <tr><td>1/2/2027</td><td>4</td></tr> <tr><td>1/6/2027</td><td>5</td></tr> <tr><td>1/10/2027</td><td>6</td></tr> <tr><td>1/2/2028</td><td>7</td></tr> <tr><td>1/6/2028</td><td>8</td></tr> <tr><td>1/10/2028</td><td>10</td></tr> <tr><td>1/2/2029</td><td>12</td></tr> <tr><td>1/6/2029</td><td>14</td></tr> <tr><td>1/10/2029</td><td>18</td></tr> <tr><td>1/2/2030</td><td>22</td></tr> <tr><td>1/6/2030</td><td>25</td></tr> <tr><td>1/10/2030</td><td>25</td></tr> </tbody> </table> </div> <p>Figure 43: Total stations</p>	Date	Total Stops/Stations	1/6/2024	0	1/10/2024	0	1/2/2025	0	1/6/2025	0	1/10/2025	1	1/2/2026	2	1/6/2026	2	1/10/2026	3	1/2/2027	4	1/6/2027	5	1/10/2027	6	1/2/2028	7	1/6/2028	8	1/10/2028	10	1/2/2029	12	1/6/2029	14	1/10/2029	18	1/2/2030	22	1/6/2030	25	1/10/2030	25
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		transportations, Seamless integration and coordination of various transportation modes, including public transit, cycling, walking, and shared mobility services, Improving accessibility and inclusivity in transportation systems, Citizen engagement
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), Citizens of Kozani, TAXI Owners Association of Kozani
	Involved stakeholders	Municipality of Kozani, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), Citizens of Kozani, TAXI Owners Association of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	24,230 MWh
	GHG emissions reduction estimate (total) per emission source sector	6,059.6 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	475,000 €

*Actions included in this package:

1. Development of a smart controlled parking system (e-parking)
2. Development of a smart mobility management system (ITS) eg smart signals and priority in public transport
3. Installation of smart stops with a telematics system for easy user information



Smart Mobility Systems for Citizens

Action outline	Action name	Implementation of Smart Systems for Mobility
	Action type	Introduction of IT technologies to mobility
	Action description	<p>The introduction of IT mobility systems revolutionizes the way citizens navigate their daily travel needs, offering sustainable transportation solutions that contribute to decarbonization and the mitigation of CO₂ emissions. By implementing a comprehensive package that includes these type of actions for the citizens, Municipality of Kozani foresees to harness the power of technology to promote shared mobility, reduce the number of private vehicles on the road, and pave the way for a greener and more sustainable future.</p> <ol style="list-style-type: none"> 1. <u>Carpooling:</u> Carpooling, facilitated by IT mobility systems, allows individuals with similar travel routes or destinations to share a ride in a single vehicle. By connecting commuters and promoting carpooling as an alternative to driving alone, this system reduces the number of cars on the road, effectively reducing traffic congestion and the associated carbon emissions. Carpooling not only maximizes the efficiency of vehicle use but also promotes social connections and reduces travel costs for participants. The promotion of carpooling through IT mobility systems significantly contributes to decarbonisation efforts and the mitigation of CO₂ emissions. The Municipality will promote this action via the educational programs that prepares from 2024 until 2030. 2. <u>Crowdsensing Tools to Record Travel Needs:</u> These tools, enabled by IT mobility systems, allow citizens to record their travel needs and preferences in real time. By providing information on travel demands, destinations, and timing, these tools facilitate efficient matching of transportation resources and reduce unnecessary trips. By utilizing crowdsourced data,



		<p>municipalities can optimize transportation services, such as public transit routes and schedules, ride-sharing availability, and micro-mobility options. This data-driven approach enhances resource allocation, reduces empty vehicle miles, and lowers overall CO₂ emissions, leading to a more sustainable transportation system. This measure will be also be promoted and provided via the educational programs that the Municipality prepares for the period of 2024-2030.</p> <p>3. “Airbnb” Style System for Car Parking: Introducing this type of system for car parking enables citizens to share and rent out their underutilized parking spaces to others in need. This system maximizes the utilization of existing parking infrastructure, reduces the need for additional parking spaces, and minimizes the environmental footprint associated with parking facilities. By promoting the efficient use of parking resources and reducing the time spent searching for parking, this IT mobility solution helps reduce traffic congestion and the resulting CO₂ emissions. Furthermore, it encourages the adoption of sustainable transportation options, such as walking, cycling, and public transit, by providing convenient access to parking near transit hubs. This action reduces the need for constructing new parking lots, conserving land resources and further contributing to emissions reduction. The Municipality plans to develop a platform that can be used by citizens in order to provide a solution for car parking. This measure is planned by mid 2026.</p>
Reference to impact pathway	Portfolio	Introduction of IT technologies to mobility
	Systemic lever	Technology / Infrastructure - Governance & policy/ Participation – Democracy - Social innovation
	Outcome (according to module B-1.1)	Increased efficiency of transportations, Lower air pollutants, Budget savings from fuel reduction, Real-time monitoring of traffic conditions, Improved Safety of transportations, Enhanced overall user



		experience by providing personalized and real-time information, Data-Driven Decision Making and Planning, Improving accessibility and inclusivity in transportation systems, Citizen engagement
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Citizens of Kozani
	Involved stakeholders	Municipality of Kozani, Citizens of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	4,711.7 MWh
	GHG emissions reduction estimate (total) per emission source sector	1,178.3 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	40,000 €

*Actions included in this package:

1. Car-pooling system
2. Use of crowdsensing tools to record travel needs
3. Air bnb for car parking



Infrastructure Upgrade to Enhance Mobility

Action outline	Action name	Infrastructure Upgrade to Enhance Mobility																																										
	Action type	Infrastructures Upgrades & Mobility Measures																																										
	Action description	<p>The establishment of well-planned and efficient infrastructures plays a pivotal role in enhancing mobility within a municipality. Kozani will implement a comprehensive package that includes various infrastructure improvements, in order not only to improve traffic flow, road safety, and accessibility but also contribute to decarbonization and the mitigation of CO₂ emissions.</p> <ol style="list-style-type: none"> <u>Change/Reduction of Speed Limits:</u> this measure, particularly in non-prioritized road networks, enhances road safety and reduces fuel consumption. Lower speeds result in smoother traffic flow, reduced traffic congestion, and fewer abrupt acceleration and deceleration events, thereby reducing CO₂ emissions from vehicles. This measure includes the purchase and installation of 600 signs which will be installed progressively from 2024 until 2030 according to the following schedule: <div data-bbox="831 1440 1396 1780" data-label="Figure"> <table border="1"> <caption>Signs for speed limit</caption> <thead> <tr> <th>Date</th> <th>Number of Signs</th> </tr> </thead> <tbody> <tr><td>1/6/2024</td><td>0</td></tr> <tr><td>1/10/2024</td><td>0</td></tr> <tr><td>1/2/2025</td><td>0</td></tr> <tr><td>1/6/2025</td><td>600</td></tr> <tr><td>1/10/2025</td><td>600</td></tr> <tr><td>1/2/2026</td><td>600</td></tr> <tr><td>1/6/2026</td><td>600</td></tr> <tr><td>1/10/2026</td><td>600</td></tr> <tr><td>1/2/2027</td><td>600</td></tr> <tr><td>1/6/2027</td><td>600</td></tr> <tr><td>1/10/2027</td><td>600</td></tr> <tr><td>1/2/2028</td><td>600</td></tr> <tr><td>1/6/2028</td><td>600</td></tr> <tr><td>1/10/2028</td><td>600</td></tr> <tr><td>1/2/2029</td><td>600</td></tr> <tr><td>1/6/2029</td><td>600</td></tr> <tr><td>1/10/2029</td><td>600</td></tr> <tr><td>1/2/2030</td><td>600</td></tr> <tr><td>1/6/2030</td><td>600</td></tr> <tr><td>1/10/2030</td><td>600</td></tr> </tbody> </table> </div> <u>Reorganization of Road Network Hierarchy - Creation of Ring-Roads:</u> Kozani plans the reorganization of the road	Date	Number of Signs	1/6/2024	0	1/10/2024	0	1/2/2025	0	1/6/2025	600	1/10/2025	600	1/2/2026	600	1/6/2026	600	1/10/2026	600	1/2/2027	600	1/6/2027	600	1/10/2027	600	1/2/2028	600	1/6/2028	600	1/10/2028	600	1/2/2029	600	1/6/2029	600	1/10/2029	600	1/2/2030	600	1/6/2030	600	1/10/2030	600
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Figure 44: Signs for speed limit



network hierarchy, including the creation of ring-roads, which will improve traffic distribution and reduce the reliance on congested city center. By diverting through traffic to outer ring-roads, local roads experience reduced traffic volume and congestion, leading to improved fuel efficiency and lower emissions. The reorganization will be studied and implemented by the technical service of the Municipality. For the prioritization of the streets of the urban network, the streets are classified into categories according to the degree of the basic function (mobility or access) that they perform: a) "Free Avenue", b) "Main arterial road", c) "Secondary arterial road", d) "local distributor road" and e) "Local street". This will be realized the first semester of 2025.

3. **Light Traffic Areas in Neighborhoods, City Center, and Sensitive Areas:** The Municipality designs light traffic areas in neighborhoods, city centers, and sensitive areas prioritizes pedestrians, cyclists, and public transportation, reducing the dominance of vehicles. Promoting non-motorized transportation options leads to lower carbon emissions, improved air quality, and a healthier urban environment. This measure includes the formation of light traffic area of approximately 478.000 m². This will be implemented based on the following time schedule:

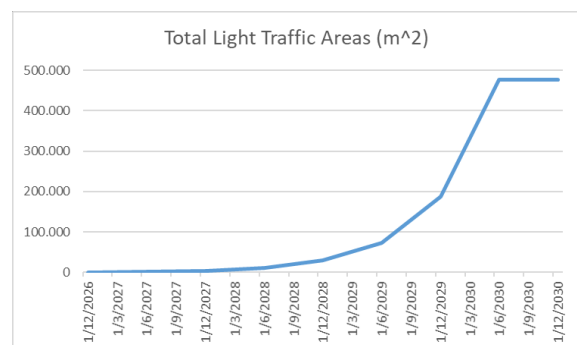


Figure 45: Total light traffic areas

4. **One-Way Streets Development:** The Municipality will introduce one-way streets that can optimizes traffic flow, reduce



		<p>conflict points, and minimizes idling time. By enhancing traffic efficiency, this infrastructure improvement reduces fuel consumption and associated CO₂ emissions, contributing to decarbonization efforts. This action concerns approximately 200m of formation of one-way street which will implemented by the end of 2024.</p> <p>5. <u>Upgrading Intersections to Enhance Road Safety (Small Roundabouts):</u> The Municipality will upgrade intersections with traffic calming measures (small roundabouts) which will contribute in improving road safety and reducing the frequency of stop-and-go traffic. Smoother traffic flow reduces fuel consumption and emissions, while the enhanced safety encourages walking and cycling and thus, further reducing vehicle reliance. Kozani plans to establish 14 nodes that will upgrade traffic conditions. The measure is planned for the period of 2025-2026.</p> <p>6. <u>Spot Node Improvements with Low-Cost Interventions:</u> This low cost interventions at spot nodes, such as improved signage, markings, and pedestrian crossings, enhances safety and accessibility. These interventions encourage active transportation and discourage unnecessary vehicle use. The Municipality plans to improve 30 nodes starting from 2025 until late 2027.</p> <p>7. <u>Reinforcement of Horizontal and Vertical Signaling - Marking:</u> This measure improves traffic efficiency and safety. Well-designed road markings, clear signage, reduce traffic congestion. This will be installed at 46.35 km of the total road network of Kozani from late 2026 until late 2027.</p> <p>8. <u>Creation of Ring Road to Prevent Congestion:</u> The Municipality will establish a peripheral ring road in order to divert traffic around the city center, preventing congestion and reducing fuel consumption caused by stop-and-go traffic. This infrastructure improves overall transportation efficiency and supports CO₂ emissions reduction. This ring-road will be ready by the end of 2026.</p>
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		<p>9. <u>Boxing of Legal Parking Spaces and Creation of Parklets:</u> By boxing legal parking spaces and repurposing them as parklets or green spaces, Kozani can reclaim valuable urban land while discouraging private vehicle use. This measure concerns 25 parklets which will be realized by late 2026.</p> <p>10. <u>Replacement of Road Paving Materials on Selected Streets:</u> The Municipality will replace conventional road paving materials with eco-friendly alternatives, such as permeable pavement or recycled materials. These reduce the carbon footprint associated with road construction and maintenance. Additionally, these materials can improve stormwater management, reduce heat island effects, and contribute to overall environmental sustainability. These materials will be installed at approximately 15km of road network of the city of Kozani by the end of 2025.</p> <p>The establishment of this comprehensive infrastructure package, encompassing speed limit changes, road network reorganization, intersection upgrades, brings multiple benefits. Beyond improving traffic flow, road safety, and accessibility, these infrastructure enhancements contribute to decarbonisation and the mitigation of CO₂ emissions.</p>
Reference to impact pathway	Portfolio	Infrastructures Enhancement
	Systemic lever	Technology / Infrastructure
	Outcome (according to module B-1.1)	Reducing the risk of accidents, Enhance accessibility for active transportation, Reducing of congestion and improvement of overall traffic management, More efficient transportation, Encouragement of walking and cycling, Reduction of noise and pollution, Promotion of vibrant community spaces, Enhancement of road safety, Prevention of congestion, Creation of additional green spaces, Improvement of driving quality



Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), Citizens of Kozani, TAXI Owners Association of Kozani
	Involved stakeholders	Municipality of Kozani, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), Citizens of Kozani, TAXI Owners Association of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	29,615.8 MWh
	GHG emissions reduction estimate (total) per emission source sector	7,406.3 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	30,237,139 €

*Actions included in this package:

1. Change/reduction of speed limits (30km in non-prioritized road network)
2. Reorganization of road network hierarchy-Creation of ring-roads
3. Light traffic areas in neighborhoods, city center and sensitive areas
4. One-way streets development
5. Upgrading intersections to enhance road safety, eg. small roundabouts
6. Spot node improvements with low-cost interventions
7. Reinforcement of horizontal and vertical signaling/markings
8. Creation a peripheral ring road to prevent congestion
9. Creation of areas of reduced vehicle traffic
10. Boxing of legal parking spaces and creation of Parklets
11. Redevelopment of public spaces
12. Replacement of road paving materials on selected streets of the Municipality




Awareness Raising Campaign for Citizens

Action outline	Action name	Awareness Raising Campaign for Citizens
	Action type	Incentives and Citizen Engagement
	Action description	<p>Citizens' awareness and information must concern all categories of mobility with the aim of a comprehensive approach to the issue. The relevant campaigns and actions should not have a piecemeal character but should be repeated on a regular basis and maintain a progressive character in the development of mobility skills and behaviours from younger to older ages.</p> <p>The awareness strategy that will be developed, is encouraged to distinguish citizens in four (4) basic categories:</p> <ul style="list-style-type: none"> • Persons aged 8 to 18: young individuals in the educative stage • People aged 18 to 25: people who are in the stage of high & higher education with intense social activities • Persons aged 26 to 50: persons of the productive age. • Persons over 50 years of age: older population. <p>The citizens' awareness plan is encouraged to include additional information education actions/events, such as seminars, speeches, presentations, etc. as well as participatory actions and promotion actions, such as the promotion of hiking etc.</p> <p>Promotional activities to change the behaviour of commuters that will be carried out are:</p> <ul style="list-style-type: none"> • Information days in associations and educational structures for Sustainable Development and Mobility • Campaigns and Incentives to promote cycling • Campaigns and Incentives to promote pedestrian travel • Public Transport Promotion Campaigns • Campaigns that showcase positive personal stories of people who have used sustainable means of travel • Road safety campaigns on speed • European Mobility Week - Car Free Day • Organization of participatory design workshops



		<ul style="list-style-type: none"> Organizing events in schools to raise awareness among students <p>These activities will take place throughout the whole plan.</p>
Reference to impact pathway	Portfolio	Incentives and citizen engagement
	Systemic lever	Governance & policy/ Participation – democracy - Social innovation - Learning & Capabilities
	Outcome (according to module B-1.1)	Lower air pollutants, Fostering environmental friendly behaviour, Raising public awareness against climate change, Fostering social interactions, Strengthened community engagement
Implementation	Responsible bodies/person for implementation	CluBE, Municipality of Kozani, Citizens' Committee
	Action scale & addressed entities	Citizens of Kozani (pre-school, students, professionals, older population)
	Involved stakeholders	National Government, Regional Authority of Western Macedonia, Municipality of Kozani, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), TAXI Owners Association of Kozani, Citizens of Kozani, Regional Directorate of Primary and Secondary Education, School Committees of Primary and Secondary Education
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	9,502 MWh
	GHG emissions reduction estimate (total) per emission source sector	2.367.3 tonnes CO ₂

ΔΗΜΟΣ ΚΟΖΑΝΗΣ Municipality of Kozani	2030 Climate Neutrality Action Plan	
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	Total costs and costs by CO ₂ e unit	7,000 €
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*Actions included in this package:

1. Organizing events to raise awareness for CO₂ emissions mitigation



Educational Seminars – Eco-Driving

Action outline	Action name	Educational Seminars – Eco-Driving
	Action type	Incentives and Citizen Engagement
	Action description	<p>Kozani Municipality understands the need of continuous education and the benefits that can provide to its citizens. Eco-driving seminars offer valuable knowledge and skills to various target groups. The Municipality will organize these seminars that focus on promoting environmentally friendly driving techniques and behaviours. By educating and empowering participants to adopt eco-friendly driving practices, Kozani can make significant strides towards achieving sustainable transportation towards a greener future. Eco-driving seminars will be addressed to the following groups:</p> <p>(a) Municipal Servants (Drivers): Eco-driving seminars for municipal servants who operate vehicles within the municipality offer a unique opportunity to lead by example. By teaching them eco-friendly driving techniques can help municipal drivers minimize fuel consumption and CO₂ emissions. This not only contributes to a cleaner environment but also reduces fuel costs and promotes efficient resource utilization.</p> <p>(b) Bus Drivers: Bus drivers have a significant impact on emissions due to the nature of their work. Eco-driving seminars tailored to bus drivers emphasize fuel-efficient driving practices e.g maintaining consistent speeds, optimizing routes and schedules to reduce idling time. By implementing these techniques, bus drivers can significantly decrease fuel consumption, and enhance the overall efficiency of public transportation system.</p> <p>(c) Taxi Drivers: Eco-driving seminars for taxi drivers focus on eco-friendly driving habits and behaviours that reduce fuel consumption and emissions without compromising customer service. Techniques such as route planning, minimizing idle time, and driving at moderate speeds can help taxi drivers provide a comfortable and timely service while contributing to decarbonization efforts. These seminars empower taxi drivers to make a positive environmental</p>



		<p>impact and set an example for other drivers in the community.</p> <p>(d) Professional Drivers: Eco-driving seminars targeting professional drivers, including those in delivery services and logistics, provide insights into sustainable driving practices. By promoting strategies such as efficient route planning, load optimization, and vehicle maintenance, these seminars help professional drivers reduce fuel consumption. Encouraging eco-friendly driving habits among professional drivers contributes to sustainable logistics operations.</p> <p>(e) Citizens: Eco-driving seminars open to citizens in general play a crucial role in raising awareness and encouraging sustainable driving habits. These seminars educate participants on eco-friendly driving techniques, including maintaining proper vehicle maintenance, avoiding aggressive driving behaviours. By empowering citizens with the knowledge and tools to make environmentally conscious driving choices, these seminars have a collective impact on reducing CO₂ emissions and promoting a culture of sustainability.</p> <p>These seminars will be held throughout the whole plan (until 2030).</p>
Reference to impact pathway	Portfolio	Incentives and citizen engagement
	Systemic lever	Learning & Capabilities
	Outcome (according to module B-1.1)	Lower air pollutants, Fostering environmental friendly behaviour, Raising public awareness against climate change
Implementation	Responsible bodies/person for implementation	Municipality of Kozani, CluBE
	Action scale & addressed entities	Citizens
	Involved stakeholders	Municipality of Kozani, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), TAXI Owners Association of Kozani, Citizens of Kozani
	Comments on implementation	-



Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	8,568.5 MWh
	GHG emissions reduction estimate (total) per emission source sector	2,142.8 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	28,000 €

*Actions included in this package:

1. Eco - driving learning –seminars



Mobility Incentives & Prevention

Action outline	Action name	Mobility Incentives & Prevention
	Action type	Incentives and Citizen Engagement
	Action description	<p>Motivating individuals and businesses to embrace sustainable transportation is crucial for enhancing mobility and reducing carbon emissions in a municipality. Significant motivation actions will be fostered. These actions include financial incentives to businesses that are friendly to active travel. By offering financial incentives to businesses that promote and support active travel, Municipality of Kozani can incentivize the adoption of sustainable transportation options. Incentives include financial area, or subsidies for public transportation passes, bicycle purchase programs, motivate these business to choose sustainable commuting options.</p> <p>To further motivate businesses to prioritize environmental sustainability, Municipality of Kozani can reduce municipal fees for businesses that demonstrate a commitment to protecting the environment. Reduction of fees for public transport will also be established.</p> <p>On the other hand, some penalty measures will also be adopted which will discourage the use of vehicles by the citizens. These actions include systematic Municipal Police inspections to prevent violations.</p> <p>These actions will be held throughout the whole plan (until 2030).</p>
Reference to impact pathway	Portfolio	Incentives and citizen engagement
	Systemic lever	Governance & policy/ Participation / democracy/ Social innovation/ Finance & Funding
	Outcome (according to module B-1.1)	Lower air pollutants, Fostering environmental friendly behaviour, Raising public awareness against climate change, Fostering social interactions, Supporting local businesses, Increasing municipal revenues and preventing violations



Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Citizens
	Involved stakeholders	National Government, Regional Authority of Western Macedonia, Municipality of Kozani, Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.), TAXI Owners Association of Kozani, Citizens of Kozani, Municipal Police
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	1,900.4
	GHG emissions reduction estimate (total) per emission source sector	475,3 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	100.000

*Actions included in this package:

1. Financial incentives to businesses that are friendly to active travel
2. Reduction of municipal fees for businesses that operate with the aim of protecting the environment



Individual action outlines

WASTE AND CIRCULAR ECONOMY



Sorting at Source

Action outline	Action name	Sorting at Source
	Action type	Sorting at Source enhancement & Recycling
	Action description	<p>Sorting waste at the source is a vital practice in the fight against climate change and the reduction of CO₂ emissions. This action aims to enhance this field and to upgrade recycling in the Municipality. Although, waste management is the most suitable field for practicing circularity, however, it is still a national issue to be resolved. This is not the case of Western Macedonia. In Western Macedonia recycling is an enhanced sector, although upgrading is also welcome.</p> <p>By implementing effective waste sorting systems, Municipality of Kozani can significantly contribute to decarbonisation and the mitigation of CO₂ emissions. This is due to the fact that when waste is properly sorted at the source, recyclable materials can be diverted from landfills. Organic waste can be composted, and recyclable materials such as paper, plastics, glass, and metals can be recycled. By reducing the amount of waste sent to landfills, the production of harmful greenhouse gases, including CO₂ and methane, is minimized. Moreover, sorting waste at source promotes higher recycling rates. By separating recyclable materials from general waste, these materials can be efficiently processed and reused in the manufacturing of new products. Recycling reduces the need for extracting raw materials, conserves energy, and decreases CO₂ emissions associated with the production process.</p> <p>At the end of 2020 the Municipality of Kozani have already proceeded to minimize the disposed waste to approximately 36% of the total fraction, when compared to the levels of 2010. Although, this quantity can be further reduced. Thus, Kozani plans to proceed on the following actions in order to minimize as</p>



		<p>possible the disposed waste, and consequently the CO₂ emissions.</p> <p>1. Green Spots: These are strategically placed facilities where residents can properly dispose of specific types of waste. By providing accessible locations for proper disposal, these facilities promote responsible waste management practices and reduce the likelihood of such items ending up in landfills or being improperly handled, minimizing associated CO₂ emissions. Moreover, green spots often include recycling stations where residents can deposit recyclable materials separately. This facilitates efficient material recovery and increases recycling rates, reducing the need for raw material extraction, energy consumption. Kozani plans to strategically establish 12 spots throughout the Municipality as well as at least two Mobile Green Spots will serve the smaller areas of the municipality, in which there is no easy and quick access to a fixed Green Spot. Their role, in addition to collecting materials for recycling and reuse, will also be informative – educational. At these spots, citizens and businesses will deposit waste, separately for each category, either waste for recycling or special management, or items for reuse. Green Spots is a first sorting and classification of materials into reusable and recyclable. Green Points can vary in size, with or without special infrastructure. According to the Government Regulation 18485/2017 (Government Gazette 1412/B) they are classified as Green Points, inside or outside settlements and especially in:</p> <ul style="list-style-type: none"> • Small Green Spots and • Big Green Spots • Neighborhood Green Spots • Mobile Green Points <p>This action starting from late 2025 and will be finalised until the end of 2027, according to the following schedule:</p>
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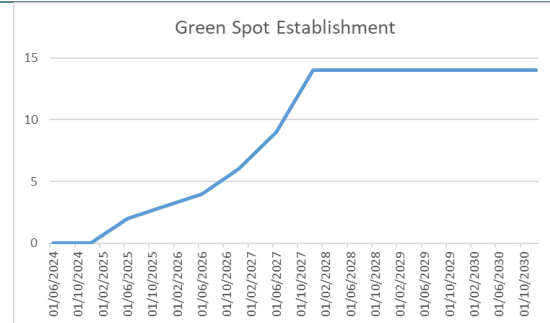


Figure 46: Green spot establishment

2. **Pay-as-You-Throw Program:** The Municipality plans to implement a pay-as-you-throw program, which considers it as an effective way to encourage waste reduction and sorting at the source. Pay-as-you-throw program charges residents based on the amount of waste they generate. This incentivizes waste reduction by encouraging individuals to be more mindful of their consumption habits, leading to a decrease in overall waste generation. Reduced waste translates to lower CO₂ emissions from waste disposal processes, connected to landfill emissions. Moreover, this program motivates individuals to separate recyclable materials, such as paper, plastic, glass, and metal. Kozani will charge lower council rates to everyone who produces less waste and/or recycles more. By implementing this prevention action, the Municipality of Kozani focuses on the promotion and support of sustainable production and consumption model and encourages the production and use of products that ensure the efficient use of resources, particularly promoting the reparability, durability and reusable nature of products. The program will begin at mid 2024 and will continued until the end of 2030.
3. **Establishment of creative re-use Centre:** Kozani plans to establish this type of centre which is a community space where volunteers offer their skills to repair broken or old items. The required tools and materials will be available to repair clothing, furniture, electrical appliances, bicycles, etc. In this centres visitors bring their damaged items and along



		<p>with the experts do their repairs. This centre promotes a culture of repairing and reusing instead of discarding and buying new items. By extending the lifespan of products, they reduce the demand for new production, which often comes with significant CO₂ emissions. Repairing and reusing items also conserve resources and energy, contributing to a more sustainable and circular economy. Moreover, this centre diverts items from landfills, reducing the environmental impact associated with waste disposal. The creative re-use centre will be established by mid 2026.</p> <p>4. Park of Circular Economy: This is one of the good practices of the promotion of circular economy as well as industrial symbiosis, i.e. a process by which the waste or products of one industrial (or industrial process) become the raw materials for another. The application of this concept allows the use of materials in a more sustainable way and contributes to the creation of a circular economy. A Park of Circular Economy is therefore a community of industrial activities, located in a common space, within which members actively cooperate, using circular economy practices, so that:</p> <ul style="list-style-type: none"> • To maximize economic, environmental and social benefits • Minimize environmental impact and resource consumption • To strengthen the economic and environmental development of the region/community <p>The Circular Economy park will be established on the outskirts of Kozani. This park will be used by the all the Municipalities of Western Macedonia and will be financed by the Regional Authority which considers it as an emblematic action. Thus, this is not an action programmed of the Municipality, however Kozani will harvest the benefits of this action.</p>
Reference to impact pathway	Portfolio	Sourcing at Source Enhancement and Recycling
	Systemic lever	Technology/Infrastructure, learning & capabilities and participation/democracy
	Outcome (according to module B-1.1)	Alignment with the principles of sustainable development, Reducing the use of raw



		materials, saving natural resources through recycling, Promotion of circular economy principles, Job creation, Promotion of prioritization in waste management and in particular the promotion of reuse and recycling with sorting at source, Recovery of higher purity materials as a result of separate collection, Promoting the initiatives of Social and Solidarity Economy in the field of the environment, Raising awareness among citizens with their direct participation and environmental education
Implementation	Responsible bodies/person for implementation	DIADYMA, Municipality of Kozani
	Action scale & addressed entities	Waste
	Involved stakeholders	Municipality of Kozani, Regional Authority of Western Macedonia, DIADYMA S.A
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	1,620.57 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	3,170,000 €



Circular Economy Upgrade of Municipal Entities

Action outline	Action name	Circular Economy Upgrade of Municipal Entities
	Action type	Certification and Green Procurements
	Action description	<p>Green certification of a Municipal Authority is a powerful tool for promoting sustainable development, mitigating CO₂ emissions, and creating environmentally conscious communities. Green certification provides a comprehensive framework in order to assess, monitor, and improve their sustainability performance. This certification sets clear targets and guidelines for reducing CO₂ emissions, promoting renewable energy, enhancing energy efficiency, and implementing sustainable practices across various sectors. This involves transitioning to clean and renewable energy sources, improving energy efficiency in buildings and infrastructure, and promoting sustainable transportation options.</p> <p>Green certification emphasizes the importance of preserving and protecting natural resources within the municipality. It encourages the adoption of sustainable land-use practices, the conservation of green spaces, and the promotion of biodiversity. With this certification Kozani fosters community engagement and education on sustainability issues. It encourages awareness raising among residents, businesses, and educational institutions about the importance of reducing CO₂ emissions and adopting sustainable practices.</p> <p>The objective of the Municipality of Kozani is the certification of products and services so that they bear Circular Economy Certification and/or Ecolabelling, as a result of which the efficient use of resources is achieved (e.g. use of secondary raw materials) so that it becomes easier and safer to disassembly, reuse and recycling. In general, there is a lack of specifications and certification bodies</p>



		<p>for a series of products derived from waste. This has the result that the manufactured or repaired products cannot be certified at national and European level, thus increasing the cost of their management and handling (making it practically impossible), while in several cases these products cannot be traded on the market, thus losing their value and undermining the business initiative.</p> <p>In order to implement the above, the municipality will create a Certification and Quality Control Center for Circular Economy Products. In the Certification and Quality Control Center for Circular Economy Products of the Municipality of Kozani, the following will be achieved:</p> <ul style="list-style-type: none"> • ecological design of new products, label and packaging • certification and standardization of final products and services • certification of products resulting from production processes based on the efficient use of resources (e.g. use of secondary raw materials) • energy labeling of products • marking of products to make disassembly, reuse and recycling easier and safer • organization and support in general of extroverted actions and activities • preparation of studies and research of any kind, such as market research, benchmarking studies, reorganization of the individual functions of the company, standardization of business risk assessment procedures, marketing plan. • life cycle analysis of products, taking into account the energy involved in the production of raw materials and final product, as well as the cost of their decomposition and disposal. • production of products avoiding the introduction of hazardous substances and facilitating reparability and life extension. formulation of measures to promote the reparability of products,
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		<p>durability and recyclability as well as ensuring the availability of spare parts in the context of an ecological design.</p> <ul style="list-style-type: none"> • adoption of ecological design indicators <p>Certification process will begin in the Municipality by mid 2026. The Municipality aspires that this certification will be adopted by other sectors, especially the business sectors of the Kozani.</p> <p>In addition, Kozani will proceed in training of the municipal employees on Green Public Contracts. This action is expected to contribute to the achievement of circular economy in the field of public contracts and procurement of the municipality. By using its purchasing power, the Municipality to procure goods, services and projects with reduced environmental impact, it can contribute at local, regional and national level to the achievement of national and international sustainability and environmental policy goals. In this context the Municipality aims also to the development of an information application for selection criteria for choosing the appropriate Green Public Contracts/Circular Public Contracts. Training will begin from the beginning of the action plan along with the development the development of the application.</p>
Reference to impact pathway	Portfolio	Certification and Green Procurements
	Systemic lever	Governance & policy - Learning & Capabilities
	Outcome (according to module B-1.1)	Minimize costs by increasing materials, recycling waste and eliminating practices that impose regulatory penalties, Reduction of sources of pollution and waste, Engagement of other economic sectors, Saving of Municipal resources, Sustainable and more efficient use of natural resources, Enhanced Reputation of the profile of the Municipality, Attraction of investments and stimulate the growth of green industries, Prioritize resource efficiency and optimize their use



Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	Waste
	Involved stakeholders	Municipality of Kozani, Chamber of Commerce and Industry of Western Macedonia, Commercial Association of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	270 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	300,000 €



Awareness raising campaign for Circular Economy & Waste		
Action outline	Action name	Awareness raising campaign for Circular Economy & Waste
	Action type	Awareness Raising for Waste Treatment
	Action description	<p>The current action is about the Educational programs concerning awareness raise activities & encouragement in the participation of citizens in the traits of Circular Economy. Raising awareness campaign are interrelated concepts that must be developed together because through information comes awareness and through awareness citizens become more receptive to being informed and ultimately to actively participating. Therefore, in the context of strengthening environmental awareness and creating a culture on circular economy issues, it is necessary that the citizens should be continuously informed. The Municipality of Kozani, in the context of promoting Circular Economy issues, will draw up a publicity - information program with targeted education and awareness actions for all its citizens.</p> <p>The composition of the training, publicity and information program presupposes the optimal combination of:</p> <ol style="list-style-type: none"> 1. factors linked to the target groups (availability, level of knowledge, etc.) and 2. external factors (budget, available experience, etc.). <p>The people/recipients of the information programs should be selected so that they can then act as multipliers of the message and thereby expand the number of recipients. It is also very important that the information programs do not only work at the start of the program, but continue throughout its duration to support its implementation for the maximum possible period of time.</p> <p>The main actions of the program refer to the following:</p> <p>A. Educational Activities in Schools</p>



		<ul style="list-style-type: none"> - Designing a manual for circular economy and zero waste specifically for students. - Educational presentations in primary and secondary schools based on the educational material "Circular Economy and Future Without Waste", for which the non-profit company Nowaste21 has approval from the Ministry of Education, for primary and secondary schools. - Pilot application of sorting at the source of separate waste streams with 10 Recycling Corners in the 10 Primary Schools,. The streams that will be collected separately are: a) paper, b) plastic bottle, c) remaining plastic-metal-composite packaging, d) electrical appliances, e) portable batteries, f) frying oils. - Actions to reward the schools with the best performance in their field. <li style="padding-left: 40px;">B. Information Actions for agencies and citizens - Pilot sorting action at the source of separate waste streams: a) paper, b) plastic bottle, c) residual plastic-metal-composite packaging, d) glass, e) electrical appliances, f) portable batteries, g) frying oils. - Designing a circular economy and zero waste handbook specially designed for households. - Development of a comprehensive manual for circular economy and zero waste specifically for catering, tourism, hotels and sports facilities. - Training seminars on circular economy and zero waste for Deputy Mayors and the technical staff of the cleaning services of the Municipality of Sparta - Press conferences to present the program and inform the local media and local stakeholders - Days to inform and raise awareness among citizens. - Workshops with restaurants, hotels and tourism businesses, chambers and sports
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		clubs for circular economy and reduction of single-use plastics. The Municipality plans to proceed in 14 large scale campaigns, starting from 2024 until 2030. The campaigns will take place twice per year.
Reference to impact pathway	Portfolio	Awareness raising
	Systemic lever	Governance & policy/ Participation – democracy - Social innovation - Learning & Capabilities
	Outcome (according to module B-1.1)	Reduction of CO ₂ emissions, awareness raising, learning capabilities
Implementation	Responsible bodies/person for implementation	CluBE, Municipality of Kozani
	Action scale & addressed entities	Waste
	Involved stakeholders	CluBE, Municipality of Kozani, DIADYMA, Citizens of Kozani, Regional Directorate of Primary and Secondary Education, Commercial Association of Kozani, Citizens of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	-
	GHG emissions reduction estimate (total) per emission source sector	337.5 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	16.800 €



Kozani Water Supply Networks Upgrade

Action outline	Action name	Kozani Water Supply Networks Upgrade
	Action type	Technical interventions
	Action description	<p>The Solution will provide the following benefits:</p> <ul style="list-style-type: none"> • Continuous monitoring of water usage throughout the network. • It reduces the cost required to read the meter in the field, (i.e. it reduces: outside work, travel by vehicle, fuel consumption, environmental burden and GHG-Green House Gas emissions.) • Reduces meter reading errors / Improves customer satisfaction. • Improved billing and cash flow (allows monthly billing). • Automatic detection of water loss/leakage by comparing the flow in each branch. • Reduction of mains leaks, water theft and other causes of unbilled water. • Improved network planning, demand and revenue forecasting <p>The system can provide as well some specific alerts in different cases that will be selected by the administrator.</p> <p>The following alarms will be available:</p> <ul style="list-style-type: none"> • Under Consumption • Overconsumption • Reverse flow • Low battery voltage • Stuck counter (no pulses are counted for 72 consecutive hours) • Device tampering or Device disconnection from water meter <p>The Solution includes a Web Portal that will provide a high-level and detailed view of the water metering information collected by the platform.</p> <p>The following main features will be included:</p> <ul style="list-style-type: none"> • Overview of total consumption (Hourly, Daily, Monthly, etc.) • Meter location on the map • Consumption Graphs • Water balance distributed • Data reports • Perform remote setup / configuration of devices (over the Air).
Reference to impact pathway	Portfolio	Awareness Raising
	Systemic lever	Technology/Infrastructure



	Outcome	Water consumption management system for the municipality of Kozani will contribute to minimum water consumption and will eliminate possible water leakages and losses. Furthermore, the ability for remotely controlling and receiving metering information will reduce further technicians visits and thus CO ₂ emissions.
Implementation	Responsible bodies/person for implementation	DEYAK
	Action scale & addressed entities	City wide – Hydrometers installations
	Involved stakeholders	DEYAK, Municipality of Kozani, Water Supply and Sewerage Companies
	Comments on implementation	From the total number of hydrometers in the area of Kozani, an amount of about 9k could be retrofitted to upgrade them into digital ones
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	25% of the total volume of leakage water could be saved by detecting those leakages
	GHG emissions reduction estimate (total) per emission source sector	While greenhouse emissions vary based on the source and distribution method, the research finds that every cubic meter of water consumed generates 10.5 kg of carbon emissions, or 85 pounds for every 1,000 gallons. Approximately 25 percent of the water in the built environment is ultimately wasted through leaks, outdated technology, malfunctions, and human error
	Total costs and costs by CO ₂ e unit	2,049,800.00 €



Individual action outlines

GREEN INFRASTRUCTURE



Agriculture/Forestry		
Action outline	Action name	Agriculture/Forestry
	Action type	Technical interventions, social participation, awareness campaigns
	Action description	The action aims to the continuous training on modernization of agricultural tractors and irrigation techniques. A wider information campaign will also be implemented. A number of technical solutions, namely electronic water extraction system for irrigation with debit cards, installation of variable speed drives and soft starters on pump motors and the installation of a power factor correction system through compensation with a capacitor array will be implemented
Reference to impact pathway	Portfolio	Green Infrastructure and nature-based solutions
	Systemic lever	Technology/Infrastructure, learning & capabilities
	Outcome (according to module B-1.1)	Reduction of CO ₂ emissions and energy consumption Reduced energy costs
Implementation	Responsible bodies/person for implementation	Municipality of Kozani, DEYAK
	Action scale & addressed entities	Agriculture
	Involved stakeholders	Municipality of Kozani, citizens of MoK
	Comments on implementation	
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	5,008.42 MWh/year
	GHG emissions reduction estimate (total) per emission source sector	1,323.68 tonnes CO ₂
	Total costs and costs by CO ₂ e unit	0.00 €



Smart Parks – Smart Benches

Action outline	Action name	Smart Parks – Smart Benches
	Action type	City equipment addition
	Action description	<p>The smart 5-seater bench will be of robust construction, all its metal elements will be made of high quality stainless steel. It will have a metal canopy on the roof of which a solar panel will be installed. A special type of battery will be placed in the body of the bench in which the solar energy will be stored and will offer an autonomy of operation sufficient for 2-3 days. The seats will be made of excellent quality wood.</p> <p>The smart bench will offer citizens and visitors access to the Internet through a wireless Wi-Fi connection. A special sensor that will be attached to it will activate the aesthetic night lighting. The user will be able to take advantage and charge their mobile devices (mobile phone, tablet and/or laptop) from the 4 charging ports (2 normal and 2 fast).</p> <p>It will support the equality of all people, since it will be able to incorporate a special type of position for people with disabilities.</p>
Reference to impact pathway	Portfolio	Green Infrastructure and nature-based solutions
	Systemic lever	Smart City Equipment
	Outcome	The Smart Benches will improve the public recreation facilities and will motivate citizens to visit local parks and squares by foot, thus avoiding using their cars and causing further CO ₂ emissions
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	City wide – Citizens
	Involved stakeholders	Municipality of Kozani
	Comments on implementation	Installation could be done per place according to the city's plan
Impact & cost	Generated renewable energy (if applicable)	250 – 400 watts electricity power production per solar panel
	Removed/substituted energy, volume or fuel type	Approximately 1.400 watt per 4 solar panels of a smart tree could be saved
	GHG emissions reduction estimate (total) per emission source sector	The Smart Benches will improve the public recreation facilities and will motivate citizens to visit local parks and squares by foot, thus avoiding using their cars and causing further CO ₂ emissions

	Total costs and costs by CO ₂ e unit	22.000€ – per bench
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Individual action outlines

SMART CITY



Digital organization and management platform for work-flows, processes, cases and documents.

Action outline	Action name	Digital organization and management platform for work-flows, processes, cases and documents.
	Action type	Software Platform
	Action description	<p>The Document Management Information System is an integrated solution for digital document management and recording workflows with support for digital signatures. It works in a fully online environment as it is a (web-based) application. It is based on Open Source Software, with customizations, adaptations and extensions thereof, to fully cover the needs of the end user.</p> <p>The Platform includes:</p> <ul style="list-style-type: none"> • Document Management System • Business Process Management System • Digital Document Signature System • Possibility of Protocol System Integration <p>The Platform provides an easy-to-use, fast and secure document, file and information management environment.</p> <p>With simple and specific procedures, each user has the ability to add-remove, edit, search electronic documents/files in their storage space. The user can create groups, cases, folders and subfolders. There is a process of marking, using tags/descriptions, for easier searching of the documents. By using optical character recognition (OCR) technologies, it provides the ability to search text in PDF documents and JPG images. At the same time, with the use of free text search, the user can search for any word/sentence in the texts, search with identifiers of the document (date, author, title, creator, etc.) or based on the characterization he has given (label, category, etc).</p> <p>The management environment is designed to be accessible even to unfamiliar users. With flexible and simple procedures, each user has the possibility to adjust the organizational structure of the System according to his preferences, to give access to other users to his documents or to lock his files.</p> <p>Business Process Management System</p>



		<p>The Platform also provides a built-in Business Process Management system that allows the user to define different workflows for their files. Workflow is designed with speed and ease of use in mind to facilitate communication and business processes. Automating redundant tasks, ensuring task tracking help increase efficiency and reduce task execution time. It is possible to send a document for approval to one or more users, to assign a review task or for any other purpose. At each stage an electronic notification is sent to the user assigned the task (email). The user can set a date and priority level for each task.</p> <p>Digital Document Signature System The Platform also contains a dedicated Cosign Connector to allow users to digitally sign their documents. It is easy and simple to sign, check and accept documents centrally stored on the Platform, without the need for any installation on the local computer. The CoSign digital signature solution supports compliance with many laws - regulations even the most stringent, both at the government level and at the level of various industries around the world.</p> <p>Protocol System Integration Capability At the same time, there is the possibility to integrate a special application for incoming / outgoing protocol, which locks the documents and gives a unique serial number that can only be modified by the authorized user.</p>
Reference to impact pathway	Portfolio	Smart City
	Systemic lever	Technology/E-gov
	Outcome	The implementation of an internal management system for the Municipality will give further possibilities to improve the municipality – citizens interaction and reduce waiting time, requests pilling and in person visits. The possibility of fulfilling remotely the citizens request will contribute to minimize commuting and thus reducing CO ₂ emissions
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	City wide – Citizens



	Involved stakeholders	Municipality of Kozani
	Comments on implementation	The platform could be installed centrally to manage different processes per case
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	Up to 14% of total transportation consumptions - 403,06 MWh
	GHG emissions reduction estimate (total) per emission source sector	Research indicates reduced commuting in 2020 has significantly lowered greenhouse gas emissions. As transportation generates 14% of global GHG emissions, reducing commuter emissions is key to a sustainable future and achieving international GHG abatement targets.
	Total costs and costs by CO ₂ e unit	150.000 € - per platform



Smart City Guide

Action outline	Action name	Smart City Guide
	Action type	Software Platform
	Action description	<p>Through the city guide, both permanent residents and visitors will have access to information about local businesses (Name, location on the map, photos, social media, etc.).</p> <p>Store needs that the Loyalty platform will cover:</p> <ul style="list-style-type: none"> • Sales increase • Reducing the cost of brochures and other printed material • Direct access to customers • Promotional actions that take into account the customer's preferences and location • Loyalty features <p>The platform will consist of:</p> <ul style="list-style-type: none"> • A website for consumers accessible to all that will present local businesses, and general offers • Loyalty web application for access by local businesses and consumers • Mobile Application (Android/iOS) • Beacons • QR Codes <p>The platform will be the official Website for the promotion of the stores to consumers (locals and visitors). It will be provided to the stores as a service through the cloud (cloud computing services) and will not require the installation of special software on the computers of the stores. The stores will be given access to a web based management system (CMS)</p> <p>A summary of the functions that will be provided:</p> <ul style="list-style-type: none"> • Consumer registration and profile creation on the Loyalty platform • Choice by consumers of those stores in which they want to take part in their Loyalty program • Presentation of the stores (texts, photos, location on the map, phones, social media) <p>Promotional actions:</p> <ul style="list-style-type: none"> • Push Notifications & QR codes • Use of Beacons that will be installed in stores (1 per store), and will communicate with consumers who pass outside them (and have installed the application) in order to display promotional messages



		<ul style="list-style-type: none"> • Sending offers through the loyalty application (web, mobile - push) • Section with store offers, in which each store will be able to post its offers • Loyalty programs and functions to use according to what suits the type of each store • "Stamps" type (e.g. for every 5 coffees we give you the 6th, for the 6 times you buy 1 kg of ice cream we give you 1 kg for free) • Type of points (e.g. at 100 points you get a 10% discount) • Business offers through web application and mobile application • Collaborative actions where stores will be able to offer combined offers (e.g. with purchases over 50 euros you get free parking) <p>Supported languages:</p> <ul style="list-style-type: none"> • Greek • English (concerns information about participating stores and not Loyalty functions)
Reference to impact pathway	Portfolio	Smart City
	Systemic lever	Technology/E-gov
	Outcome	The implementation of a Smart City Guide app will have a significant impact both in growing the attraction of the local business and in the elimination of activities (mainly marketing) that was done before in a physical way – for example: printed leaflets, printed posters, etc.. – That consumes resources and produce CO ₂ emissions.
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	City wide – Citizens
	Involved stakeholders	Municipality of Kozani
	Comments on implementation	-
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	The suggested solution could lead to a reduction of 26% of energy use by replacing printed advertising materials
	GHG emissions reduction estimate (total) per emission source sector	The production of major materials (iron and steel, aluminum, cement, chemical products, and pulp and paper) accounted



		<p>for 26% of global final energy use and 18% of CO₂ emissions from fossil fuels and industrial processes in 2014. Material- or resource efficiency measures the quantity of physical services provided per unit of material. For climate change mitigation, material efficiency (ME) strategies seek to achieve similar outcomes with the use of less materials or less emissions-intensive materials. ME strategies such as light-weighting of and lifetime extension for products, reuse, remanufacturing, recycling of materials, and appropriate material choice, have recently been recognized as an important yet hereto largely untapped opportunity for emissions abatement.</p>
	Total costs and costs by CO ₂ e unit	158.000€ - for 150 stores



Application of the Municipality's Electronic Appointments

Action outline	Action name	Application of the Municipality's Electronic Appointments
	Action type	Software Platform
	Action description	<p>Features of the Application:</p> <ul style="list-style-type: none"> • Application of electronic appointments, through which a citizen or a business can make an appointment with a specific service and a specific municipal employee, on a predetermined day and time, in order to be served without crowding into waiting lines. • The visitor will be able to register his visit remotely through the operator's website, either from his computer or from his mobile phone. • The visitor receives the Response to his Request, via email and/or SMS on his mobile phone. • His Request may be approved or rejected. • The approval response will be accompanied by the confirmation QR code, which is the access code to the building,.
Reference to impact pathway	Portfolio	Smart City
	Systemic lever	Technology/E-gov
	Outcome	<p>The implementation of an electronic appointment management system for the Municipality will give further possibilities to improve the municipality – citizens interaction and reduce waiting time, requests pilling and in person visits. The possibility of booking an appointment in advance and knowing the exact time/date that you will be served will contribute to minimize commuting and thus reducing CO₂ emissions</p>
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	City wide – Citizens
	Involved stakeholders	Municipality of Kozani
	Comments on implementation	One central platform could manage the total of the appointment's requests
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	An amount of 287.9MWh on electricity consumption per 10% reduction of commuting could be saved by implementing the suggested solution



	GHG emissions reduction estimate (total) per emission source sector	6.13GHG emissions could be saved per 10% reduction of commuting in order to interact with public services info points
	Total costs and costs by CO ₂ e unit	100.000€ - per platform



Smart city platform		
Action outline	Action name	Smart city platform
	Action type	Software Platform
	Action description	<p>The Smart City Platform is the central point of collection, control and management of all the data that will be collected from the individual subsystems it has and that will be developed by the Municipality in the future. The offered Platform is an open, cloud-based platform that enables the interconnection and communication of individual smart city solutions and applications.</p> <p>The Smart City Platform is based on open-source software and takes advantage of Internet of Things (IoT) technologies by connecting citizens, processes, data and objects in order to achieve the monitoring of all factors affecting city life.</p> <p>The Smart City Platform is extensible and has a Community Application Development Interface (API). It has the ability to securely manage and share data and to be able to make the stored data available to third-party applications for additional analysis, synthesis and visualization of data (in a list or on a map).</p> <p>The Smart City Platform provides an operation control center with dashboards, where the overall picture of the Municipality's operations is captured in an understandable and comprehensible way on the same screen in order to minimize the operational complexity between the Municipality's services and to support the decision-making of those in charge based on "real - live" data.</p> <p>Through the Smart City Platform, the Municipality is also given the possibility to display to the Citizens, through a mobile app, any of the data it wishes, e.g., free parking spaces, environmental data, traffic data, etc. The proposed solution is fully customizable, flexible for all Municipalities and the entire environment is in the Greek language.</p>
Reference to impact pathway	Portfolio	Smart City
	Systemic lever	Technology/E-gov
	Outcome	The main concern is the improvement of the quality of life and the creation of a



		measurable benefit for the citizens and businesses of the Municipality without an administrative burden on the executives of the Municipality.
Implementation	Responsible bodies/person for implementation	Municipality of Kozani
	Action scale & addressed entities	City wide – Citizens
	Involved stakeholders	Municipality of Kozani
	Comments on implementation	A main platform could host all the existing and new smart cities apps
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	From the total of 1,027,511.17MWh of power consumption in Kozani a percentage of 30% could be reduced by monitoring the corresponding activities via a Smart City Platform
	GHG emissions reduction estimate (total) per emission source sector	The Smart City Platform will provide the Municipality with the ability of having an overall monitoring system that will gather all the indications and data related to environmental and CO ₂ emissions. By combining all the above info, the Municipality will be able to have a robust view of their environmental situation and decide about the actions needed.
	Total costs and costs by CO ₂ e unit	350.000€ - per platform



B-2.3: Summary strategy for residual emission

In order to improve the quality of life and remove residual emissions, the Municipality of Kozani will introduce green spaces and proceed to the afforestation and reforestation of areas in the Municipality. Ways to enhance carbon in soil such as former lignite-mines phytoremediation are also evaluated. At the same time new bioenergy production stations with carbon capture and storage system (BECCS) will be installed. Moreover, the installation of a direct air capture (DAC) pilot system covering its energy needs by the excess energy of RES is an alternative.

CERTH participates in **Life Terra** (<https://www.lifeterra.eu/en>) which is one of Europe's largest climate action initiatives. It brings together 16 experienced organisations from 8 countries and is led by the newly established Life Terra foundation. Life Terra is founded on the fact that tree planting is regarded as the most cost-effective nature-based solution to capture carbon. As part of a multi-faceted mitigation strategy, planting trees can play an important role in the fight against climate change and the devastation it causes (heat waves, drought, forest loss, desertification, erosion, flooding). Life Terra seeks to bring people together to plant 500 million trees in Europe, harnessing and monitoring nature's own carbon capture mechanism and enabling citizens to take urgent action against the climate crisis.

So far, within the administrative boundaries of the Municipality of Kozani, about 3,205 trees have been planted, including an iconic plantation effort of 2,030 trees with a clear significance and message towards the local society! According to international literature, a mature tree (older than 15 years) captures annually about 20-40kg of CO₂. Based on the number of trees already planted and the above annual capture amount, the trees planted in Kozani during the LIFE Terra project contribute to the capture of approximately 64 to 128 tonnes of CO₂ per year. By the end of the project (2025), based on its objectives, 250,000 trees will be planted in the region of Western Macedonia (most of them in mining areas). It is therefore estimated that these trees will contribute to the capturing of **5,000 to 10,000 tonnes of CO₂ per year**.

An effort has already been initiated in order to quantify the amount of trees and other types of vegetation that currently exist and cover various topographical areas within the boundaries of the territory of the MoK. A second step is the development of a model that estimates the amount of CO₂ that is mitigated by the various types of flora. As part of the Climate Action Plan, a detailed inventory will be developed which will monitor the changes in the distribution of the various types of vegetation and the use of land in general, on an annual basis. At the same time the amount of mitigated CO₂ will be monitored and in combination with the monitoring of the CO₂ emissions from other sources, the estimation of the residual emissions will be more accurately calculated. This will allow a more accurate quantification of the requirements for new planting of trees beyond the amount of trees that will be planted in the framework of the Life Terra programme. In parallel, the MoK will organise a continuous planning process that will dynamically identify and prioritise the public spaces for planting of trees, seeking at the same time all the necessary resources. At the same time, the co-creation process of the CAP will engage citizens in the process of making their own individual contribution by 'greening' their privately owned land and/or participating voluntarily in the actions of the Municipality.



Module B-3 Indicators for Monitoring, Evaluation and Learning

Module B-3 “Indicators for Monitoring, Evaluation and Learning” should contain a selection of indicators taken from the Comprehensive Indicator Sets developed by NZC. The following should be provided: An overview table listing the indicators selected per outcome and impact including targets and evaluation points (B-3.1); and a metadata table for each indicator selected, as specified in the Comprehensive Indicator Sets (B-3.2).

B-3.1: Impact Pathways

Outcome s/ impacts addressed	Action/ project	Indicator No. (unique identified)	Indicator name	Target values		
				2025	2027	2030
Reduced CO ₂ emissions	Covering District Heating Thermal Needs with Green Energy	DH1	CO ₂ emissions from DH	87,222.51	47,696.89	8,507.96
	Deep energy retrofit of residencies	RB	CO ₂ emissions from residencies	59,536.54	58,794.16	62,607.99
	Deep energy retrofit of Municipal buildings (incl. RE installations)	MB	CO ₂ emissions from Municipal buildings	3,442.53	2,472.03	-7,095.37
	Public lighting	PL	CO ₂ emissions from Public Lighting	795.66	795.66	795.66
	Deep energy retrofit of the tertiary sector buildings	TB	CO ₂ emissions from tertiary sector buildings	65,194.97	63,058.79	60,388.55
	Mobility	MOB	CO ₂ emission from transport	54,338.76	43,708.46	17,377.34
	Waste & Circular Economy	WCE	CO ₂ emission	*	*	*



			from waste				
	Agriculture/Forestry	AF	CO ₂ emission from AFOLU		3,801.29	3,470.37	3,056.72
Increased local renewable energy production	7MW Photovoltaic Power Plant by the Energy Community of the Municipality of Kozani	RE1	Local renewable energy production		10,500,000	10,500,000	10,500,000
	Renewable Energy Systems				441,192,307	665,951,782	1,003,090,994
	Building integrated Renewable Energy Systems				6,928,430	6,928,430	6,928,430
Reduced District Heating emissions factor	Covering District Heating Thermal Needs with Green Energy	DHF	CO ₂ emissions factor		0.330	0.180	0.032
Reduced local electricity emissions factor	Renewable Energy Systems	RE2**	CO ₂ emissions factor		0	0	0
	Building integrated Renewable Energy Systems						
Residual emissions	-	REM	Residual emissions		5,00%	10,00%	19.62%

* Available data are being assessed and it is possible either by the final submission or during the monitoring process to add initial information and target values for this indicator.

** This indicator is already monitored as the local Emission Factor for Electricity (EFE). However, due to the large number of PV installations in MoK its values are now negative. The Action Plan development team has to consider while a negative EFE should be used as a residual emissions reduction factor or kept to zero.

*** Other indicators are going to be added in future versions of the plan and during the monitoring process. The number of buildings that are being retrofitted, the number of electric car charging spots and the public funds spend to the actions are some of the indicators that the development team is going to add.



B-3.2: Indicator Metadata

DH1 – CO₂ emissions from DH	
Indicator Name	CO ₂ emissions from DH
Indicator Unit	tn CO ₂
Definition	CO ₂ emissions from the operation of the District Heating
Calculation	Using data from DEYAK
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Buildings (residencies, Municipal, tertiary sector)
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Energy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	DEYAK
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-



RB – CO₂ emissions from residencies	
Indicator Name	CO ₂ emissions from residencies
Indicator Unit	tn CO ₂
Definition	CO ₂ emissions from the operation of the residencies
Calculation	Using data from ELSTAT and DEDDIE
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Residencies
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Energy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	ELSTAT, DEDDIE
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Annual data provided by DEDDIE and statistical data by ELSTAT
Other indicator systems using this indicator	-



MB – CO₂ emissions from Municipal buildings	
Indicator Name	CO ₂ emissions from Municipal buildings
Indicator Unit	tn CO ₂
Definition	CO ₂ emissions from the operation of the Municipal buildings
Calculation	Using data from MoK
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Municipal buildings
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Energy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	MoK
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Annual energy bills data
Other indicator systems using this indicator	-



PL – CO₂ emissions from Public Lighting	
Indicator Name	CO ₂ emissions from Public Lighting
Indicator Unit	tn CO ₂
Definition	CO ₂ emissions from the operation of the Public Lighting
Calculation	Using data from MoK
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Public lighting
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Energy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	MoK
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Annual electricity bills data
Other indicator systems using this indicator	-



TB – CO₂ emissions from tertiary sector buildings

Indicator Name	CO ₂ emissions from tertiary sector buildings
Indicator Unit	tn CO ₂
Definition	CO ₂ emissions from the operation of the tertiary sector buildings
Calculation	Using data from ELSTAT and DEDDIE
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Tertiary sector buildings
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Energy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	ELSTAT, DEDDIE
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Annual data provided by DEDDIE and statistical data by ELSTAT
Other indicator systems using this indicator	-



MOB – CO₂ emissions from transport	
Indicator Name	CO ₂ emissions from transport
Indicator Unit	tn CO ₂
Definition	CO ₂ emissions from transportation
Calculation	Using data from ELSTAT, MoK and Western Macedonia Regional Authority
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Mobility and Transportation
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	ELSTAT, MoK and Western Macedonia Regional Authority
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Data from ELSTAT, MoK and Western Macedonia Regional Authority
Other indicator systems using this indicator	-



WCE – CO₂ emissions from waste	
Indicator Name	CO ₂ emissions from waste
Indicator Unit	tn CO ₂
Definition	CO ₂ emissions from waste
Calculation	Using data from MoK and DIADYMA
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Waste (not included in A-1)
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Waste and Circular Economy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	MoK and DIADYMA
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Data from MoK and DIADYMA
Other indicator systems using this indicator	-



AF – CO₂ emissions from agriculture	
Indicator Name	CO ₂ emissions from agriculture
Indicator Unit	tn CO ₂
Definition	CO ₂ emissions from agriculture
Calculation	Using data from ELSTAT and DEDDIE
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Agriculture
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Green Infrastructure
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	MoK
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Annual data provided by DEDDIE and statistical data by ELSTAT
Other indicator systems using this indicator	-



RE1 – Local renewable energy production

Indicator Name	Local renewable energy production
Indicator Unit	kWh
Definition	Increase in the share of local renewable energy due to the renewable energy projects in MoK
Calculation	Using data from RAE and DEDDIE
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it impact?	-
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Reduced electric energy coefficient
Can the indicator be used for monitoring impact pathways?	Yes
If yes, which NZC impact pathway is it relevant for?	Energy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	RAE and DEDDIE
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Data from RAE and DEDDIE
Other indicator systems using this indicator	-



DHF – CO₂ emissions factor for DH	
Indicator Name	CO ₂ emissions factor for DH
Indicator Unit	-
Definition	Mass GHG emissions per unit of grid-supplied energy
Calculation	Using data from DEYAK
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Buildings (residencies, Municipal, tertiary sector)
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Energy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	DEYAK
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-



RE2 – CO₂ emissions factor for electricity	
Indicator Name	CO ₂ emissions factor for electricity
Indicator Unit	-
Definition	Mass GHG emissions per unit of grid-supplied energy
Calculation	Using data from RAE and DEDDIE
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Buildings (residencies, Municipal, tertiary sector)
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	yes
If yes, which NZC impact pathway is it relevant for?	Energy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes, Covenant of Mayors
Data requirements	
Expected data source	RAE and DEDDIE
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Data from RAE and DEDDIE
Other indicator systems using this indicator	-



REM – Residual emissions	
Indicator Name	Residual emissions
Indicator Unit	-
Definition	The difference between Kozani's GHG emissions inventory and their 2030 climate neutrality target
Calculation	Using data from MoK about tree planting actions
Indicator Context	
Does the indicator measure direct impacts (i.e., reduction in greenhouse gas emissions?)	Yes, reduction in greenhouse gas emissions
If yes, which emission source sectors does it impact?	Residual Emissions
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Can the indicator be used for monitoring impact pathways?	No
If yes, which NZC impact pathway is it relevant for?	-
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	MoK
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	Data from MoK
Other indicator systems using this indicator	-



Part C

Enabling Climate Neutrality by 2030



Part C – Enabling Climate Neutrality by 2030

Part C “Enabling Climate Neutrality by 2030” aims to outline any enabling interventions, i.e. with regard to organizational setting or collaborative governance models, or related to social innovations – designed to support and enable the climate action portfolios described in Module B-2 as well as aiming to achieve co-benefits outlined in the impact pathway (Module B-1).

Module C-1 Organisational and Governance Innovation Interventions

Module C-1 “Organisational and Governance Innovation Interventions” consists of a summary table, listing organizational and governance interventions and describing their impact (C-1.1) and a section for more detailed descriptions and comments (C-1.2).

C.1.1: Enabling organisational and governance interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
IoT network and smart city applications	A wireless LoRa-based IoT network. MoK aims to integrate smart devices into multiple application domains until 2030 to collect data that can be used for decision making	Municipality of Kozani (MoK) University of Western Macedonia (UoWM)	Municipality of Kozani (MoK) University of Western Macedonia (UoWM) All local governance and public agencies Citizens	Lower CO ₂ emissions via solutions such as smart fleet management and smart parking, as well as data-driven smart decision-making procedures	Lower air pollutants Budget savings from fuel reduction Air quality will be improved Cleaner environment Better health conditions for the citizens
Citizen participation and citizen-driven democracy	e-democracy tools. Some strategic e-planning processes are published to trigger	Municipality of Kozani (MoK) Kozani’s Development Organisation (KDO)	Municipality of Kozani (MoK) Kozani’s Development Organisation (KDO)	Bilateral dialogue between the municipal council and citizens, allowing	Improvement of the municipality - citizens interaction



	discussions. MoK will adopt a citizen participation platform until 2030.			citizens to get real-time information, propose local laws and debate with others, will result in citizen-friendly decisions	Improvement of the quality of life and the creation of a measurable benefit for the citizens and businesses of the Municipality without an administrative burden on the executives of the Municipality
Transparency for municipal decisions	Creation of an online platform where procurements, municipal council decisions etc. are made available online to ensure complete transparency	Municipality of Kozani (MoK) Kozani's Development Organisation (KDO)	Municipality of Kozani (MoK) Kozani's Development Organisation (KDO) Citizens	Improved transparency and accountability in local governance Increased citizen trust in local authorities	Improvement of the municipality - citizens interaction Improvement of the quality of life and the creation of a measurable benefit for the citizens and businesses of the Municipality without an administrative burden on the executives of the Municipality
Citizens directly reporting issues online	Creation of an online platform and map of the municipality where citizens can report	Municipality of Kozani (MoK) Kozani's Development	Municipality of Kozani (MoK) Kozani's Development	Greatly improved response times and efficiency for municipal	Improvement of the municipality - citizens interaction



	issues in real time according to category and be informed of the authorities' response. Includes broken streetlights, garbage accumulation, issues with infrastructure etc.	Organisation (KDO)	Organisation (KDO) Citizens' committee Citizens	authorities to solve issues Increased social participation Increased trust in local government	Improvement of the quality of life and the creation of a measurable benefit for the citizens and businesses of the Municipality without an administrative burden on the executives of the Municipality
Establishment of the appropriate management scheme	MoK will reinforce the Municipal Development Organisation by proper authorisation. Further, it will assemble the local ecosystem of related actors and stakeholders to unite under the common goal of pursuing climate neutrality Establishment and upgraded role of Citizens' Committee	Municipality of Kozani (MoK) Kozani's Development Organisation (KDO)	Municipality of Kozani (MoK) Kozani's Development Organisation (KDO) CluBE University of Western Macedonia (UOWM) CERTH Technical Chambers Citizens' Committee	This is very critical in terms of implementing the planned interventions: MoK needs to authorise the Development Organisation to be able to perform many or all of the necessary activities, providing the framework and the enabling conditions for Climate Neutrality to be achieved Fulfilling remotely the citizens request will contribute to	Improvement of the municipality - citizens interaction Improvement of the quality of life and the creation of a measurable benefit for the citizens and businesses of the Municipality without an administrative burden on the executives of the Municipality



				minimize commuting and thus reducing CO ₂ emissions	
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C-1.2: Description of organisation and governance interventions – textual and visual elements



1) IoT network and smart city applications

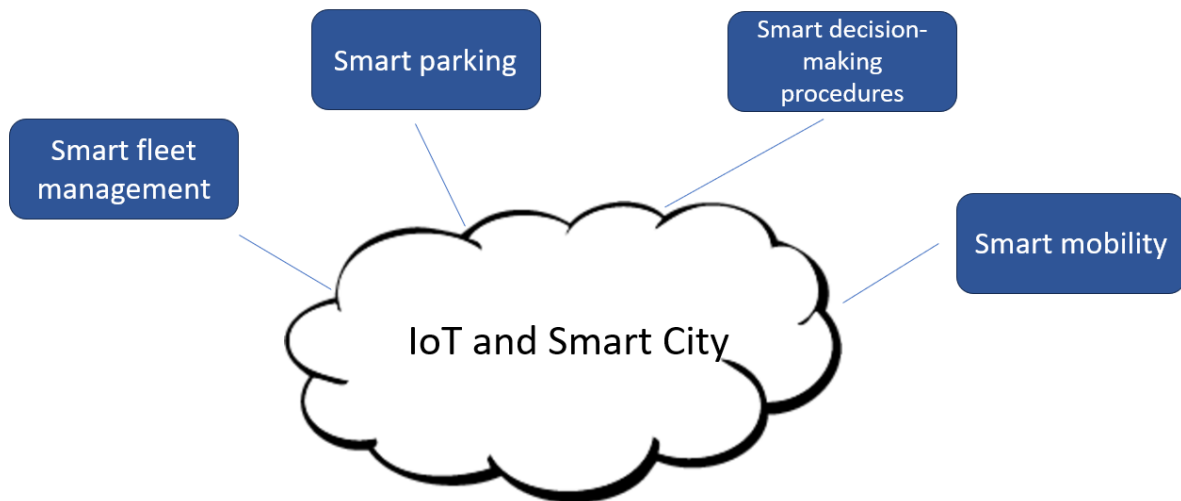


Figure 47: IoT network and Smart City applications

The rise of the Internet of Things (IoT) has created a profound opportunity to reimagine urban living, enabling us to transform our cities into Smart Cities. The Municipality of Kozani is at the forefront of this change, utilizing a LoRa-based IoT network. By 2030, MoK aims to integrate smart devices into numerous application domains, creating an extensive, data rich IoT network, as shown in Figure 47.

The core objective of this ambitious plan is to harness the power of data for decision-making. IoT devices across the MoK, embedded into infrastructure and public services, will constantly collect a vast array of data. This data will provide valuable insights into the functioning of the city, feeding into data-driven decision-making procedures.

A significant benefit of this IoT initiative is the potential to dramatically reduce emissions, contributing to the fight against climate change. By leveraging smart technologies, solutions such as smart fleet management and smart parking will become an integral part of Kozani's urban ecosystem.

On the other hand, smart parking systems could reduce congestion and associated vehicle emissions. These systems provide real-time information about available parking spaces, minimizing the time drivers spend searching for a spot. This not only saves time but also reduces the carbon footprint of each journey.



2) Citizen participation and citizen-driven e-democracy



Figure 48: Citizen participation platform and its components

The Municipality of Kozani is setting an ambitious goal to adopt a citizen participation platform by 2030. E-democracy, or digital democracy, refers to the use of technology to enhance democratic processes within a political unit. The proposed platform is one tool aimed to foster bilateral dialogue between the municipal council and its citizens. Some indicative components of the platform are presented in Figure 48.

The goal is to create a participatory environment where citizens can receive real-time information and engage in discussions. This transparent approach ensures that policies and plans are subject to public opinion and critique, making the city's governance more accountable and responsive.

This open dialogue is expected to drive climate-friendly decisions, as the citizens become more involved and aware of the city's environmental footprint. By enabling citizens to propose local laws, the city is harnessing the collective intelligence and innovative thinking of its populace to find novel solutions to environmental challenges. This could result in innovative climate initiatives and an increased commitment to sustainability within the community.



3) Transparency for municipal decisions

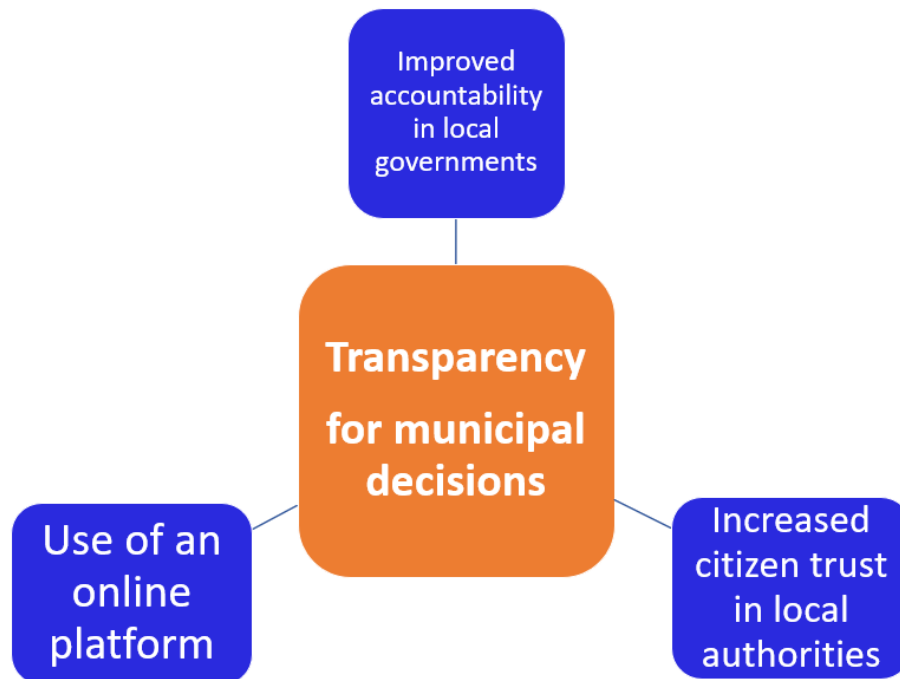


Figure 49: Transparency for municipal decisions.

In an effort to ensure transparency and foster public trust, the Municipality of Kozani is going to bring municipal decision-making processes into the digital sphere, as presented in Figure 49. Central to this effort is the creation of an online platform where critical information, including procurement details and municipal council decisions, will be made publicly accessible. This is a significant step forward in promoting open governance and deepening democratic engagement.

The proposed online platform will serve as a hub of information, about the inner workings of local governance. By making key details about procurements and council decisions available to the public, the Municipality of Kozani aims to cultivate an environment of transparency.

This transparent approach is expected to have a substantial impact on the relationship between the city's residents and its local authorities. With an increased understanding of municipal processes, citizens can develop a stronger sense of trust and confidence in their local governance structures. This open dialogue and accountability can lead to a more inclusive city administration that is more closely aligned with the needs and aspirations of its citizens.



4) Citizens directly reporting issues online

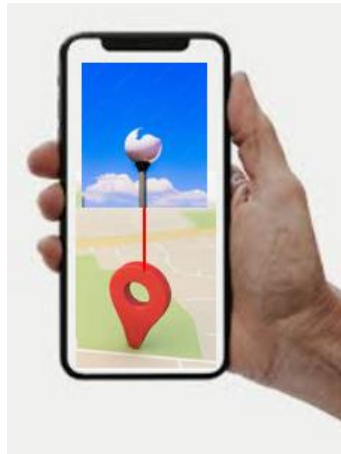


Figure 50: Citizens reporting app



Figure 51: Reporting app benefits

This intervention will include the creation of an online platform and a map of the municipality where citizens can report issues in real time according to category and be informed of the authorities' response. The platform will be available as both a website and a smartphone app. It will allow citizens to directly report issues such as broken streetlights, garbage accumulation, issues with infrastructure, issues with the quality of roads etc. The use of the app will result in a much more efficient procedure for reporting issues, greatly improved response times and



efficiency for municipal authorities, increased social participation, and increased trust in local government, as presented in Figure 50 and Figure 51.

5) Establishment of the appropriate management scheme for Kozani 2030

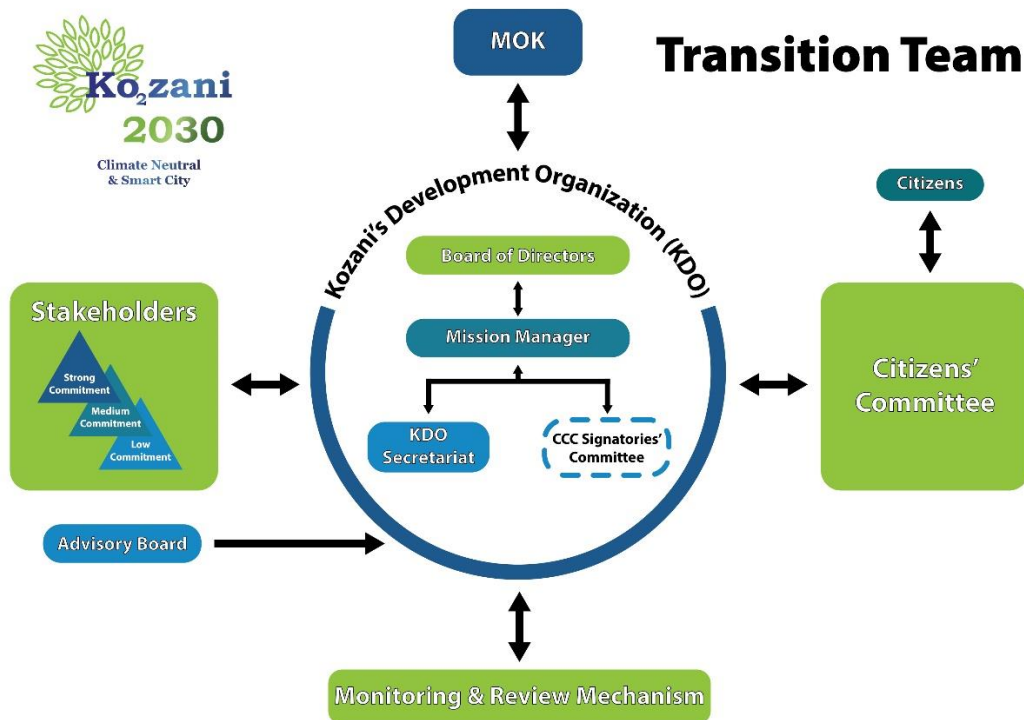


Figure 52: Establishment of the appropriate management scheme for Kozani 2030

The Municipality of Kozani is set to undertake a crucial step towards achieving climate neutrality by establishing an appropriate management scheme, the transition team, as illustrated in Figure 52. A central component of this scheme is the reinforcement of the Kozani's Development Organisation (KDO) through proper authorisation. This will equip the organisation with the necessary resources to carry out a variety of activities, that are vital to the pursuit of climate neutrality.

Under this framework, the KDO will play a pivotal role in driving climate action, ensuring that all efforts are aligned with the overall goal of climate neutrality. The organisational capacity will be augmented to effectively handle the scale and complexity of these climate-related initiatives.

However, what makes the Mission of "100 climate neutral and smart cities by 2030" unique, is the approach related to citizens' and stakeholders' inclusion and the co-design of the overall process. MoK has facilitated the establishment of the Citizens' committee in the last years and



initiated its upgraded role in the management scheme from the very beginning of the Mission's announcement.

Furthermore, the Municipality of Kozani plans to assemble the local ecosystem of related actors and stakeholders, fostering a collaborative environment to pursue their common objective. This includes businesses, environmental organizations, community groups, educational institutions, and other stakeholders who can contribute to the cause. This collective effort is critical, as achieving climate neutrality requires a holistic and comprehensive approach, addressing a wide range of interconnected issues.

By unifying these actors under a common goal, Kozani can harness their collective expertise and resources, creating a powerful force for climate action. This inclusive approach not only accelerates progress but also ensures that the actions taken are well-rounded, addressing the needs and concerns of all stakeholders.



Module C-2 Social and Other Innovation Interventions

Module C-2 “Social and Other Innovation Interventions” consists of a summary table, listing organizational and collaborative governance interventions and describing their impact (C-2.1) and a section for more detailed descriptions and comments (C-2.2).

C.2.1: Enabling social innovation interventions					
Intervention name	Description	Responsible entity/ dept./ person	Involved stakeholder	Enabling impact	Co-benefits
Upskilling and reskilling	Establishment of a STEM laboratory for primary and secondary school students	Regional Authority of Western Macedonia Ministry of Education	Regional Authority of Western Macedonia Ministry of Education	Upskilling and reskilling the citizens on new and emerging technologies will lead to skilled workforce, supporting the implementation of green and sustainable technologies in the region	Creation of innovative jobs to alleviate unemployment in Western Macedonia The city will become a paradigm of pioneering evolution towards climate neutrality that will attract international investments Indirect CO ₂ emissions reduction
	Changing the university study courses to include new emerging technologies	Municipality of Kozani (MoK) University of Western Macedonia (UOWM)	Municipality of Kozani (MoK) University of Western Macedonia (UOWM)		
	Creation of new apprenticeship programmes to provide the necessary training to workforce	Regional Directorate of Education of Western Macedonia	Regional Directorate of Education of Western Macedonia Citizens' committee Citizens		
Awareness-raising campaigns & actions to citizens, pupils and students	Awareness raising campaigns targeting the local society and schools	Municipality of Kozani (MoK) Cluster of Bioeconomy and Environment of Western Macedonia	Municipality of Kozani (MoK) Cluster of Bioeconomy and Environment of Western Macedonia	Promoting climate neutrality and bioeconomy concepts to the citizens and especially the younger	Transportation of people or goods more efficient with less emissions Reducing the use of raw



	Establishment of an environmental training center	Macedonia (CluBE)	Macedonia (CluBE) Citizens' committee Citizens Students	generations that will be the future citizens	materials, saving natural resources through recycling Indirect CO ₂ emissions reduction Better health conditions for the citizens
Promotion of carbon farming to local farmers	Actions promoting the concept of carbon farming to local farmers, especially new farmers setting up. Guidance and consultation services will also be provided.	Regional Authority of Western Macedonia Municipality of Kozani (MoK) Cluster of Bioeconomy and Environment of Western Macedonia (CluBE)	Regional Authority of Western Macedonia Municipality of Kozani (MoK) Cluster of Bioeconomy and Environment of Western Macedonia (CluBE) Local farmers Citizens	Increased income for local farmers, CO ₂ removal from the atmosphere, environmental phytoremediation	CO ₂ removal from the atmosphere
Citizen ambassador programme	A programme of accepting voluntary "ambassadors" from groups of citizens based on demographic features or neighbourhood	Municipality of Kozani (MoK) Kozani's Development Organisation (KDO)	Municipality of Kozani (MoK) Kozani's Development Organisation (KDO) Citizens' committee	Increased social participation Better and more direct representation of citizen	Indirect CO ₂ emissions reduction



	s, to directly communicate citizen concerns to local governance.		Citizen	Feedback to the local government	
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C-2.2: Description of social innovation interventions – textual and visual elements

1) Upskilling and reskilling

In a rapidly evolving digital world, keeping pace with new and emerging technologies is crucial. Acknowledging this, the Municipality of Kozani is initiating a forward-looking program focused on upskilling and reskilling its citizens.

The cornerstone of this initiative is the establishment of a Science, Technology, Engineering, and Mathematics (STEM) laboratory for primary and secondary school students. The STEM laboratory is set to be a vibrant learning hub where young minds can engage with cutting-edge technologies and acquire skills that are vital in today's technology-driven world. The laboratory will offer a hands-on, explorative learning environment, encouraging students to dive into subjects ranging from coding and robotics to renewable energy and sustainable engineering.

Beyond providing an innovative education for young students, the initiative also aims to change and adapt the university study courses to include all the necessary modules, required for the transition to a climate neutral society.

Continuous learning and apprenticeship programs will be also put in place, focusing on emerging technologies and their applications. These programs are expected to equip Kozani's citizens with the necessary skills and knowledge to adapt to the shifting technological landscape.

A central goal of these upskilling and reskilling efforts is to foster a workforce capable of supporting the implementation of green and sustainable technologies in the region. As Kozani pursues its ambition of climate neutrality, a workforce skilled in these areas will be critical. They will drive the transition to renewable energy sources, develop and maintain sustainable infrastructure, and implement innovative solutions to environmental challenges.

2) Awareness-raising campaigns & actions to citizens, pupils, and students



Figure 53: Awareness-raising event to pupils and citizens

This intervention includes a series of awareness-raising and environmental training actions for citizens of all ages from kindergarten pupils to the elderly ones. Such actions featured



presentation and dialogues on clean energy and climate change, the encouragement of private initiatives such as used cooking oil recycling and planting plants at school, as shown in Figure 53.

These actions promote the learning of concepts such as climate change and bioeconomy from an early age to younger generations, as well as the education of older adults who do not often have the opportunity to access this kind of information.

3) Promotion of carbon farming to local farmers

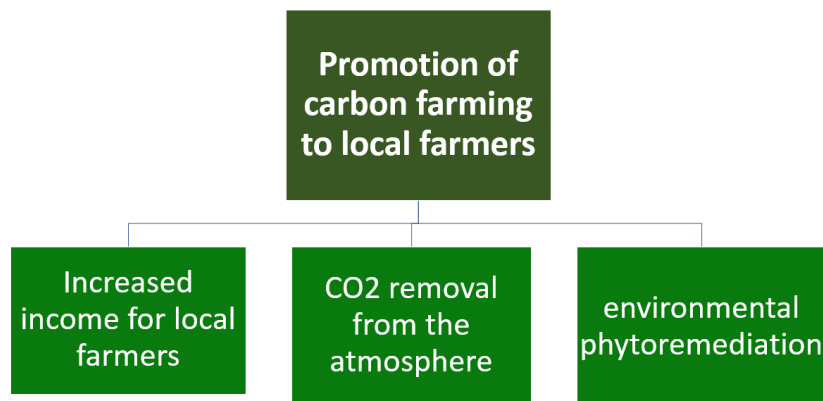


Figure 54: Benefits of carbon farming for local farmers

Recognizing the pivotal role that agriculture plays in carbon sequestration, MoK aims to promote the concept of carbon farming among local farmers, with particular emphasis on those setting up new farming operations.

Carbon farming refers to agricultural practices that can absorb and store CO₂ from the atmosphere, a process known as carbon sequestration. This includes practices such as reforestation, cover cropping, and rotational grazing, which not only sequester carbon but also enrich the soil, boost crop yields, and enhance overall farm productivity.

The Municipality of Kozani's initiative will involve educating farmers about these practices, showing them the potential benefits and teaching them how to incorporate carbon farming into their operations. This involves various actions promoting the concept and providing guidance and consultation services. It's a comprehensive effort designed to ensure farmers have the necessary knowledge, skills, and support to implement these practices effectively.

This approach holds significant promise for increasing income for local farmers. By adopting carbon farming practices, farmers can improve the health and fertility of their soil, which can lead to higher crop yields and, consequently, increased income. Moreover, there are emerging markets for carbon credits, which could provide an additional income stream for farmers who can demonstrate they are sequestering carbon.



In addition to the economic benefits, carbon farming can make a significant contribution to CO₂ removal from the atmosphere, aiding in the fight against climate change. These farming practices also promote environmental phytoremediation, a process that uses plants to remove, detoxify, or immobilize environmental contaminants, thus improving the health of the local ecosystems.

4) Citizen ambassador programme

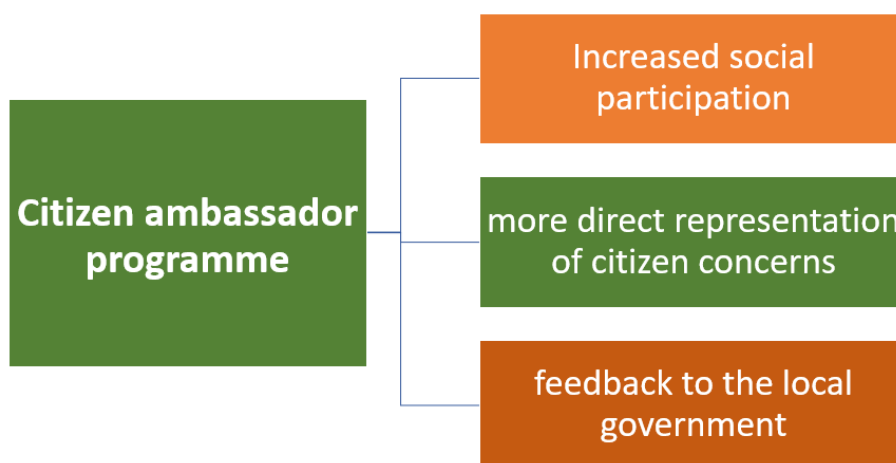


Figure 55: Benefits of citizen ambassador programme

In a bid to strengthen citizen participation and enhance the connection between its people and local governance, the Municipality of Kozani is set to launch a pioneering Citizen Ambassador Programme. This innovative initiative will consist of voluntary "ambassadors" from various demographic groups or neighbourhoods who will connect community and local government.

This programme is designed to enable direct communication of citizen concerns to the local government. The selected ambassadors will gather feedback, concerns, and suggestions from their respective communities and present them to the local authorities. This will ensure that the voices and concerns of Kozani's citizens are heard and considered in municipal decision-making processes.

By representing specific demographic groups or neighbourhoods, these ambassadors can provide an understanding of the unique challenges and needs of their communities. The benefits of a Citizen Ambassador Programme are summarized above in Figure 55. It is also expected to foster increased social participation. By giving citizens a direct channel to voice their concerns and contribute to the decision-making process, the initiative encourages citizen engagement and active participation in local governance. This inclusivity can lead to a more informed and engaged citizenry, fostering a stronger sense of community and shared responsibility for the city's well-being.



Module C-3 Financing of Action Portfolio

Module C-3 “Financing of Action Portfolio” should contain the list of action portfolios and interventions outlined in Modules B-2, and those from C-1 and C-2 with cost implication to provide a summary list of interventions that need to be unpacked in the Investment Plan.

C-3.1: Summary of interventions with cost implication (to be unpacked in Investment Plan)							
Field of Action	Action/ intervention name /details	Responsible entity and person	Start/end date	Portfolio	Impact [tn CO2]	Total cost estimated (in €)	
ENERGY	Covering district heating thermal needs with green energy	DEYAK	2023-2025	Renewable Energy Generation	83,305.21	124,000,000	
	7MW photovoltaic power plant by the Energy Community of MOK	Energy Community of Municipality of Kozani	2023-2028	District Heating thermal needs	2,704.03	6,249,600	
	Deep energy retrofit of residencies	Citizens of Kozani	2024-2030	Energy Efficient Buildings	58,923.65	145,000,698	
	Deep energy retrofit of Municipal buildings	Municipality of Kozani	2024-2030	Energy Efficient Buildings	11,251.99	20,186,036	
	Deep energy retrofit of school buildings	Municipality of Kozani	2024-2030	Energy Efficient Buildings		28,855,288	
	Deep energy retrofit of the sports facilities of the Municipality of Kozani	Municipality of Kozani	2024-2030	Energy Efficient Buildings		18,673,672	
	Building integrated Renewable Energy Systems	Installation of thermal solar	Citizens of Kozani	2024-2030	Renewable Energy Generation	687.65	7,891,114
		Installation of 10kWp photovoltaics on roofs	Citizens of Kozani	2024-2030	Renewable Energy Generation		118,366,706
	Energy Upgrading of the Public Lighting	Energy upgrading of the Municipal Lighting of Kozani	Municipality of Kozani	2022-2025	Renewable Energy Generation	707.22	7,657,530.72
		Energy saving in Municipal Lighting of Kozani in focus areas not priority A	Municipality of Kozani	2021-2024	Renewable Energy Generation	66.47	180,772.16
		Energy saving in Municipal Lighting of Kozani in focus areas not priority B	Municipality of Kozani	2021-2025	Renewable Energy Generation	134.2	619,172.92



	Renewable Energy Systems	Installation of Photovoltaics	Municipality of Kozani	2024-2030	Renewable Energy Generation		96,255,591
		Installation of Wind Farms	Municipality of Kozani	2024-2030	Renewable Energy Generation		69,956,829
		Installation of Hydroelectric Power Plants	Municipality of Kozani	2024-2030	Renewable Energy Generation		22,962
		Installation of Biomass and Biogas Units	Municipality of Kozani	2024-2030	Renewable Energy Generation		
	Deep energy retrofit of Tertiary Sector buildings	Lighting system upgrade	SME owners	2024-2030	Energy Efficient Buildings	2,570.60	3,788,486
		Use of lighting control systems	SME owners	2024-2030	Energy Efficient Buildings	1,267.21	1,867,573
		Replacement of old air conditioners with new inverter technology and high energy class air conditioners	SME owners	2024-2030	Energy Efficient Buildings	982.52	1,447,969
		Awareness actions to improve energy behavior	SME owners	2024-2030	Energy Efficient Buildings	-	
		Insulation	SME owners	2024-2030	Energy Efficient Buildings	2,656.32	8,221,744
	Smart Energy systems	Smart Energy Management	Municipality of Kozani	2024-2030	Smart Energy systems	-	609,126
MOBILITY AND TRANSPORT	Penetration of vehicles fuelled by CNG and LPG		Private vehicle owners of Kozani	2024-2030	Introduction of alternative fuel in transportations	48,862.05	10,300,000
	Replacement of municipal vehicles with EV with RES installation of charging stations and GPS management		Municipality of Kozani	2024-2030	Introduction of alternative fuel in transportations		20,390,000
	Replacement of private vehicles with EVs using RES		Private vehicle owners of Kozani	2024-2030	Introduction of alternative fuel in transportations		98,545,000
	Replacement of heavy-duty vehicles with hydrogen technology		Municipality of Kozani	2024-2030	Introduction of alternative fuel in transportations		22,500,050
	Zone with low emissions of air pollutants with priority on the use of EVs		Municipality of Kozani	2024-2030	Introduction of alternative fuel in transportations		330,000
	Upgrade of Public Transportation System		Local Urban Transportation	2024-2030	Upgrade of Public Transportation System and Urban Logistics		776,000



	Enterprise (KTEL Astikon Grammon Kozanis A.E.)				
	Enhancement of Urban logistics	Municipality of Kozani	2024-2030	Upgrade of Public Transportation System and Urban Logistics	1,145,000
	Promotion of Walkability	Municipality of Kozani	2024-2030	Walkability and Cycling Strategy	4,448,415
	Promotion of Cycling	Municipality of Kozani	2024-2030	Walkability and Cycling Strategy	2,510,600
	Implementation of Smart Systems for Mobility	Municipality of Kozani	2024-2030	Introduction of IT technologies to Mobility	475,000
	Smart Mobility Systems for Citizens	Municipality of Kozani	2024-2030	Introduction of IT technologies to Mobility	40,000
	Infrastructure Upgrades to enhance Mobility	Municipality of Kozani	2024-2029	Incentives and citizen engagement	30,237,139
	Awareness raising strategy	CluBE	2024-2030	Incentives and citizen engagement	7,000
	Education	Municipality of Kozani	2024-2030	Incentives and citizen engagement	28,000
	Incentives to citizens	Municipality of Kozani	2024-2030	Incentives and citizen engagement	100,000
WASTE AND CIRCULAR ECONOMY	Creation of Green Spots	Municipality of Kozani	2024-2030	Sorting at Source enhancement and cycling	940,000
	Pay as you throw	Municipality of Kozani	2024-2030	Sorting at Source enhancement and recycling	1,530,000
	Eco-Industrial Park	DIADYMA	2024-2030	Sorting at Source enhancement and recycling	2,228.10
	Centers for Creative Reuse of Materials	DIADYMA	2024-2030	Sorting at Source enhancement and recycling	700,000
	Certification	Municipality of Kozani	2024-2030	Certification and Green Procurements	200,000



	Green Procurements	Municipality of Kozani	2024-2030	Certification and Green Procurements		100,000
	Educational programs and promotion of Circular Economy	CluBE	2024-2030	Awareness Raising		16,800
	Kozani Water Supply Networks Upgrade	DEYAK	2024-2030	Awareness Raising		2,033,000
GREEN INFRASTRUCTURE	Agriculture/Forestry	Municipality of Kozani	2024-2030	Green Infrastructure and nature-based solutions	1,323.68	
	Smart parks (solar trees, etc)	Municipality of Kozani	2024-2030	Green Infrastructure and nature-based solutions	-	110,000
SMART CITY	ICT	Municipality of Kozani	2024-2030	Electronic governance	-	350,000
	Electronic Governance	Municipality of Kozani	2024-2030	Electronic governance	-	408,000
Total					217,670.88	858,070,874



Outlook and next steps

This section should draw any necessary conclusions on the Action Plan above and highlight next steps and plans for further refining the Action Plan as part of the Climate City Contract.

Plans for next CCC and Action Plan iteration – textual elements

The effort for the preparation of the climate city contract and the climate action plan has been very intensive and continuous. There is a lot of team work and interaction with citizens and stakeholders, since they are the center of the co-design approach of the future Kozani as analytically described in the 3 reports, uploaded in the platform under the category “other” (PDF file: 1st Phase CCC - Stakeholders' Workshops and CCB Summary Report, PDF file: 2nd Phase CCC - Stakeholders' Engagement Report and PDF File: 2nd Phase CCC - Citizens' Engagement Report). At the same time there is an ongoing networking effort with the other Greek cities in order to facilitate both the preparation and more importantly the implementation process.

The Municipality of Kozani has now developed its climate city contract and officially submitted it on 13.09.2023. The under-establishment transition team, as described above in Figure 52 (p.230), will be in charge of the contract's implementation, whose scientific review will take place in three steps and more specifically in:

- 2026: 1st official review of the CCC
- 2028: 2nd official review of CCC
- 2030: final review of CCC and recommendations

The emblematic project prioritizes the groups of actions that are going to take place as next steps and defines them as follows:

- The establishment of the transition team, that will be in charge of the project's implementation
- Intensification of awareness-raising campaigns to spread the message to every single citizen
- Implementation of the actions defined as 'early changes'
- Implementation of the actions defined as 'later outcomes'

Annexes

Add any textual or visual material to the 2030 Climate Neutrality Action Plan in the ANNEX as necessary.

Climate City Contract

2030

Climate Neutrality Commitments of the Municipality of Kozani

ΔΗΜΟΣ ΚΟΖΑΝΗΣ
Municipality of Kozani



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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

The Municipality of Kozani (MoK), with its more than 71.000 citizens, is located in the north-west part of Greece and has been the entire **Greece's energy centre since 1955**, when the huge lignite deposits were discovered and their exploitation to produce electricity has begun. For the following decades, Kozani has held a leading role in the **country's electricity scenery**, producing more than 75% of **the country's total electricity**.

This heavy production of electricity brought high development standards for the entire Region, but, as it was based on fossil fuels, this development came at a high cost, as the environmental degradation and the health problems came along, further multiplying as the lignite-based electricity production surged in the beginning of the current century.

However, things started changing in the last decades at global level: the Paris Agreement in 2015, signed by the vast majority of countries around the world, calls for holding the rising **temperature level at "well below" two degrees Celsius to avoid an irreversible environmental degradation**.

Greece has signed the historic Paris Agreement on climate change, in December 2015, as it has also supported the European Green Deal, approved in 2020. The EU Green Deal **legislated that EU's greenhouse gas emissions should be 55% lower in 2030 compared to 1990**, with the main goal of achieving climate neutrality in 2050.

In light of the above, the bold decision of the Greek Government in 2019 for the decarbonization of the electricity production and the decommissioning of the lignite mines and power plants by 2028 with the simultaneous transition to a greener energy and economy aligned **with Kozani's vision for a greener future and better standards of living and well-being**. Kozani has been preparing its post-lignite development (Post-lignite Development Plan 2020, **Kozani's Declaration on Climate Neutrality 2021**) and has been **actively promoting the Paris Agreement's targets, also in line with the EU's Green Deal and the Greek National Strategy on Energy and Climate (2019)**.

At the same time, Kozani is looking into the present and future and considers it is high time to act and maintain its role as the leader of energy production in the country: being a pioneer on energy and environmental topics, the city can take advantage of the well-established local know-how on these fields and change its development model, transitioning to sustainable technologies and thus keep pioneering in the future, inspiring the rest of the Greek and EU cities.

However, this transition results in loss of jobs and income for the area, which also affects the loss of population, evident during the latest national census of 2021 (more than 10% population decline during the last decade). Facing this challenge, Kozani declares determined to take advantage of the move towards a greener future, creating new and greener jobs and offering



new opportunities for the city and more generally for the Region of Western Macedonia. It will thus aim to promote local economy, bring economic benefits in terms of new jobs, savings and business opportunities and more generally, improve citizens' well-being.

The **city's** transition to a climate neutrality by 2030 is a major challenge that can be turned into a huge opportunity for the city and its citizens, as it will strengthen and promote its economic **development, offer new and more job opportunities, thus enhancing the area's demographic** development, and improve air quality and therefore quality of life.

The Municipality of Kozani (MoK) has the potential and the ambition to accelerate the transition of the city to climate neutrality by 2030. In this framework, Kozani made itself another bold decision: the Mayor and the Municipal Council, fully aligned with the goals of the Mission, have declared the commitment of Kozani **to achieve climate neutrality by 2030 (Kozani's Declaration on Climate Neutrality 2021, Municipal Council Decision No. 216/2021)**. In this framework, the Municipality has responded to the relevant Expression of Interest with a high-quality proposal which eventually resulted into its selection among the first 100 climate-neutral and smart cities!

Kozani has now developed its present climate city contract (CCC), but in the meantime it has already taken steps towards climate neutrality:

The Municipality of Kozani has already taken steps towards climate neutrality:

- First of all, in the past it had set the target to reduce CO₂ emissions by 21% in year 2020, as compared to the baseline year of 2010 (SEAP 2012, Municipal Decision No. 534/2013). The target was achieved and in fact it exceeded the initial target by reaching approximately 33,3%.
- In addition, the Mayor of Kozani declared climate emergency on July 2021 aiming to make the Municipality climate neutral by 2030. To this end, Kozani adjusted the existing SECAP from an initial 50% reduction target towards the new goal for climate neutrality aiming a 100% reduction by 2030 (new SECAP 2021, officially adopted by the Municipal Council with the decision No. 6/2022).
- Besides, the Municipality of Kozani (MoK) works closely with citizens and local stakeholders (i.e. the Cluster of Bioeconomy and Environment of Western Macedonia - CluBE, the University of Western Macedonia - UoWM, the Municipal Enterprise for Water Supply and Sewage – DEYAK, etc) in implementing a number of smart cities and digitalization projects with a direct effect in the Municipality of Kozani,
- MoK has also retrofitted the majority of municipal buildings, installed photovoltaics on their rooftops, optimized the municipal lighting system, while the energy community of the municipality is investing in local energy production, since the study for the construction of a 7MW photovoltaic park, covering 100% of its electricity needs, has been already approved.



- Furthermore, the Municipality of Kozani participates in several networks about climate neutrality, such as the Covenant of Mayors for Climate and Energy, the Green City Accord, the CIVITAS, CLIMATTICA, ICLEI, crAFt and Intelligent Cities Challenge 2023-2025 Edition.
- It has also established a network with the city of Limassol (Cyprus) and the six Greek municipalities, which participate in the Mission, under the name “Climanet” and has been awarded several awards in contests, among others the European Mobility Week Awards for 2020, 2021, 2022 and Oikopolis.

Since the very beginning of the announcement of the EU Mission on November 2021, the Municipality of Kozani has realized the pivotal role that the local society, including the local **stakeholders and the citizens, will play in the successful mission’s implementation** for Kozani.

The implementation of this unique mission requires bold changes and could only be successful, if the local society as a whole is included in the co-design process and owns a share of the overall problem and therefore its solution. **A city with the citizens, for the citizens and by the citizens** is being developed, since the Municipality has adopted a bottom-up approach to climate change policies that requires the engagement of all stakeholders, among others municipal enterprises, ministries, public authorities, SMEs, and citizens.

Stakeholders’ and citizens’ engagements are based on long-term, honest relationships and require a very careful approach to facilitate their involvement, make them active members of the co-design process and finally partners in the project. The Municipality of Kozani decided to cover this part together with the Cluster of Bioeconomy and Environment-CluBE, an organization with extensive experience on similar tasks, having been responsible for the **successful proposal’s submission, in the 1st phase of the Mission on January 2022 and coordinating the project management office team, preparing Kozani’s climate city contract.**

Numerous events with the citizens have been organized since November 2021 to transfer the message to the citizens, promote the scopes of the Mission and engage them with the project (1st phase of the Mission). Other than this extensive awareness-raising campaign, 3 workshops with relevant stakeholders on different topics related to climate neutrality and 1 workshop with citizens took place in the 1st phase of the Mission, prior to the submission of **Kozani’s answer to the Expression of Interest in late January 2022**, taking into consideration their opinion, facilitating decision making and paving the way for the new required governance model. A report covering in detail the actions of the 1st phase of the Mission with citizens and stakeholders is uploaded in the platform (PDF file:1st Phase CCC - Stakeholders' Workshops and CCB Summary Report)

In the 2nd phase of the Mission, after Kozani’s selection, as one of the 100 cities of the EU Mission of “100 climate-neutral and smart cities by 2030”, the municipal authority has undertaken additional actions to deepen its cooperation with local stakeholders and upgraded the role of the citizens in the Mission.



The Municipality of Kozani in collaboration with CluBE identified, mapped the key local stakeholders and proceeded with 2 rounds of 1-on-1 meetings with each of them to capture their requirements and later on proposed concrete engineering and investment solutions aligned with the goals of the Mission and managed to receive their commitments. Moreover, a dedicated workshop on Mobility has been organized to inform enterprises related to the sector. A report covering thoroughly the abovementioned actions is also uploaded in the platform (PDF file: 2nd Phase CCC - Stakeholders' Engagement Report)

Large scale innovations and radical changes, as those initiated by the Mission, could only turn **into reality if citizens' majority participate in decision making and co-design the "future city" according to their needs. According to Kozani's approach, the citizen is placed in the center of the Mission and is inextricably linked with every single decision related to it. New interactive tools such as mentimeter are used to facilitate citizens' participation in decision making and e-democracy in general, supporting the Mission's concept. Moreover, the existing citizens' committee has now an upgraded role and will be a key actor in the management scheme of this emblematic project. Citizens' engagement actions of the 2nd phase of the Mission can be analytically found in the uploaded report (PDF File: 2nd Phase CCC - Citizens' Engagement Report).**

More specifically, citizens will play a pivotal role in driving systemic transformation towards climate neutrality in a participatory process as users, producers, consumers, owners or political actors, together with local stakeholders from academia, the energy sector, mobility, buildings, ICT, agriculture, and forestry. The **citizen's committee** will evolve to act as Living Labs or Citizen Labs and incorporate regulatory sandbox processes that facilitate experimentation, social entrepreneurship, prioritization and decision-making and make the co-creation approach the new normal.

To support the aforementioned approach, a compelling communication campaign has already been established, having its own website "<https://climateneutral2030.cityofkozani.gov.gr/en/>", its own logo as shown in Figure 1, **based on the slogan "Kozani is making a leap into the future"**, and surrounded by many initiatives, among others:

- Awareness-raising campaign and events, dedicated to pupils and students
- Establishment of a **permanent information spot in Kozani's central square**
- Meetings with the citizens in neighbourhoods periodically
- Meetings with stakeholders periodically
- **Establishment of a citizens' committee**
- Organisation of the Environment week annually
- Organisation of the Mobility week annually



- Organisation of the Climate neutrality week annually
- Organisation of the Waste reduction week annually
- Organisation of the Green carnival annually
- Workshops with citizens and stakeholders
- Establishment of a **students'** digital competition since 2020
- **Evolution of the citizen's committee to operate as Citizen Labs and incorporate regulatory sandbox processes for experimentation and social entrepreneurship**



Figure 1: Logo of the emblematic project “Kozani 2030”

Summarizing all the above, the Municipality of Kozani has an ambitious vision towards climate neutrality accompanied by a very well-structured climate city contract and a communication campaign related to it, enabling the city to turn its vision into reality.

The well-structured climate city contract sets not only the overall ambition of the Municipality, but also the further commitments, principles and processes, which Kozani adopts, follows and commits to, in order to deliver its Mission.

Kozani's climate city contract is based on the co-design approach with many stakeholders and citizens and the cross-sectoral approach, trying to create synergies between them and



focusing on the actual needs of the city and its citizens. **More than a commitment, Kozani's CCC is a process that builds trust between different stakeholders based on a new governance model.**

It also provides all stakeholders with the opportunity to engage in this cause by signing a Memorandum of Understanding (PDF file: Commitments_Appendix I), a Declaration of Cooperation (PDF file: Commitments_Appendix II) and/or a Letter of Commitment (PDF file: Commitments_Appendix III) depending on the level of their engagement and their activities **related to MoK's goals.**

The city of Kozani will act as an open Living Lab itself, providing the ground for experimentation and innovation. In this way, it will also become an example for many other EU cities, especially the EU's highly carbon-dependent regions to meet their climate goals.

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

The city's vision for climate neutrality is explicitly stated in Kozani's Declaration on Climate Neutrality 2021, joining that way the rapidly growing global community that has recognized the planet's climate emergency. Kozani's existing SECAP has been already adjusted: the initial reduction target was decided at 50%, whereas the new goal for climate neutrality is even more ambitious setting an emissions' reduction target of 100% by 2030, according to SECAP 2021, (Municipal Council Decision No. 6/2022). The newly developed climate city contract of Kozani, officially adopted by the Municipal Council with the decision No. 383/2023 (uploaded in the platform with the PDF file: Municipal Council Decision No. 383.2023), applies to the whole Municipality of Kozani without any exclusion areas, analyses in detail the sustainable implementation of the specified actions, in terms of engineering and finance, and concludes to the final goal of 80,3% emissions' reduction by 2030 and to a total investment of 858.071 million Euros.

There is also a detailed plan to offset the remaining emissions. More specifically, as part of the Life Terra initiative 250.000 trees will be planted in the region, capturing 5.000-10.000 tonnes of CO₂ annually. Furthermore, there is a plan to develop a detailed inventory of existing trees and other types of vegetation and a model that estimates the CO₂ mitigated by them.



Taking into consideration the abovementioned offset actions and calculations, an accurate quantification of the requirements for new planting trees will take place to eliminate emissions. At the same time, the co-creation process of the CAP will engage citizens in the process of **making their own individual contribution by 'greening' their privately owned land and/or participating voluntarily in the actions of the Municipality.**

While this goal refers to the existing inventory, focusing on the CO₂ emissions, other pollutants, currently unaccounted, will be accurately quantified, assessed, and addressed with appropriate actions through the dynamic implementation of the Climate Action Plan. The more significant GHGs that are going to be quantified and assessed are Methane (CH₄) and Nitrous Oxide (N₂O). Hydrofluorocarbons, perfluorocarbons, Sulphur hexafluoride (SF₆) and Nitrogen trifluoride (NF₃), also known as the F-gases, despite **their high global warming potential**, are expected to have a significantly smaller contribution to the GHG emissions in Kozani and will be included when appropriate studies will be conducted during the implementation of the Climate Action Plan. The thorough inventory will be developed as a priority action and monitoring and assessment will be included in future progress reports during the implementation of this plan.

Kozani's ambition to become a climate neutral and smart city keeps also **pace with IPCC's** objectives. According to the IPCC (Intergovernmental Panel on Climate Change), there are multiple sectors of vital importance that are primarily affected by the climate change and so, the reduction of GHG emissions emerges as a dire need.

Taking into consideration its Emission Inventory, presented also in SECAP 2021, and the relevance of the required actions to achieve its climate neutrality, the Municipality of Kozani has divided the emblematic project into five fields of action as shown in Figure 2, each of them containing portfolios of actions and many actions respectively, described in detail in chapter 3 below, to facilitate its implementation and monitoring.

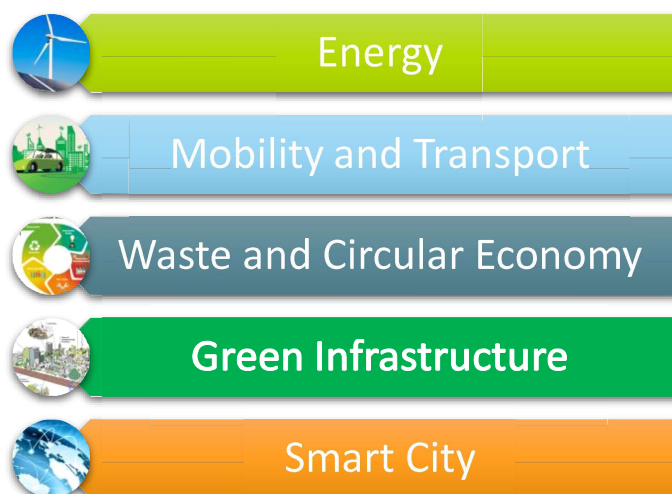


Figure 2: Fields of action of Kozani's Climate City Contract



These actions are going to take place in the coming years to assure the objective of emissions' reduction to 80,3% by 2030, compared to the most current emissions' inventory, placing always at the same time the **improvement of citizen's life** at the center and are analyzed in section 3 below.

The transition to climate neutrality will offer co-benefits to the city and its local community that **are analytically presented in the impact pathways of Kozani's** climate action plan and summarized per field of action as follows:

Energy

- New infrastructures and large scale investments related to the energy sector may alleviate the unemployment in Western Macedonia and increase the revenues for local businesses
- Emissions and energy cost will be significantly reduced
- Improved air quality, cleaner environment and better health conditions for the citizens
- **The city will become a paradigm of a pioneering evolution towards 'real zero and green'** energy heating
- Reduction of CO₂ penalties for municipal and local companies such as DEYAK

Mobility and Transport

- Renewing the municipal fleet with more efficient vehicles, reducing fuel consumption and emissions
- Familiarization of citizens with alternative and more environmental means of transportation
- Seamless integration and coordination of various transportation modes, including public transit, cycling, walking, and shared mobility services
- Introduction of smart systems to monitor mobility leading to increased efficiency of transportations, decongestion of city traffic, improved safety of transportation
- Lower air pollutants, improved air quality, less pollution and noise
- Promotion of physical activity, leading to improved health and well-being
- Enhanced accessibility to public transportation
- Promotion of vibrant community green spaces
- Raising public awareness against climate change and fostering environmental friendly behaviour

Waste and circular economy

- Alignment with the principles of sustainable development economy principles
- Sustainable and more efficient use of natural resources
- Reducing the use of raw materials, saving natural resources through recycling, waste reduction
- Recovery of higher purity materials as a result of separate collection
- Job creation
- Raising awareness among citizens with their direct participation and environmental education
- Engagement of other economic sectors



- Improved image/profile of the Municipality
- Attraction of investments and stimulate the growth of green industries
- Lifestyle changes in the behaviour concerning waste
- Circular economy concepts fosters a culture of innovation and entrepreneurship
- Community Engagement and Social Cohesion

Green Infrastructure

- Irrigation management system will have a strong impact on water resources conservation
- **Farmers' engagement**
- Fostering environmental behaviour
- Reduced cost of agricultural products
- Improvement of the municipality – citizens interaction
- Improvement of the quality of life and the creation of a measurable benefit for the citizens and businesses of the Municipality without an administrative burden on the executives of the Municipality

Smart City

- Improvement of the municipality – citizens interaction
- Improvement of the quality of life and the creation of a measurable benefit for the citizens and businesses of the Municipality without an administrative burden on the executives of the Municipality

These co-benefits are in line with all the necessary steps that the Municipality of Kozani will take to promote a three-folded action on the basis of sustainable development and sustainable development goals (SDGs, 2015) and can be grouped as follows:

- **Economic:** invest in new and smart technologies, smart energy consumption, energy production, green mobility, circular economy and bioeconomy, savings for the stakeholders and the citizens, test bed for attracting foreign investments.
- **Social:** support the local community and citizens, ensure social justice and a socially just transition, promote digital governance, build social partnerships and participatory decision-making.
- **Environmental:** improve the environmental conditions and the well-being of the citizens, enhance environmental resiliency, build a zero-greenhouse gas development model.

The citizens' well-being and health will obviously improve, as new job opportunities will be created and negative impacts on environment and health will be minimized. The participatory approach followed in this CCC will ensure all individuals are part of the climate neutrality process and **“no-one is left behind”**, as the central, transformative promise of the 2030 Agenda and its SDGs declare. Equity and climate justice are central to the promotion of sustainable development and the local community will benefit from this whole process towards climate neutrality.



To become neutral by 2030, the Municipality of Kozani collaborates with a broad range of stakeholders across government and non-government agencies, the private sector and **representatives of the local community**. Thus, the city's ambition is well supported by wider stakeholder groups, which are committed to implement the developed climate city contract and facilitate collaboration between the parties. The Municipality of Kozani collaborates with the following stakeholders:

- The Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.):
- **the Taxi Owners' Association of Kozani**
- the Municipal Enterprise for Water Supply, and Sewerage of Kozani (DEYAK)
- the Waste Management Enterprise of Western Macedonia (DIADYMA SA)
- the Energy Community of the Municipality of Kozani
- the Commercial Association of Kozani
- the Chamber of Commerce and Industry of Western Macedonia (EBE)
- **the Economic Chamber of Greece, Regional Department of Western Macedonia (OEE)**
- the Regional Administrative Authority of Western Macedonia, which manages the Regional Operational Program, as well as with Metavasi S.A., the managing body of the Just Transition Fund at regional level, the two most important sources of EU financial support in Western Macedonia
- **the Property Owners' Association of Kozani**
- the Technical Chamber of Greece, Regional Department of Western Macedonia (TEE – TDM)
- the Ministry of Environment and Energy (YPEN)
- The Cluster of Bioeconomy and Environment of Western Macedonia (CluBE), a unique quintuple helix Cluster which has as members many of the abovementioned stakeholders
- The academic and research community, such as the University of Western Macedonia, the Aristotle University of Thessaloniki and the Center for Research and Technology Hellas (CERTH), all active in research and development



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 transition to net-zero requires economies and societies to adjust their key priorities and strategic interventions, in order to proceed to meaningful changes. Kozani has identified the following 5 key strategic priorities or fields of actions, as illustrated in Figure 2 above:

- Energy
- Mobility and Transport
- Waste and Circular Economy
- Green Infrastructure
- Smart City

Each of the above fields of actions is divided into portfolios **to facilitate the project's** breakdown structure, implementation and monitoring. These portfolios are further divided into specific actions or interventions as listed and described in detail in Table B2-1 of the climate action plan. Below an overview of the portfolios of each field of action and a summary of the actions follows:

1) **The Energy field of action** is divided into four portfolios of actions, as shown in Figure 3:

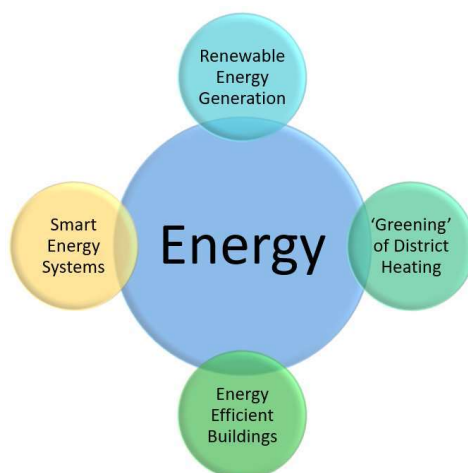


Figure 3: Portfolios of actions related to Energy



a. Renewable Energy Generation

Kozani will use its environmental and energy expertise to continue playing a pivotal role in the **country's energy** affairs by replacing the conventional power generation units with renewable ones. At a local level there is also a detailed plan focusing on:

- The construction of a 7 MW Photovoltaic Park to **cover 100% of Municipality's electricity** needs (public lighting, buildings etc) through the virtual net metering scheme.
- Energy upgrading of public lighting with the installation of LED lights and smart lighting system
- Integrated RES to existing buildings (RES installation on the rooftops, including PV and solar thermal) and especially residences that account for 57% of CO₂ emissions.
- The construction of RES systems, leading to a greener energy mix

b. 'Greening' of District Heating

The District Heating of Kozani is currently powered by heat produced in the lignite-fired power plant of Agios Dimitrios of PPC, while its peak energy demand is covered by oil burners, leading to a ratio of 0.347 kg CO₂ per kWh. The system is going to be completely redesigned to provide cleaner energy and effectively reduce GHG emissions to over 80%. In 2030, the supplied heat is expected to come from:

- 60% cogeneration of heat and electricity (CHP fired with natural gas) at the facilities of the former Kardias power plant
- 30% introduction of thermal energy production from a system of heat pumps, supplied with green electricity (probably via PPA)
- 6% solar thermal installation
- 4% electric boiler

This system is going to cover the total demand for District Heating for the city of Kozani and the communities of Nea Haravgi and ZEP, **that is why it is deemed as the "green basis" for its energy supply** for its District Heating.

However, the Municipality is keen on exploring even greener resources of District Heating energy, considering of course the stability and sustainability of the new paths and will adapt accordingly its Climate Neutrality Plan during the process.

c. Energy Efficient Buildings

Regarding the Energy Efficiency of Buildings, Kozani will implement deep energy retrofit with activities that will include insulation, electrification, double glazed windows, infrastructure, lighting systems, pumping stations etc. of the following building categories:



- private residences
- municipal buildings
- school buildings
- sport facilities
- tertiary sector buildings

d. Smart Energy Systems

Kozani will establish a Smart Energy Management System on 35 municipal buildings, contributing to energy consumption optimization and CO₂ emissions reduction. The specific system monitors and controls the functions of the building, allowing a smooth operation and efficient functioning of the building, through an innovating software combined with sensors and actuators. The software will consist of a web application as well as an application for smartphones and tablets.

2) **The Mobility and Transport field of action** comprises the following portfolios of actions, as illustrated in Figure 4:

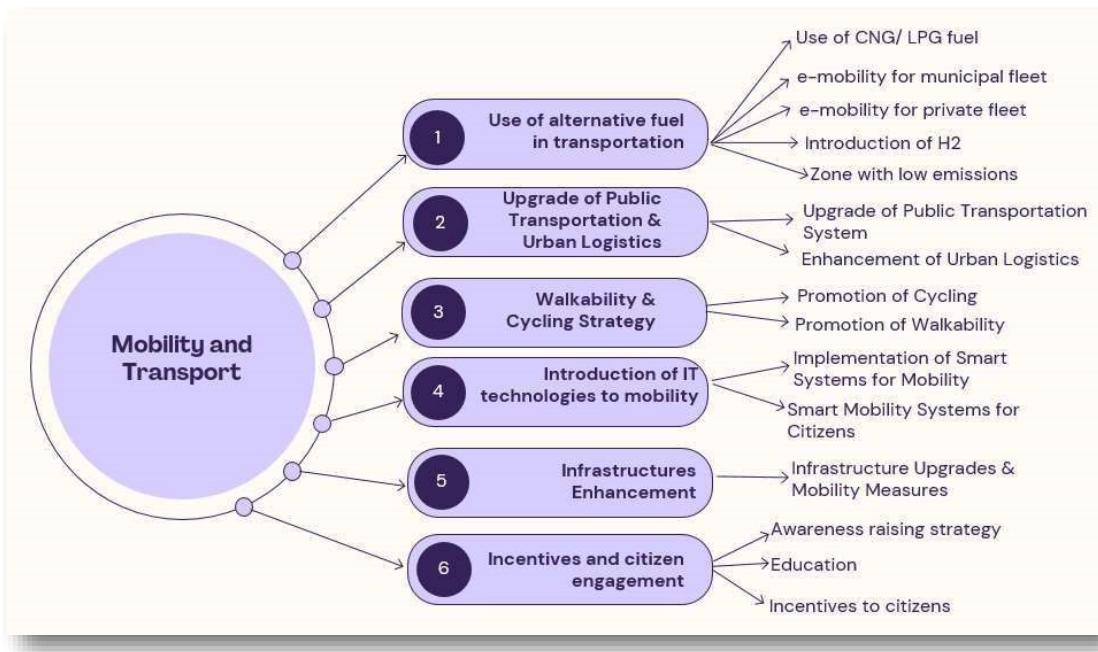


Figure 4: Portfolios of actions related to Mobility and Transport



- a. Introduction of alternative fuel technologies in transportation
- b. Upgrade of public transportation system and urban logistics
- c. Walking and cycling strategy
- d. Introduction of IT technologies to mobility sector
- e. Infrastructure enhancement
- f. Incentives and citizen engagement

MoK intends to achieve a more efficient transportation of people and goods. Besides, it aims to secure driving conditions and save money by reducing the fuel needs. In order to do so several infrastructure upgrades will take place. These upgrades will help in the promotion of walking and cycling. MoK will implement several measures with the aim to provide motivation **to citizen's and increase their engagement as well as to increase municipal revenues and decrease violations**. Such measures include, but are not limited to, the following: financial incentives to businesses that are friendly to active travel, reduction of municipal fees for businesses that operate with the aim of protecting the environment, reduction of fees for public transport, discouraging the use of vehicles by the citizens.

Furthermore, a small number of conventional vehicles will be replaced by CNG or LNG-fuelled ones, while it is expected that EV mobility can reach 10% of the private vehicles of the city by 2030. Moreover, EVs are expected to replace the existing municipal passenger cars to 100%, and the municipal trucks and buses to 51%. EV mobility will also be promoted by the installation of EV charging stations and the creation of low-emissions and noise zones, prioritizing the use of electric vehicles.

3) The Waste and Circular Economy field of action will focus on three main portfolios of actions, as depicted in Figure 5:

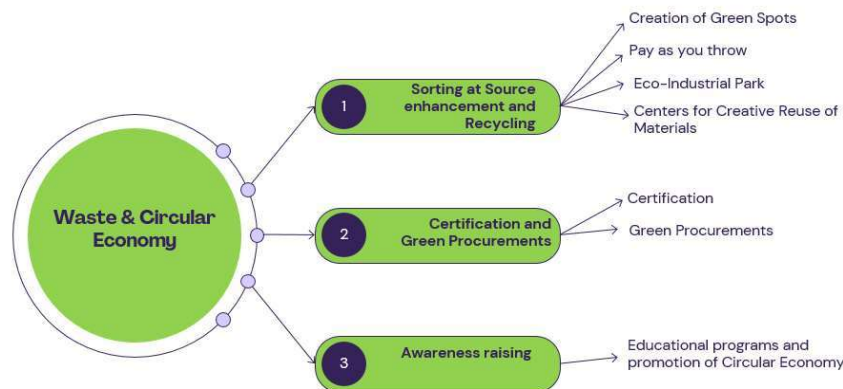


Figure 5: Portfolios of actions related to Waste and Circular Economy

- a. sorting at source and recycling, leading to the reduction of CO₂ emissions and waste disposal as well as the recovery of useful materials and job creation.
- b. certification procedure and green procurements to train municipal employees on Green Public Contracts, contributing to the achievement of circular economy in the field of public contracts and procurement of the municipality and leading to the reduction of CO₂ emissions, the recovery of useful materials, the acquisition of green and circular economy certificates
- c. awareness raising activities to encourage citizens' participation in the traits of Circular Economy

4) Green Infrastructure field of action

- a. Green Infrastructure & nature based solutions portfolio of actions comprises of the following actions:
 - the continuous training of farmers on new energy efficient agricultural machinery and irrigation techniques. A wider information campaign will also be implemented. A number of technical solutions, namely electronic water extraction system for irrigation with debit cards, installation of variable speed drives and soft starters on pump motors and the installation of a power factor correction system through compensation with a capacitor array will be implemented.
 - improve urban living, meet the modern needs of cities as well as understand citizens' behaviours and desires. The creation of smart parks, equipped with solar trees with smart benches as an energy-independent, urban, multi-functional rest station is a first priority. The robust 5-seater smart bench will offer citizens and visitors access to the



Internet through a wireless Wi-Fi connection and improve the public recreation facilities and will motivate citizens to visit local parks and squares by foot, thus avoiding using their cars and causing further CO₂ emissions. At the same time, its integrated sensors will offer the possibility of quantitative and qualitative evaluation of environmental data to strengthen the planning of actions to improve urban living.

5) Smart City field of action

a. Smart City portfolio of actions:

As part of this portfolio, MoK will enable a series of organisational and governance interventions that include the development of:

- a digital organization and management platform for workflows, processes, cases and documents as a solution to the problems arising from the management and archiving of large amount of information
- a smart city guide for both residents and visitors, providing them with access to information related to local businesses. The app will help reduce the carbon footprint by eliminating physical marketing activities such as: printed leaflets, printed posters, etc.
- an electronic appointment management system improving the municipality – citizens interaction, allowing online appointment booking, reducing waiting time and in person visits and thus minimizing commuting and reducing CO₂ emissions
- a Smart city platform as the central point of collection, control and management of all the data that will be collected from the individual subsystems it has and that will be developed by the Municipality in the future. The offered Platform is an open, cloud-based platform that enables the interconnection and communication of individual smart city solutions and applications.



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

Kozani is one of the 100 cities, selected under the EU Mission of “100 climate neutral and smart cities by 2030” to deliver concrete results towards climate neutrality by promoting research and innovation and introducing new forms of governance and collaboration. Engaging citizens for addressing the challenges and facilitating the **city’s** co-design with citizens, for the citizens and by the citizens is the sole and only way to achieve these goals and are pivotal to EU Missions. The necessary adjustments towards net zero cities can be promoted through coordinated action engaging local communities in collaboration schemes with local governments.

To this end, **Kozani’s** climate city contract consists of a cross-sectoral plan, including the thematic fields of energy, mobility and transport, waste and circular economy, green infrastructure and smart city, which involves citizens, the private sector, the public sector, municipal enterprises, research organizations and other stakeholders in the process.

The Municipality of Kozani participates in many EU and national projects, namely STARDUST, TIPS4PED, REFORMERS, EHHUR, ProLight, JUST STREETS, NEUTRON, SYMBI, In2UCO, NOMAD, LIFE-IP CEI-GREECE and SYMBIOSIS, analytically described in the climate action plan. Kozani works also closely with other Mission Cities establishing cooperation schemes and exchanging views and ideas. In particular, Kozani is part of the following cooperation schemes and networks:

- a) Climanet, a network of the Greek cities, participating in the Mission, and the city of Limassol, Cyprus,
- b) Cooperation and exchange of best practices with other EU cities participating in the Mission, such as Cluj-Napoca and Tampere.
- c) City to city sessions in the NZC platform

I. Principles

The Municipality of Kozani refines its core principles to deliver best results and accelerate transition by 2030. The core principles include:

Participatory bottom-up approach

All relevant stakeholders, the local community, representatives from local unions, private enterprises, NGOs and others, will be involved in the decision-making. Multiple stages of participation will be available, including face-to-face meetings, online consultations etc. A multi-party bottom-up approach will be promoted at all stages and levels of cooperation. This has been clearly demonstrated during the proposal preparation phases 1 and 2, when various multistakeholder engagement processes have been put in motion, such as the Committee of



Citizens, workshops with actors, open consultations with citizens, student engagement events and many other similar organised to motivate and mobilise citizens and stakeholders to actively contribute to the Climate Action Plan development. An additional factor is the fact that MoK engaged the Cluster of Bioeconomy and Environment of Western Macedonia as the main proposal development coordinator, aiming to emphasize the multi-actor approach significance and importance for the entire Climate Action Contract!

Innovation – new approaches

Kozani aims to boost the development of innovation and for this, it is going to continue working closely with the main innovation poles of the Region, i.e. the University of Western Macedonia (UoWM), the Cluster of Bioeconomy and Environment of Western Macedonia (CluBE) and the Centre for Technology and Research Hellas (CERTH). Together with the above, but also other stakeholders, Kozani is implementing or has implemented a number of EU projects that help introduce innovation to a number of fields and operations of the city, including the District Heating, Production of RES, Mobility, Digital operations, New Bauhaus, etc. This, on one hand demonstrates the commitment of Kozani towards Innovation, while on the other it highlights its openness to new approaches: Kozani dares to act like a test bed, aiming at incorporating the pilot or demo tests, once successful, to the rest of the city.

Co-creation and joint-learning

Even beyond the Climate Neutral and Smart Cities Mission, the Municipality of Kozani was already positive towards involving actors and stakeholders in certain decision-making processes. However, it was during the preparation of the proposal for the Mission that Kozani applied co-creation extensively, mainly through workshops organised on thematic levels, in order to gain knowledge on specific topics and co-develop the solutions for tomorrow. Having witnessed the effectiveness and positive impacts of such procedures, the Municipality plans to integrate it within the implementation phase of its Climate City Contract and, eventually, extend it to even more domains and municipal operations. At the same time, the Municipality and the key stakeholders believe that this process is a two-way learning method for everyone involved: the stakeholders and the society will learn what the Municipality is planning and heading for and, on the other hand, the Municipality will get a much better grasp of what the society is looking for, bringing both sides even closer than where they currently are.

Access to information

The Municipality of Kozani will ensure that all stakeholders have access to information about respective projects. Citizens will be able to submit their written complaints, ask for information via telephone or e-mail communication. For this purpose, MoK has already developed **Kozani's 2030** website, a dedicated website to this emblematic project the main Kozani 2030, which already contains a lot of information and is planned to host the majority of public information available to the society.

Inclusion



The Municipality of Kozani will ensure equal access for all, especially people who might otherwise be excluded or marginalized, because of physical or intellectual disabilities and will put special effort in engaging members of minority groups. The Municipality of Kozani will also include vulnerable groups, women, young professionals etc. All procedures undertaken for turning Kozani to a neutral city will be culturally appropriate.

Accountability

Accountability is the cornerstone of the principles declared hereby. It underlines the duty of the Municipality to take responsibility for its actions and provide explanations when necessary. The proposed Monitoring Mechanism will offer the means to apply this principle.

Transparency

Transparency is a core value of good governance and sustainable development, too. It directly relates with accountability and participation. The Municipality of Kozani is committed to transparency and will ensure it in all its activities and actions. Besides, the Municipality of Kozani will be releasing all respective documents for consultation and will hold regular meetings with the public. For this purpose, the main website it has already established to promote the Mission in Kozani will also serve as the tool to expose every aspect and decision making process to the wider public, in order to raise awareness and involve the society to the maximum possible.

Precautionary Principle

The Municipality of Kozani will follow the precautionary principle in all the projects that will be implemented towards climate neutrality. The precautionary principle prevents causing harm when extensive scientific knowledge on the matter is lacking and lies at the heart of sustainable development.

II. Processes

The Municipality of Kozani refines adopts certain critical processes to deliver best results and accelerate transition by 2030. The core processes include:

Building support among stakeholders towards the neutrality goal

Raising awareness is extremely important for building support inside the local community. Apart from the private sector, unions and citizens groups, individual citizens will also be included in the process. The Committee of Citizens, already established in the first phase of the proposal, is a good example, other cases, more neighborhood focused, will be set in motion by the Municipality as well as by stakeholders and end users in the city.

Mainstreaming ownership

Citizen engagement is a prerequisite for achieving the Mission. Thus, the citizens will play a major role in implementing and taking the ownership of the transition. This is envisaged both in the co-creation process of the entire Contract, as well as during the constant review of the activities to be implemented. Such an ambitious target will be achieved through the Committee



of Citizens, as well as numerous other participatory processes that the core team will set in motion once the whole procedure kicks off officially.

Reporting back to the community

The Municipality will provide regular feedback to relevant stakeholders to clarify issues and concerns related to its Mission. It will present results and invite the local community to be part of the process.

III. Multi - Governance Collaboration Mechanism

The current climate governance model of the Municipality of Kozani involves its Directorate for the Environment, the Programming Office, the Technical Services Directorate and the Energy Efficiency Office, all coordinated directly by the Mayor.

To achieve its goals towards climate neutrality, the Municipality of Kozani undertakes all necessary steps to establish a new, efficient and innovative governance mechanism with all stakeholders on board. The new governance model, presented in Figure 6 and called the Transition Team, will embrace an inclusive and participatory approach towards climate neutrality, help overcome existing barriers, enable organizational recruitment flexibility and develop accountable mechanisms.

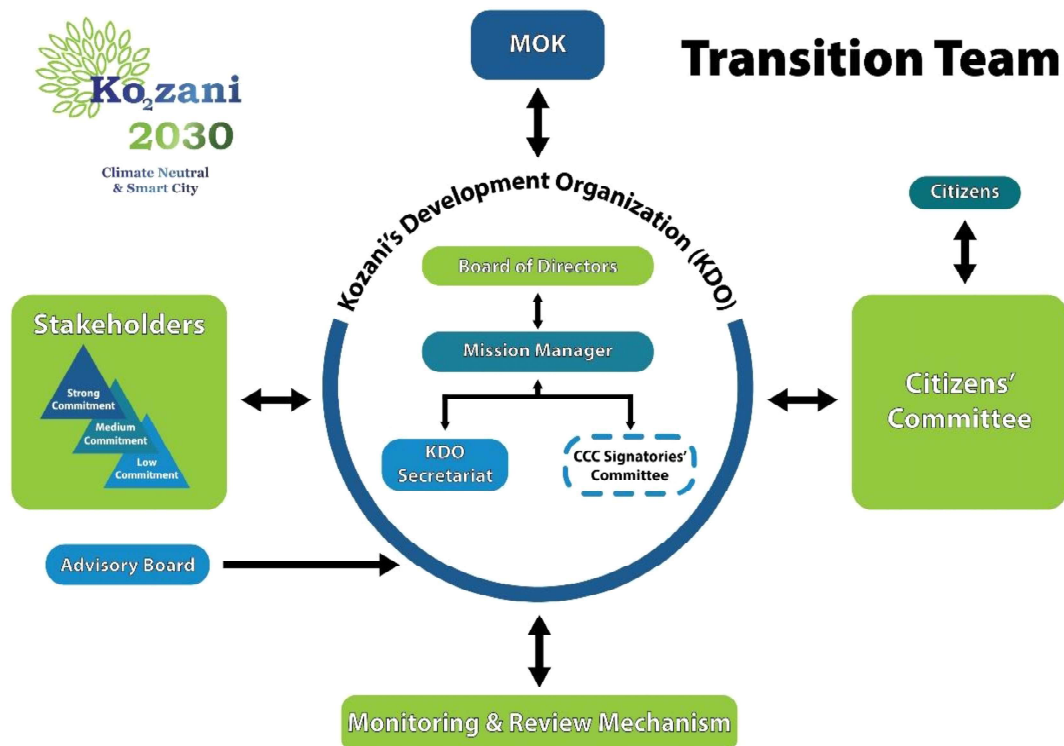


Figure 6: Presentation of the Transition Team



In specific, the Municipality of Kozani establishes the **Kozani's Development Organization**, which will be responsible for the implementation of the climate city contract and all related projects, acting under the guidance and reporting to the Municipality of Kozani and the Municipal Council.

The Kozani's Development Organization (hereinafter KDO) will be organized as follows:

A. Board of Directors

The members of the Board of Directors are elected by the General Assembly of shareholders, according to the provisions of Law 4548/2018.

B. Mission Manager

The Mission Manager is a non-executive member of the KDO, who coordinates the Development Organization and **the city's actions to fulfil its Mission**. The Mission Manager lies at the cornerstone of the necessary new governance model, which links different plans and projects into an overarching environmental portfolio.

He/she ensures the coordination of related projects and funds and monitors the sound implementation of the respective activities.

Both the executive members of the Board of Directors, as defined in the relevant statutes, and the Mission Manager have proven work experience in the planning, execution and implementation of development programs and the sustainable development of local societies

C. KDO's Secretariat

The Secretariat supports the Mission Manager in his/her daily workload and is responsible for communication, dissemination, coordination and all administrative activities, which facilitate the operation of the KDO.

D. CCC signatories' committee

The organizations, signed the climate city contract, will operate closely to the Mission Manager and support his operation by covering thematic fields and areas of their respective expertise. This scheme, although not internal organisation of the Municipality, will play an important role **in the project's implementation**.

The KDO is directly connected and interacts with a number of external schemes that play a pivotal role in shaping the program and its activities towards Climate Neutrality and Smartness.

More specifically:

E. Advisory Board

The Advisory Board will include high profile experts from academia and business to provide scientific and market steering and ensure continued political support to the process.



F. Citizens' committee

During the 1st phase of the Mission, the Municipality of Kozani has developed a **Citizens' Committee**, with the aim to provide consultation on actions and priorities that should be included within the proposal. The success of this endeavour led the Municipality to continue working with this Committee for the climate city contract preparation. The Municipality now intends to officially establish this Committee as a legal form, which will then acquire its independence and act as a constant interlocutor and reviewer of the suggested actions, while playing an active role in the regular updates of the Climate City Contract.

G. Stakeholders

Since the very beginning of the announcement of the EU Mission on November 2021, the Municipality of Kozani has realized the pivotal role that the local stakeholders should play in the development of the Vision and the Action Plan for Kozani.

In this framework, MoK adopted a bottom-up approach to climate change policies and mobilised and engaged many local and regional stakeholders, including among others municipal enterprises, ministries, public authorities. SMEs, associations, etc.

A number of workshops during the 1st phase of the Mission and dedicated meetings with an important number of key stakeholders for the 2nd phase of the Mission proved to be very effective and paved the way for its plan to involve many stakeholders during the implementation of its Climate City Contract: these stakeholders (and many more to be later identified) will be in constant communication and cooperation with the KDO, in order to improve the implementation of the planned interventions, but also to constantly provide the floor for new ideas and innovations to be incorporated within the continuously updated Climate Action Plan.

H. Citizens

Citizens are placed in the heart of the co-design process and the extensive ongoing awareness-raising campaign, that accompanies the Municipality since 2021.

Citizens will be a crucial part of the transition team and will interactively communicate with the **citizens' committee to provide it with useful insights regarding the project's implementation.**

I. Monitoring and Review Mechanism

Monitoring and review mechanisms are very important for environmental and development projects. The Municipality of Kozani will establish a Monitoring and Review Mechanism in order to address any community concerns, to reduce any possible risks and to resolve concerns **linked to the city's transition to a neutral city.**

The Monitoring and Review Mechanism will:

- a. Check annually the follow up of the projects related to the Mission and report back to the Community.



b. **Scientifically review Kozani's** overall Climate and Energy Strategy, policies and projects on a regular basis and proceed to changes and adjustments when necessary. More specifically, the climate city contract will be officially reviewed based on the following timeline:

- 2026: 1st official review of the CCC
- 2028: 2nd official review of CCC
- 2030: final review of CCC and recommendations

c. Serve as a transparent and credible process of evaluating the impacts and results of the implemented projects and activities

The reports will be prepared on an annual basis by the Mission Manager, and/or persons appointed by the KDO in cooperation with the Mission Manager. The preparation of the report **will follow a participatory approach, where the Citizens' Committee and the local stakeholders** shall contribute substantially in it in cooperation with the authors. Their contribution maybe facilitated by regular meetings with the authors and/or by offering data and information throughout the preparation process.

The Monitoring and Review Mechanism will follow specific principles and processes in order to be effective and legitimate, such as:

- **Accessibility:** all stakeholders will be aware of the mechanism and will have access to it. Further care will be provided in case of particular groups of people, which face access barriers.
- **Equity:** fair and informed terms of the process for all
- **Transparency:** sufficient information will be provided at all stages of the process

Its reliable structure will build trust between all stakeholders of the community.

IV.Barriers

Kozani starts its Mission with the establishment of a new governance model introducing **Kozani's Development Organization (KDO)** and the position of the Mission Manager. However, this will be a dynamic process and necessary adjustments will be enforced in the future if required.

Currently the most important barriers could be summarized as follows:

- Fragmentation of responsibilities, i.e. the degree of involvement of each stakeholder
- Discrepancies between the strategy and its implementation, due to the complexity of the whole project and **implementation's** timeline
- Resources/ cost of investments

The necessary adjustments to overcome barriers are:



a. Regulatory/institutional:

- Need for an enabling regulatory framework at the national level
- Incentives

b. Socioeconomic – financial:

- Ensure that significant Public and Private Funding will be available for over a long period of time
- Use innovative financing tools
- Engage the private sector
- Re-skilling
- Scaling up staff capacity
- Vulnerable groups

c. Structural/technical:

- Systemic approach, which ensures that all actors are involved
- Deepen cooperation between Mission cities
- Enhance dialogue with industry

The Climate Action Plan has demonstrated the systemic barriers to climate neutrality, highlighting the role of several stakeholders in the process (such as DIADYMA and DEYAK). Cooperation schemes established by the Municipality of Kozani with respective stakeholders will support the necessary adjustments, especially regarding the role of each stakeholder towards the Mission.

Apart from the cooperation and network schemes, that are necessary for the Mission to be successful, there is a greater need for an enabling regulatory framework at the national level, which will offer more incentives to all relevant stakeholders.

In addition, it is of utmost importance to ensure that funding, both public and private, will be available and the Municipality of Kozani has already undertaken actions to engage the private sector in the process and use new financing tools.

Citizens' awareness is a top priority of the Municipality and projects for re-skilling are necessary as well. The Municipality of Kozani involves all citizens in the process and cooperates with other cities to exchange good practices. By establishing the Monitoring and Review Mechanism the Municipality of Kozani will be able to regular review its actions and policies and make all necessary adjustments to overcome any barriers and fulfil the Mission.



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.

The Municipality of Kozani has developed three types of documents reflecting three levels of upscaling commitment towards engaging stakeholders respectively:

- a. The Letter of Commitment (LoC), by which the signatories express their commitment towards the Mission but without referring to specific activities at this stage. These documents can be found in **the uploaded document "Commitments_Appendix III"**.
- b. The Declaration of Cooperation (DoC), which is a general declaration of the signatories, that are willing to assist the Municipality towards the Mission without referring to specific targets. These documents can be found in **the uploaded document "Commitments_Appendix II"**.
- c. The Memorandum of Understanding (MoU), which is a comprehensive document that describes in more detail the actions to be undertaken by the signatories in the forthcoming months. The stakeholders that signed this type of document are listed below and the documents can be found in the uploaded document **"Commitments_Appendix I"**:

Name of the institution	Sector/Area	Legal form	Name of the responsible person	Position of the responsible person
The Local Urban Transportation Enterprise (KTEL Astikon Grammon Kozanis A.E.):	Mobility and Transport	MoU	Theodoros Michailidis (Θεόδωρος Μιχαηλίδης)	President
The Taxi Owners' Association of Kozani	Mobility and Transport	MoU	Vasileios Agorastos (Βασίλειος Αγοραστός)	Member of the Board
The Municipal Enterprise for Water Supply, and Sewerage of Kozani (DEYAK)	Waste and Circular Economy	MoU	Vasileios Kitidis (Βασίλειος Κιτιδής)	President
The Waste Management Enterprise of Western Macedonia (DIADYMA SA)	Waste and Circular Economy	MoU	Panagiotis Plakentis (Παναγιώτης Πλακεντάς)	President
The Energy Community of the Municipality of Kozani	Energy	MoU	Ελπίδα Κουιμτζίδου (Elpida Kouimtزيدou..)	President