



## Climate City Contract

### 2030 Climate Neutrality Action Plan

### Sønderborg





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## Summary and background

An abstract **summarizes the content** of the 2030 Climate Neutrality Action Plan and Sønderborgs “operating system” for the energy and climate transition.

### Textual element

*This section will summarize the content of the Sønderborg’s 2030 Climate Neutrality Action Plan and address how Sønderborg has integrated its current climate action plans.*

*The 2030 Action Plan is based on the Sønderborg DK2020 Action Plan respectively the ProjectZero Masterplan2029 Action Plan. Each of the plans are available in Danish language and are both very detailed.*

*For this document (for the CCC 2030 Climate Action Plan), the specific climate actions have been consolidated and reported as sector actions. The reason is that going forward, Sønderborg and stakeholders will focus its efforts on the execution of the DK2020 respectively the Masterplan2029 – making the CCC 2030 Climate Neutrality Action Plan a twin of these plans.*

*The CCC Investment Plan document contain all the associated CAPEX investment calculations (2007 – 2021) and CAPEX investment projections towards 2029. This document will present a brief summary of the conclusions in chapter 5.3.*

### Introduction to CCC Sønderborg

Our scope for this Climate City Contract (CCC) application is, as expressed in the EoI, all energy system (buildings, transport, industry, energy) related CO<sub>2</sub>-emissions including emissions from waste. As explained in the CCC-application, our climate ambitions go beyond this scope, but the scope represents the historic (since 2007) and current consolidated climate goals agreed by the city council and the ProjectZero ecosystem.

The next level climate actions will target NetZero carbon emissions (by 2050) and include AFOLU (farming) and IPPU etc., where specific reduction goals will be aligned with the national frame setting and new climate action partnerships are to be established with the farming associations, the food industry and municipalities in a wider geographical area, across the Southern Denmark Regions municipalities (South Jutland).

In the Climate City Contract (CCC) Commitments document, Sønderborg explains and re-confirms its commitment to achieve carbon neutrality in its buildings, transport, industry, energy production and waste systems by 2030. The commitment is stated by key society stakeholders representing the ProjectZero ecosystem supporting the city council’s commitment.





In this CCC Action Plan document, we explain and document how Sønderborg's already developed and approved action plans (DK2020 and Masterplan2029) will help Sønderborg achieve its ambitious goals, supported by the city council and municipal administration and co-executed by the ProjectZero ecosystem). The segmented hotspot approach will secure a strong focus on getting "things done", and the integrated systemic 360 degrees approach also addressing the just social, inclusion, innovation challenges and opportunities.

In the CCC Investment Plan document, we document that 1/3 of Sønderborg's transition investments (since 2007) is already completed and 2/3 is still to go from an investment point-of-view, even that the CO2-meter by end of 2021 showed a 55% accumulated CO2 reduction since 2007. The majority of investments has been made and will also in future be made by citizens and private sector stakeholders, however the municipality is playing important roles as local policy maker, front runner and strategic partner in the ProjectZero public-private partnership. Harvesting the additional transition benefits like new green job creation, grow local green competencies and skills in industry, among craftsmen and in local schools and university educations, secure a robust and low-cost energy system and supply – and at the same time addressing vulnerable groups, social inclusion and innovation. Investment figures are high, but funding sources are considered available to finance the execution of the ambitious Sønderborg Action Plan.

### Following the NZC systemic change model

The Sønderborg climate action approach has (as described in the CCC Commitments document) since 2007 been based on strong local political/society commitments, specific ambitious carbon reduction goals and continuous planning, combined with techno/economic measures, policy setting and citizen/stakeholder engagement.

Sønderborg thereby follows the systemic approach as expressed in the CCC-change model.

The Sønderborg systemic change model and stakeholder engagement approach has since 2007 been the Sønderborg normal for change management as now recommended in the NetZeroCity systemic change model. Key society (hotspot) representatives across all sectors have formed the ecosystem for change. The ProjectZero public-private partnership has helped Sønderborg first build a strong mandate. Since 2007, the ecosystem partners (now hotspot participants) during planning and implementation have learned and understood the system, co-created a portfolio, been taking and implementing actions, learned and reflected (during planning-events and specific project executions), respecting a just climate transition and always aiming at making *the new normal* in Sønderborg.





By adapting to the Cities Mission Climate City Contract, Sønderborg municipality plans to progress and accelerate all current action plans, cooperations and financials to achieve our ambitious joint climate/energy goals. Plans will continue to be reviewed and updated every year (or for DK2020: every second year) to secure a strong alignment with new solutions, technologies, national and international policy framing, changes in citizen/stakeholder climate interest/engagement etc.

### **Summary of the CCC Sønderborg 2030 Action Plan**

This CCC Sønderborg 2030 Action Plan document focuses on how Sønderborg will achieve its remaining territory reduction of 334,129 tons of CO<sub>2</sub>-emissions by 2030 focused on buildings, transport, industry, energy and waste – scoped as applied in the Sønderborg EoI targeted the EU Mission for Climate Neutral and Smart Cities submitted in January 2022. The additional two CCC documents describe Sønderborg's Commitments to achieve the zero-target and the associated Investments and Finance Plan.

Since 2007, Sønderborg has reduced its emissions by 55% (equal to 391,517 tons of CO<sub>2</sub>-emissions by 2021) based on primary a 17% energy efficiency improvement across all sectors, green district heating transition and energy from renewable sources. The continued journey towards 2030 will focus on further energy efficiency improvements in buildings/companies, electrification of transport, sector integration, renewable energy from wind and sun - and Power-to-X production based on renewables and biogenic carbon from local biogas-production.

The CCC action plan is contained in the Sønderborg DK2020 and ProjectZero Masterplan2029 co-created with local stakeholders in 2020/2021, approved by the Sønderborg city council and now being executed in partnership with same stakeholders. Previous plans were co-created with local energy experts and stakeholders in 2008/09 (Masterplan2029/Roadmap2015), 2014 (Roadmap2020), 2018 (Roadmap2025), 2020 (DK2020).

All of them with the focus and ambition to achieve Sønderborg's carbon neutrality for the energy system transformation by 2029, except for DK2020, focused on making Sønderborg climate net-zero by 2050 with 2030 sub targets. The portfolio of well-defined actions has usually (since 2018) consisted of 50+ well defined actions with KPI's, deadlines, responsibilities etc. and tested for citizen and stakeholder value proposition and business model generation.

The Masterplan2029's 15+ hotspot-groups are in a joint partnership/coalition taking responsibility for executing the CCC 2030 Action Plan. More than 70 local experts and stakeholders participate in the execution and quarterly review meetings, aligned with the ProjectZero Project Management Office (PMO), which quarterly review the progress versus the defined KPI's and report status, progress, challenges and opportunities to the ProjectZero board of directors and the city council climate committee (NKM-udvalget). Corrective actions, if necessary, are decided by the associated hotspot group leaders and implemented.

An overview showing the extensive stakeholder (Hotspot) map along with the relevant local, national and international policies, strategies and plans below illustrates, how the



decarbonisation of the system will be driven by segmentation, climate actions and active stakeholder participation.

A list of specific (consolidated) sector actions for decarbonisation by 2030 is presented along with the related early and late outcomes, direct and indirect impacts, how will these be monitored and evaluated in order to achieve the 2030 goals.

Furthermore, the action plans outlines governmental changes, innovations and approaches that are happening within the municipality. Majority of actions and implementations are already in process and will be re-iterated based on frequent reviews and learnings. Chapter 7 is presenting how the ProjectZero engine fuels Sønderborg's climate transition.

CAPEX-investments have already been made since 2007 and the remaining part of the journey until 2029 will require twice the investments already made as the nearshore windturbine park, the new wastewater treatment plants and the Power-to-X plan is very CAPEX intensive. These investments are short presented in chapter 5.3 and further much more detailed elaborated in the CCC Investment Plan.



## List of figures

The list of figures **identifies the titles and locations** (page numbers) of **all visual elements**: figures, drawings, photos, maps, etc. used in the Action Plan.

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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.

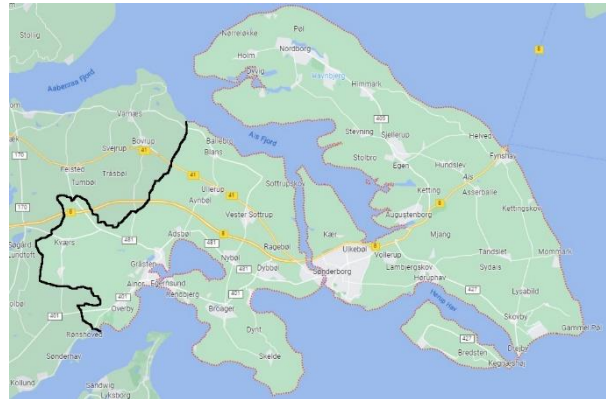
Abbreviations and acronyms	Definition
CO2	Carbon dioxide
CO2-e or CO2e	Carbon dioxide equivalent
CCC	Climate city contract
SMEs	Small and medium sized enterprises
DH	District heating
PtX	Power-to-x
t	Tonnes
kt	Kilo tonnes
NZC	Net zero cities
CAP	Climate action plan
C40	A network of the world's megacities committed to addressing climate change
MWh	Megawatt hour
IPPU	Industrial process and product use
AFOLU	Agricultural, Forestry and Open Land Use
PV	Photovoltaic
EU	European Union
DK	Denmark
BCG	Boston consulting group
Sønderborg	Sønderborg means unless expressed otherwise the Sønderborg territory defined by the municipal jurisdiction – and not the municipality as an organisation



# 1. Introduction

## Introduction - textual element

Sønderborg's geographic boundaries are shown on the below map of the Sønderborg territory. Most geographic borders are coastlines of 250 km, as 2/3 of the Sønderborg territory is located on the island of Als. Remaining 1/3 is located on the mainland, part of "Continental Europe" and bordering with the neighbour municipality Aabenraa. The entire territory amounts to 500 km<sup>2</sup> with 74,000 citizens.



Sønderborg's 2030 Climate Neutrality Action Plan is based on the climate actions contained in the Sønderborg Masterplan2029 (see A-2.1 for more information) facilitated by ProjectZero (see Commitments document for more information) and the DK2020 climate action plan (see A-2.1 for more information). Both plans are new, co-created and approved by the Sønderborg City Council.

DK2020 is a national Danish program with the aim to support Danish municipalities prepare ambitious climate action plans that will lead the path to climate neutrality no later than 2050, with a 2030 milestone. The Sønderborg DK2020 plan was co-created and adopted by the city council and integrated in the municipal planning in 2020 and addresses climate actions including scope 1, 2 and 3.

The Masterplan2029 was co-created in 2021 by 75+ local experts and stakeholders from the energy, housing, industry and transport sectors. The process resulted in the delivery of a robust overall strategy and action plan which will ensure that Sønderborg will transition to a CO<sub>2</sub>-neutral energy system by 2029. Together the DK2020 and Masterplan2029 will conclude the CCC 2030 Action Plan scope which will be elaborated in the next sections/chapters.

The CCC 2030 Climate Action Plan fits well with the current energy/climate planning of Sønderborg. In fact, it will be used as a document that will highlight all the work done and ambitions within the Masterplan2029 incl. planning, stakeholder engagement, learnings from first monitored year after the Masterplan2029 was published and new updated sub-goals for 2029. Since the Masterplan2029's scope is strictly dealing with the energy system, the DK2020 plan ensures that also the waste sector is integrated in the CCC 2030 Climate Action Plan.





The CCC Action Plan is based on the following shared Masterplan2029/DK2020, Energy, Waste & Social priorities for Sønderborg - as presented in the CCC Commitments document:

1. Energy efficiency and electrification of buildings and industry including conversion to 100% green heating sources.
  2. Electrification of the transport sector – passenger as well as heavy transport
  3. A cost-effective sector integrated energy & waste system utilizing excess energy from industry and utility processes and optimizing the energy demand/supply balance.
  4. Establish renewable energy sources – biogas, wind, solar and power-to-x that will compensate for the remaining carbon in the transport sector thus reaching neutrality
- Citizen engagement and stakeholder planning co-creation
  - Smart data visibility and deployment
  - Utilize the ProjectZero engine to fuel the climate transition

Whereas the first 4 strategic interventions are rather technical systemic interventions and prioritized (Trias Energetica), the last 3 are mainly consolidated social systemic interventions. All social interventions interact, integrate and fuel the technical systemic interventions.

The Masterplan2029 segments Sønderborg's energysystem in 15 segments called Masterplan2029 hotspots which cover the buildings, transport, industry and transport sectors. Key stakeholders from each hotspot have participated in the planning process of the Masterplan2029 (in 2021), and same hotspots will be overall responsible for the implementation and execution of the Masterplan2029 during 2022 – 2029. The ProjectZero secretariat acts as a Project Management Office ensuring the continuous motivation and progress and monitoring of results for each hotspot. Therefore, the ProjectZero Management representatives are also engaged in hotspots supporting and coordinating a smooth implementation/execution of the climate actions planned. Furthermore, quarterly meetings have been established where all hotspot project managers present an update of their hotspot actions, potential delays and risks and a discussion on how to overcome them is conducted.

Below is an overview of the hotspot-segmentation along with a description of the key stakeholders involved in each hotspot.

### **Building sector**

The hotspots in this sector-segment are split in **rented homes, owner occupied homes and public buildings**. The key stakeholders participating in these hotspots are representatives from all housing associations in Sønderborg, selected homeowner representatives, craftsmen, utilities, energy consultants, private landlords and municipal administration/authority responsible for the public buildings in Sønderborg.

### **Transport sector**

There are three hotspots under this segment – **private transport, transport of goods & heavy transport and agricultural machinery**. Private transport hotspot is led by the municipality supported by car dealers and citizen representatives. The Transport of goods and heavy



transport hotspot involves the following key stakeholders: Industry organisation for the Danish Road Freight; two companies with experience in trade, transport and the environment; a biogas producer; and a truck manufacturer. The agricultural machinery is a hotspot that deals with emissions and consumption coming only from the machines used in agriculture, all other emissions/consumption are included within the Business sector. The key stakeholders are coming from machinery experts, agricultural school in Sønderborg, and a local farmer.

### **Business sector**

The Business segment has been divided in three hotspots – **brick manufacturing** companies, the **seven largest companies** in the municipality (excluding the brick manufacturers) and **SMEs**. The associated hotspot groups are made of key representatives from these hotspots.

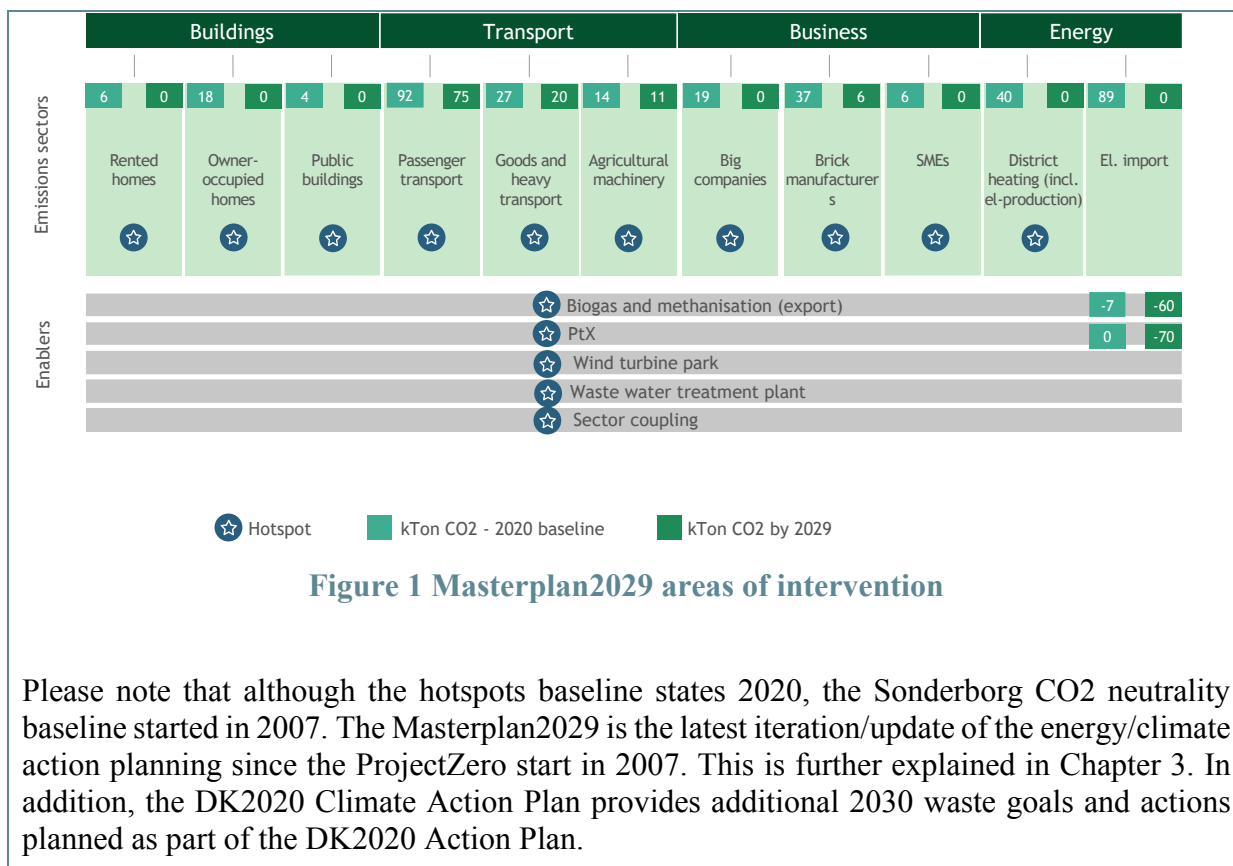
### **Energy sector**

This segment has one active and one passive hotspot. The active hotspot is **District Heating** where key representatives from all three-citizen owned district heating companies on the territory of Sønderborg along with the municipality and Danfoss. The passive hotspot is called **electricity import**. There is (current) no active hotspot participants as it is a tracking of the national goals for decarbonising the electricity system in Denmark.

### **Enablers**

There are five hotspots which are under the common name “enablers”. Enablers, because these hotspots will enable further decarbonising and carbon offsetting of the energy system. The **biogas** hotspot deals with the implementation of biogas plants/capacity in Sønderborg municipality, and it is managed by the Nature Energy Company; **PtX** hotspot is comprised of representatives from the European Energy Company, the private company partner planning the scheduled PtX plant in Sønderborg. The **Wind Park** hotspot is managed by public-private partnership behind the nearshore wind farm, “Lillebælt Syd”, managed by the Sønderborg utility company (Sønderborg Forsyning) and the European Energy Company. The wind farm is expected to be operational by 2026/2027. Another hotspot is dealing specifically with the establishment and operation of the new consolidated Sønderborg **waste treatment plant** which will be more efficient, boost biogas production and deliver excess heat for district heating etc. The plant is expected to start operation by 2028. The owner of the hotspot is the “Sønderborg Forsyning” utility company. The last hotspot is called **Sector Integration** which deals with the integration of energy end-use and supply sectors with one another by improving efficiency, flexibility and reliability of Sønderborg’s energy system. The stakeholders involved in this hotspot are key players from the energy and enabler hotspot. The point is to utilize synergies across hotspots to make the energy system more efficient, i.e. to cooperate across silos.

All hotspots and their respective baseline by 2020 and 2029 goal in kt CO<sub>2</sub> can be seen in the graphic below.





## 2. Work Process

### Work Process - combination of textual and visual elements

The Work Process for the creation of the CCC 2030 Action Plan has been to reflect on the work process, planning and results of the ProjectZero Masterplan2029 and Sønderborg DK2020 plan as these plans are in sync with the NZC Climate Transition Map working steps.

The CO<sub>2</sub> neutrality journey for Sønderborg started in 2007 with the creation of the ProjectZero project and public-private partnership (see Commitments document for more information) and agreeing that Sønderborg must transition its energy system to carbon neutrality by end of 2029. The 2007 energy system baseline was 700 kt CO<sub>2</sub> and a long-term (masterplan2029) plan was created in 2008/09 focused on how to achieve CO<sub>2</sub> neutrality by 2029.

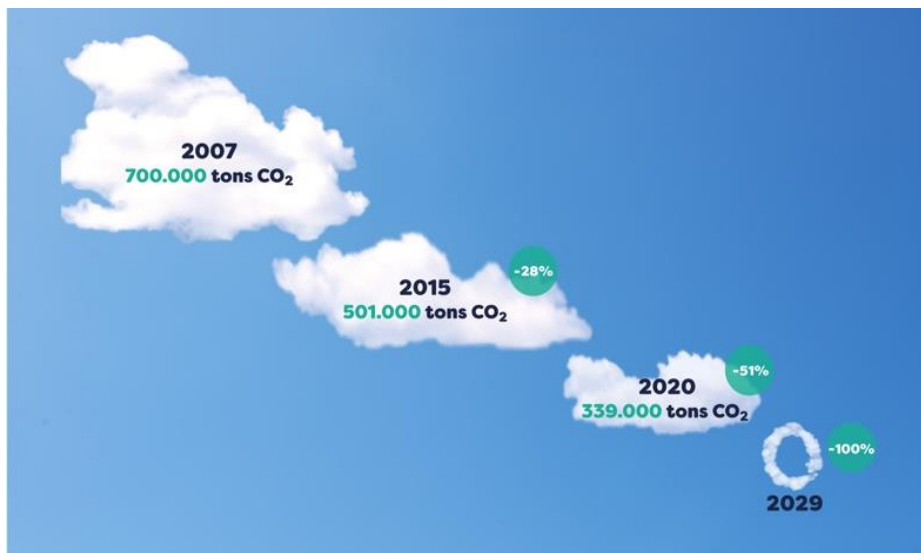


Figure 2 Sønderborg's CO<sub>2</sub> journey (energy system)

Several ProjectZero Roadmaps have been created since then, looking into 5-year detailed planning of actions with several milestones along the way:

- 2015 – focused on a 25% reduction
- 2020 – focused on a 50% reduction

The Sønderborg DK2020 Climate Action Plan was approved in 2020, and Sønderborg became one of only two pioneer Danish municipalities having an approved Climate Action Plan following the C40 CAP principles. The DK2020 plan addresses not only climate mitigation, but also adaptation and open-land/farming-related carbon emissions. The plan will be used as a basis for the waste segment in the CCC 2030 Climate Action Plan.

In 2018, the Roadmap2025 was co-created focused on how Sønderborg should achieve a 75% reduction of CO<sub>2</sub> by 2025, which in 2021 was updated/upgraded to the current Masterplan2029. The Masterplan2029 has a new baseline - 2020 - and has identified the most economic path to create a CO<sub>2</sub> neutral energy system in 2029. An illustration of the work process can be seen below.

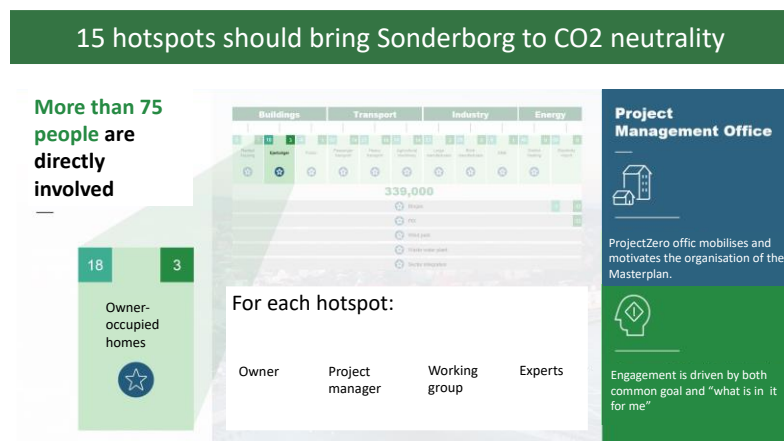


Furthermore, the visualisation below (**Figure 4**) outlines the work process of developing and maintaining the Masterplan2029.

**Step 1 – Ideate.** The Masterplan2029 started with the idea to develop an energy & climate action plan that will be used until 2029 with the aim of fulfilling Sønderborg’s CO2 neutrality goal. The Masterplan2029 is co-created as a further iteration of the ProjectZero Roadmap2025 (2018), an updated Sønderborg strategic energy plan (2020) and a new Sønderborg heatplan (2021) including local energy expert and stakeholder engagement in its development phase and a strong city council and municipal support.

**Step 2 – Define.** The long-term goal has been outlined, different actions have been formed, defining how the different parts of the Sønderborg community should be included in the actions and associated investment plans.

**Step 3 – Process.** In this step the local stakeholders were engaged in the development phase, they provided feedback and took ownership of the different actions is identified. The stakeholders were grouped in hotspots including a hotspot “owner”, a “manager”, a working group, and experts for each hotspot. In the example shown in Figure 3, the setting of a hotspot is visualised. In addition to the participants in the hotspot, ProjectZero acts as a project management office (PMO) driving and monitoring the development of the hotspot.



**Figure 3 Example of the organisation of a hotspot**

**Step 4 – Plan.** In this step the Masterplan2029 was created including the creation of all hotspots, their working groups, their 2029 CO2 neutrality goals, actions that needed to be implemented, barriers and risks they contain and their cost/investment implication. In this step the municipality (city council) approved the Masterplan2029 in December 2021.

**Step 5 – Repeat.** This step is necessary as the Masterplan2029 is intended to be always up to date with the constantly changing national and international framework conditions, be able to reflect local ambitions, stakeholder development, citizen response and participation etc. Therefore, it is agreed that each year the Masterplan and its actions will be re-evaluated and updated accordingly.



TIMELINE

Masterplan2029

**1 IDEATE (Q1 2021)**

The Masterplan2029 was built on the idea of creating a CO2 neutral Sønderborg by 2029. The plan addresses specific actions and measures to improve energy efficiency, increase the use of renewable energy sources, and more. The plan mitigates the worst impacts of climate change and ensures a more sustainable future for all.



**2 DEFINE (Q2 2021)**

- The Masterplan2029 had to:
- Include long term goals and actions which will support the decarbonisation of the municipality
  - Include an investment plan
  - Be inclusive to all parts of society and all energy sectors



**3 PROCESS (Q3 2021)**

The Masterplan2029 was created by ProjectZero and supported by BCG along with almost 70 stakeholders participants in the planning process. These stakeholders later were grouped in the so called hotspots which ensures that the actions are led by and the responsibility of the municipality as a whole and not only as an institution.



**4 PLAN (Q4 2021)**

The Masterplan2029 was approved by Sønderborg's city council and adapted within the municipal city planning. The start of the implementation of the plan started. Actions within the hotspot groups started. This work is followed by ongoing quarterly reviews



**5 REPEAT**

The Masterplan2029 had to serve as a tool which will be able to adapt to the constant national and international framework conditions and societal changes. This is why each year the goals and actions are being re-evaluated and the Masterplan2029 adjusted.



Figure 4 Work process of Masterplan2029

### 3. 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.

#### 3.1 Module A-1 Greenhouse Gas Emissions Baseline Inventory

Sønderborg’s climate transition journey started in 2007 which is why 2007 is the baseline year. The table below outlines the baseline energy use and includes the grid losses which gives an indication to the primary energy use of the municipality. This is done for coherence between the baseline, the interim year (2020) and how energy use is being monitored currently in Sønderborg and how it will be monitored in the future.

<b>A-1.1: Final energy use by source sectors</b>				
Base year: 2007	Unit: MWh/year			
	<b>Scope 1</b>	<b>Scope 2</b>	<b>Scope 3</b>	<b>Total</b>
<b>Buildings</b>	863,464	803,628		1,667,092
Electricity		484,816		
District heating		317,881		
Oil	283,591			
Natural gas	501,175			
Biomass	48,120			
Coal (used in industry)	30,578			
<b>Transport</b>	652,519			652,519
Petrol	328,997			
Diesel	323,522			
Biogas	0			
NOTE	Rail/air/maritime transport not included in the ProjectZero scope			
<b>Waste</b>	Emissions from waste, wastewater are included in A-1.6. Waste incineration for production of district heating is included in Buildings.			
<b>Industrial Process and Product Use (IPPU)</b>	Insignificant			Insignificant
<b>Agricultural, Forestry and Land Use (AFOLU)</b>	Insignificant			Insignificant
<b>Grid losses/ conversion</b>				255,000
<b>Total</b>				<b>2,574,612</b>



IPPU and AFOLU are not a part of the Sønderborg CCC 2030 Climate Action Plan scope as per the EU Mission Sønderborg EoI submitted as they are considered insignificant (according to the CCC-definitions for inclusion) for this version of the CCC 2030 Climate Action Plan. Rail, air and maritime transport are also not a part of the Sønderborg ProjectZero scope which is why they are excluded from the CCC 2030 Action Plan. The waste part is included in the emissions tables only as these types of emissions do not directly correlate to “energy used”. The waste as a part of the CCC 2030 Climate Action Plan is defined as waste (landfills) and wastewater. The energy used from waste incineration for production of district heating is included in the buildings segment.

The interim 2020 year is introduced in the table below, as the methods for energy consumption monitoring and segmentation since 2007 was changed. When the Masterplan2029 was created, it was based on the (baseline) year 2020. As explained in the previous chapters and in the Commitments document, the Masterplan2029 was split in 15 hotspots segmenting the Sønderborg society in different areas of action. Before showing the distribution of primary energy use in the 15 hotspots for the year 2020, the table below outlines the 2020 final energy use including grid losses as per the template of the CCC 2030 Action Plan.

In addition, it is important to be mentioned that the municipality reduced its energy consumption by 426 GWh in the period 2007-2020, equivalent to a 17% energy efficiency improvement during the period.

<b>A-1.2: Final energy use by source sectors</b>				
Interim year: 2020	Unit: MWh/year			
	<b>Scope 1</b>	<b>Scope 2</b>	<b>Scope 3</b>	<b>Total</b>
<b>Buildings</b>	592,944	802,953		1,395,898
Electricity		456,393		
District heating		346,561		
Oil	18,306			
Natural gas	355,639			
Biomass	200,611			
Coal (used in industry)	18,389			
<b>Transport</b>	537,833			537,833
Petrol	208,167			
Diesel	320,333			
Biogas	9,333			
NOTE	Rail/air/maritime transport not included as not part of the scope.			
<b>Waste</b>	Emissions from waste, wastewater are included in A-1.6. Waste incineration for production of district heating is included in Buildings.			
<b>Industrial Process and Product Use (IPPU)</b>	Insignificant			Insignificant
<b>Agricultura, Forestry and Land Use (AFOLU)</b>	Insignificant			Insignificant
Grid losses/ conversion				214,951
<b>Total</b>				<b>2,148,682</b>

The table below outlines the primary energy use of Sønderborg segmented by hotspots. As explained above, the waste element is not represented in “energy” but is included in the





emissions' tables further down. The reference year is 2020 (Sønderborg's interim year, not the baseline). Since the 2020 figures from the Masterplan2029 provide a better and more detailed energy planning elements, it has been decided to continue measuring Sønderborg's ProjectZero CO2 neutral goal based on the 15 hotspots.

A-1.3: Primary energy use		Sector	2020 [MWh/year]
Hotspots according to the Masterplan2029	Buildings	Owner occupied homes	539,531
		Rental homes	261,063
		Public buildings	161,583
		Big companies	229,863
		SMEs	205,771
		Brick manufacturers	182,473
	Transport	Passenger transport	366,805
		Transport of goods	56,361
		Heavy transport	61,916
		Agricultural machinery	52,750
	Energy and Enablers	Electricity import	Included elsewhere
		District heating (Scope 2 only)	29,567
		Sector coupling	N/A
		Biogas Export	N/A
		PtX	N/A
		Wind turbine park	N/A
	Wastewater treatment plant	N/A	
		<b>Total</b>	<b>2,148,682</b>

The table above provides information for both Scope 1 and 2, as it has been decided that the energy part of the Masterplan2029 will be planned, monitored, and evaluated for both scopes at the same time without splitting them. The electricity import is distributed among the other hotspots, district heating energy use is shown only for scope 2 i.e. only the electricity they use for boilers and heat pumps and the rest scope 1 is in distributed among the other hotspots, the rest of the Energy and Enablers are not relevant for energy consumption as they are producers of energy.

The emission factors used for the Masterplan2029 elements are only including CO2 emissions. The CO2 factors used are outlined in A-1.4 by type of energy source. The emissions used in the DK2020 for waste and included in A-1.5 are in CO2 equivalent and therefore are not present in A-1.4.

A-1.4: Primary energy/ energy source	Carbon Dioxide (CO <sub>2</sub> ) tonnes per MWh
Import of electricity / (2007 figures)	0.211 / (0.445)
District heating network / (2007 figures)	0,083 / (0,220)
LPG and kerosene	0.227
Coal	0.342
Fuel oil (used in industrial boilers)	0.281
Fuel oil (used in gas-oil boilers both in households and industry)	0.266
Diesel	0.266



JP1	0.259
Petrol	0.263
Natural gas	0.204
Wind energy	0
Water energy	0
Solar power	0
Geothermal	0
Heat sources for heat pumps	0
Livestock manure	0
Biofuel and energy crops	0
Straw	0
Firewood and wood chips	0
Wood pellets and wood waste	0
Organic waste, industry	0
Organic waste, households	0
Landfill, sludge, treatment plant	0
Waste, not biodegradable	0.340

The emissions of the baseline year (2007) are seen in table A-1.5.

Note that part of the emissions from waste is calculated as CO2 equivalents.

<b>A-1.5: GHG emissions by source sectors</b>				
Base year 2007	Unit – t CO2			
	<b>Scope 1</b>	<b>Scope 2</b>	<b>Scope 3</b>	<b>Total</b>
<b>Buildings</b>	189,473	338,925		528,397
<b>Transport</b>	172,647			172,647
<b>Waste</b>	16,987			16,987
<b>Industrial Process and Product Use (IPPU)</b>	Insignificant			Insignificant
<b>Agricultural, Forestry and Land Use (AFOLU)</b>	Insignificant			Insignificant
<b>Total</b>				<b>718,031</b>

Similarly, to the energy use tables above, it is important to introduce the emissions of the interim year (2020) for coherency with table A-1.7.

<b>A-1.6: GHG emissions by source sectors</b>				
Interim year 2020	Unit – t CO2			
	<b>Scope 1</b>	<b>Scope 2</b>	<b>Scope 3</b>	<b>Total</b>
Buildings	84,075	121,534		205,609
Transport	133,227			133,227
Waste	13,705			13,705
Industrial Process and Product Use (IPPU)	Insignificant			Insignificant
Agricultural, Forestry and Land Use (AFOLU)	Insignificant			Insignificant
<b>Total</b>				<b>352,542</b>



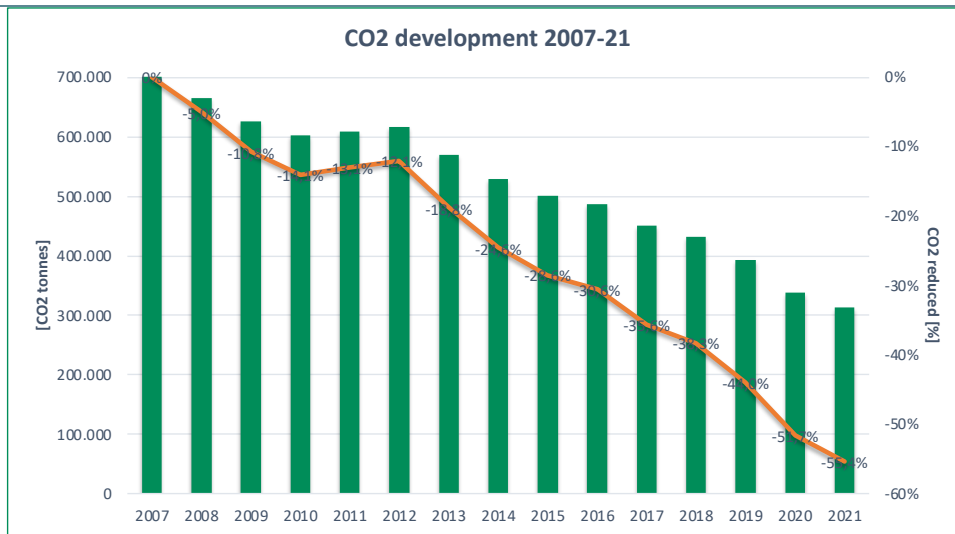
Table A-1.7 shows a more detailed emissions overview based on the Masterplan2029 and DK2020 plan for the interim year 2020. As mentioned before, the emissions format provided in A-1.7 is the most recent and detailed way of presenting, monitoring, and evaluating Sønderborg emissions and this is how it would be presented in the future. All emissions from the Masterplan2029 are presented by Scope 1 only. This is the preferred method of presenting the emissions as it is easier to plan and evaluate different actions.

<b>A-1.7: GHG emissions by Masterpln2029 and DK2020</b>		<b>Sector</b>	<b>2020 [tonnes CO2]</b>
<b>Masterplan2029</b>	<b>Buildings</b>	Owner occupied homes	17,624
		Rental homes	5,521
		Public buildings	3,801
		Big companies	18,880
		SMEs	1,392
		Brick manufacturers	36,857
	<b>Transport</b>	Passenger transport	92,187
		Transport of goods	13,919
		Heavy transport	13,070
		Agricultural machinery	14,053
	<b>Energy and enablers</b>	Electricity import	88,631
		Sector coupling	-
		District heating (Scope 2 only)	40,286
		Biogas Export	-7,383
		PtX	-
		Wind turbine park	-
		Wastewater treatment plant	-
		<b>Total Masterplan2029</b>	<b>338,837</b>
<b>DK2020</b>		Waste, wastewater, random fires	13,705
		<b>Total CCC scope</b>	<b>352,542</b>

#### **A-1.8: Description and assessment of GHG baseline inventory**

The development in the Sønderborg's CO<sub>2</sub> reduction within the energy system (aka Masterplan2029 scope) in the period 2007-2021 is shown in Figure 2. The realized CO<sub>2</sub> reduction amounts to 55,4%, which corresponds to a reduction of 388,235 tonnes of CO<sub>2</sub> since 2007. The remaining CO<sub>2</sub> emissions of 312,809 tonnes must be reduced to zero by 2029.

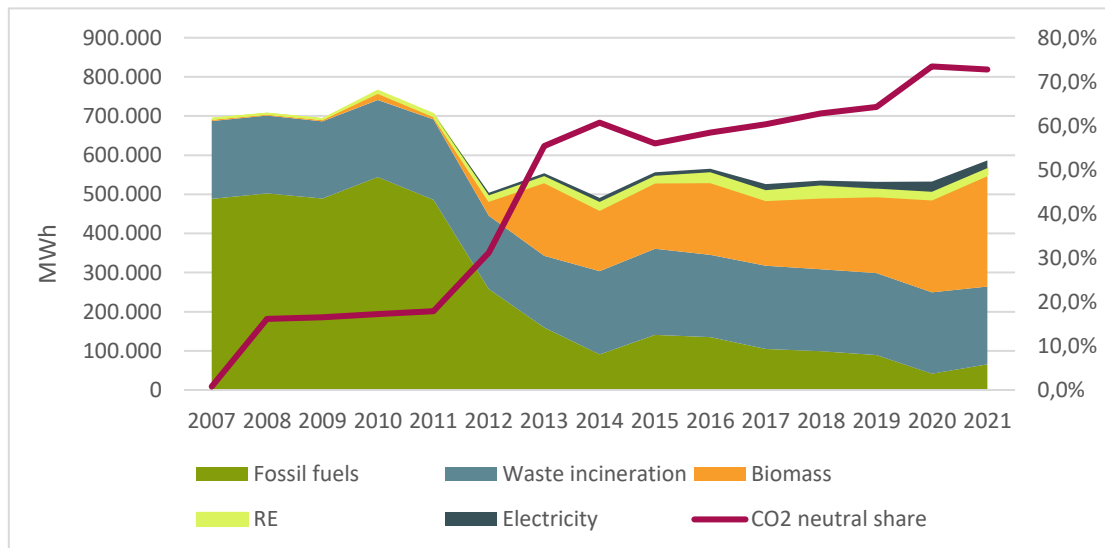
NOTE: Figure 5 below shows the reduction of CO<sub>2</sub> emissions from 2007 to 2021. The left y-axis shows the amount of tonnes emitted, whereas the right y-axis shows the percentage which has been reduced (e.g. in 2020 the CO<sub>2</sub> emission was 338,837 tonnes (green pillar) which meant a reduction of 51.7% (red line)).



**Figure 5 CO2 development of Sønderborg’s energy system, 2007-2021**

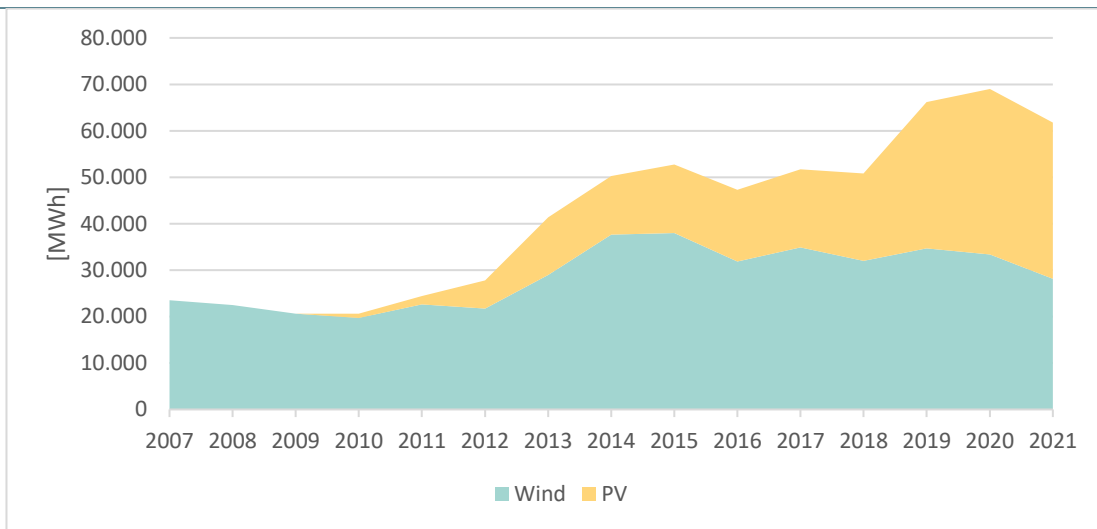
The biggest carbon reduction measure since 2007 was the decarbonisation of the district heating grid, conversion of fossil based individual heating systems to district heating or heat pumps and the energy renovations of buildings which contributed not only to reducing emissions but also to the strategic important improvement of energy efficiency in buildings.

Figure 6 visualises the DH fuel mix since 2007 showcasing the efforts towards decarbonising the DH grid in Sønderborg which reached a little over 70% CO2 neutral share (red line) in 2021. It is seen that use of fossil fuels drastically reduced over the years and was replaced by use of biomass, RE (incl. solar and geothermal) sources and electricity. The use of waste for district heating generation is relatively stable in the past decade, however, the waste mix is more and more biodegradable and less emissions intensive.



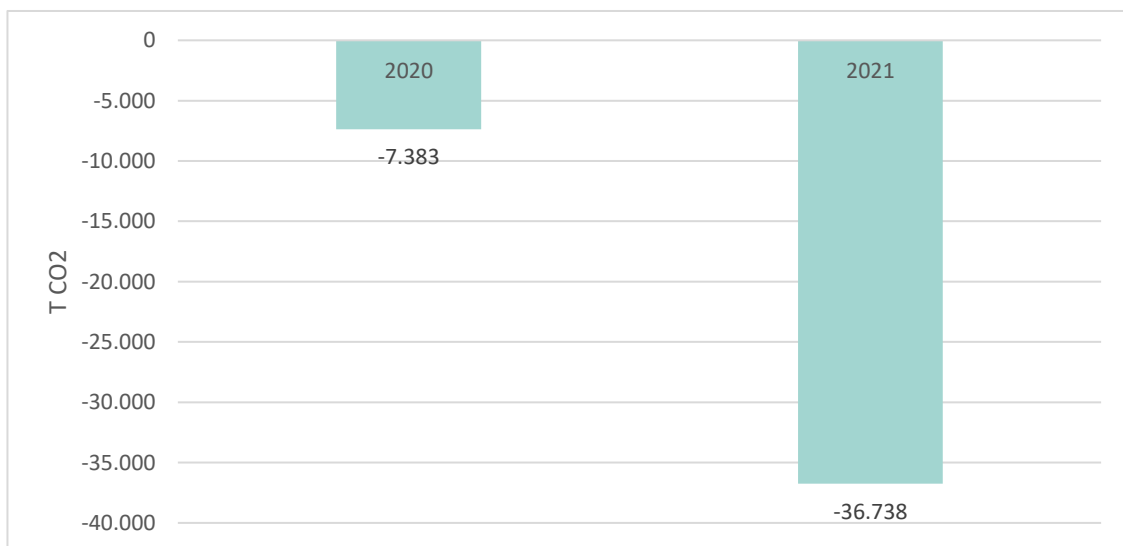
**Figure 6 District heating fuel mix**

Furthermore, the production of green energy has contributed to the decrease of emissions. Figure 7 provides an overview on how green electricity grew since 2007.



**Figure 7 Production of electricity from PV and wind**

Figure 8 visualises the production of biogas from the Glansager biogas plant (first of Sønderborg’s now two biogas production plants) which started operation in Q4 2020. This made a significant contribution to the CO<sub>2</sub> reduction in the last two years. The second biogas plant “Kværs” which has started operation in 2022 will contribute even further to the reduction of emissions.



**Figure 8 CO<sub>2</sub> reduction based on biogas production from Glansager biogas plant**

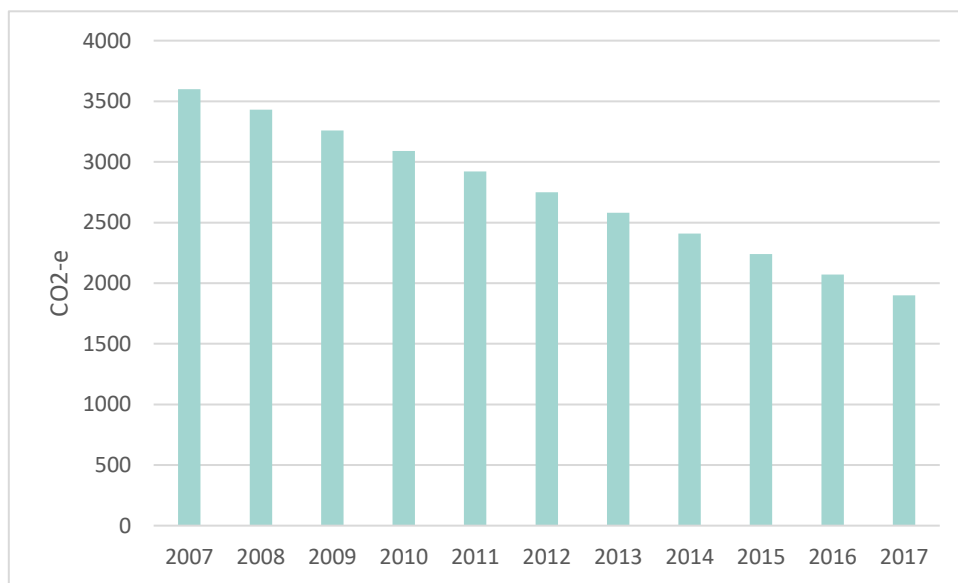
The framework and technology for the transport sector has been lagging which is why it has been difficult to see huge reductions in the transport sector. In recent years, the technology and policies on both national and international level have picked up the pace and more reductions in this sector will be evident in the future.

The waste-based emissions have been calculated using national figures which were scaled down to represent the local context in Sønderborg, since it is/was not possible to make a precise local based calculation. They consist of emissions from landfill and wastewater treatment emissions. While wastewater emissions cannot be monitored very precisely at local level, the utility company which is responsible for the landfill in Sønderborg has measures on methane in Sønderborg.



The methane production in the core of the landfill is high so to avoid explosions and fires, the landfill is equipped with a gas system to capture the methane. The methane is burned in a dual fuel motor generating electricity.

Methane emissions from the landfill has been last measured in 2017. They are measured approx. every 5-6 years when the municipal waste plan is updated. Based on the measurement in 2017, the estimated emissions of methane were 74.5 tons of methane equivalent to 1.9 kt CO<sub>2</sub>-e. Since 2007 the primary sources of methane emissions within the landfill (methane hotspots) were incorporated in the gas system. It is assumed that 60% of the emissions from 2007 have been removed by 2017 when the gas system was expanded to include the methane hotspots, therefore it is estimated that the emissions from the landfill alone were approx. 3.6kt CO<sub>2</sub>-e in 2007. This means that about 1/4<sup>th</sup> of the emissions from waste in 2007 came from the landfill.



**Figure 9 Methane emissions from landfill in Sønderborg (based on estimations)**



### 3.2 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.

<b>A-2.1: List of relevant policies, strategies &amp; regulations</b>					
Type	Level	Name & Title	Description	Relevance	Need for action
(regulation/ policy/ strategy/ action plan)	(local, regional, national, EU)	(Name of policy/ strategy/ plans)	(Description of policy/ strategy/ plans)	(Describe relevance/ impact on climate neutrality ambition)	(list any suggested action in relation – to be further picked in Module C-1)
Action Plan	Local	Roadmap2025	Created in 2018 segmenting community into 8 segments and providing specific actions toward achieving 75% reduction of emissions. Later used as a basis for Masterplan2029	Relevant to the Buildings, Transport and energy part of the CCC.	-
Strategy	Local	Sønderborg’s heat plan 2022	Based on national framework stating that municipalities must ensure that from 2035 there will no longer be homes heated by gas boilers, Sønderborg municipality updated their heating plan.	Relevant to Buildings and energy (district heating) part of CCC.	
Action Plan	Local	Masterplan2029	Masterplan2029 is the core action plan achieving a Sønderborg’s CO2 neutrality goal by 2029.	The Masterplan2029 is in sync with the EU Mission climate neutrality ambition by 2030 – Scope 1 and 2.	
Action Plan	Local/National	DK2020	DK2020 addresses Scope 1, 2 and 3 emissions of Sønderborg towards neutrality by 2050 with interim 2030 targets too.	Main relevance to IPPU, AFOLU and Waste parts of the CCC. But include also Energy based on Roadmap2025.	



Action Plan	Local	Waste plan 2019-2030	The waste plan's objectives and initiatives have been drawn up taking into account the Sønderborg Municipal Plan 2017 – 2029, the national waste strategy and the EU waste package.	Main relevance to the Waste parts of the CCC.	
Strategy	National / International	Global Climate Action Strategy: A Green and Sustainable World	Denmark shall be a green frontrunner in global climate action that inspires and encourages the rest of the world. National goal is 70% emissions reductions by 2030 and climate neutrality by 2050.	Relevant to the overall 2030 CCC goal.	
Agreement	National	Climate agreement on green electricity and heat June 2022	Denmark will quadruple the production of solar and wind energy on land, as well as the possibility of a fivefold increase in offshore wind power. The ambition is that all gas in Denmark must be green by 2030, and from 2035 there will be no homes that are heated with gas.	Overall CCC relevance.	
Plan	National	Climate plan for waste sector and circular economy	The visions for a green waste sector: <ul style="list-style-type: none"> <li>• The waste sector must be climate neutral by 2030.</li> <li>• Sorting out 80 per cent. Danish plastic from incineration in 2030.</li> </ul>	Relevant to the overall 2030 CCC goal.	Decrease nitrous oxide, methane, and CO2 emissions. Decrease incineration of plastic. Decrease the amount of waste.





			<ul style="list-style-type: none"> <li>The amount of waste must decrease – less waste, less waste and more recycling.</li> </ul>		
Plan	Local	Strategic Energy Plan November 2020	The updated strategic energy plan illustrates how Sønderborg can become CO2 neutral by 2029 within the energy and transport sector.	Relevant to the overall 2030 CCC goal.	

### A-2.2: Description & assessment of national & Sønderborg policies and plans

**Sønderborg - Roadmap2025** - Roadmap2025 was created using the Integrated Energy Planning framework developed within the Horizon2020 funded SmartEnCity project and it investigates how Sønderborg can achieve 75% CO2 emission reduction by 2025 and pave the way to a carbon neutral municipality by 2029. The roadmap has been segmented into eight segments grouped in eight working groups: owner-occupied housing, housing associations, private rental, private transportation, heavy transport and renewable energy production. A total of 52 energy and climate action projects were described, that support the ongoing initiatives within energy renovation, green transportation, citizen engagement, electrification, phasing in of sustainable energy production etc. The roadmap was co-created facilitated by ProjectZero and approved and ratified by the City Council in December 2018.

**Sønderborg - Masterplan2029** – In 2021, ProjectZero and the 75 local stakeholder participants were supported by Boston Consulting Group (BCG) to assess and co-create a masterplan for Sønderborg’s CO2-neutrality by 2029 and ensure robust action plans for the different intervention areas. The plan builds on the Roadmap2025, the 2020 strategic energy plan and the 2021 heat plan and provide a strong basis for achieving Sønderborg’s 2029 goal.

In 2018, Sønderborg lacked a national climate framework and ambitious national climate goals and actions. The adoption of the Danish Climate Act in 2020 provided this framework. With the Green Deal, Bauhaus and Renovation Wave, the EU has set an ambitious framework for the EU's climate efforts, which is already creating cross-pressure on companies' production and energy use, agriculture, the banks/financial world, etc. - and ultimately supports citizens' climate journeys on housing, transport, food, consumption etc.

The technologies integrated in the Masterplan2029 have become more mature and cheaper, but are still focused on 1) energy efficiency, 2) avoiding/exploiting waste between sectors (sector coupling) and 3) smart/intelligent phasing in of energy from wind, solar and biomass. New area in the Masterplan is 4) the need for production of synthetic (Power-to-X) fuels for heavy transport.

The defined actions include citizen and company engagement based on evaluated value propositions and business models – based on iterations of the since 2009 co-created ZERO-participatory programs (see the CCC Commitments document), addressing also vulnerable citizens living in rural areas.



Masterplan2029 has addressed these challenges and, through planning/implementation discussions in the related "hotspot" working groups, ensured a robust and cost-effective action planning for the remaining Sønderborg journey towards zero by 2029.

**National - DK2020** – In the DK2020 Climate Action Plan, Danish municipalities work with the same standard for climate action planning as used by the C40 Cities network but including also farming (AFOLU emissions). This is the first time that the C40 standard is being used by and further developed for use in smaller cities and municipalities. Sønderborg's DK2020 plan is intended to live up to the objectives of the Paris Agreement, both in terms of reduction of greenhouse gases and adaptation towards climate change, according to the C40's Climate Action Planning Framework.

**National - Climate agreement on green electricity and heat 2022** – Denmark and Europe should become safer and greener. This requires a significant expansion of renewable energy sources – both towards 2030 and in the years after. Solar parks and onshore wind turbines can deliver cheap, green energy quickly in the years leading up to 2030. At the same time, Denmark's large sea areas, with good wind and seabed conditions, ideal conditions for also in the future to harvest the sea wind and profits in the North Sea. Offshore Danish waters have the potential to become a green power plant not just for Denmark, but also for Europe.

With this agreement, the parties agree to ensure framework conditions that can enable a quadrupling of total electricity production from solar energy and onshore wind towards 2030. The parties in addition agree to enable the tender of at least 4 gigawatts (GW) of offshore wind for realization by 2030 at the latest on the condition that the offshore wind does not negatively burden the state's finances over the project period. Denmark currently produces 2.3 GW of green electricity from offshore wind. It is expected that the current from the wind parks, among other things, can be used by PtX facilities in Denmark and thereby potentially contribute to the green conversion of the Danish aircraft, heavy transport etc. Political agreements have been made on offshore wind farms, which should ensure a little more over 16 GW, including two energy islands. This corresponds to the power consumption of more than 23 million households in Europe, but the possibilities are far from exhausted.

**Sønderborg - Sønderborg's heat plan 2022** – The Heat plan 2022, building on the updated Heat plan 2021, determines the municipal objectives for the development of the heating supply sector in the municipality. It determines the (village/rural) areas where the municipality would like to see district heating established in the future. It also specifies which measures must be taken to switch to 100% fossil-free heat in the areas outside the district heating areas.

The heat plan is not legally binding, but it is a basis for cooperation between the municipality, ProjectZero and the district heating and utility companies. At the same time, the heat plan must support authority processing in relation to applications. It can be an application for exemption from a connection obligation for the individual citizen or an application for the establishment of a major heating project.

**Sønderborg - Waste plan 2019-2030** – The waste plan is the City Council's overall plan for how the municipality's handling of waste should develop over the next 12 years. The plan contains a description of an overall objective for the municipality's waste management, as well as several measures, with associated goals and initiatives, which must help to ensure that we also have efficient and environmentally sound waste management in the future.



In addition, the plan focuses on how we will work to achieve municipal goals, such as the ProjectZero goal that Sønderborg Municipality must be a CO<sub>2</sub>-neutral growth area in the year 2029.

The plan applies for a period of 12 years and must be reviewed at least every 6 years.

The planning part of this waste plan applies to the period 2019-2024, while the objectives in the plan apply to the entire planning period 2019-2030.

The plan has been developed according to the latest national waste strategy – “Denmark without waste” (2013) – the following goals must be incorporated into the municipal waste plans:

- 50% of household waste will be recycled by 2022
- 75% of electronic waste must be collected
- 55% of all batteries must be collected

The plan also integrates the EU targets from the EU’s waste directive.

**National - Global Climate Action Strategy: A Green and Sustainable World** - The Danish Government’s new long-term strategy on global climate action sets the direction for Denmark’s international climate efforts. Main goals:

Increase global climate ambition - Denmark will work to influence states and non-state actors to commit to ambitious objectives contributing to limiting global warming. We will work with, i.e., States, multilateral organisations, and civil society for ambitious efforts on climate adaptation, resilience and sustainable development.

Reduce global greenhouse gas emissions - Denmark will work for a global green transition focused on reducing emissions of large emitters and sustainable development in developing countries.

Strengthen focus on adaptation and sustainable development - Denmark wants to inspire and drive resilience and adaptation initiatives. We want a far more climate-oriented development cooperation focused on climate change and sustainable development in the poorest and most fragile developing countries. We want to spread Danish prevention and adaptation solutions globally.

Shift financial flows to green - Denmark will contribute to shifting global financial flows from fossil fuels to green, climate friendly investments. We will support greening of financial markets and the energy markets and systems designed to foster investments in renewables. We will also strive to increase mobilization of climate finance for the poorest and most fragile countries.

Cooperate with the private sector on green solutions - To drive successful global climate action, Denmark will work with the private sector to promote green Danish solutions globally.

**National - Climate plan for waste sector and circular economy, June 16. 2020** – The aim of the plan is to reduce greenhouse gas emissions by 0.7 million ton (national DK figure) in 2030. This is scheduled to be achieved by reducing the amount of waste through extending the lifetime of products. In addition, incineration of plastic must be reduced by 80% and recycling must generally be more comprehensive and efficient. The plan anticipates future legislation on nitrous oxide emissions.



**Sønderborg - Strategic Energy Plan, November 2020** - The updated strategic energy plan re-iterates how Sønderborg can become CO<sub>2</sub> neutral by 2029 within the energy, buildings and transport sector. The plan is based on the existing strategic energy plan from 2015 and the 2029 scenario, created as part of the Roadmap2025 creation process in 2018. The reduction targets in Roadmap2025 have not changed.

The plan also deals with measures to become climate neutral in 2050. The 2050 scope includes all greenhouse gas emissions in Sønderborg, including methane and nitrous oxide emissions from agriculture. CO<sub>2</sub> compensating initiatives, such as exporting green energy to other municipalities, cannot be used to achieve the 2050 goal. The background for the update is the significant changes in the national framework conditions that have occurred over the last 1-2 years, especially the adoption of the climate act and the objective of a 70% reduction of the national greenhouse gas emissions in 2030 as well as new technological opportunities especially before for sector coupling and PtX.

Table A-2.3 visualises the Sønderborg climate trajectory of emissions from 2007 to 2030. It is an important table as it provides insight and overview of the baseline (2007), the last monitored year (2021), the planned emission reductions from the last monitored year until 2030 and the CCC 2030 emission targets. The planned reductions are further unpacked into Part B of the CCC 2030 Action Plan. Additionally, the progress between the baseline and the last monitored year are reflected.

<b>A-2.3: Climate emissions trajectory 2007 - 2030</b>					
CCC scope areas	2007	2021	Progress 2007/2021	Planned reductions 2022/2030	CCC CO <sub>2</sub> emissions target 2030
Transport	172,647	137,162	-20.6%	31,436	105,726
Energy (built environment)	528,397	212,385	-59.8%	206,185	6,200
Waste, wastewater	16,987	13,705	-19.3%	3,252	10,453
<b>Total excl. export</b>	<b>718,031</b>	<b>363,252</b>	<b>-54.5%</b>	<b>240,873</b>	<b>122,379</b>
Masterplan2029 export of biogas and PtX (offsetting)		-36,738	n/a	93,256	-129,994
<b>Total incl. export</b>		<b>326,514</b>	<b>n/a</b>	<b>334,129</b>	<b>-7,615</b>
					<b>CCC result</b>

Table A-2.4 shows the expected 2030 residual emissions after all planned interventions have been implemented. It also provides a detailed overview of how these will be addressed and what would the “gap to be addressed” in 2030 be.

<b>A-2.4: Detailed emissions gap analysis</b>		<b>2030 [tonnes CO<sub>2</sub>]</b>
Buildings	Owner occupied homes	0
	Rental homes	0
	Public buildings	0
	Big companies	0
	SMEs	0
	Brick manufacturers	6,200



Transport	Passenger transport	74,543
	Transport of goods	10,438
	Heavy transport	9,802
	Agricultural machinery	10,943
Enablers	Electricity import	0
	Sector coupling	0
	District heating (Scope 2 only)	0
	Biogas Export	-59,994
	PtX	-70,000
	Wind turbine park	0
	Wastewater treatment plant	0
<b>Total Masterplan2029 gap</b>		<b>111,926</b>
<b>Total Masterplan2029 offsetting</b>		<b>-129,994</b>
Waste gap	Waste, wastewater, random fires	10,453
<b>Total CCC scope (gap to be addressed)</b>		<b>-7,615</b>

Overall, the buildings will be able to reach neutrality as the heating from oil and natural gas will be either converted to district heating (which is scheduled to become 100% CO2 neutral by 2029) or to heat pumps (ran by 100% green electricity). The leftover emissions of 6.2 kt CO2 in the brick manufacturers are a result of the use of coal for a part of the brick production. There is a possibility to eliminate these by carbon capture (CCS). However, there are not specific plans for that yet.

The other significant emissions are in the transport sector. It is considered that with the current and already existing frameworks it is not possible to lower the emissions further. However, there is an upside which might lower the emissions further which is conditional to future policies and financial support with the aim of further electrifying the transport sector or the use of alternative green fuels. However, this is still unknown, so it has not been taken into account.

Emissions from waste are considered to reach a slightly lower level by 2030. A bigger proportion of these emissions will be lowered towards 2050.

It is expected that the local production of biogas and PtX will be able to offset the remaining emissions and bring the net-result to -7.6 kt CO2 by 2030. Therefore, it is anticipated that there would be no further gap that needs to be addressed in this Action Plan as it is already addressed in the Masterplan2029 and DK2020.

Table A-2.5 shows a top-down overview of the emission gap analysis, showing the baseline emissions, how much needs to be reduced, the remaining in 2030 emissions and how many will be offset and finally the result or “gap to be addressed”, which as explained above, will not be needed to be addressed as it already covered in the current action plans made by Sønderborg.

<b>A-2.5: Emissions gap</b>	<b>Absolute</b>	<b>% from baseline</b>
Baseline emissions in 2007	718,031	0%
Baseline reduction target	595,652	83%
Residual emissions in 2030	122,379	17%
Emissions offsetting	-129,994	18%
<b>CCC result (gap to be addressed)</b>	<b>-7,615</b>	<b>101%</b>



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

Table A-3.1 provides a Hotspot overview of engagement of stakeholders in Sønderborg, including the networks of stakeholders that they work with, who they are influencing when actions are implemented and the “what’s in it for me” interest for the stakeholders as well as the overall goals.

<b>A-3.1: Systems &amp; stakeholder mapping</b>				
<b>System description</b>	<b>Stakeholders involved</b>	<b>Network</b>	<b>Influence</b>	<b>Interest</b>
Homeowners' buildings	Homeowner representatives	Banks and financial institutions District heating Advisors The Municipality Private companies	Citizens	<u>Overall:</u> Reducing cost, energy and emissions in buildings <u>Stakeholder:</u> Insights and business development Creation of green jobs
Rental buildings	Representatives from all six housing associations in Sønderborg Private landlords – representatives	Housing associations Private rentals Advisors BL - Public housing associations The dorm administrators	Citizens	<u>Overall:</u> Reducing cost, energy and emissions in buildings <u>Stakeholder:</u> Insights, learnings and business development Creation of green jobs
Public Buildings	Municipal administration – department that deals with public buildings	tbd	The public administration Citizens (indirectly affected)	<u>Overall:</u> Reducing cost, energy and emissions in buildings <u>Stakeholder:</u> Creation of green jobs Example for good practices
Big (7) companies	Representatives from the seven biggest companies in Sønderborg		Representatives from the seven biggest companies in Sønderborg	<u>Overall:</u> Reducing cost, energy and carbon footprint emissions from Sønderborg's industries <u>Stakeholder:</u> Insights, learnings and business development Creation of green jobs
Brick manufacturers	Representatives from all three brick manufacturer companies		Representatives from all three brick conglomerate manufacturing companies	<u>Overall:</u> Reducing cost, energy and carbon footprint emissions in Sønderborg's industry <u>Stakeholder:</u> Insights, learnings and new business development Creation of green jobs
SMEs	Representatives from different	Larger SMEs	Larger SMEs	<u>Overall:</u> Reducing cost, energy and



	SMEs in Sønderborg	Green growth association Local producers of green el. Via PVs	Green growth association Local producers of green electricity using PV-systems	carbon footprint emissions in industry <u>Stakeholder:</u> Business development Creation of green jobs
Passenger transport	Municipal administration – department that deals with transport	The financial institutions The electric car owners The car dealers The electric car alliance The companies South traffic Parts/city car companies	Citizens	<u>Overall:</u> Reducing energy and decarbonising passenger transport <u>Stakeholder:</u> Insights, policy understanding, business development Creation of green jobs
Transport of goods and heavy transport	Industry Organisation for the Danish Road Freight; Companies with heavy transport Biogas producer Truck manufacturer	Industry Organisation for the Danish Road Freight; Companies with heavy transport Biogas producer Truck manufacturer	Industry SMEs	<u>Overall:</u> Reducing cost, energy and decarbonising the transport sector <u>Stakeholder:</u> Business development Creation of green jobs
Agricultural machinery	Agricultural machinery experts Agricultural school Local farmers	Agricultural machinery experts Agricultural school Local farmers	Local farmers	<u>Overall:</u> Reducing energy and decarbonising the agricultural machinery stock in Sønderborg
District heating	Representatives from all (3) district heating companies Municipality	Representatives from all (3) district heating companies Municipality	Citizens Industry	<u>Overall:</u> Reducing cost, energy and decarbonising the DH networks in Sønderborg <u>Stakeholder:</u> Insights, learnings and new business development Creation of green jobs
Electricity import	TSO Local electricity operator		Industry Citizens	100% green electricity by 2030 Creating a robust grid for electrification
Biogas	Nature Energy	Nature Energy Industry Citizens The municipality	Industry Citizens PtX	<u>Overall:</u> Producing biogas Decarbonising the gas grid <u>Stakeholder:</u> Business development Creation of green jobs
PtX	European Energy	European Energy Heavy transport industry The municipality	Industry Citizens	<u>Overall:</u> Producing PtX Decarbonising the transport sector



				<u>Stakeholder:</u> Insights, learnings and new business development Creation of green jobs
Wind farm (offshore)	Sønderborg Forsyning (Utility company in Sønderborg) European Energy	Sønderborg Forsyning (Utility company in Sønderborg) European Energy Citizens	PtX Citizens	<u>Overall:</u> Green electricity for electrification and production of e-fuels <u>Stakeholder:</u> Business development Creation of green jobs
Wastewater treatment plant	Sønderborg Forsyning (Utility company in Sønderborg)	Sønderborg Forsyning (Utility company in Sønderborg) The municipality	Citizens	<u>Overall:</u> Reducing cost, energy, emissions and utilisation in PtX <u>Stakeholder:</u> Business development Creation of green jobs
Sector integration	Sønderborg Forsyning, DH companies, Nature Energy, European Energy, the municipality, TSO, local electricity operator		Citizens	Reducing cost, energy consumption and emissions across all sectors Insights, learnings and new business development across all sectors Creation of green jobs across all sectors
Waste	Sønderborg Forsyning (Utility company in Sønderborg) Private utility companies,		Citizens Companies Sønderborg Varme (waste incineration plant)	Reducing cost, waste, recycling waste, creation of green jobs in waste sector

### A-3.2: Description of systemic barriers & opportunities – textual elements

The main barriers within the buildings' segments are related to the following concerns: will the district heating companies have the capability / capacity to implement all conversion measures, is there enough labour force to implement the measures, are there enough materials (regarding conversion to heat pumps and implementing district heating) and waiting times and the cost of implementing the measures. A systemics opportunity is to increase the percentage of subscribers to district heating networks, as district heating will have a perfect fit with future excess heat from PtX processes.

Passenger and goods transport are not considered to have big risks with the targets set in the plan as the electrification infrastructure is well under way. The supply/component-issues seen in the car industry during 2022 are expected to be fixed but supply of critical components is certainly a risk also going forward. Higher vehicle cost initially might delay a fast migration to e-cars.

Heavy transport is dependent on national subsidies and incentives as well as framework conditions that are not yet in place. The same goes for agricultural machinery. Therefore, the





targets for these hotspots are relatively low. A systemics opportunity will be to fuel majority of heavy transport with PtX energy sources.

It will be a risk/barrier if the imported electricity cannot become 100% green by 2030. A systemic opportunity is the new plan for four times more local land-based VE

Another risk is related to the technology of carbon capture & storage (CCS) for emissions coming from burning waste for production of heat or brick manufacturing based on burning coal, which is a technology that needs to mature. However, Denmark has in March 2023 demonstrated that collected/compressed carbon can be stored offshore.

Barriers regarding PtX are related to national and local approval processes and conditions for implementing the plant which may push the project timeline. The same goes for the wind park project, which is a prerequisite for the PtX plant. A positive business model alternative state subsidizing is a precondition for the PtX-plant. A systemics opportunity is to use the wind-energy for PtX-production, when excess power is available due to too much wind energy feeding the energy system.

The sector integration represents systemic opportunities in using today's wasted biogenic carbon in PtX-production, utilizing wastewater instead of groundwater for electrolyzing, and utilizing wasted heat from industries, brick manufacturers, biogas and PtX-production. Better balancing of energy production and energy consumption is essential for improving overall efficiency of the energy system.

The terms of reuse and reduce waste are not new to the Sønderborg citizens. However, new ways of approaching reuse and reduce are needed. Recycling of plastic, gypsum and building materials are more expensive than having a landfill and incineration. Without the demand from customers for recycled products and more climate friendly products, companies may lack incentive to recycle and reuse. Solutions from households are more likely to be widely spread as many households use for example secondhand shops for handover and shopping, however, households lack the economic incentive to repair and reuse their own products. However, Sønderborg experiences a strong interest and historic citizen engagement and participation in waste management and kids learn about waste in schools.

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

The local engagement with involvement of citizens and stakeholders is the DNA of Sønderborg's ProjectZero vision. Over the years since the project started in 2007 the model for stakeholder engagement has been developed and refined. Today the stakeholder-organization is formed by 15 groups (hotspots) across the sectors of the energy system. Each and every stakeholder has an interest in taking part in the work and this way involves citizens and companies in joint efforts. The continuous effort and interaction make the Sønderborg (stakeholder) community work together, engage further and co-create across sectors.

A key organizational element to support the strategic goal of sector integration is the integrated energy system hotspot, which is a cross-organizational / matrix hotspot that drives the idea generation and project development across hotspots. This hotspot consists of hotspot owners and project managers from the other hotspots to develop solutions across sectors to optimize energy system performance and utilize biogenic resources.

The ProjectZero project management office (PMO) mobilizes and motivates the masterplan organization and follows up with quarterly reviews of the action plans.



Sønderborg City Council and ProjectZero Board of Directors															
ProjectZero - Project Management Office															
Sector	Energy					Buildings			Industry			Transport			
Hotspot	Integrated energy system	District heating	Lillebælt Syd Wind park	Power-to-X	Biogas	Wastewater plant	Owner occupied housing	Rented housing	Public buildings	Large manufacturers	Brick companies	SME	Goods and heavy transport	Agricultural machinery	Passenger transport
Hotspot owner	Christian Udby (Sønderborg Forsyning)	Erik Wolff (Sønderborg Varme)	Christian Udby (Sønderborg Forsyning)	Emil Vikjær-Andresen (European Energy)	Jonas Svendsen (Nature Energy)	Stinne Stokkebo (Sønderborg Forsyning)	Morten Vestergaard (Broager Sparekasse)	Jan Mortensen (Nordborg Andelsboligforening)	Willy Feddersen (Sønderborg Kommune)	Martin Johanning (BMC Fonden)			Niels H. Schmidt (Gråsten Landb.Skole)	Willy Feddersen (Sønderborg Kommune)	
Project manager	Allan Pilgaard-Jensen (ProjectZero)	Tue Christensen (Sønderborg Varme)	Sarah Bach (European Energy) og Susanne L. Aagaard (Sønderborg Forsyning)	Lotte Lindeloff (European Energy)	Markus H. Pedersen (Nature Energy)	Susanne Vesten (Sønderborg Forsyning)	Anne Branderup (ProjectZero)	Anne Branderup (ProjectZero)	Mie R. Nielsen (Sønderborg Kommune)	Jens Chr. Moltke-Leth (ProjectZero)					Louise Bjerklid Petersen (Sønderborg Kommune)
Group	The hotspot owners across sectors	The three district heating companies The municipality Danfoss	Lillebælt Syd wind park project team led by European Energy and Sønderborg Forsyning	PTX project team led by European Energy Sønderborg Danfoss	Biogas project team Nature Energy projektteam	Wastewater project team led by Sønderborg Forsyning	Craftsmen Banks Utility The municipality Real estate agent Energy consultant Architect	Repre. from the housing associations Energy consultant Architect Private renting house repre.	Municipality building team	Repre. from the manufacturers	Repre. from the brick manufacturers	Repre. from small and medium-sized companies	Repre. from companies using heavy duty transport Repre. from truck manufacturer Repre. from logistics organization	Jens Lei Thomas Langer Erik Westergaard	Municipality teams on cars fleet, public transport, bicycling, carpooling, Car dealer Passenger car organization EV charging company

Figure 10 Stakeholder Participatory model of Sønderborg

The stakeholders since 2009 have co-created and re-iterated the ZERO-participatory programs, enabling citizens and companies to decide and implement own climate actions based on SAFE knowledge, stakeholder support and local finance programs. For more information about the ZERO-programs and platforms please study the Sønderborg CCC Commitments document. Further iteration of the programs are expected to be implemented based on the hotspot groups continued plan, do, check & act processes.



## 4. 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.

### 4.1 Module B-1 Climate Neutrality Scenarios and Impact Pathways

Module B-1 “Climate Neutrality Scenarios and Impact Pathways” lists 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>B-1.1: Impact Pathways</b>					
<b>Fields of action</b>	<b>Systemic levers</b>	<b>Early changes (1-2 years)</b>	<b>Late outcomes (3-4 years)</b>	<b>Direct impacts (Emission reductions by 2030)</b>	<b>Indirect impacts (co-benefits)</b>
<b>Energy systems / Green infrastructures</b>	Technological innovation and infrastructure	Key actors are identified, business models and investments for solutions are developed	<p>Technological advancement has increased</p> <p>Increased number of available solutions</p> <p>New technologies are accepted by the community</p> <p>Results from solutions become measurable and are able to reach more stakeholders, actors, etc.</p>	130,000 t CO2 will contribute to offsetting residual emissions in 2030. This will be available from the production of biogas and PtX in the period 2007-2030	<p>Lower cost of energy (compared to no-action)</p> <p>Maintaining economics in the local Sønderborg community loop instead of importing fossil fuels.</p> <p>Improved quality of life</p> <p>Green job creation</p>
	Finance and funding	Local, national and international financing	More focused financial portfolio including local, national, international donors		Attracting private capital



	Social innovation				
	Democracy and participation	Various society groups involved in planning of CO2 neutrality	More groups from the society involved in the execution of the CO2 neutral vision  High acceptance rate of tech.solutions in Sønderborg		Enhanced participatory culture
	Governance innovation				
	Learning, capacity and capability building				
<b>Mobility &amp; transport</b>	Technological innovation and infrastructure	Key actors are identified, business models and investments for solutions are developed	New critical infrastructure being implemented  Noticeable change of vehicle fleet towards use of EVs, PHEVs and other alternative fuels	66,922 t CO2 expected to be reduced 2007-2030  31,436 t CO2 expected to be reduced 2022-2030.	Improved quality of life  Green job creation  New competencies and innovations
	Finance and funding	Financing of infrastructure  Identifying barriers for financing	Increased financial support through national and international policies		Forming new policies with cross pressure support from EU
	Social innovation	Co-creation and co-production have been initiated with both business players (NaboGo) and local NGOs (Mobilitetsforeningen). More mobility innovations are expected to happen.	Strong sense of ownership of solutions' successful implementation within stakeholders, citizens		High rate of social inclusion, sense of community, job creation



	Democracy and participation	Co-creation of solutions and coalition of actors / stakeholders	Ensuring solutions are carried out despite of the political scene in the future  Very strong citizen engagement and participation		Increase common knowledge and competences  Enhanced participatory culture
	Governance innovation				
	Learning, capacity and capability building	Identification of need for capacity building  Learning from other cities is set up including cooperation and sharing learnings	Knowledge sharing for both learning and disseminating purposes		Learning bridge the gap between the actions, ambitions and alignment of the goals
<b>Waste &amp; circular economy</b>	Technological innovation and infrastructure	Key actors are identified, business models and investments for solutions are developed.	New sewage treatment plant implemented.	6,534 t CO <sub>2</sub> -e expected to be reduced 2007-2030	Increased biodiversity and marine environment in some of the fjords.  Green job creation
	Finance and funding	Local financing. Possibilities of national and international financing is explored.	Local financing. Possibilities of national and international financing is explored. Attracting private capital in regards to waste water treatment inventions.	3,252 t CO <sub>2</sub> expected to be reduced 2022-2030.  Further reducing Methane Emission on landfill. Reducing CO <sub>2</sub> e emissions. Nitrous Oxide emissions from sewage water reduced.	Households finance the recycling and circular economy and reduction of Nitrous Oxide from wastewater due to local regulations. Waste and the circular economy for companies is market driven.
	Social innovation	Strong stakeholder engagement in planning and beginning of implementation. Second hand use and reuse of waste is immature and a big playground for new	Stakeholders are already strongly committed to achieving goals of actions that are ran by them with support from the		Social inclusion, improved wellbeing



		innovations – at all society levels.	municipality and ProjectZero		
	Democracy and participation	Stakeholders are involved in creating solutions based on new national and local legislation and regulations.	Collaboration between utility companies and private companies develops new methods.		Stakeholders are involved when local legislation is changing.
	Governance innovation	City administration / staff are adapting to newly proposed structures and processes	City administration / departments embedded within local stakeholder implementation		Highly adaptive governance based on strong local stakeholder cooperation
	Learning, capacity and capability building	The utility company and municipal department learn from peers and experts.  Suppliers of technical equipment and solutions learn by cocreating with utility companies.	Knowledge sharing for both learning and developing more and better methods.		Business development and development of utility companies and municipalities.
<b>Built environment</b>	Technological innovation and infrastructure	New technological advancements are identified for retrofit components and solutions	Implementation of solutions has picked up the pace	522,197 t CO2 expected to be reduced 2007-2030  206,185 t CO2 expected to be reduced 2022-2030.	Higher rate of energy efficiency in buildings is achieved  Green job creation
	Finance and funding	Financial support on national and international level is identified	Stronger financial support on national / international level. Special supporting programs for vulnerable citizens living in rural areas.		Larger part of the built environment is refurbished and less personal investments are needed. An energy efficient home has become the new normal when buying a house.
	Social innovation	All groups of society are included in the transition. The housing associations are lead	More social groups are actively participating in		Better quality of life, better air quality



		partners in this innovation.	the transition of the built environment	
	Democracy and participation	More stakeholders, social groups, and others are included in the transition with a clearer roles. The housing associations are lead partners in this innovation.	Strong democratic empowerment leads to strong sense of ownership within the implementation phase. Special attention is given to support vulnerable citizens living in rural areas.	New generations grow up with a highly democratic and participatory mindset leading to better impact in the future
	Governance innovation	New framework conditions are identified, and goals adjusted	Collaborating with civil society, private sector actors to co-design and co deliver public services leads to maximization of public value and social impacts.	Visionary long term leadership
	Learning, capacity and capability building	Learning helps with adjusting expectations, clearly identifying roles and where impact can be seen and who can contribute to it and benefit from it	Knowledge sharing for both learning and developing more and better methods.	Methods integrated in citizens way of thinking

**B-1.2: Description of impact pathways– textual and visual elements**

The impact pathways listed above have been selected from the Theory of Change Chapters 2 and 3 and are applied to the Sønderborg climate transition. More context is provided below along with a visualisation (Figure 11) of the impact towards 2030. The starting point of the visualisation follows the Masterplan2029 which is the year 2020 as this is when more detailed oriented goals have been created and split in 15 intervention areas. However, some context on how the baseline will be developed towards 2030 by sectors is also provided below.

**Mobility & transport**

The mobility and transport sector are considered the hardest to be decarbonised. The framework conditions both on national and international level as well as financing support are falling behind and are not as ambitious as they look forward to 2050 and not 2030. This leaves a gap of residual emissions in 2030 that need to be addressed towards 2050. These residual



emissions are being offset with the local production and export of biogas and PtX planned in Sønderborg.

The Masterplan2029 provides the groundwork for this sector in the form of various interventions which will help decarbonise the sector. According to the Masterplan2029 passenger transport's emissions will decrease with 19% by 2030, goods and heavy transport with 25% and agricultural machinery with 22%. On Figure 11 a gradual decrease in emissions is seen within these hotspots.

Overall, since 2007, the transport emissions incl. agricultural machinery will be decreased with 39%.

#### Additional direct impacts (according to ToC)

- Reduced GHG emissions
- Increased modal shift to public transit, walking, cycling
- Rethinking mobility as a service (NaboGo, public transportation, Landsbybussen, carsharing etc)
- Decreased modal share of private vehicles
- Increased uptake of low-carbon technology vehicles for private, freight, public transport (EVs, e-bikes, hydrogen-fuelled etc.)

#### Additional indirect impacts (according to ToC)

- Enhanced citizen & communities' participation & social capacities for participation/engagement

### **Waste & circular economy**

The decarbonisation of the Sønderborg waste sector is part of the DK2020 plan, the municipal Waste plan and the national plans and legislation. On Figure 11 a gradual decrease in emissions is seen since 2020 which will amount to 24%, however, since 2007 the waste sector has been decreased 37% by 2030. Circular economy is implied in all segments of the Masterplan2029 and DK2020 and each intervention is looked at through the circularity prism and applied accordingly.

#### Additional direct impacts (ToC)

- Reduced GHG emissions

#### Additional indirect impacts (ToC)

- Enhanced citizen & communities' participation & social capacities for participation/engagement
- Improved waste management and efficiency
- Decreased food waste
- Decreasing waste by reuse and reduce
- Increased economic thriving (quality of jobs, sustainable supply chains etc.)
- Increased economic returns of natural capital





### **Green infrastructure & nature-based solutions**

The production of biogas and PtX in Sønderborg is a crucial element which will contribute to the CO<sub>2</sub> neutrality towards 2030. As seen in Figure 11, biogas production started in Q4/2020 and slowly is increasing its production. In 2020 the biogas plant named Glansager started operation and by the end of 2022 a new biogas plant, named Kværs, started operation. The increase in production is seen in the figure. Furthermore, it is expected that PtX plant will be in operation in 2027 which will increase the possibility to offset the residual emissions from 2030, especially the ones from transport.

#### Additional direct impacts (ToC)

- Increased access to clean, stable, affordable energy

#### Additional indirect impacts (ToC)

- Increased technological readiness & rate of adoption

### **Built environment**

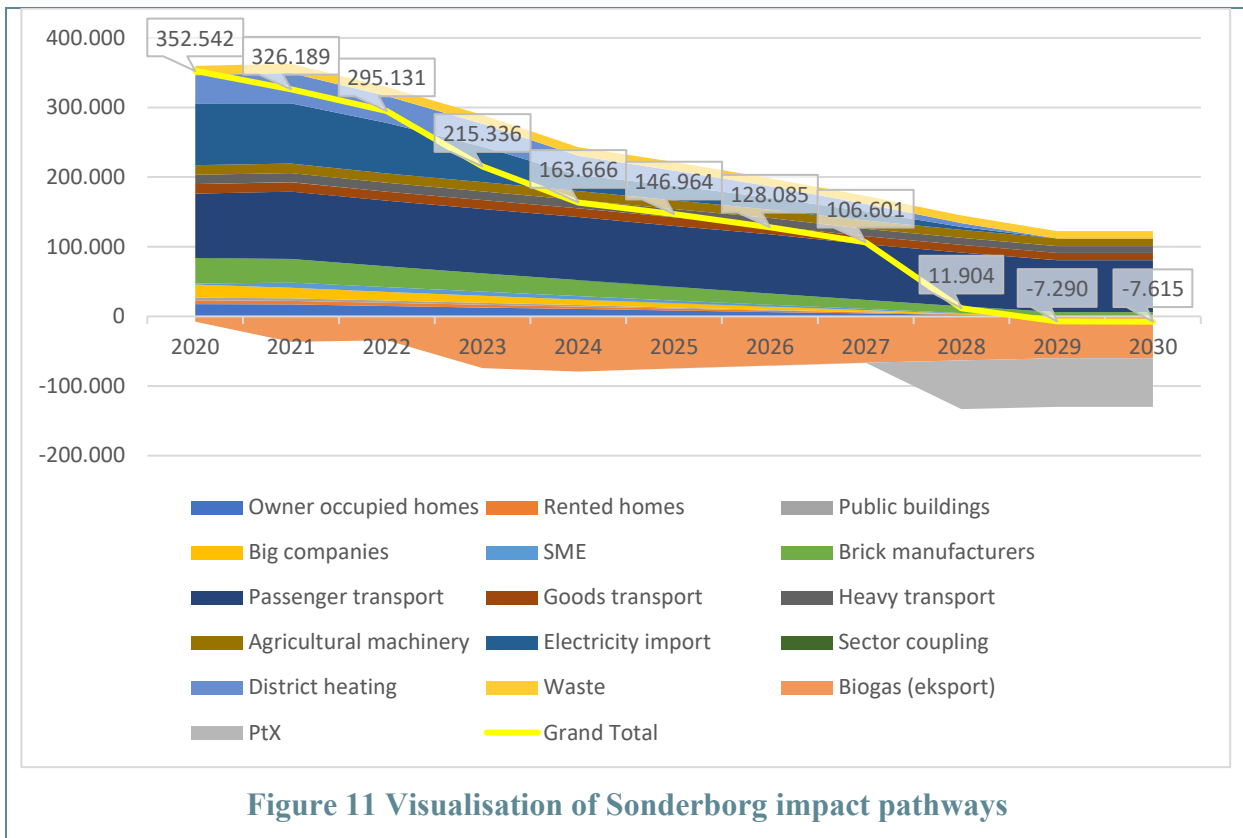
All emissions coming from buildings shall be eliminated by 2030. Individual heating based on fossil fuels such as natural gas and oil boilers will be replaced with heat pumps and district heating. In return the electricity in Denmark is expected to be 100% green by 2030 and the district heating in Sønderborg too. Therefore, there will be no emissions coming from heating or electricity consumption. This is well seen in Figure 11 below. The only residual emissions that are attributed to this segment (as per Masterplan2029, Brick manufacturers hotspot) are the emissions coming from coal for the production of bricks. It is currently not possible to foresee how the national/international framework conditions and/or possible technologies that could be applied will develop by 2030. However, the Masterplan2029 will be re-evaluated each year and the most current policies, techniques and technologies will be applied, hence, the residual emissions might be addressed before 2030.

#### Additional direct impacts (ToC)

- Reduced GHG emissions
- Increased energy efficiency or rate of retrofit (including district heating)
- Reduced energy demand, needs, or consumption
- Increased access to clean, stable, affordable energy

#### Additional indirect impacts (ToC)

- Enhanced liveability attractiveness/ aesthetics (align with New EU Bauhaus Goals)
- Equitable & affordable access to housing
- Enhanced citizen & communities' participation & social capacities for participation/engagement



## 4.2 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
Mobility & transport	Conversion to EVs, PHEVs and use of biofuels	Reduction in kilometres driven in passenger hotspot and conversion to EV/PHEV, reduction in km driven in the goods transport and implementing EV/PHEVs, Electrification of heavy transport, Biofuels in heavy transport and electrification in agricultural machinery
Waste & circular economy	Increase the reuse of materials and goods. Increase the recycling of plastic.	Inspire companies to increase use of recycled materials such as building materials. Increase the citizens awareness of using goods and prolong life span of things through repairs and reuse. Increased citizens awareness of recycling their waste, especially plastics and food waste.
Green infrastructure & nature-based solutions	Construction of biogas plants, PtX plant, Coastal wind turbines, new wastewater treatment plant	2x biogas plants i.e. Glansager and Kværs managed by Nature Energy, PtX plant managed by European Energy, Implementation of coastal wind park, “Lillebælt Syd” managed by Sønderborg Forsyning (utility company) and



		European Energy, Waste water treatment plant managed by Sønderborg Forsyning. Additional onshore and PV-parks in rural areas.
Built environment	Abolishing natural gas and oil boilers in buildings and natural gas in production. Energy efficiency in buildings and production	All individual heating must be replaced by district heating operated by 100% green DH network or by heat pumps on 100% green electricity outside district heating areas. Production processes electrified and on 100% green electricity. Industry processes with high temperatures converted from natural gas to biogas

The following table B-2.2 outlines the individual actions that will be undertaken to achieve the 2030 CCC Climate neutrality starting 2022 as these are the actions that need to be implemented following the latest monitored year (2021). Their respective CO<sub>2</sub> emission impact is also outlined, and the CAPEX cost is outlined in the CCC 2030 Investment Plan document.

Most actions are driven by value propositions, technology and business models; but require stakeholder engagement and strong citizen acceptance, support and participation to be successfully implemented.

<b>B-2.2: Individual action outlines</b>		
Action outline	Action name	<b>Conversion to EVs and PHEVs</b>
	Action type	Technical, social and systemic intervention
	Action description	Conversion of petrol and diesel-based vehicles to electric or plug in hybrid vehicles. The consolidated action also includes biking and public transport (busses and flextrafic). Opportunities for smart mobility measures are being investigated, especially for people living in rural and semi-rural areas (by the ‘Mobiliteitsforeningen’)
Reference to impact pathway	Field of action	Passenger transport
	Systemic lever	#1, #2, #3, #4, #6
	Outcome (according to module B-1.1)	The necessary infrastructure has been implemented to mitigate the increase in number of EVs and PHEVs (34% required according to the Masterplan2029). There will be a strong sense of ownership and knowledge sharing between EV/PHEV owners and new potential EV/PHEV owners.
Implementation	Responsible bodies/person for implementation	Sønderborg municipality, ProjectZero
	Action scale & addressed entities	Municipal boundary
	Involved stakeholders	The financial institutions The diesel and petrol car owners (to be convinced) The electric car owners (to be ambassadors) The car dealers (to influence decisions) The electric car alliance The companies (to motivate employees and participate) South traffic (busses) Parts/city car companies Citizen groups, “Mobiliteitsforeningen” and rural area communities



	Comments on implementation	ProjectZero is responsible for overseeing how the different activities are ran by the hotspot owners aka “responsible bodies/person for implementation”.
Impact & cost	Generated renewable energy (if applicable)	n/a
	Removed/substituted energy, volume or fuel type	Since the goal includes a future increase of consumption due to more vehicles and general growth of the sector, the reductions will not be enough to be able to see a decline in consumption. Instead the result will be balanced out by the growth of the sector and the planned reductions.
	GHG emissions reduction estimate (total) per emission source sector	22.4 kt CO2
	Total costs (CAPEX) and costs by CO2e unit	Please see CCC Investment Plan for more information.
Action outline	Action name	<b>Conversion of heavy and goods transport</b>
	Action type	Technical, and systemic intervention
	Action description	Conversion of diesel vehicles in goods and heavy transport to electric vehicles and agricultural machinery
Reference to impact pathway	Field of action	Heavy and goods transport and agricultural machinery
	Systemic lever	#1, #2
	Outcome (according to module B-1.1)	Conversion of diesel vans and trucks to electric ones or ones that use biofuels requires financial incentives through national and international policies and/or subsidies. The infrastructure (charging stations or hydrogen gas stations) is critical.
Implementation	Responsible bodies/person for implementation	ProjectZero
	Action scale & addressed entities	Municipal boundary
	Involved stakeholders	Industry organisation for the Danish Road Freight; two companies with experience in trade, transport and the environment - a biogas producer; and a truck manufacturer.
	Comments on implementation	ProjectZero is responsible for overseeing how the different activities are ran by the hotspot owners aka “responsible bodies/person for implementation”.
Impact & cost	Generated renewable energy (if applicable)	n/a
	Removed/substituted energy, volume or fuel type	Expected reduction of 17GWh
	GHG emissions reduction estimate (total) per emission source sector	9,000 t CO2
	Total costs (CAPEX) and costs by CO2e unit	Please see CCC Investment Plan for more information.
Action outline	Action name	<b>Waste and circular economy:</b> Increase the reuse of materials and goods.



		<b>Increase the recycling of plastic.</b>
	Action type	Technical, social and systemic intervention
	Action description	Increasing reducing of waste and recycling
Reference to impact pathway	Field of action	Waste
	Systemic lever	#1, #2, #3, #4, #6
	Outcome (according to module B-1.1)	Increased focus on reuse of materials in order to decarbonize the waste treatment process and the end product.
Implementation	Responsible bodies/person for implementation	Municipality, Sønderborg Forsyning
	Action scale & addressed entities	Municipal boundary
	Involved stakeholders	Utility companies, private waste management companies, citizens, businesses, private companies.
	Comments on implementation	some of the necessary action all market driven and are not subject to regulation or legislation.
Impact & cost	Generated renewable energy (if applicable)	n/a
	Removed/substituted energy, volume or fuel type	n/a
	GHG emissions reduction estimate (total) per emission source sector	3,300 t CO <sub>2</sub> e  Surprising low carbon-impact considering the investments associated.
	Total costs (CAPEX) and costs by CO <sub>2</sub> e unit	Please see CCC Investment Plan for more information.
Action outline	Action name	<b>Construction of biogas plants</b>
	Action type	Technical and systemic intervention
	Action description	The biogas plant Glansager started in operation in September 2020 and the biogas plant Kværs started operation in 2022. Both will contribute to produce biogas for industry, export and systemic upgrade to Power-to-X energy fuels – based on side products.
Reference to impact pathway	Field of action	Production of green energy, Enablers
	Systemic lever	#1, #2, #4
	Outcome (according to module B-1.1)	The biogas plants will contribute to Sønderborg's green energy production, help offset residual emissions and bring awareness among citizens and local stakeholders on the benefits of producing biogas in the area. Biogenic carbon from the biogas production will feed the PtX production plant.
Implementation	Responsible bodies/person for implementation	Nature Energy
	Action scale & addressed entities	Municipal boundary
	Involved stakeholders	The municipality, ProjectZero
	Comments on implementation	Nature Energy is the responsible organisation for the implementation and operation of the plants.
Impact & cost	Generated renewable energy (if applicable)	459 GWh yearly
	Removed/substituted energy, volume or fuel type	n/a



	GHG emissions reduction estimate (total) per emission source sector	60,000 t CO <sub>2</sub> (2020-2030)
	Total costs (CAPEX) and costs by CO <sub>2</sub> e unit	Please see CCC Investment Plan for more information.
Action outline	Action name	<b>PtX</b>
	Action type	Technical and systemic intervention
	Action description	Construction of a PtX plant
Reference to impact pathway	Field of action	Production of green energy, Enablers
	Systemic lever	#1, #2, #4,
	Outcome (according to module B-1.1)	The PtX plant will contribute to Sønderborg's green energy production, help offset residual emissions, feed the district heating and bring awareness among citizens and local stakeholders on the benefits of producing PtX in the area. Power-to-X production will be based on renewable energy from the Lillebælt Syd coastal near windturbine project and biogenic carbon (side product) from the local biogas production.
Implementation	Responsible bodies/person for implementation	European Energy and partners
	Action scale & addressed entities	Municipal boundary
	Involved stakeholders	ProjectZero, the municipality, Sønderborg Forsyning, Danfoss
	Comments on implementation	European energy is responsible for implementing the project and running the plant afterwards.
Impact & cost	Generated renewable energy (if applicable)	50,000 ton e-metanol (potentially 100,000 ton)
	Removed/substituted energy, volume or fuel type	n/a
	GHG emissions reduction estimate (total) per emission source sector	70,000 t CO <sub>2</sub> (potentially up to 140,000 t)
	Total costs (CAPEX) and costs by CO <sub>2</sub> e unit	Please see CCC Investment Plan for more information.
Action outline	Action name	<b>Nearshore Coastal wind park (Lillebælt Syd)</b>
	Action type	Technical and systemic intervention
	Action description	Construction of the "Lillebælt syd" coastal wind park
Reference to impact pathway	Field of action	Production of green electricity, Enablers
	Systemic lever	#1, #2, #4
	Outcome (according to module B-1.1)	"Lillebælt syd" will contribute to Sønderborg's green energy production and provide renewable electricity for the PtX-production and bring awareness among citizens and local stakeholders on the benefits of wind-power. OBS : Additional renewable electricity is scheduled to be produced on-shore based on either PV-parks or wind-turbines. 14 areas are pre-identified in the municipal strategiproces – to be filtered/agreed with support from citizens and local stakeholders.
Implementation	Responsible bodies/person for implementation	Sønderborg Forsyning and European Energy (public-private partnership)



	Action scale & addressed entities	Municipal boundary
	Involved stakeholders	The municipality, ProjectZero
	Comments on implementation	European Energy and Sønderborg Forsyning are responsible for the implementation of the project.
Impact & cost	Generated renewable energy (if applicable)	160MW capacity
	Removed/substituted energy, volume or fuel type	560 GWh electricity (estimated)
	GHG emissions reduction estimate (total) per emission source sector	80% of produced electricity goes to production of PtX. 20% goes to grid. However, electricity in Denmark is planned to be fully renewable by 2030 therefore there will be no additional GHG emissions reduction.
	Total costs (CAPEX) and costs by CO <sub>2</sub> e unit	Please see CCC Investment Plan for more information.
Action outline	Action name	<b>Wastewater treatment plant</b>
	Action type	Technical and systemic intervention
	Action description	Construction of a new wastewater treatment plant
Reference to impact pathway	Field of action	Production of green energy and wastewater treatment, Enablers
	Systemic lever	#1, #2, #4, #5
	Outcome (according to module B-1.1)	New sewage treatment plant will reduce both CO <sub>2</sub> but has indirect effects and will also reduce methane and nitrous oxide. The treatment plant will pave the way for developing new methods in collaboration between utility companies and private companies. The plant will not only treat wastewater but will generate energy from sludge and the utilization of the wastewater temperature. Furthermore, the sector integration synergies with the PtX plant are to be explored further.
Implementation	Responsible bodies/person for implementation	Sønderborg Forsyning
	Action scale & addressed entities	Municipal boundary
	Involved stakeholders	The municipality, Sønderborg Varme, ProjectZero, Danfoss
	Comments on implementation	Sønderborg Forsyning is responsible for the implementation of the project.
Impact & cost	Generated renewable energy (if applicable)	n/a
	Removed/substituted energy, volume or fuel type	n/a
	GHG emissions reduction estimate (total) per emission source sector	Energy generated from the wastewater treatment plant will go in to the district heating grid which is expected to be carbon neutral by 2029. Therefore no additional GHG emission reductions from this action.
	Total costs (CAPEX) and costs by CO <sub>2</sub> e unit	Please see Investment Plan for more information.
Action outline	Action name	<b>Abolishing natural gas and oil boilers in buildings, natural gas in industry, and energy production. Energy efficiency in buildings, industry, and energy production.</b>
	Action type	Technical and social intervention



	Action description	All individual natural gas and oil boilers in all types of buildings shall be abolished. In addition to this production processes shall be electrified and the use of natural gas shall be replaced by use of biogas in high temperature production processes. This action includes the conversion to 100% green DH grid and electricity grid.
Reference to impact pathway	Field of action	Owner occupied homes, rented homes, SMEs, public buildings, brick manufacturers and big companies' buildings and production
	Systemic lever	#1, #2, #3, #4, #5, #6
	Outcome (according to module B-1.1)	All natural gas boilers will be replaced either by district heating or heat pumps  Strong financial support nationally and internationally combined with collaboration across private sectors and civil society has increased the pace of implementation of district heating and heat pumps. All natural gas boilers can therefore be abolished.
Implementation	Responsible bodies/person for implementation	The hotspot owners of each of the "field of action"
	Action scale & addressed entities	Municipal boundary
	Involved stakeholders	Housing associations, private landlords, banks & financial institutes, SMEs, the municipality, ProjectZero
	Comments on implementation	The impact mentioned below includes also natural gas abolishment as a whole also from the industry
Impact & cost	Generated renewable energy (if applicable)	n/a
	Removed/substituted energy, volume or fuel type	363 GWh
	GHG emissions reduction estimate (total) per emission source sector	206,200 t CO <sub>2</sub>
	Total costs (CAPEX) and costs by CO <sub>2</sub> e unit	Please see CCC Investment Plan for more CAPEX investment information.

### B-2.3: Summary strategy for residual emissions

As shown in table A-2.4, in 2030 there will be approx. 122,000 t CO<sub>2</sub> left as residual emissions. These are envisioned to be offset with the unutilised production and export of biogas and PtX which amounts to approx. 60,000 t CO<sub>2</sub> from biogas and 70,000 t CO<sub>2</sub> from PtX in 2030. This would result in a negative emission result for Sønderborg estimated to 7,600 t CO<sub>2</sub>.

However, as explained previously, this result is based on current interventions which were first analysed, planned to include a deep stakeholder engagement. Interventions are now "owned" by the Hotspot-group stakeholders, thus making them responsible for the successful implementation.

They are supported by the ProjectZero secretariat staff, the municipality and other stakeholders.





The current estimated result is also based on the existing framework conditions which may affect positively the result by 2030 as they will change and evolve with the years following more strictly the Paris agreement and having more ambitious goals toward CO2 neutrality. However, the ProjectZero current PMO and Plan, Do, Check, Act approach will secure that KPI-deviations are addressed timely and efficient.

### 4.3 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, specified in the Comprehensive Indicator Sets (B-3.2).

<b>B-3.1: Impact Pathways</b>						
Outcomes/ impacts addressed	Action/ project	Indicator No. (unique identified)	Indicator name	Target values in t CO2		
				2025	2027	2030
(list early changes/ late outcomes and impacts to be evaluated by indicator)	(list action/ pilot project if applicable)	(indicate unique identifier)  Hotspot #	(Insert indicator name)	(list one value per indicator)	(list one value per indicator)	(list one value per indicator)
Energy renovations, abolishment of oil and natural gas boilers	Homeowners' buildings	1	Homeowners' buildings	8,557	4,279	0
Energy renovations, abolishment of oil and natural gas boilers	Rental buildings	2	Rental buildings	2,693	1,347	0
Energy renovations, abolishment of oil and natural gas boilers	Public Buildings	3	Public Buildings	1,585	673	0
Abolishment of natural gas, product design improvement	Big companies	4	Big companies	6,125	2,650	0
Abolishment of natural gas,	Brick manufacturers	5	Brick manufacturers	19,454	12,709	6,200



product design improvement						
Energy renovations, abolishment of oil and natural gas boilers	SMEs	6	SMEs	3,879	1,940	0
Reduced km driven, improving of energy efficiency in vehicles, conversion to EV and PHEVs	Passenger transport	7	Passenger transport	85,755	80,155	74,543
Reduced km driven, improving of energy efficiency in vehicles, conversion to EVs, biofuels	Transport of goods and heavy transport	8	Transport of goods and heavy transport	24,012	22,336	20,240
Improving of energy efficiency in tractors, conversion to e-machinery and use of alternative fuels	Agricultural machinery	9	Agricultural machinery	12,585	11,764	10,943
100% green district heating	District heating	10	District heating	21,879	10,939	0
Production of biogas	Biogas	11	Biogas	-74,721	-66,621	-59,994
Production of PtX	PtX	12	PtX	Not yet established	Not yet established	-70,000
Recycling, reducing of waste	Waste	13	Waste	11,873	11,305	10,453

For each one of the indicators above an extensive monitoring and evaluation has been already implemented and put in place as a part of Masterplan2029 and DK2020. The calculation, monitoring and evaluation of the Masterplan2029 is done by ProjectZero in a specifically created for the purpose tool called “Masterplan tool”. The monitoring-results are pre-reviewed every quarter (as part of the ProjectZero Project Management Office) and reviewed/reported one a year. The waste segment is monitored by the municipality as a part of the DK2020 plan.



<b>B-3.2: Indicator Metadata</b>	
(for each indicator selected – take from Comprehensive Indicator Sets)	
Indicator Name	<b>Homeowners' buildings</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1  Built environment
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	Chimney sweepers, natural gas distribution company, BBR national system
Expected availability	Available
Suggested collection interval	On a yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
Indicator Name	<b>Rental buildings</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1



	Built environment
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	Chimney sweepers, natural gas distribution company, BBR national system
Expected availability	Available
Suggested collection interval	Yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
<b>Indicator Name</b>	<b>Public buildings</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1  Built environment
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	Chimney sweepers, natural gas distribution company, BBR national system
Expected availability	Available
Suggested collection interval	On an yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
<b>Indicator Name</b>	<b>Big companies</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	



Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1  Built environment
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	Natural gas distribution company, data taken directly from the companies
Expected availability	Available
Suggested collection interval	On a yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
<b>Indicator Name</b>	<b>Brick manufacturers</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1  Built environment
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	Natural gas distribution company, data taken directly from the companies
Expected availability	Available



Suggested collection interval	On a yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
<b>Indicator Name</b>	<b>SMEs</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1  Built environment
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	Natural gas distribution company
Expected availability	Available
Suggested collection interval	On a yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
<b>Indicator Name</b>	<b>Passenger transport</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1  Mobility and transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	National inventories
Expected availability	Available
Suggested collection interval	On a yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
<b>Indicator Name</b>	<b>Transport of goods and Heavy transport</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1  Mobility and transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	National inventories
Expected availability	Available
Suggested collection interval	On a yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
<b>Indicator Name</b>	<b>Agricultural machinery</b>



Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1  Mobility and transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	National inventories
Expected availability	Available
Suggested collection interval	On a yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
<b>Indicator Name</b>	<b>District heating</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  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?	Impact Pathways according to - according to Module B-1  Green infrastructure & nature based solutions
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	





Expected data source	Local data directly from district heating companies
Expected availability	Available
Suggested collection interval	On a yearly basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
Indicator Name	<b>Biogas production</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  N/A
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?	Impact Pathways according to - according to Module B-1  Green infrastructure & nature based solutions
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	Nature Energy
Expected availability	Available
Suggested collection interval	On a yearly basis but possible on more frequent basis
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
Indicator Name	<b>PtX</b>
Indicator Unit	Tonnes of CO2
Definition	Hotspot as a part of Masterplan2029
Calculation	Masterplan tool
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  N/A



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?	Impact Pathways according to - according to Module B-1  Green infrastructure & nature based solutions
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
<b>Data requirements</b>	
Expected data source	European Energy
Expected availability	Not available as not yet established
Suggested collection interval	On a yearly basis – assumed
<b>References</b>	
Deliverables describing the indicator	Monitoring reports, Quarterly meetings with the hotspot stakeholders
Other indicator systems using this indicator	This indicator is used as a part of the whole energy system monitoring and evaluation and is just one among many measured indicators.
<b>Indicator Name</b>	<b>Waste</b>
Indicator Unit	Tonnes of waste
Definition	Part of the DK2020 plan / Municipal waste plan
Calculation	Waste system
<b>Indicator Context</b>	
Does the indicator measure direct impacts (i.e. reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it impact?	Fields of action according to GHG inventory format – Module A-1  Waste
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
<b>Data requirements</b>	
Expected data source	
Expected availability	Monthly / yearly
Suggested collection interval	Yearly
<b>References</b>	
Deliverables describing the indicator	Waste plan
Other indicator systems using this indicator	



## 5. 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).

Part C seems (from a Sønderborg perspective) to be created to be filled in mainly by the city administration dealing with the green transition and implementation of the CCC 2030 Climate Neutrality Plan. However, this section does not fit Sønderborg’s CCC execution as Sønderborg has established ProjectZero to catalyse and implement the energy system transition. However, all interventions will of course be having the municipality’s support.

Therefore, part C outlines only the Sønderborg municipal interventions enabling climate neutrality by 2030. The enabling Masterplan2029 interventions carried out by ProjectZero and the hotspot partners etc. have been outlined in the previous sections – and in detail described in the Summary and Background chapter in the beginning of this document.

### 5.1 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).

<b>C.1.1: Enabling organisational and governance interventions</b>					
<b>Intervention name</b>	<b>Description</b>	<b>Responsible entity/ dept./ person</b>	<b>Involved stakeholder</b>	<b>Enabling impact</b>	<b>Co-benefits</b>
<b>(indicate name of intervention)</b>	<b>(describe the substance of the intervention)</b>	<b>(indicate responsible)</b>	<b>(list all stakeholder involved and affected)</b>	<b>(describe how intervention enables climate neutrality)</b>	<b>(indicate how intervention helps achieve impact listed in Module B-1)</b>
Restructuring of departments	Restructuring as a part of the Masterplan2029	Municipality	Municipal administration	Enhanced productivity of the department	Transparency, Enhanced participatory culture, Political support, increased competences

<b>C-1.2: Description of organisation and governance interventions – textual and visual elements</b>
When the Masterplan2029 was established, there were several departments within Sønderborg municipality that were working on different parts of the plan. It was decided to merge these departments, so all people working on the Masterplan2029 would be brought



together in one department. This will enable them to work together more effectively, support citizens and collaborate more efficient with ProjectZero and other Masterplan2029 and hotspot stakeholders.

In addition to this, the new department is able to better communicate needs, goals and solutions to the city council members including the Mayor of Sønderborg and therefore, resulting in better outcomes and impact.

## 5.2 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).

Comprehensive social innovation is already taking place inside and across the hotspot platforms and in the rural area development. Therefore, the below table mainly addresses the inside the sector/hotspot innovations.

<b>C.2.1: Enabling social innovation interventions</b>					
<b>Intervention name</b>	<b>Description</b>	<b>Responsible entity/ dept./ person</b>	<b>Involved stakeholder</b>	<b>Enabling impact</b>	<b>Co-benefits</b>
<b>(indicate name of intervention)</b>	<b>(describe the substance of the intervention)</b>	<b>(indicate responsible)</b>	<b>(list all stakeholder involved and affected)</b>	<b>(describe how intervention enables climate neutrality)</b>	<b>(indicate how intervention helps achieve impact listed in Module B-1)</b>
City strategic plan – citizen engagement	Citizen meetings where the city plan is presented, explained and discussed	The Municipality	Citizens ProjectZero	Supporting the implementation of enablers from Masterplan2029	Social inclusion, improved wellbeing
Strategic energy plan – citizen engagement	Citizen meetings where the strategic energy plan is presented, explained and discussed and the benefits of it are communicated to the citizens	The Municipality	Citizens ProjectZero District heating companies	Supporting the implementation of enablers from Masterplan2029	Social inclusion, improved wellbeing
Heat plan – citizen engagement	Citizen meetings where the heat plan is presented, explained and discussed. It is explained how this will affect/benefit	The Municipality	Citizens District heating companies, Landsbyforum, ProjectZero	Supporting the implementation green DH and abolishment of individual use of fossil fuels for heating from Masterplan2029. EU COHEAT2	Higher rate of energy efficiency in buildings is achieved.



	the citizens and the green transition. The plan and discussions provide a platform for citizens own initiatives and local actions.			project is facilitating the discussions with knowledge, process and tools.	Better quality of life, better air quality  Engagement and participation.
Heat pump and energy envelope renovation financing	The government provides financing schemes for citizens to change their fossil based heating to heat pump and to energy retrofit their houses. The Municipality has been guiding citizens in the application, how to access the finances, what solutions to apply for, etc.	The Municipality	Citizens, ProjectZero, Landsbyforum	Supporting the owner occupied and rental homes hotspots	Bring awareness, learning  Larger part of the built environment is refurbished and less personal investments are needed.  Better quality of life, better air quality
Personel transport	The municipality will engage in establishing the public e-charging infrastructure and secure knowledge about a safe citizen journey towards e-mobility	The municipality	Citizens, Landsbyforum, Mobilitetsforeningen	Supporting the passenger transport hotspot Establishment of new public e-chargers	Provide a safe citizen transition journey  Support visiting tourists  Better air quality

### C-2.2: Description of social innovation interventions – textual and visual elements

Below is presented several examples of how the since 2009 initiated ProjectZero participatory platforms has inspired, developed and form a new Sønderborg Climate Action DNA engaging both citizens at home, at work, at sport and during leisure time.

As people and companies in Sønderborg also has a strong interest in technical solutions, it is not a surprise that several social measures also have become technical. Sønderborg's [House](#)



of Science initiative secure a strong coordination of climate, innovation and sustainability along the learning progression from Kindergarten to PhD.

### **Citizen and company engagement in energy savings and flexibility**

Since 2009 ProjectZero, the municipality and partners have co-created a number of participatory programs, making it easy to participate in climate action program and saving energy and money (value proposition) for kick-starting citizens, shops and SME companies. For more information on the programs, please study the CCC Commitments document.

The established participatory platforms are now “owned” by the associated Masterplan2029 buildings and transport sector hotspot groups and further iterated during the quarterly meetings based. Still with the ambition to kick-start the target groups citizens and companies’ climate actions based on a non-profit, but valuable and easy to join program.

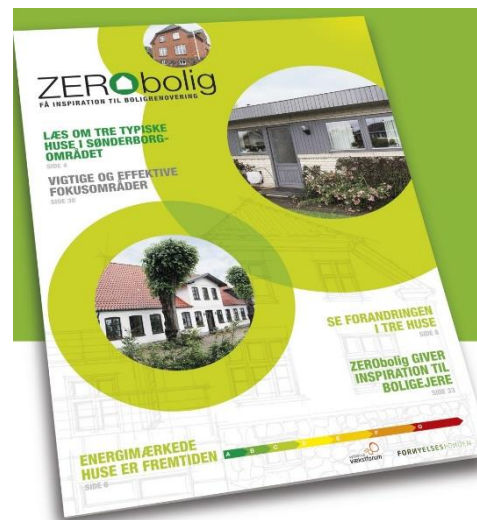
The experience is, that once the individual citizen/shop/SME get started, they normally will be able to continue the co-creation journey with own local network.

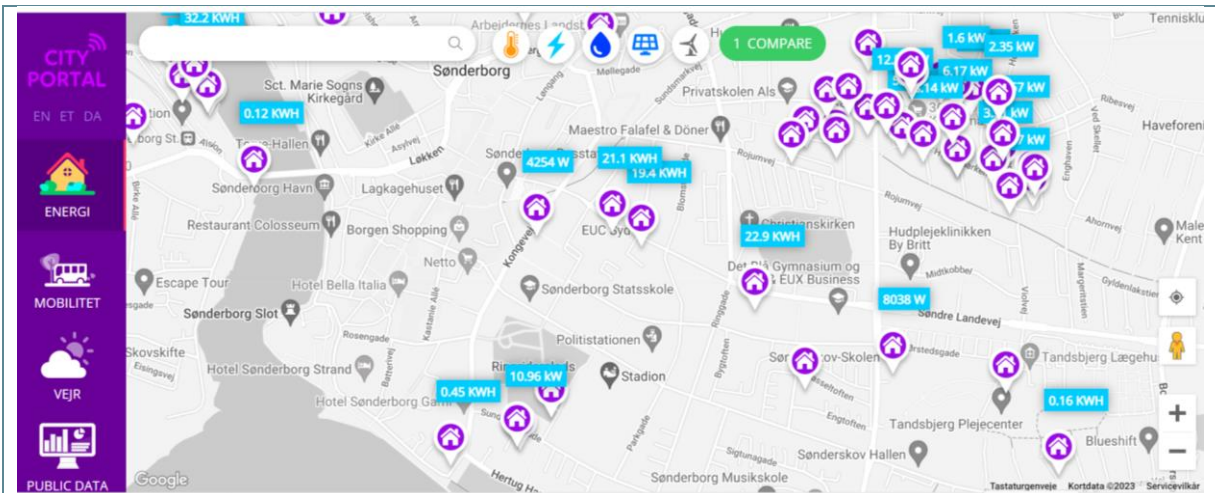
Local energy communities, as launched by the EC, seems to have a good potential for spreading especially in the rural areas. However, Denmark already has a very strong tradition for community or citizen owned energy infrastructures. E.g., most electricity/utility companies and district heating companies across Denmark is still community or citizens owned/controlled based on traditional Danish-AMBA (association) legal structures.

The next level of support to citizens is focused on the “Climate Customer Journey”, where the shared ProjectZero and education-institutions ambition is (2022-2023), to integrate sustainability and green energy solutions in the young craftsmen and consultants training (in school and University College). By this initiative, the next generation of craftsmen and consultants will carry sustainability and energy in their DNA and become ambassadors across society, as these people will be employed by local banks, construction companies, real estate agents, energy consulting companies etc. The Climate Customer Journey training program is supported financially by the Region of Southern Denmark, with the ambition to disseminate the toolbox and results across the Region and Denmark.

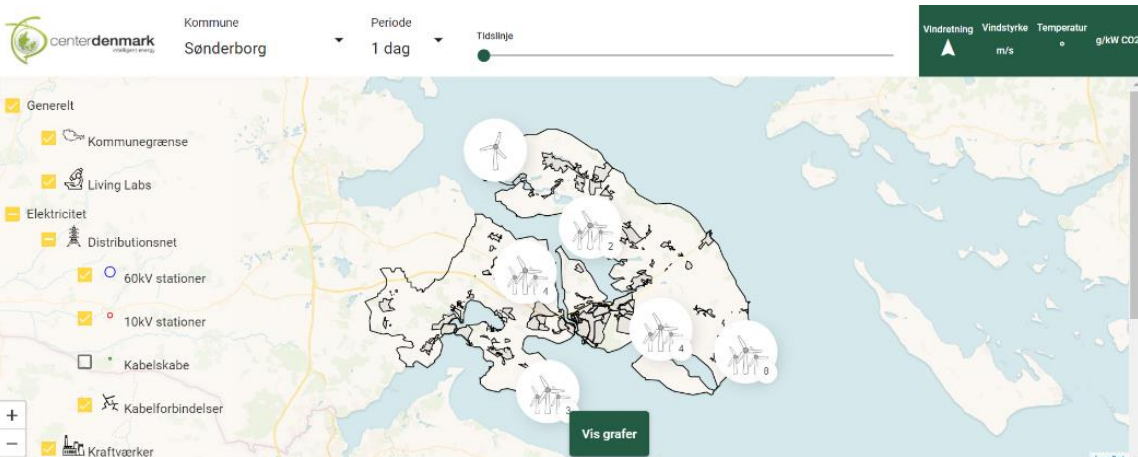
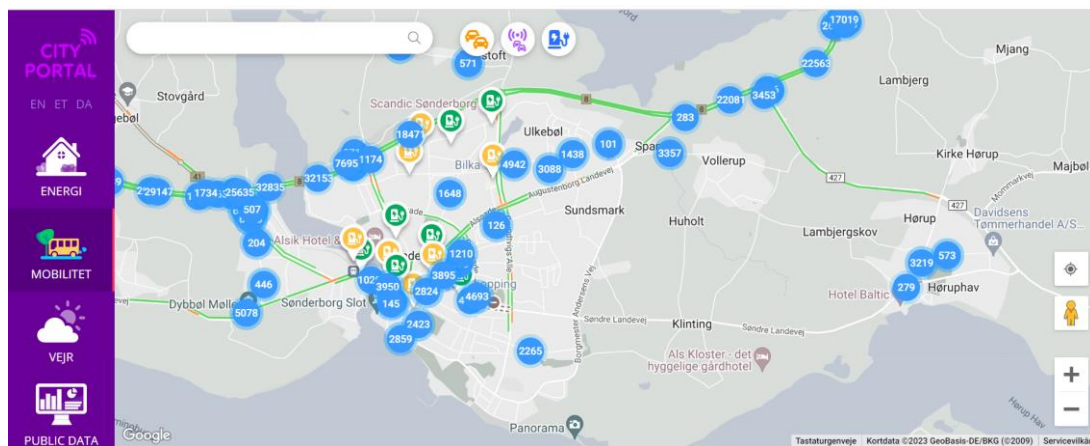
### **Smart City and -citizens development**

The EU SmartEnCity project provided in 2019 a Sønderborg opportunity to frontload building and transport data at household, neighbourhood and city level into a City Information Open Platform (CIOP). The CIOP-platform developed by Telia/Esti, was also implemented in Tartu, also a Lighthouse city in the SmartEnCity project.





For the first time in Sønderborg history, citizens (all ages) were 2019 – 2023 able in public to see and share their energy consumption and production data (most of them live). Thanks to a cooperation with the Danish Road Authority (Vejdirektoratet), ProjectZero was also able to show dynamic traffic count-figures on the main roads across Sønderborg.





The CIOP was succeeded by a [CIOP landingpage](https://klimaklogSonderborg.dk) (klimaklogSonderborg.dk), enabling citizens to progress their learning from interest in climate and Sønderborg’s ProjectZero to interest in exploring own energy data or Sønderborg transport data or energy production data in the nearby public school.

The CIOP-platform presented data at citizen-level, still respecting the GDPR-rules by having a citizen acceptance of the presented data. However, a learning was, that scaling up such presentations to include all citizens would be too time-consuming and therefore the CIOP-platform is in spring 2023 being migrated to the national Danish [CenterDenmark](https://centerdenmark.dk) (CDK) Energymap/data-platform, co-created by the Danish Tech Universities and approved by EU as an European Innovation Hub.



The CDK-data-solution will collect data from both the energy consumption side and the energy production/supply side. The consumption data will be aggregated and anonymized before presented, respecting the European GDPR-laws.

Since the recent energy crises (2022), a number of Danish energy APP’s for phones/tablets have successfully been introduced with an impressive impact on reduction of energy use and moving the timing of the use away from the “cooking point” (daily between 17.00 – 20.00 hours). Danish citizens have during 2022/2023 demonstrated that they can save app. 20% on electricity and heat as a response to dramatic increases in electricity and gas prices. Additionally, citizens across Denmark have shifted their use of electricity away from the “cooking point” and now start the washing- and dishwashing machines and e-car charging at night.



The energy/utility companies are welcoming this new development and support further shift of load (“market driven flexibility”) by new incentive tariffs for electricity transport/delivery. District heating companies have started examining how they potentially can introduce similar incentives for their heat services.

**Citizen engagement and sustainable rural area development**

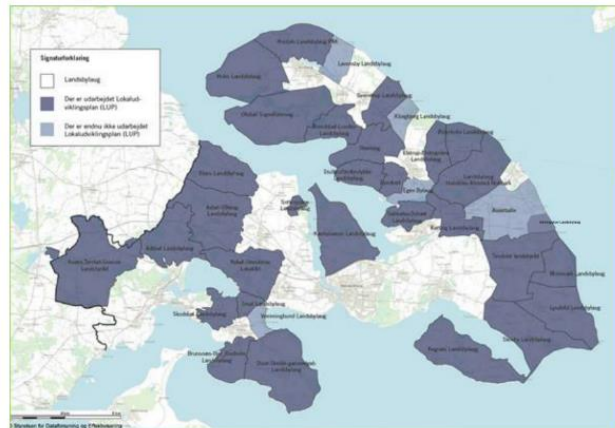
Sønderborg Municipality with its 73,500 citizens is covering a territory of 500 km<sup>2</sup>. Majority of Sønderborg citizens are living in the Sønderborg (Center) city with 30,000 citizens or in towns with 5,000 – 15,000 citizens. The remaining app. 30% of citizens are living in villages/communities (semi-rural) or rural areas. During the last 25+ years, the urbanization tendency has also challenged Sønderborg municipality (territory). To secure a balanced development between urban- and countryside, the city council since 2009 have actively supported the (re)development of Sønderborg’s rural areas, based on supporting citizens own joint initiatives and actions – and promoted local rural area committees to be established in each of the Sønderborg rural area districts. The political ambition is, that the (re)development shall be driven by the citizens, supported by the city council and the municipality.





Sønderborg's now 36 rural area committees have adopted sustainability (bæredygtighed), energy and transport as core focus areas for the rural area (re)development programs, driven by local citizens in each of the 36 districts and supported by a city council elected sustainability and rural area committee and dedicated municipal staff (2 persons).

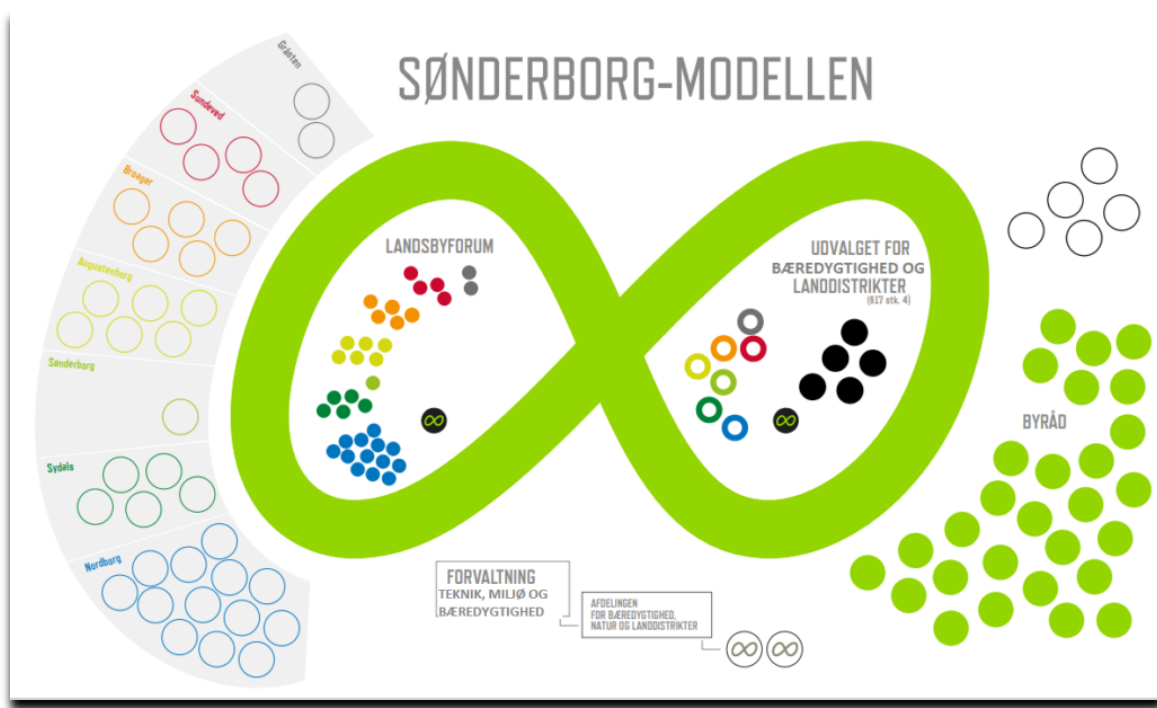
Special rural area participatory programs covered by "Landsbyforum" umbrella are addressing among others issues also sustainability, energy and mobility have been initiated to support the app. 22,000 citizens living in primary their own homes in these areas.



The map is showing not only the rural area territories of Sønderborg, but also the status for citizens co-creation of local "village" action plans. The dark color is signaling a very dynamic, active and ambitious co-creation in the rural areas.

The "Sønderborg model" for how the local citizens organize, cooperate, focus and co-create on selected subjects in close cooperation with the city council and the municipality, is known across whole Denmark as an inspiration for rural area development and citizen engagement.

See the Sønderborg model (with Danish language txt) below.





Sønderborg's new Heat plan (2022) also addresses the future heating sources outside the urban areas and how/where the current district heating networks can be extended into rural area villages, alternatively how/where smaller communities can co-create their own local heat-network.

The implementation is supported by ProjectZero's participation in the EU LIFE COHEAT2 project focused on transition of heating sources combined with energy efficiency improvement in private homes.



The rural area citizens have since the recent energy crises (2021/2022) become very active in co-creation discussions and actions, including the district heating companies, normally mainly focused on the densely populated urban areas. Citizens do not await coordinated municipal and ProjectZero actions, but impatient push and co-create new solutions, very often in close cooperation

with the district heating companies.

A Sønderborg rural area mobility committee (Mobilitetsforeningen) is currently together with the municipality and city council members, looking into how mobility (as a service) can be re-engineered across mobility measures and offer better and cheaper mobility solutions to citizens living in rural areas – and thereby potentially support how rural area families can avoid buying their second car.



During several years, the mobility committee has been pilot-testing several rural area busses (Landsbybussen), with the purpose of understanding how a number of local (small) busses can support green mobility as a service in rural areas.

The busses have so far been used for joint sports, culture and leisure tours in Denmark and abroad – and thereby supported the “we-community” mindset.

But the experience is (so far) also, that mobility is “flexibility” and very personal - not just something you share with your even good neighbors – a mindset that needs to be further addressed and challenged.

Sønderborg municipality will also in future support and facilitate of the rural area (re)development focused on sustainability, heating, transportation, energy and waste. ProjectZero will support the energy and heating initiatives.

## New energy production parks in rural area Sønderborg

The social innovation interventions are related to further engagement and transparency with the citizens. The municipality organizes open citizen events where relevant plans and strategies are presented, elaborated, and discussed.

The benefits of the new infrastructure are highlighted and also it is communicated how local citizens can become a part of the associated actions and potentially also of the ownership.

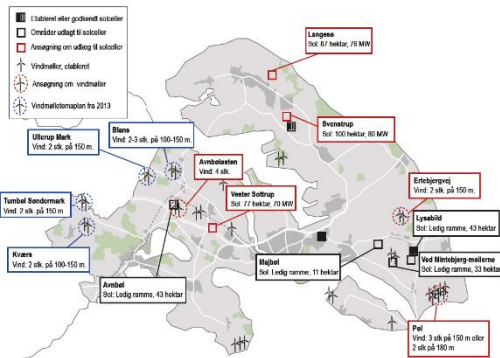


Figure 12 Sønderborg map of 14 new potential locations for wind and PV-parks

Such a citizen meeting was organized mid-March 2023 presenting and discussing the 14 designated areas where renewable energy production projects are possible located in future. More than 200 citizens participated and expressed their ideas and concerns for further discussions.

Such discussions and activities help build a stronger involvement and participation from citizens in the green energy transition. Very often the discussions imply co-creation of better and more balanced projects – a win-win-win for both local citizens, developers and society!

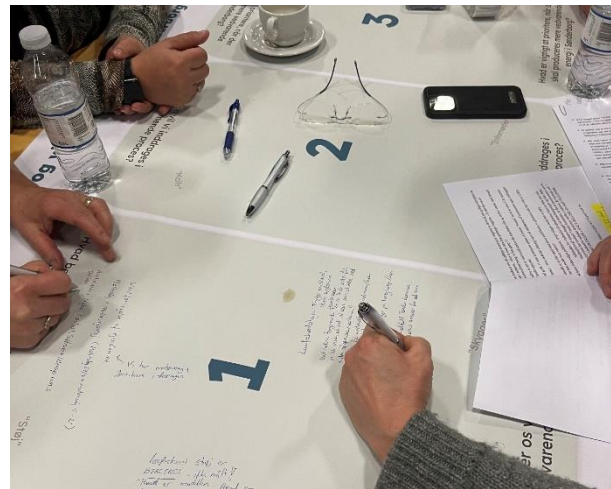


Figure 13 picture taken from Sønderborg citizen engagement discussions mid-March 2023

## Specific social climate actions addressing vulnerable citizen groups

Attention is given to vulnerable citizens aiming for a Sønderborg just transition; with the ambition of creating decent new green job opportunities and leaving no one behind.

Vulnerable citizens in Sønderborg are often living in either rural areas or facilitated in the housing associations located in Sønderborg Center, towns or semi-rural areas. The municipality has in the DK2020-project (2019/2020) analyzed the impact of climate change on vulnerable citizen groups.



ProjectZero staff has together with the 6 housing associations (2020-2022) co-created a Green Ambassador participatory program, training residents and staff in the housing associations to support other neighbor residents with energy/waste/nature social advice and support.



The Green Ambassador program has also become a part of the new EU Horizon ARV-project, but now looking into how residents can be stronger engaged in energy saving initiatives based on digital energy consumption figures available, but not addressed today.

Also, the Danish State has addressed vulnerable citizens defined (by the State) as: young families with kids, elderly people living alone in own homes or low-income families with a gas/oil-burner in their private homes. Special economic support packages (“[Varmecheck](#)”) each with a value of app. €800 have been released to these citizen groups in autumn 2022.

The Danish government also in 2022 decided to substantially lower state-taxes paid on electricity consumption for first and second quarters of 2023. The State have in Q1/2023 announced that they will continue to support the phase out of especially gas-burners in private homes, with the ambition to make 2035 a final deadline for use of natural gas in heating.

It is expected that the Danish government also in future will create new ambitious incentive packages to support the phase out of natural gas in heating and support vulnerable citizens group conditioned that the energy prices will increase to same high levels as seen during 2022.

The municipality and ProjectZero (based on communication measures, events and the COHEAT2-project execution) will also in future support the citizens acquisition of national finances for implementation of heat pumps and energy renovations, and in this way enhance the efforts towards decarbonizing the built environment.



## 5.3 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. Table C-3.1 shows the summary of the future interventions from 2022 until 2030 that will further be elaborated in the Investment plan.

As mentioned above, all estimated CAPEX cost are presented in the CCC Investment Plan document as referenced below. However, the following table from the CCC Investment Plan provides a good overview of the projected CAPEX investment cost 2022 – 2029 mirroring the associated investments by execution the CCC Action Plan.

Updated 2023.02.28	Estimated CAPEX investments 2022-2030 mio EURO	%	Main scheduled actions/solutions 2022-2030	CO2-reduction estimate 2022-2030 ton CO2	Other benefits Job-creation estimate 2022-2030 acc Full time equivalent
<b>Sector/ProjectZero-hotspot (exchange-rate DK/EUR: 7.45)</b>					
<b>Buildings (and citizens)</b>	<b>196</b>	<b>9,5%</b>			<b>1.960</b>
Rental homes	68	3,3%	shift of energy sources, EE & PV	17.114	685
Owner occupied homes	104	5,1%	shift of energy sources, EE & PV	5.387	1.044
Public buildings	23	1,1%	EE/PV	3.699	232
<b>Transport</b>	<b>545</b>	<b>26,5%</b>			<b>5.450</b>
Passenger transport (cars)	472	23,0%	e-mobility, carsharing, biking	22.413	4.724
Goods & heavy transport	47	2,3%	e-mobility	6.287	468
emobilityinfrastructures (charging)	26	1,3%	e-chargers	n/a	258
Public transport	0	0,0%	NA	n/a	0
Farming machinery	0	0,0%	NA	2.736	0
<b>Industry</b>	<b>57</b>	<b>2,8%</b>			<b>569</b>
Big enterprises	15	0,8%	EE/PV	14.724	154
Brick manufacturers	28	1,4%	EE/PV	27.450	281
SME companies	13	0,7%	EE/PV	7.758	134
<b>Energy production</b>	<b>1.077</b>	<b>52,5%</b>			<b>10.772</b>
District heating (production)	149	7,2%	Extension of networks, shift of sources	43.757	1.487
Power import & distribution (grid)	81	3,9%	Upgrading distribution power-grid	86.295	805
Biogas & metanizing	27	1,3%	PtX and upgrades	23.256	268
PtX production	228	11,1%	New PtX-plant	70.000	2.282
Nearshore windturbine & PV-parks	593	28,9%	Windturbines and PV-parks	0	5.929
<b>Waste (methane &amp; nitrous oxide)</b>	<b>179</b>	<b>8,7%</b>			<b>1.785</b>
Waste handling	4	0,2%	Industry fragment sorting	n/a	40
Wastewater treatment	174	8,5%	New centralized sewage treatment plan	3.252	1.745
<b>TOTAL</b>	<b>2.054</b>	<b>100,0%</b>		<b>334.128</b>	<b>20.537</b>
			<b>Avg. estimated # of LOCAL full time equivalents (FTE)</b>		<b>505</b>

Figure 14 - Sønderborg 2022-2030 sectorial/hotspot CAPEX-costing, CO2-reductions, and job-creation (from the CCC Investment Plan document)

The CAPEX investment cost (per hotspot) has been estimated in close cooperation with the hotspot owners and external consultants. The conclusion (from the CCC Investment Plan document) is that majority of CAPEX investments is in front of the project execution, even that a 55% CO2-reduction by 2021 already has been achieved. As the table shows, majority of CAPEX is requested for the “energy” transition, including establishing the nearshore windturbine park, the PtX production plants and the new wastewater treatment plant.



<b>C-3.1: Summary of interventions with cost implication (to be unpacked in Investment Plan)</b>					
<b>Action/ intervention name</b>	<b>Responsible entity and person</b>	<b>Start/end date</b>	<b>Field of action</b>	<b>Impact</b>	<b>Total cost estimated</b>
<b>(list action portfolios and interventions from Modules B-2, C-1 and C-2, which have a cost implication)</b>	<b>(indicate responsible entity and person)</b>	<b>(indicate start and end date of the activity)</b>	<b>(indicate the field of action the interventions belongs to)</b>	<b>(indicate impact - i.e. the GHG reduction/ co- benefit)</b>	<b>(indicate the total costs in €, estimated for the intervention)</b>
<b>Conversion to EVs, PHEVs and use of biofuels</b>	Municipality, Danfoss, Agricultural associations	2022-2030	Passenger transport Heavy and goods transport Agricultural machinery	31,400 t CO <sub>2</sub>	Please see Investment Plan for specific CAPEX information.
<b>Recycling / sorting</b>	Sønderborg Forsyning	2022-2030	Waste	3,300 t CO <sub>2</sub> e	Please see Investment Plan for specific CAPEX information.
<b>Green collection vehicles</b>	Sønderborg forsyning	2022-2030	Waste		
<b>PtX plant</b>	European Energy	2022-2030	Energy production	70,000 t CO <sub>2</sub>	Please see Investment Plan for specific CAPEX information.
<b>Coastal wind turbines</b>	Sønderborg forsyning	2022-2030	Energy production	160 MW	Please see Investment Plan for specific CAPEX information.
<b>Wastewater treatment plant</b>	Sønderborg forsyning	2022-2030	Energy production / wastewater treatment	n/a	Please see Investment Plan for specific CAPEX information.
<b>Abolishing oil and natural gas boilers and natural gas consumption in industry</b>	Citizens, SMEs, municipality	2022-2030	Owner- occupied homes, rental homes, public buildings, SME	76,000 t CO <sub>2</sub>	Please see Investment Plan for specific CAPEX information.



## 6. 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.

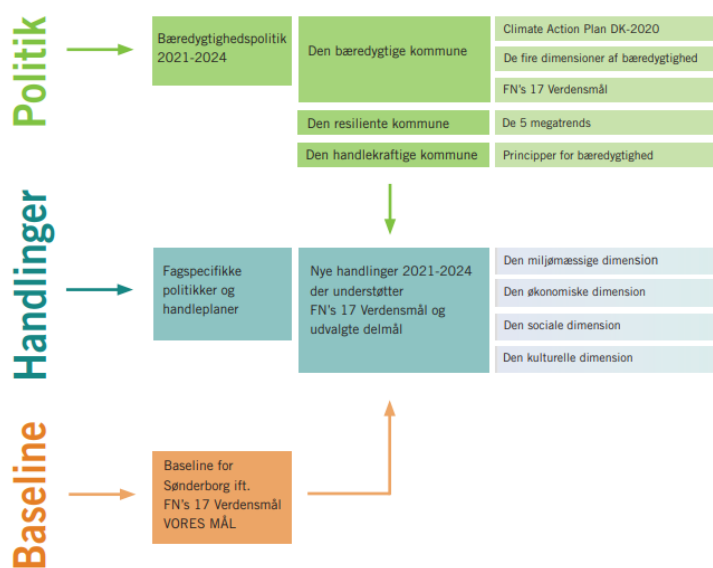
### Plans for next CCC and Action Plan iteration – textual elements

Sønderborg's energy/climate transition journey started in 2007 and by 2021 a 55% CO<sub>2</sub>-emissions reduction has already been achieved. The Masterplan2029 and DK2020 Climate Action Plans were approved by the city council in 2021 resp. 2020 and most of the defined climate actions have already been implemented/executed or corrected following the updated plans.

The CCC Action Plan is a twin/mirror of these plans. The CCC Action Plan performance will be reviewed quarterly/annually as part of the described Governance for the Masterplan2029 and the DK2020. Corrective actions will be taken by the associated hotspot owners, ProjectZero management and Sønderborg Forsyning - and implemented accordingly to secure that the defined goals will be achieved.

### Next step actions for AFOLU & IPPU – not being part of the CCC Action Plan scope

The city council has a strong commitment to continue the action-oriented co-creation journey towards a sustainable and resilient Sønderborg by 2050. Below is a reflection on how this potentially will affect the AFOLU, IPPU challenges (outside the CCC Action Plan scope), all having a timeline beyond 2030.



Sønderborg has committed to contribute to co-create a sustainable, resilient and action oriented Sønderborg based on the DK2020 Climate Action Plan, a four-dimensional interpretation of sustainability (including culture), the UN Global Goals, 5 megatrends and specific principles for sustainability.

The policy and action planning have been approved by the city council and is supported by sustainability, climate, environment and nature being

important measures for the city council constitution in 2021 (after last election). In 2021 the municipality also completed/approved a comprehensive Global Goal Sønderborg [baseline analysis](#).



Majority of larger companies in the Sønderborg region have also committed to the UN Global Goals and/or the [SBTi Science Based Targets](#) and the Sønderborg [UN Learning City](#) participation have provided a strong platform for joint municipal and company best practice sharing regarding sustainable, inclusive actions and learnings.

The UN Global Goals for 2030 (and beyond) is therefore expected to provide the guiding star and direction for Sønderborg's long term sustainability transformation.

Sønderborg's more specific next level social and technical programs towards 2030 and beyond (not addressed in the Masterplan2029) is expected to target and include:

- Biodiversity respecting special species, forestation and use of land. More knowledge and solutions are required, however the Green ambassador program (2000 – 2022) indicated very positive citizen response to an increased focus. Same from kids in schools learning about biodiversity as part of the House of Science training. Local farmers and food industry should be partners in any next step.
- Low carbon food programs addressing use of local fruit and vegetables and eating less meat. Younger people and young families with kids have already changed behavior, but the adult and older people generation is still potential participants in this next level behavior change.
- AFOLU emissions potentially in a new coalition between subregional farming associations, municipalities, food companies and local NGO's. The DK2020 AFOLU analysis showed that multiple interventions and actions will need to be addressed and that there are very few low hanging fruits to be picked. Local/regional planning awaits clearer national political frame setting in 2023+ and DK2020 cooperations across municipalities.
- IPPU emissions targeting the remaining carbon emissions in the local brick industry and in the Sønderborg incineration plant (part of the Sønderborg Varme). For the incineration plant, the decision awaits a potential close-down of the facility during 2030 as described in the Masterplan2029. The most likely technical solution will be CCS.
- Sharing economy programs (deleøkonomi) for sharing everything from cars to equipment to reduce the carbon footprint from consumption and import. Local Sønderborg entrepreneurs '[WeUse](#)' in Sønderborg have created a concept for community scaling, which is now being tested across Denmark. It was also two former Sønderborg high school students who 5 year back created the national [NaboGo](#) app for carsharing, which is now exported to other countries.
- Multiple new Smart City digital platforms targeting citizens and companies are expected to evolve during the next years. The digital platforms and tools will help the citizens transition in their everyday life and before making important purchase decisions and support future planning processes with more specific knowledge about progress, barriers and opportunities. The CenterDenmark [Energikort.dk](#) application





will help society with data collection without conflicting with GDPR-rules and provide data for new business driven innovations and APPs.



## 7. How the ProjectZero engine fuels Sønderborg's climate transition

Below we have in brief described the social systemic ProjectZero approach facilitating Sønderborg's execution of the CCC 2030 Action Plan.

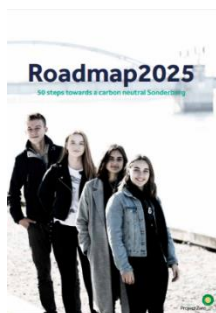
### Public-private partnership addressing society 360-degree

Public-private partnership and strong energy/climate planning traditions have been fueling the transition since 2007, where the city council embraced the ProjectZero-vision and co-created the ProjectZero-secretariat as an enabling and catalysing public-private body for planning, innovation, execution, monitoring, communication etc. with citizens and stakeholders.

Public-private, because less than 3% of the Sønderborg territory carbon emissions (2007) were created by municipal buildings, transport etc. The public-private partnership has since 2007 developed into a Sønderborg DNA, demonstrated effectively also in other important city council projects, like the Gehry Harbour project, the Nordals holiday resort etc. As part of the [EU BSR Act-Now project](#), Sønderborg created a [Public Private Partnership Guideline](#), as the Act-Now project management concluded that the climate transition can only be effective by a such collaboration.

### Co-created ProjectZero Masterplan & Roadmaps since 2009

The five-year planning approach has since first implemented in 2008/2009 proven to be work in Sønderborg, especially because each planning process attracted and engaged up to 100 local experts and stakeholders in the co-creation process.



The stakeholders have worked in (segmented) working groups, addressing sectorial energy/climate challenges. [Roadmap2025](#), developed as an IEP (Integrated Energy Plan in 2018) as part of the EU Horizon2020 [SmartEnCity project](#), were based on 8 such working-groups. The strong stakeholder commitment was maintained during the execution-phase, where the stakeholders took and have demonstrated additional responsibility for implementation, monitoring and communication.

As described in the CCC Commitments document, the Roadmap2025 plan also shaped the climate mitigation plans when Sønderborg in 2020 co-created the [Sønderborg DK2020 Climate Action Plan](#), following the C40 framework. The [Sønderborg DK2020 plan](#) was approved by C40/Concito in June 2020 and Sønderborg became together with the Island of Samsøe DK2020-frontrunners in Denmark. By now (spring 2023) majority of Denmark's 98 municipalities have completed their DK2020 Climate Action Plan, following same framework.





When creating the Masterplan2029, the number of groups/hotspots were increased to 15 to secure a strong stakeholder-participation in the masterplan co-creation process, followed by same stakeholders taking shared responsibility in the implementation and execution of the Masterplan2029.

Sønderborg City Council and ProjectZero Board of Directors															
ProjectZero - Project Management Office															
Sector	Energy					Buildings			Industry			Transport			
Hotspot	Integrated energy system	District heating	Lillebælt Syd Wind park	Power-to-X	Biogas	Wastewater plant	Owner occupied housing	Rented housing	Public buildings	Large manufacturers	Brick companies	SME	Goods and heavy transport	Agricultural machinery	Passenger transport
Hotspot owner	Christian Udby (Sønderborg Forsyning)	Erik Wolff (Sønderborg Varme)	Christian Udby (Sønderborg Forsyning)	Emil Vikjær-Andersen (European Energy)	Jonas Svendsen (Nature Energy)	Stinne Stokkebo (Sønderborg Forsyning)	Morten Vestergaard (Broager Sparekasse)	Jan Mortensen (Nordborg Andelsboligforening)	Willy Feddersen (Sønderborg Kommune)	Martin Johanning (BMC Fonden)			Niels H. Schmidt (Gråsten Landb.Skole)	Willy Feddersen (Sønderborg Kommune)	
Project manager	Allan Pilgaard-Jensen (ProjectZero)	Tue Christensen (Sønderborg Varme)	Sarah Bach (European Energy) og Susanne L. Aagaard (Sønderborg Forsyning)	Lotte Lindeloff (European Energy)	Markus H. Pedersen (Nature Energy)	Susanne Vesten (Sønderborg Forsyning)	Anne Brandrup (ProjectZero)	Anne Brandrup (ProjectZero)	Mie R. Nielsen (Sønderborg Kommune)	Jens Chr. Moltke-Leth (ProjectZero)			Louise Bjerklid Petersen (Sønderborg Kommune)		
Group	The hotspot owners across sectors	The three district heating companies The municipality Danfoss	Lillebælt Syd wind park project team lead by European Energy and Sønderborg Forsyning	PX project team led by European Energy projektteam	Biogas project Nature Energy projektteam	Wastewater project team led by Sønderborg Forsyning	Craftsmen Banks Utility The municipality Real estate agent Energy consultant Architect	Repre. from the housing associations Energy consultant Architect Private renting house repre.	Municipality building team	Repre. from the manufacturers	Repre. from the brick manufacturers	Repre. from small and medium-sized companies	Repre. from companies using heavy duty transport	Jens Lei Thomas Langer Erik Westergaard	Municipality teams on cars fleet, public transport, bicycling, carpooling, car dealer Passenger car organization EV charging company

The execution of Masterplan2029 is supported by the ProjectZero Project Management Office, since 2022 responsible for monitoring the KPI-progress and results. The results are shared with the hotspot-groups, ProjectZero management and city council committees as per the Masterplan2029 and DK2020 Governance.

Sønderborg's CCC 2030 Climate Neutrality Action Plan is based on the Masterplan2029 and DK2020 plan. The Action Plan describes the two plans and how they relate to the CCC scope. The Action plan includes a detailed GHG inventory baseline and energy use baseline, how these will be reduced by 2030 including possible gaps and how they will be addressed and what possible barriers could hinder the development.

### Citizen participation, co-creation and co-production since 2009

Citizen engagement in Sønderborg's ProjectZero transition has been a key political goal since the project started in 2007. The ZEROfamily program with 1000+ participating families in 2009 learned us important lessons and the need for constant new iterations addressing more specific citizen subsegments, that just "citizens" in general. We experienced that a sub-segmentation based on the ownership of the "homes" would help us understand the different challenges between being a homeowner-family and being a tenant or a resident. We learned how to fine-tune value-propositions and target/communicate them in society, and we found civil society partners and organizations with whom we could co-create, co-produce and scale up the engagement. Kids in schools became our first green ambassadors and now these kids have progressed into climate activists, PhD-students in climate, environmental or nature subjects, several of them now working with policy in government agencies, at universities or consulting companies – spreading a green transition message from Sønderborg.

Vulnerable families/groups in Sønderborg include elderly people living in their own old fossil fueled home, young low-income families with kids living in private rented homes in rural areas of Sønderborg. Together with the municipality, ProjectZero since 2009 and will



continue to address low hanging climate action solutions, to onboard these families addressing no-cost or low-cost energy saving opportunities, as our learning is, that these families will progress their own actions based on a successful initial (climate) customer journey.

The rural areas of Sønderborg account for app. 30% of Sønderborg's population and in the 36 municipal rural area districts, there is a strong social systemic structure for supporting citizens – and potentially leaving no one behind.

### **Learning from collaboration with other European ambitious cities**

Since 2007, the ProjectZero project has catalysed and supported Sønderborg municipality, citizens, companies and interested key stakeholders in ramping up and executing innovative climate approaches/solutions supporting Sønderborg's carbon neutrality by 2029 ambition.

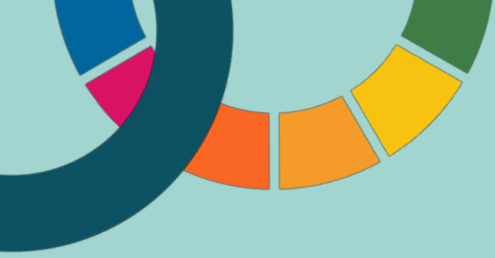
We have learnt and progressed from our early energy and climate frontrunner initiatives, mistakes and results achieved. We have corrected our plans and approaches based on the learning and shared the learnings with other ambitious cities in Denmark ([Energibyerne](#)) and abroad (eg. the [SmartEnCity Network](#)).



### **A data-driven Plan–Do–Check–Act process**

From initially a lack of data for planning and monitoring, we have together with Danish utility and engineering companies, authorities and agencies paved the way for making energy data available, despite but respecting the EU GDPR-laws. Such data has helped us (since 2009) monitor sectorial energy efficiency and carbon reduction improvement and address/target specific windows of opportunities in our planning iterations since 2008/2009, when we co-created the initial Masterplan2029 and the Roadmap2015 focused on a 25% CO<sub>2</sub>-reduction by 2015.

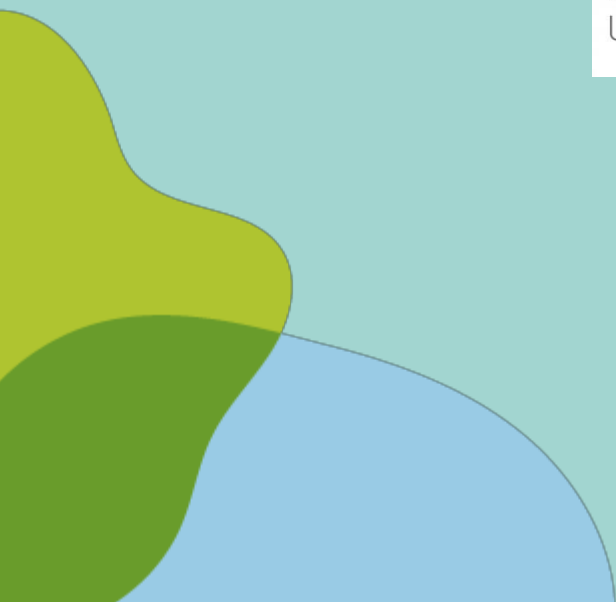
*The ProjectZero public-private partnership is committed to continue supporting the Masterplan2029 journey until 2029, align the Masterplan2029 stakeholders, monitor and report the KPI-progression and results according to the Masterplan2029 Governance.*



## Climate City Contract

### Climate Neutrality Commitments

#### Sonderborg





## Disclaimer

The content of this document reflects only the author's view. The European Commission is not responsible for any use that may be made of the information it contains.

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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

### Sønderborg’s motivation for joining the EU Mission ‘100 Climate-Neutral and Smart Cities by 2030’ program and develop a Climate City Contract

Being a zero-carbon city frontrunner since 2007, much before cities started playing ambitious roles in energy & climate, Sønderborg soon realized the importance to co-create, partner, share, learn and scale from best practice around-the-world solutions.

Our expectation is that the EU Cities Mission will become a Climate Lighthouse Project for Europe and enables ambitious cities across Europe by co-creation to inspire all other cities and show the world how cities and communities can systemically transition, save resources and money and co-create new local green jobs – while we create a better and more sustainable and inclusive world.

We see the development of the Climate City Contract as an opportunity to adapt to the new NetZeroCities framework, a platform for common understanding and cooperation across cities, and for sharing our Sønderborg learnings. We also expect that the Cities Mission Label will recognize the Sønderborg achievements so far - and help us secure the necessary additional partnerships, knowledge, funding, inspiration etc. for getting to our climate neutrality destination by 2029 – and for the extended journey towards a NetZero community by 2050.



Our scope for this Climate City Contract (CCC) application is, as expressed in the EoI, all energy system related CO<sub>2</sub>-emissions including emissions from waste. As explained in this CCC-application, our climate ambitions go beyond this scope, but the scope represent the historic (since 2007) and current consolidated climate goals agreed by the city council and the ProjectZero ecosystem. The next level climate actions will target NetZero carbons (by 2050) and include AFOLU (farming) and IPPU etc., where specific reduction goals will be aligned with the national frame setting and new climate action partnerships are to be established with the farming-associations, the food-industry and municipalities in a wider geographical area, across the Southern Denmark Regions municipalities (South Jutland).

In this Climate City Contract (CCC) Commitments document, Sønderborg explains and re-confirms its commitment to achieve carbon-neutrality in its buildings, transport, industry, energy production and waste systems by 2030. The commitment is stated by key society stakeholders representing the ProjectZero ecosystem supporting the city council’s commitment.

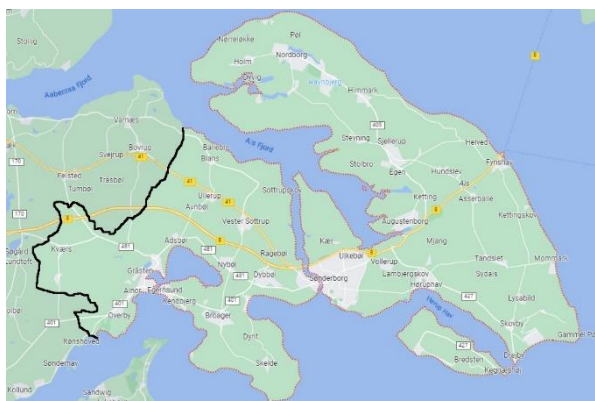


In the CCC Action Plan document, we explain and document how Sønderborg’s already developed and approved action plans will help Sønderborg achieve its ambitious goals, supported by the city council and municipal administration and co-executed by the ProjectZero ecosystem. The segmented hotspot-approach will secure a strong focus on getting “things done”, and the integrated systemic 360 degrees approach also addressing the just social, inclusion, innovation etc. challenges and opportunities.

In the CCC Investment Plan document, we document that 1/3 of Sønderborg’s transition (since 2007) is already made (and invested) and 2/3 is still to go from an investment point-of-view, even that the CO2-meter by end of 2021 showed a 55% accumulated CO2-reduction since 2007. The majority of investments has been made and will also in future be made by citizens and private sector stakeholders, however the municipality is playing important roles as local policy maker, front runner and strategic partner in the ProjectZero public-private partnership. Harvesting the additional transition benefits like new green job creation, grow local green competencies and skills in industry, among craftsmen and in local schools and university educations, secure a robust and low-cost energy system and supply – and at the same time addressing vulnerable groups, social inclusion and innovation. Investment figures are high, but funding sources are considered available to finance the execution of the ambitious Action Plan.

### About Sønderborg Municipality and the municipal administrative territory

In 2007, Sønderborg municipality was created by a merger of seven former independent municipalities. The municipality of Sønderborg is beautifully located in the south of Denmark next to the Baltic Sea, near the German Danish border. The municipality has 73,500 citizens. Sønderborg Municipality is by size today Denmark’s #18 municipality (out of 98).



Sønderborg is located in the very south of Denmark only 40 km from the German Danish border. 2/3 of the Sønderborg territory is located on the Island of Als and 1/3 is part of “Continental Europe”. Sønderborg is well connected with a local airport supporting domestic flights to Copenhagen plus private business jets; with a train and highway connection and with three ferry connections supplementing two bridge connections to the island of Als.

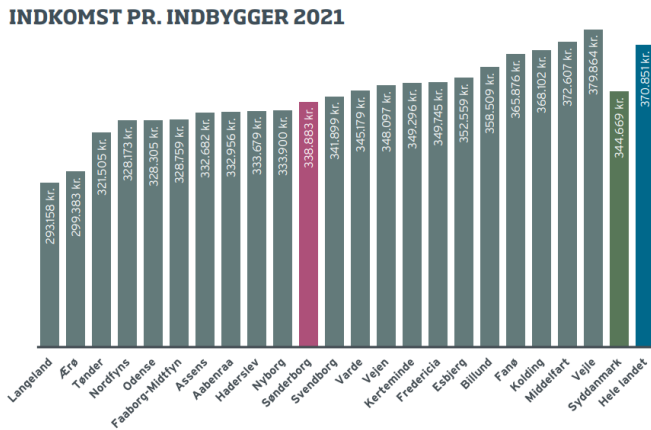
Industry, farming and tourism generate the main income – and make Sønderborg a strong internationally connected city/municipality. Global leaders in green tech companies like [Danfoss](#) and [Linak](#) have their headquarters located in Sønderborg and create a growing demand for highly skilled employees and young talents.





The SDU Alsion university campus (the University of Southern Denmark) plays together with an academy school, a technical and a business college among other schools an important role in the municipal learning DNA and attracting new young talents to industry and society.

From a socio-economic point of view Sønderborg has a large proportion of citizens with high educations and high income, a large citizen group well educated with good/medium income, but also a group of potentially vulnerable citizens characterized by elderly or young children families living in rural area homes, owned by themselves or rented.



Personnel income per citizen in Southern Denmark municipalities 2021, source: [Kontur 2022](#), the Southern Denmark Regional statistics for Sønderborg 2021

The above statistic/graphics is showing income per citizens (2021) across municipalities in the Southern Denmark Region. It shows, that even Sønderborg’s average citizen-income seems to be located in the middle among the Regions 22 municipalities, the average Sønderborg income is less than 8% from the average income in Denmark. Other regional statistics indicate that especially low-income families are over-represented in Sønderborg, compared to average in the Region.

Other regional statistics are showing that people in Sønderborg have the highest average number of living years, which indicate “the good life”, but potentially also an “aged population”. Unemployment rates and house prices in Sønderborg are among the lowest across the regions 22 municipalities.



App. 35% of all homes in Sønderborg are owned by the areas six housing associations, which help Sønderborg offer affordable homes to vulnerable citizens wanting to live in the urban and semi-urban areas, where majority of these app. 10,300 homes are physically located.

Sønderborg has a long tradition for being a first mover. In 1990 Sønderborg was awarded the Danish Environmental Municipality of the year. In 2007 Sønderborg City Council approved the ProjectZero vision as a City Council lighthouse. In 2020 Sønderborg (and the



island of Samsø) became the first municipalities (apart from Copenhagen) having an approved DK2020 Climate Action Plan following the City40 Climate Action Planning principles.

### **Sonderborg - high-lights and participatory approaches since 2007**

The Municipality of Sonderborg already started its journey in 2007 towards a CO2-neutral Sonderborg. The 'ProjectZero' vision was created by a local think-tank and adapted by the city council, making ProjectZero a lighthouse-project for the city council.

The ProjectZero project is focused on co-creating a zero-carbon energy system by 2029, including all society sectors within the municipal borders of Sonderborg, based on 1) energy efficiency, 2) electrification of the transport sector, 3) sector integration including re-use of energy already produced, 4) expand and produce renewable energy sources from biogas, wind, solar to PtX. A strong citizen and stakeholder engagement has from 2007 been an important success criterion for the project. Citizen engagement started very simple by asking 100+ families to address their energy use, showing that 25% energy could be saved and the participation turned (and continuous iterated) into co-creation and further co-production with civil society stakeholders aiming for collaborative climate actions.

During 2007 – 2021 a 55,4% CO2-reduction and a 13% energy saving has been achieved based on annual monitoring and reports available from the [ProjectZero-website](#).

As the think tank recognized a public-private partnership as the only enabler to achieve the ambitious goal, the ProjectZero project was anchored in the public private 'ProjectZero partnership', co-created in 2007 by the Sonderborg city council, the Bitten & Mads Clausen foundation (Danfoss), Sonderborg Forsyning (local utility company), SydEnergi (regional energy company) and the Nordea (bank) foundation.

### **International climate approach - with global impact ambitions**

Being an early front-runner in energy and climate transition, Sonderborg's transition journey and learnings have attracted multiple attention from cities, industry, NGO's, universities, provinces, and states – enabling also Sonderborg to work and learn from best practices abroad.

Sonderborg created in 2008 based on WWF-recommendations an energy sister city cooperation with Chinese City Baoding (11 million citizens), including demonstration of green industry solutions provided by the Danfoss Company and Yingli manufacturers of Sonderborg and Baoding.

In 2009, the first ProjectZero Masterplan2029 and Roadmap2015 were co-created and launched as a result of more than 100 participating local stakeholders and national experts' discussions in 2008/2009. The Masterplan and Roadmap created a robust planning and stakeholder methodology and involvement platform, which has been further iterated with



new city councils approving roadmaps for 2020 (in 2014) and 2025 (in 2018) based on the same stakeholder engagement, co-creation and commitment as Roadmap2015.

In 2010, Sønderborg was awarded the EU Commissions Sustainable Energy Europe 'Sustainable energy communities' award and in 2018, the EU Commission named Sønderborg the European "City in the spotlight" award for best practice Climate & Energy City (with a size between 10,000 and 250,000 citizens).

Sønderborg joined the EU Covenant of Mayors in 2012 and the first iteration of the Masterplan2029, became Sønderborg's CoM SEAP-plan.

In 2012, Sønderborg was accepted as a CPDP city participant by the CCI Clinton Climate Initiative. US (former) President Clinton visited Sønderborg in 2012. CCI merged its CPDP-portfolio into City40, where the CPDP-concept remained until 2020, focused on how climate positive development projects could inspire capital cities to go zero-carbon.

In 2013, Sønderborg created its second energy sister city cooperation with Chinese city Haiyan and both sister cities (Sønderborg and Haiyan) were in November 2013 presented as signing cities on stage in the People Hall, Beijing, signing the EU China City Cooperation Partnership in front of the Chairman of the EU Commission, José Manuel Barroso and Chinese Prime Minister Li Keqiang. During 2014 the sister city cooperation between Sønderborg and Haiyan was referenced several times as a role model for city cooperation in PM Keqiang-speeches in Brussels.

In 2016, Sønderborg was selected/awarded as a Lighthouse City in the ambitious EU H2020 SmartEnCity (SEC) project. The SEC-project ended summer 2022. In the SEC-project, Sønderborg not only demonstrated green transition and municipal commitments, but also took the lead in co-creating the SmartEnCity Network with 70 named cities across Europe, demonstrating how cities can inspire and learn from each other. Learn more about the SmartEnCity Network and its 70 city members [here](#).

In 2018, Sønderborg created the Danish Energibyerne.dk network as a Danish sub-section of the SmartEnCity Network, allowing 7 Danish cities to meet and discuss strategic climate action planning and implementation in national context and language. The network has set new standards for city cooperation in Denmark and abroad, where similar national networks have been established in Estonia, Spain, Italy and Bulgaria – based on the Energibyerne 'formula' and learning experience.

In 2020, Sønderborg (and the island of Samsø) became the first municipalities (apart from Copenhagen by definition already having a C40 CAP) having an approved DK2020 Climate Action Plan following the C40 CAP principles. The DK2020 Climate Action Plan addresses not only climate mitigation, but also adaptation and open-land/farming-related carbon emissions. Sønderborg played an important role in creating the regional support structure for further scaling of the [DK2020 project](#), which now has participation from 96 of the in total 98 Danish municipalities.

In 2021, Sønderborg with support from the BCG Group (Boston Consulting Group), co-created the new Masterplan2029 based on the same stakeholder engagement, co-creation and commitment mentioned – and focused on creating an intelligent cost-effective energy system – created with the ambition to be replicated abroad. The Masterplan2029, based on



a sector approach with 15 hotspot groups was approved by the city council in December 2021. In 2022 the implementation started with a new project management office (PMO) approach including quarterly reviews of KPI and progress reporting. Learn more about the Sønderborg's Masterplan2029 [here](#).

In January 2022, Sønderborg partners became the proud participants in the four years EU Green Deal 4.1 ARV (Herritage) project lead by Norwegian NTNU University of Trondheim. The ARV project will demonstrate how local society can rethink/rebuild and scale up society based on Climate Positive Circular Communities (CPCC). Key measures are innovation, new knowledge, technology, data/digitalization, citizen engagement and co-creation. The local partners include Sønderborg's largest housing association (SAB), the Danfoss Company and ProjectZero.

In June 2022, Sønderborg was the proud city host of the 7th IEA Global Conference on Energy Efficiency Conference 2022, organized in cooperation between the IEA, the Danish Ministry of Climate, Energy and Supply – supported by the Danfoss Company and Foundation. During the conference, the 40 ministers and almost 400 international participants joined a 'seeing is believing' tour across the Sønderborg geography, demonstrating how modern energy efficiency solutions can help a society gaining significant energy savings and thereby minimize the investments needed for the transition. For more information about the IEA/Sønderborg conference click [here](#). The Conference concluded the importance of Energy Efficiency in a joint IEA statement and the Sønderborg Action Plan – read more [here](#).

The Sønderborg City Council's approval of the Masterplan2029 and the DK2020-plan constitutes the governance structure and basis for a successful implementation of the plans in a close cooperation with the hotspot groups. The division of work and responsibilities between the plans will be the same used for creating the DK2020-plan:

- The Sønderborg ProjectZero Masterplan2029 will focus on the transformation of the energy system across the scoped sectors: buildings, transport, businesses, and energy.
- The Sønderborg DK2020 plan will contribute with addressing the waste-element of the CCC-scope.



## 2 Goal: Climate neutrality by 2030

### Your text

#### **Sønderborg commitment, scoping and definitions**

The goal of the Sønderborg ProjectZero project is to turn Sønderborg Municipality climate neutral by 2030. To this end, Sønderborg Municipality and local stakeholders commit themselves to deliver bold climate actions, that will enable them to achieve the indicated goal on time. Sønderborg Municipality agrees to do this in a fair and sustainable way, not leaving anyone behind.

The scope and definitions of ‘climate neutrality’ follows the framework presented by the EU Cities Mission project and the Sønderborg Expression of Interest (EoI) dated January 2022:

- Stationary energy (buildings, equipment, facilities), energy production and distribution – core part of the ProjectZero scope
- Transport (passenger cars, heavy transport, agricultural machinery) – core part of the ProjectZero scope
- Waste management (embedded GHG) – core part of the Sønderborg DK2020 scope

The IPPU and AFOLU sectors are integrated in the Sønderborg DK2020 ambition, but with a different (2030+) timeline and therefore not part of the Sønderborg Mission project expressed by the EoI:

- IPPU Industrial processes (if significant) – part of the DK2020 scope. The measures (CCS) are technically complex and expensive, but expected to become more mature during next 5+ years.
- AFOLU Agriculture, Forestry and Other Land Use (changes in GHG from any changes in land use – if significant) – part of the DK2020 scope, but with deadline beyond 2030, targeting 2050. Actions have been initiated, but targets and structure await national frame-setting.

The associated Climate emissions trajectory 1990 – 2030 for the Sønderborg Cities Mission focus/scope (as defined by the Sønderborg EoI) and beyond (including also the IPPU and AFOLU sectors) is shown below.



Climate emissions trajectory 1990 - 2030 Total emissions Sønderborg Municipality (ton CO2-e)	Reference 1990	Climate account 2007	Climate account 2018	Climate account 2021	Progress 2007/2021 %	Planned reductions 2022-2029	CCC - CO2-emissions target 2030
<b>CCC scope:</b>							
Transport	125.848	172.647	154.870	137.162	-20,6%	31.436	105.726
Energy	555.127	528.397	278.544	212.385	-59,8%	206.185	6200
Waste, Wastewater and random fires	21.278	16.987	13.705	13.705	-19,3%	3.252	10.453
<b>Offsetting - export of biogas and PXK</b>				<b>-36.738</b>			<b>129.994</b>
<b>Total for CCC scope</b>	<b>702.253</b>	<b>718.031</b>	<b>447.119</b>	<b>326.514</b>	<b>-54,5%</b>	<b>240.873</b>	<b>122.179</b> >>> CCC preliminary gap <b>-7.615</b> >>> CCC result
<b>Scope 3 not incl. in suggested CCC:</b>							
IPPU - industrial processes and Product use	18.931	15.325	12.568	12.568	-18,0%	n/a	12.568
Plant breeding	67.045	56.338	48.150	48.150	-14,5%	n/a	48.150
Animal husbandry	148.204	144.319	141.348	141.348	-2,1%	89.827	51.521
Territory use	60.601	46.929	36.474	36.474	-22,3%	n/a	36.474
<b>Total Scope 3</b>	<b>294.781</b>	<b>262.911</b>	<b>238.540</b>	<b>238.540</b>	<b>-9,3%</b>	<b>89.827</b>	<b>148.713</b>
<b>DK2020 scope</b>							
Energy system total (Masterplan2029)	680.975	701.044	433.414	312.809	-55,4%	105.726	111.926
AFOLU - farming and open land	275.850	247.586	225.972	225.972	-8,7%	89.827	136.145
Industry, waste and wastewater	40.209	32.312	26.273	26.273	-18,7%	10.453	15.820
<b>Total</b>	<b>997.034</b>	<b>980.942</b>	<b>685.659</b>	<b>565.054</b>	<b>-42,4%</b>	<b>206.006</b>	<b>263.891</b>

The climate neutrality ambition for Sønderborg has since June 2020 been contained in the Sønderborg DK2020 Climate Action Plan and the ProjectZero Masterplan2029 (2009, 2021). All plans approved by the Sønderborg City Council and monitored/reported by the municipality and ProjectZero.

The division of responsibilities between the DK2020 plan resp. Masterplan2029 and the core Sønderborg climate neutrality partners are as follows:

- Stationary energy (buildings, equipment, facilities), energy production and distribution – contained in the Masterplan2029 (ProjectZero scope)
- Transport – contained in the Masterplan2029 (ProjectZero scope)
- Waste management (embedded GHG) – contained in Sønderborg’s DK2020 Climate Action Plan (Responsibility of Sønderborg Forsyning)
- IPPU Industrial processes (if significant) – brick-manufacturers and incineration of waste by Sønderborg Varme – contained in Sønderborg’s DK2020 Climate Action Plan
- AFOLU, Agriculture, forestry and other land use (changes in GHG from any changes in land use – if significant) – no significant change in land use planned for Sønderborg

The associated Climate Actions are further described in the annexed 2030 Climate Neutrality Action Plan and the estimated associated investments are further described in the annexed 2030 Climate Neutrality Investment Plan.

### Multiple co-benefits

Climate is a major driver for Sønderborg’s transition into a climate neutral and smart city by 2030, but there are multiple additional benefits supporting the society motivation for journey into sometimes unknown solutions and destinations.

These co-benefits include:

- new green competencies in schools, among craftsmen and in industry and service,
- new green job creation,
- making Sønderborg a more attractive place to study, work & live,



- making Sønderborg a more attractive place to be innovative, co-create and establish a new green business,
- making Sønderborg known as an attractive place to visit as a tourist,
- a stronger city branding and green profile in the public and the national press,
- cleaner air, less pollution, a place where nature is respected, sustainability-transition
- co-creating a better world ...



### 3 Key priorities and strategic interventions

This is the core section of the Commitments document that should summarize **at least 3 or 4 systemic strategic priorities** that need to be implemented for your city to become climate neutral by 2030.

#### Your text

Based on DK2020-plan and Masterplan2029, Sønderborg in 2020/2021 analyzed the state of current affairs and identified the following Citizen/Stakeholders, Energy and Waste key strategic priorities that is urgently addressed in order to achieve the 2030 CCC climate neutrality goal.

1. Energy efficiency and electrification of buildings and industry including conversion to 100% green heating sources.
2. Electrification of the transport sector – passenger as well as heavy transport
3. A cost-effective sector integrated energy & waste system utilizing excess energy from industry and utility processes and optimizing the energy demand/supply balance.
4. Establish renewable energy sources – biogas, wind, solar and power-to-x that will compensate for the remaining carbon in the transport sector thus reaching neutrality.
  - Citizen engagement and stakeholder planning co-creation
  - Smart data visibility and deployment
  - Utilize the ProjectZero engine to fuel the climate transition

Whereas the first 4 strategic interventions are rather technical and prioritized (inspired since 2007 by the Trias Energetica), the last 3 are mainly consolidated social interventions. All social interventions interact, integrate, interlink and fuel the technical interventions.

All interventions built on the Sønderborg learnings (and iterations) since the ProjectZero journey started in 2007. They are further explained and elaborated in the CCC Action Plan.

ProjectZero as a social systemic engine for fueling Sønderborg's transition since 2007 is described further in the Appendix.





## 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

#### Sønderborg climate intervention principles, processes & actions

Sønderborg's energy/climate ambitions for co-creating a zero-carbon energy system focused Sønderborg area by 2029 was initiated by the ambitious ProjectZero vision in 2007 and a unique unanimous City Council resolution, supporting the new elected city council's commitment to achieve the ProjectZero goal by 2029 by naming the ProjectZero vision a political Lighthouse Project for Sønderborg. Since 2007, the ProjectZero vision has remained a City Council Lighthouse project.

The City council's approval of the Sønderborg DK2020-plan in June 2020 created an additional level of commitments to frame and address CO<sub>2</sub>(e) emissions from IPPU, Waste, climate adaptation, IPPU, farming (AFOLU) on top of the ProjectZero climate (mitigation) actions already addressed by the ProjectZero project and 15+partnership. However, with the IPPU, AFOLU (and climate adaptation) having a 2050 deadline for achieving a net-zero Sønderborg.

The ProjectZero climate actions since 2007 have focused on:

- Establishing ProjectZero as Sønderborg's common and shared vision for the transition. Securing a strong commitment and funding base from city local sources. Establishing the ProjectZero office with mandate to operate and coordinate the co-creation processes, measure and communicate results etc.
- Creation of Masterplan2029 (2009, 2021), Roadmap2015 (2009), Roadmap2020 (2014), Roadmap2025 (2018) – co-created by local experts and stakeholders, ensuring that all actions are systemic aligned and focused on an intelligent cost-efficient energy system transformation. Each planning process (Masterplan/Roadmap) have had participation from 70 – 100+ stakeholders and local experts, taking also active participation in the execution of the plans, by joining the below mentioned working and hotspot groups.
- Co-designing a portfolio of Climate Actions as the outcome of the planning processes. With a 3-5-year iterative cycle time process since creating the Masterplan2029/Roadmap2015 in 2008/2009, making the new Masterplan2029 the most comprehensive umbrella with its 15+ climate action hotspots.
- Using the EU Covenant of Mayors and EU projects, events, awards to connect to EU policy and best practices.



- Using the DK2020 project as an enabler/opportunity to involve the Southern Denmark Region and neighbour municipalities. Using close connections to the [Realdania Fund](#) and Denmark’s Green Thinktank, [Concito](#), to push the Danish government (Energy Agency) to engage stronger in the national DK2020-movement. Establishing the [Energibyerne.dk](#) in 2018 to create a strong alliance among the seven leading Danish municipalities. Supporting the creation of the “Grøn Bolig” project (Green Housing) to push for new role models and national commitments for retrofit of buildings/houses.
- Maintaining a strong support from (every four years) changing city councils and core ProjectZero stakeholders (in hotspots) and sponsors (Danfoss company/foundation, Sønderborg Forsyning etc.)
- Segmented sectorial interventions (hot spots) focused on energy efficiency improvements, reuse of wasted energy, sector integration, renewable energy generation, power-to-x generation.
- Citizen engagement activities, events and programs since 2009, where 100+ interested families kick-started the participation journey with the ZEROfamily-program, showing other citizens how to reduce heat and electricity consumption by average 25% - by picking the low hanging fruits in everyday life. Initiating the ZEROhome-program with 1,500 energy checks in private homes, supported by local craftsmen, banks, architects, real-estate agents and the municipality. Including special local community-programs for Sønderborg’s 36 rural-area districts, implemented in close cooperation with the municipality etc. Leading to similar participatory programs for citizens living in apartments, leading to the ZEROambassador-program for residents across the six housing associations with a wider scope (than energy/transport) by including biodiversity, nature and waste. The journey has taught us, that a segmentation based on the type of “ownership of home” is core for attracting not only interest, but also local participation.



- As part of the Sønderborg City warm-up to welcome Tour de France in Sønderborg (3. July 2022), ProjectZero and partners organized a 6-days “Green jersey pitstop” citizen focused local energy and climate tour including pitstops in rural area villages. Learn more about the week 20/2022 pitstop tour (in Danish) [here](#).

Sønderborg’s ProjectZero-vision was also presented as a visible participating decorated frontrunner e-tourcar during the three days TdF in Denmark 1. – 3. July 2022.



- During the [IEA Sønderborg Conference](#) in June 2022, ProjectZero and local stakeholders organized and facilitated three ClimateDays (In Danish: klimadage) focused on energy, transport, food, biodiversity, waste and local green business innovations/solutions at the Sønderborg Harbour including 14 public debates – everything targeted kids and citizens all ages (across the segments). Learn more about the Sønderborg ClimateDays 2022 (in Danish) [here](#).



- Citizen, enterprise and stakeholder engagement in hotspots and specific actions. Creating and maintaining specific segmented participatory platforms addressing the core targets groups with high visibility across the Sønderborg geography in everyday life:
  - The ZEROhome program (18,600 homeowner-families) addressed since 2009 in progressing iterations including 1,500 energy visits to the families, training programs for customer journey stakeholders, events and awards, homeowner support for applying state funding etc. Generating strong results and impact on behaviour and energy efficiency.
  - The ZEROhouse-association program (9,300 resident-families) addressing since 2016 energy efficiency and renewable energy sources in the multi-storage apartment buildings, creating and training an ambassador-team across the six independent house associations, co-creation of the EU H2020 Happi-project across the housing associations.
  - The ZEROlandlord program (6,000 tenant-families and 100+ private landlords), providing since 2013 training and technical support programs for improving energy efficiency in multi-storage apartments based on climate attention, solution knowledge and improved communication/cooperation between tenant and landlord. Addressing also sectorial barriers for climate actions in national legislations and potential adjustments – in cooperation with the national GI-stakeholder
  - The ZEROcompany program (100+ SME-companies), providing learning, focus and climate-actions, support, awards, certification, communication. Since 2012 in close cooperation with local (Broager Sparekasse) and from 2020 with national banks (Danske Bank, Jyske Bank, Sydbank).



Enabling the SME-companies (including global Danfoss Company) already from 2009+ to co-create and execute their own ambitious climate action plans.

- The ZEROshop program (250 local shops), providing advice, support, awards, public promotion of the 200+ participating shops.

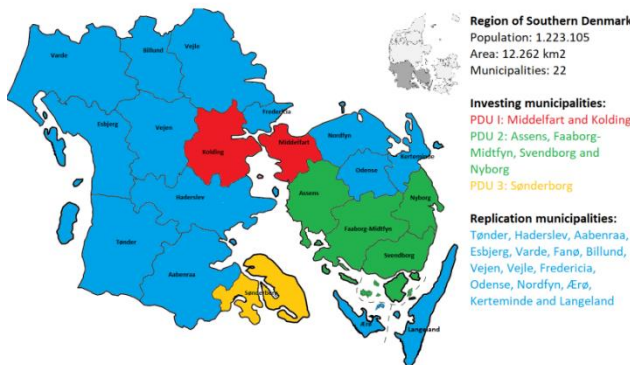


- Sønderborg Municipality has since the approval of the new co-created Sønderborg Heatplan 2021 (approved in summer 2021 and updated in 2022), been very focused on how its citizens can transition their heating sources from gas/oil to green district heating (in urban areas) and heat-pumps outside urban areas – leaving no families behind. The Municipal Heatplan and the ProjectZero Masterplan2029 (giving special attention to the energy system systemic role of district heating), have accelerated the process – but since 2022 citizens living in rural-areas (outside existing district heating areas), have strongly engaged in new collective heat-system creation discussion/processes supported by the district heating companies, ProjectZero and Sønderborg Municipality.



The district heating companies have confirmed their commitment to extent existing district heating networks to new nearby villages on the island of Als and on the mainland Sundeved/Jutland side, which will allow more citizen families to transition to green district heating than anticipated when the Heatplan was first approved in 2021. Only concern is that additional cost of the extension will have to be accepted/paid by the new citizen family subscribers as stated by the community (amba legal structure) operated district heating companies.

- The new EU COHEAT-project created by the Region of Southern Denmark & municipal partners etc. provide during 2022-2025 a strong partnering- and competence-platform for the co-creation process with a just ambition of leaving no family behind. However, the project partners are aware that young families with kids living in own rural area houses and poor families living in rented rural area houses are economic vulnerable citizens and will address these challenges, not only by cost-effective technical solutions, but also by including the local banks to secure attractive and affordable financing and loans.



- Co-creating the House of Science “learning platform for kids and students from KG to PhD” in 2008. Training 80+ craftsmen in energy consultancy 2010+ and further craftsmen energy skills training programs (EU Social Fund financed) addressing (regional) 400 local craftsmen 2016+, energy training programs for all private family advisors in 10 local banks (2012+), all real estate agents (2012+), co-creating climate customer journey training programs for young students and craftsmen (2022+). Making climate actions the new normal in society.



- Supported by comprehensive communication means – including strategic story telling at city, enterprise, and citizen levels. Distribution of a bi-weekly ZEROnyt newsletter to app. 3,000 citizens, company managers and the local and national press.
- A green Sønderborg learning from kindergarten to PhD, including schools, university, craftsmen training – strategically framed by Sønderborg being a UNESCO (sustainable) Learning City since 2017
- Co-managed by a formal PMO Project Management Office (since 2021) with quarterly performance reviews of the 15+ Masterplan2029 hotspots and progress reporting. The Masterplan2029 is scheduled to be reviewed and updated yearly. For more information about how the hotspots align with the PMO and the Sønderborg City Council, please see Appendix 1 (Individual Signatory Commitments) and more detailed descriptions in Sønderborg’s CCC Action Plan and CCC Investment Plan.
- Annual progress reporting (in June/July) to the City Council, the ProjectZero board of directors, hotspot groups and the local citizens and companies

The DK2020-plan and actions have since 2020 focused additionally on

- Waste – by making Sønderborg a DK-pioneer in sorting household waste into 9+1 fragments to reuse/recycle waste. The waste-management system is currently being transitioned into shops and industry. By 2027 current wastewater-treatment plants are scheduled to be consolidated into one new facility, build to best available zero-energy-use technology standard.
- IPPU – in Sønderborg mainly emitted from the brick manufacturing process and from incineration of sorted household at Sønderborg Kraft Varmeværk (Sønderborg District Heating). However, lacking easy solutions to decrease the associated carbon-emissions, except use of CCS technologies.
- AFOLU - farming and use of land – transitioning the value chain from farm to fork by, scheduled to be driven by the farmers and farmers associations in the “Sønderjylland” sub-region of Southern Denmark Region with support from the four subregional municipalities: Sønderborg, Aabenraa, Tønder and Haderslev.

As reflected above, Sønderborg’s ProjectZero project has since 2007 been a strong social systemic enabler for the Sønderborg community to work together, engage further, plan, co-create, co-produce, implement, measure and correct – with a partnership, commitments, approaches and actions very much like the EU Cities Mission’s Climate City Contract approach – and making reduction of carbon-emissions *the new normal* in our society. The above-described multiple approaches are all examples from Sønderborg’s exiting citizen engagement journey, and reflect the learning from how to attract attention to how to co-create, co-produce and ramp up the number of citizens participation. A core learning has been the importance of presenting a value-proposition and also securing a reasonable business model to anchor the solution in society after its trial.



The ProjectZero catalytic planning, implementation and engagement approach focused on co-creating the new normal for Sønderborg will be continued until 2030, based on the hotspot dedication and the PDCA (Plan, Do, Check, Act) method. The hotspot participants represent the ecosystem around the individual hotspot defined challenge - and they are 360-degrees focused on making the systemic transition work full scale, including society learning, competence development, social/income/participation barriers, local political and municipal admin support, availability of technical solutions, communication and strategic story telling in the community.

The citizen focused hotspot participants are aware that the 73,500 citizens are not all the same but represent different challenges and opportunities - and therefore should be approached different. The current hotspot structure (to a certain extent) has been created to secure such a differentiated approach by the sub-segmentation of citizens home approach – with the ambition of leaving no family behind. But, also in the action plans secure that families being ready to transition to a green living in their everyday life will be offered such solutions as part of their “customer journeys”, when building a new house, retrofitting their home or considering their future transport measure – while capacity and solutions (social, technical, financial, policy, communication, network etc.) are co-created and co-produced to secure similar transition of vulnerable families/groups.

Vulnerable families/groups in Sønderborg include elderly people living in their own old fossil fueled home, young low-income families with kids living in private rented homes in rural areas of Sønderborg. Together with the municipality, ProjectZero since 2009 will continue to address low hanging climate action solutions, to onboard these families addressing no-cost energy saving opportunities, as the learning is that families will progress their own actions based on a successful initial (climate) customer journey. The rural areas of Sønderborg account for app. 30% of Sønderborg’s population and in the 36 rural area districts, there is a strong structure for supporting citizens – and potentially leaving no one behind.

The Sønderborg DK2020 CAP since 2020 has supported the iteration and progression from an energy-focused approach to a climate (sustainability) approach, including a stronger focus on inclusion of vulnerable groups and municipal focus on the UN Global Goals.



The Sønderborg systemic change model and stakeholder engagement approach has since 2007 been the Sønderborg normal for change management as now recommended in the NetZeroCity systemic change model. Key society (hotspot) representatives across all sectors have formed the ecosystem for change. The ProjectZero public-private partnership has helped Sønderborg build a strong mandate. Since 2007, the ecosystem partners (now hotspot participants) during planning and implementation have learned and understood the system, co-created a portfolio, been taking and implementing actions, learned and reflected (during planning-events and specific project executions), always aiming at making it *the New normal* in Sønderborg.



By adapting to the Cities Mission Climate City Contract, Sønderborg municipality expect to progress and accelerate all current action plans, cooperations and financials to achieve our ambitious joint climate/energy goals. Plans will continue to be reviewed and updated every year (or for DK2020: every second year) to secure a strong alignment with new technologies, national and international policy framing etc.



## 5 Signatories

Include a list of stakeholders who have committed to help your city achieve its goal to reach climate neutrality by 2030. Detailed commitments and agreements between individuals or groups of stakeholders should be appended to this Commitments document. This list will likely increase over time.

Name of the institution	Sector/Area	Legal form	Name of the responsible person	Position of the responsible person
Sønderborg municipality	City Council and municipality as authority and company	Municipality	Erik Lauritzen	Mayor of the Municipality of Sønderborg
Sønderborg Forsyning	Waste	Municipal company	Ellen Trane Nørby	Chairman of the board
ProjectZero Foundation	Energy/Masterplan2029	Foundation	Lars Tveen	Chairman of the board
ProjectZero Hotspot	Integrated Energy system	N/A	Christian Udby	CEO, Sønderborg Forsyning and hotspot-owner
ProjectZero Hotspot	District heating	N/A	Erik Wolff	CEO, Sønderborg Varme and hotspot-owner
All ProjectZero Industry-hotspots	Industry sector including all hotspots for Large manufacturers, Brick- and SME companies	N/A	Martin Johanning	Director Real Estate Operations, Bitten & Mads Clausen Foundation and Industry sector/hotspot-owner
ProjectZero Hotspot	Owner Occupied Housing	N/A	Morten Vestergaard	Deputy director, Broager Sparekasse and hotspot-owner
ProjectZero Hotspot	Passenger transport & Public buildings	N/A	Tim Hansen	Chief Executive of the Municipality of Sønderborg

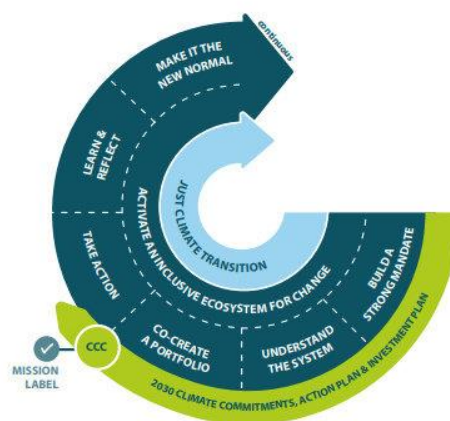




## Appendix 1: Individual Signatory Commitments

Specific agreements that articulate the details of the climate action(s) between the municipality and other stakeholders (individual or groups) can be added to the Commitments document appendix.

As mentioned, not only in this Sønderborg CCC Commitments document, but also the Sønderborg CCC Action Plan and the Sønderborg CCC Invest Plan, the Sønderborg's Masterplan2029 has a strong society & stakeholder anchoring. 70+ local stakeholders and climate experts in 15+ ProjectZero hotspots co-created the Masterplan and take now joint responsibility for the execution, monitoring and reporting of progress towards 2029. The Sønderborg systemic change model and stakeholder engagement approach have thereby since 2007 been following the much later best practice change management recommendation expressed by the NZC model. Key society representatives across all sectors have formed the ecosystem for change. The ProjectZero public-private partnership has helped Sønderborg build a strong mandate. Since 2007, the ecosystem partners (now hotshot participants) during planning and implementation have learned and understood the system, co-created a portfolio, been taking and implementing actions, learned and reflected (during planning-events and specific project executions), always aiming at making it *the New normal* in Sønderborg.



The graphics below show the hotspot-structure and how the current 70+ participating stakeholders (representatives of the Sønderborg ProjectZero ecosystem) align with the ProjectZero management/PMO, the ProjectZero board of directors and Sønderborg's City Council.

Sønderborg City Council and ProjectZero Board of Directors															
ProjectZero - Project Management Office															
Sector	Energy					Buildings			Industry			Transport			
Hotspot	Integrated energy system	District heating	Lillebælt Syd Wind park	Power-to-X	Biogas	Wastewater plant	Owner occupied housing	Rented housing	Public buildings	Large manufacturers	Brick companies/SME	Goods and heavy transport	Agricultural machinery	Passenger transport	
Hotspot owner	Christian Udby (Sønderborg Forsyning)	Erik Wolff (Sønderborg Varme)	Christian Udby (Sønderborg Forsyning)	Emil Vikjær-Andersen (European Energy)	Jonas Svendsen (Nature Energy)	Stinne Stokkebo (Sønderborg Forsyning)	Morten Vestergaard (Broager Sparekasse)	Jan Mortensen (Nørrebro Andelsboligforening)	Willy Feddersen (Sønderborg Kommune)	Martin Johanning (BMC Fonden)		Niels H. Schmidt (Gråsten Landb. Skole)	Willy Feddersen (Sønderborg Kommune)		
Project manager	Allan Pilgaard-Jensen (ProjectZero)	Tue Christensen (Sønderborg Varme)	Sarah Bach (European Energy) og Susanne L. Aagaard (Sønderborg Forsyning)	Lotte Lindeloff (European Energy)	Markus H. Pedersen (Nature Energy)	Susanne Vesten (Sønderborg Forsyning)	Anne Branderup (ProjectZero)	Anne Branderup (ProjectZero)	Mie R. Nielsen (Sønderborg Kommune)	Jens Chr. Moltke-Leth (ProjectZero)			Louise Bjørklid Petersen (Sønderborg Kommune)		
Group	The hotspot owners across sectors	The three district heating companies The municipality Danfoss	Lillebælt Syd wind park project team led by European Energy and Sønderborg Forsyning	PIX project team led by European Energy Sønderborg Danfoss	Biogas project team Nature Energy projektteam	Wastewater project team led by Sønderborg Forsyning	Craftsmen Banks Utility The municipality Real estate agent Energy consultant Architect	Repre. from the housing associations Energy consultant Architect Private renting house repre.	Municipality building team	Repre. from the manufacturers	Repre. from the brick manufacturers	Repre. from small and medium-sized companies	Repre. from companies using heavy transport	Jens Lei Thomas Langer Erik Westergaard	Municipality teams on cars fleet, public transport, bicycling, carpooling Car dealer Passenger car organization EV charging company

Additional supporting signatories have been provided by the following selected key hotspot/sector-owners:



- Christian Udby, hotspot-owner, Integrated energy system
- Erik Wolff, hotspot-owner, District heating
- Martin Johanning, sector/hotspot-owner, Industry and all associated hotspots
- Morten Vestergaard, hotspot-owner, Owner occupied housing
- Willy Feddersen, hotspot-owner, Passenger transport & Public buildings



## Appendix 2 - How the ProjectZero engine fuels Sønderborg's climate transition

Below we have in brief described the social systemic ProjectZero approach facilitating Sønderborg's execution of the CCC 2030 Action Plan.

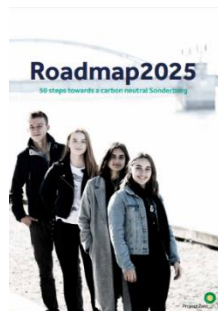
### Public-private partnership addressing society 360-degree

Public-private partnership and strong energy/climate planning traditions have been fueling the transition since 2007, where the city council embraced the ProjectZero-vision and co-created the ProjectZero-secretariat as an enabling and catalysing public-private body for planning, innovation, execution, monitoring, communication etc. with citizens and stakeholders.

Public-private, because less than 3% of the Sønderborg territory carbon emissions (2007) were created by municipal buildings, transport etc. The public-private partnership has since 2007 developed into a Sønderborg DNA, demonstrated effectively also in other important city council projects, like the Gehry Harbour project, the Nordals holiday resort etc. As part of the [EU BSR Act-Now project](#), Sønderborg created a [Public Private Partnership Guideline](#), as the Act-Now project management concluded that the climate transition can only be effective by a such collaboration.

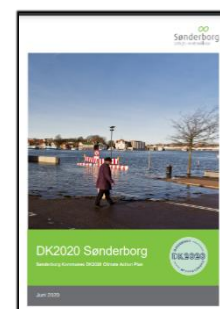
### Co-created ProjectZero Masterplan & Roadmaps since 2009

The five-year planning approach has since first implemented in 2008/2009 proven to be work in Sønderborg, especially because each planning process attracted and engaged up to 100 local experts and stakeholders in the co-creation process.



The stakeholders have worked in (segmented) working groups, addressing sectorial energy/climate challenges. [Roadmap2025](#), developed as an IEP (Integrated Energy Plan in 2018) as part of the EU Horizon2020 [SmartEnCity project](#), were based on 8 such working-groups. The strong stakeholder commitment was maintained during the execution-phase, where the stakeholders took and have demonstrated additional responsibility for implementation, monitoring and communication.

As described in the CCC Commitments document, the Roadmap2025 plan also shaped the climate mitigation plans when Sønderborg in 2020 co-created the [Sønderborg DK2020 Climate Action Plan](#), following the C40 framework. The [Sønderborg DK2020 plan](#) was approved by C40/Concito in June 2020 and Sønderborg became together with the Island of Samsøe DK2020-frontrunners in Denmark. By now (spring 2023) majority of Denmark's 98 municipalities have completed their DK2020 Climate Action Plan, following same framework.





When creating the Masterplan2029, the number of groups/hotspots were increased to 15 to secure a strong stakeholder-participation in the masterplan co-creation process, followed by same stakeholders taking shared responsibility in the implementation and execution of the Masterplan2029.

Sønderborg City Council and ProjectZero Board of Directors															
ProjectZero - Project Management Office															
Sector	Energy				Buildings				Industry			Transport			
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Project manager	Allan Pilgaard-Jensen (ProjectZero)	Tue Christensen (Sønderborg Varme)	Sarah Bach (European Energy) og Susanne L. Aagaard (Sønderborg Forsyning)	Lotte Lindeløff (European Energy)	Markus H. Pedersen (Nature Energy)	Susanne Vesten (Sønderborg Forsyning)	Anne Brandrup (ProjectZero)	Anne Brandrup (ProjectZero)	Mie R. Nielsen (Sønderborg Kommune)	Jens Chr. Moltke-Leth (ProjectZero)			Louise Bjørklid Petersen (Sønderborg Kommune)		
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The execution of Masterplan2029 is supported by the ProjectZero Project Management Office, since 2022 responsible for monitoring the KPI-progress and results. The results are shared with the hotspot-groups, ProjectZero management and city council committees as per the Masterplan2029 and DK2020 Governance.

Sønderborg’s CCC 2030 Climate Neutrality Action Plan is based on the Masterplan2029 and DK2020 plan. The Action Plan describes the two plans and how they relate to the CCC scope. The Action plan includes a detailed GHG inventory baseline and energy use baseline, how these will be reduced by 2030 including possible gaps and how they will be addressed and what possible barriers could hinder the development.

### Citizen participation, co-creation and co-production since 2009

Citizen engagement in Sønderborg’s ProjectZero transition has been a key political goal since the project started in 2007. The ZEROfamily program with 1000+ participating families in 2009 learned us important lessons and the need for constant new iterations addressing more specific citizen subsegments, that just “citizens” in general. We experienced that a sub-segmentation based on the ownership of the “homes” would help us understand the different challenges between being a homeowner-family and being a tenant or a resident. We learned how to fine-tune value-propositions and target/communicate them in society, and we found civil society partners and organizations with whom we could co-create, co-produce and scale up the engagement. Kids in schools became our first green ambassadors and now these kids have progressed into climate activists, PhD-students in climate, environmental or nature subjects, several of them now working with policy in government agencies, at universities or consulting companies – spreading a green transition message from Sønderborg.

Vulnerable families/groups in Sønderborg include elderly people living in their own old fossil fueled home, young low-income families with kids living in private rented homes in rural areas of Sønderborg. Together with the municipality, ProjectZero since 2009 and will



continue to address low hanging climate action solutions, to onboard these families addressing no-cost or low-cost energy saving opportunities, as our learning is, that these families will progress their own actions based on a successful initial (climate) customer journey.

The rural areas of Sønderborg account for app. 30% of Sønderborg's population and in the 36 municipal rural area districts, there is a strong social systemic structure for supporting citizens – and potentially leaving no one behind.

### **Learning from collaboration with other European ambitious cities**

Since 2007, the ProjectZero project has catalysed and supported Sønderborg municipality, citizens, companies and interested key stakeholders in ramping up and executing innovative climate approaches/solutions supporting Sønderborg's carbon neutrality by 2029 ambition.

We have learnt and progressed from our early energy and climate frontrunner initiatives, mistakes and results achieved. We have corrected our plans and approaches based on the learning and shared the learnings with other ambitious cities in Denmark ([Energibyerne](#)) and abroad (eg. the [SmartEnCity Network](#)).



### **A data-driven Plan–Do–Check–Act process**

From initially a lack of data for planning and monitoring, we have together with Danish utility and engineering companies, authorities and agencies paved the way for making energy data available, despite but respecting the EU GDPR-laws. Such data has helped us (since 2009) monitor sectorial energy efficiency and carbon reduction improvement and address/target specific windows of opportunities in our planning iterations since 2008/2009, when we co-created the initial Masterplan2029 and the Roadmap2015 focused on a 25% CO2-reduction by 2015.

*The ProjectZero public-private partnership is committed to continue supporting the Masterplan2029 journey until 2029, align the Masterplan2029 stakeholders, monitor and report the KPI-progression and results according to the Masterplan2029 Governance.*