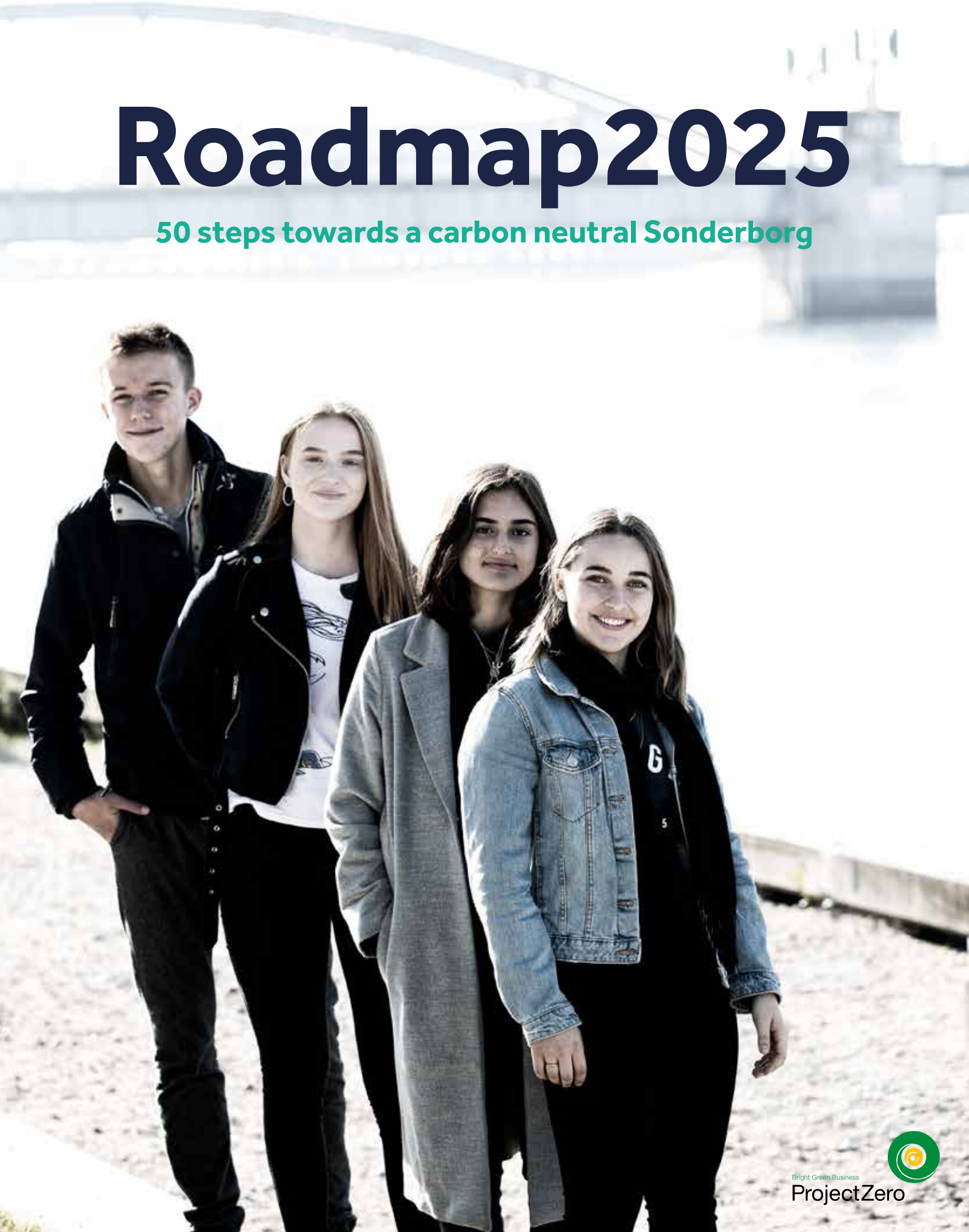
Roadmap2025

50 steps towards a carbon neutral Sonderborg



Bright Green Business
ProjectZero

Welcome to Sonderborg's Roadmap2025

Sonderborg continues its journey towards a carbon neutral Sonderborg area in 2029. Since the start in 2007, the need for action has only grown. Climate challenges are becoming more and more visible, and the transition will have to go into a higher gear to live up to what the international community agreed to in Paris in 2015. Cities play a crucial role, and Sonderborg will be a role model and front runner in this process.

The City Council's ambitious goal of carbon neutrality in 2029 is a common driving force for citizens, businesses, educational institutions, utility companies and the municipality. The ProjectZero Vision makes Sonderborg the front runner concerning climate initiatives, and helps to strengthen the area's regional, national and international reputation. Since 2007, carbon emissions in the Sonderborg area have been reduced by 35% and energy consumption by 14%.

The Roadmap2025 report describes how the Sonderborg area will attain a 75% carbon reduction by 2025, based on local cooperation, coordinated efforts and the willingness to make a difference. Roadmap2025 is thus an important milestone on the road to zero in 2029. Roadmap2025 is the result of more than 100 people working in 8 defined areas for more than half a year.

Local involvement creates climate effects while developing a sustainable and attractive community. The journey towards a carbon neutral Sonderborg creates innovation and growth in the many Sonderborg businesses working in energy efficiency, urbanisation and new smart and sustainable technologies. The journey is based on learning and climate education from ABC to PhD, and it attracts and retains citizens who would like to be part of a meaningful community.

Sonderborg has world-class view. We learn and share our experience. We therefore hope that Roadmap2025 will inspire all cities and businesses to ambitious climate efforts, thus contributing to a sustainable and better world for future generations.

Sonderborg, 4 December 2018.

Lars Tveen
Chairman of the ProjectZero Foundation
Director, Danfoss Heating Sector

Erik Lauritzen
Mayor of Sonderborg Municipality
Deputy Chairman of the ProjectZero Foundation

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The energy system of the future

The transition is based on 100% renewable energy, which must be phased in with respect for solutions and the market

The dynamic energy system

Today, biomass accounts for most of the renewable energy in Denmark, but in the longer term, solar and especially wind power are expected to become the dominant renewable energy sources.

In Denmark, electricity provision is expected to be 100% from renewable energy sources from 2030, and in Northern Europe it is likely that wind and solar will account for 45% of the total electricity production in that year.

This will lead to a huge integration challenge, with regional cooperation on new foreign connections and large-scale electrification in almost all parts of the energy system both being important measures.

The three biggest challenges in integrating wind and solar power are:

1. Securing production value when there is surplus, to prevent a large part of the energy produced being sold at low or nil prices.

2. Guaranteeing adequate production capacity when there is no wind or sunshine. Wind and solar expansion means that it will be less attractive to build traditional power and heating plants.

3. Managing the uncertain predictability of wind and changing production patterns.

The integration challenge will be reflected in electricity prices, which will vary considerably more than at present. There will be several hours of high prices and several hours with very low prices in particular. This will open up interesting business opportunities to service the growing need for flexibility in the electrical system. Energy companies, businesses, agriculture, home-owners and stakeholders in the transport sector will be affected by this change and can help to meet the challenge.

What does this mean for Sonderborg's transition?

Heat pumps in the heat supply constitute the most obvious electrification option in the short term. Due to the availability of heat storage and good opportunities for switching among different technologies, the greatest potential lies in district heating. With the reduction of electricity tax, electric heat pumps will gradually become competitive with biomass solutions, so heat pumps will be an important part of future production. The use of individual heat pumps can be made flexible by using buildings and hot water reservoirs as heat storage units.

Electrification in industry and agriculture can also offer flexibility to the electrical system by postponing electrical consumption or switching among different heating sources, depending on the needs of the electrical system.

In addition, home-owners are increasingly expected to become "prosumers" who produce and consume electricity, and by combining solar cells with batteries they will be able to provide additional flexibility to the electrical system.

The transport sector will be a significant buyer of electricity, and the batteries in electric vehicles can help balance the electrical system. However, electric vehicle charging has a powerful impact, and if the electric vehicle owners do not get an incentive to charge (and discharge) according to the needs of the electrical system, electric vehicles could pose a challenge to the distribution network.

Green gas is an important source of supply in those sectors where electricity is not practical or where energy is needed for longer periods of time. This applies to certain industries, parts of the heavy transport sector and to power plants to provide backup for wind and solar.

The green gas is produced from Sonderborg's biogas plants or by biomass gasification. It can be supplemented with synthetic green gas derived from hydrogen from electrolysis plants. Electrolysis systems can also play an important role as buyers of cheap surplus power from solar plants and wind turbines.

Challenges and opportunities for Sonderborg

The plans for electrification of the heat supply and the electricity usage targets in the transport sector in Sonderborg will greatly support a more dynamic energy system and contribute to the integration of solar and wind power.

However, it is crucial that these new electrical consumption modes will be flexibly integrated into the electrical system. This will require that home-owners, district heating suppliers and businesses play along in electricity markets that signal consumers about shortages or excesses in the network via electricity prices.

Sonderborg must play an important role as a 'demonstration' venue for new technologies and business concepts that will be necessary in the dynamic energy system of the future.

Demonstration projects should be based on special skills or prerequisites in the Sonderborg area. These may be existing collaborations and partnerships, companies with special skills and products or special infrastructure requirements.

Sonderborg way

Action, cooperation and curiosity drive the process

A better place to live and work

The City Council decided as early as 2007 to make ProjectZero – transition to a carbon neutral community by 2029 - one of Sonderborg's three lighthouses. The other lighthouses are the City Port, with the Gehry Harbour Project and Nordals Holiday Resort. Lighthouse projects are an indications of the City Council's daring, prioritising, acting and implementing.

The lighthouses reflect Sonderborg's DNA, namely, how to reconcile simultaneous concrete challenges while ensuring that they are solved in a committed public-private partnership aimed at strengthening skills, growth and job creation.

Learning and skills are the basis of development and growth. Sonderborg's participation as UNESCO Learning City ensures coherent learning processes - not only from ABC to PhD but in lifelong learning focused on sustainability and the UN's Sustainable Development Goals.

It is about making the Sonderborg area a more attractive place to live and work, and it is about putting Sonderborg on the world map and contributing to local pride and growth.

Curiosity and technical ingenuity

In the Sonderborg area, curiosity and technical ingenuity has created wealth in agriculture and industry and remain an important basis for the area's development.

Mads Clausen, who founded Danfoss, was the son of a farmer's family, and Bent Jensen founded LINAK on the basis of the family machine factory that had manufactured to the agricultural sector since 1907. First, the School for Craftmenship (now EUC Syd) and later Sonderborg Teknikum (now the University of Southern Denmark, Alsion Campus) attracted young talents who subsequently established their own companies in radio, communications and IT, mechanical engineering and controls and automation.

That created the foundation for the diversity of local businesses, which today provide consulting and energy efficiency solutions to the whole world. And tomorrow, perhaps they will be delivering smart energy solutions to smart cities.

In the area's primary schools, science, technology and mathematics are supported by the House of Science partnership, which also ensures that climate, innovation and sustainability continue to be solid rails on the learning track from ABC to PhD.

At the Gehry Harbour, the new Alsik hotel is being built as a show case for the area's energy-efficient solutions and green district heating.

At the University of Southern Denmark Alsion Campus, a public-private partnership is founding a new Centre for Industrial Electronics (CIE), which will attract new talents from the outside and create new green spearhead skills for the area's businesses.

SmartEnCity is developing the future smart city of the future in Sonderborg

Sonderborg is an EU SmartCity lighthouse. Together with lighthouse cities Tartu (Estonia), Vitoria-Gasteiz and follower cities Lecce (Italy) and Asenovgrad (Bulgaria), Sonderborg is demonstrating how to electrify, digitise and convert an entire city.

The EU Horizon2020 project is called SmartEnCity and focuses on energy-efficient buildings, transition to renewable energy production, green transport and IT.

But it is not just about the five cities' transition, since as a demonstration project, it will show all small and medium-sized European cities how to handle the transition based on the experiences in Sonderborg, inter alia.

The smart city is based on the ZERO objectives, with a focus on smart and integrated interplay among buildings, energy production and transport, based on learning and skills, involving residents and local stakeholders in planning, subsequent actions and collaborating with other cities.

In the SmartEnCity Network, cities are inspired by the best experiences from the network's 40 member cities, which also meet in national networks.

Mandatory cooperation as part of the DNA

ProjectZero was conceived by a local think tank in 2007 and was founded as a public-private partnership shortly thereafter, with support from both the City Council and local businesses. The idea is that only through a collaborative culture where businesses, residents and organizations contribute, can an entire region lift itself out of provincial thinking, to the benefit of the community and the stakeholders themselves. In the same spirit, Alsion, Kultur i Syd, the Gehry Harbour Project, the House of Science, UNESCO Learning City, Nordals Holiday Resort and the Centre for Industrial Electronics have been established as public-private partnerships.

Sonderborg's participation in the national DK2050 project under the Danish Architecture Centre confirmed Sonderborg's special will to go all the way. Not only did Sonderborg choose to extend the project for a special two-year period, but it also chose to develop the 'Green Guerilla' scenario in close collaboration with the area's business leaders, politicians and youth.

Greater involvement of young people is also the theme of Sonderborg's participation in the Nordic Council of Ministers' Attractive Nordic Towns project, in which Sonderborg, in collaboration with Narvik, Norway is focusing on how young people can be more involved in green urban planning/development and green entrepreneurship.

The energy patrol causes children to turn off lights

Hi Michelle. Have you seen we've got a green smiley again?

That phrase was often heard as eighth-grader Michelle Yde Junker met some of the youngest students in the corridors of the Sønderskov School. Last year she was in the school's special energy patrol and she was around to teach the youngest classes to save energy. There was a small competition where the classes got a smiley and the students really got involved in being the best.

The school's energy patrol has existed for five years. Teacher Henrik Fenneberg is behind it, and he emphasises that all activity ideas come from the patrol members. But it is a regular component that the patrol teaches the youngest classes, and Henrik Fenneberg can see a clear result of the effort.

'There is great awareness of saving energy. In any case, I think the school is carbon-neutral during break time', he said.

Mathilde Kobberø was also in the patrol last year and it has been very instructive.

'I have become much more aware of energy. We have also talked about it at home and I can catch my parents forgetting to turn off the iron', laughed Mathilde Kobberø.

The energy patrol happily participates in Project Zero's school competition and brings one of the prizes home. Sønderskov is also the only school in Sonderborg Municipality to have received the Outdoor Council's green flag.

Quality can always pay off

In any case when you now...

That is the motto of most energy refurbishment, and also for HKS Invest, who in 2017 took over a 900 square-meter villa at Kongevej 73 in Sonderborg. Something had to be done with the roof, and it ended with a huge renovation.

Along the way, the company's CEO, Carsten Piepgras, and architect Jørn Kjeld Andersen agreed to reinsulate the entire attic and roof structure in the old part of the property.

The villa dates from 1980, with a large extension from 2005. When HKS Invest took over the property, a former tenant left, and it has now been rebuilt so that a new tenant, Guide2know, got it exactly as they wanted.

'We chose quality all the way. Our company founder always wanted things done properly, and I think it's worth it. We switched all the lights to LED and selected some good quality lamps that we do not have to change all the time', explained Carsten Piepgas.

IT company saves driving for dustmen

A small plastic gizmo the size of a computer mouse can save the country's dustmen thousands of kilometres of driving and significantly reduce carbon emissions.

The device comes from Sonderborg's Maack IT company, which has gone from 7 to 14 employees in a short time because of the technology developed by proprietor Esben Maack and his team.

The idea is very simple. The little mouse is attached to a waste container, and then it can tell a central computer how much waste is in it. In this way, the collectors do not have to drive down the small roads and empty half-full containers.

'The system runs in 7000 containers at recycling depots in Kolding Municipality and has saved 3 out of 4 emptyings. That means both manpower and carbon. Thus, Kolding Municipality can manage with fewer trucks", said Maack.

The sensors in the waste containers are not new, and they can deceive. A container may look full if there is a large cardboard box filled with air in it.

The Sonderborg company's sensor sends sound waves into the container and measures how long they take to return. The sooner they do, the more full the container.

Esben Maack started his IT company as a spare-time project in 2007. In 2012, he hired the first employee and began developing his own solutions.

'I have been working with ProjectZero since the start and have received inspiration and dialogue on a regular basis. There is no doubt that it has helped develop the business to become what it is today. It is really exciting to work for the reduction of carbon emissions in Denmark.'

Maack IT sells its solutions to municipalities, waste companies and haulers throughout the country, and Esben Maack has also begun to look into other countries.

There is a great potential for the green solution from Sonderborg. But a plastic gizmo filled with electronics - is that especially environmentally friendly?

'Yes. We have deliberately developed it so it's easy to separate. Then you'll be left with plastic, metal and electronics that can be recycled', explained Maack.

Total annual carbon reduction in the 8 areas in 2025

A

Owner-occupied housing

The housing customer journey, together with district heating, heat pumps and green power, will ensure transition

ZEROhousing customer journey

The ZEROhousing customer journey will help home-owners implement profitable energy renovations. The customer journey has 11 steps, which:

- support the decision process and implementation;
- help the home-owners to showcase their efforts; and
- help them to initiate new renovation projects.

The customer journey was developed in the Netherlands, where it has helped a number of cities to strengthen their renovation efforts in close collaboration among the municipality, financial institutions and craftsmen.

The ZEROhousing customer journey is being implemented in the Sonderborg area, and local stakeholders have developed ideas to strengthen the process in connection with Roadmap2025:

- The municipal "Byg & Bolig" department will strengthen communication about the need to take energy and climate into account when considering rebuilding, expanding or new construction. Communication is reinforced by targeted inspirational leaflets.
- The primary schools' green curriculum will develop a practice track enabling students to apply their energy and climate skills at home and in the community, thus helping to translate the family's energy ambitions into action and altered behaviour.
- All Sonderborg area banks and real estate agents take energy and climate into account in giving advice and pay special attention to the right timing of their customers' housing market transactions, or roof or heating replacement.
- EUC Syd will target new training programmes for the area's construction and installation companies. The nearly 80 companies that have previously educated themselves as energy consultants form the basis for training in common imaging on the customer journey process, strengthened efficiency and business potential through all the steps of the customer journey.

> ***All banks in the area need to be offensive to get more people to energy renovate.***
>
> *Morten Vestergaard, Deputy Director, Broager Sparekasse.*

- ProjectZero will develop badges/stickers for home-owners who have made a special effort. Recognition and visibility are important elements.

Experience shows not only that the Netherlands' and Sonderborg's economic security and guidance motivate home-owners on their first customer journey, but also that home-owners subsequently continue their journey with new renovation measures, so that the housing will achieve an even better energy label.

The coming years are expected to increase the pressure on home-owners to energy-renovate their homes, reducing the energy consumption of owner-occupied houses by 50–60%.

From the EU, the ambition of nZEB Nearly ZERO Energy Buildings is also expected to influence the Danish framework and advance the resulting energy rehabilitation efforts. The carbon reduction expectations are determined on the basis of specific Building and Dwelling Register-based potential calculations of profitable energy renovations.

Green district heating will phase out 4,100 oil and gas burners in the cities

The Sonderborg area's district heating plant has phased out fossil fuels over the last few years, and the heat supply is now based on sorted waste, biomass, large heat pumps, solar heat, geothermal power, etc.

The municipal heating plan (2015) forms the basis for district heating expansion and fuels. On the island of Als, gas is converted into biomass and surplus heat for housing in both Nordborg and Guderup.

The Sonderborg area's district heating is therefore a carbon neutral, cheap and future-proof source of heat for home-owners in urban areas and thus also the foundation for phasing out the approximately 400 oil burners and 3,700 gas burners in current or future district heating areas.

Carbon reduction Owner-occupied housing

15,000 tonnes	CUSTOMER JOURNEY
12,000 tonnes	HEAT PUMPS MUST PHASE OUT OIL AND GAS BURNERS
4,500 tonnes	DISTRICT HEATING - PHASING OUT OF OIL AND GAS BURNERS
0 tonnes	REDUCED POWER CONSUMPTION
3,500 tonnes	ROOF-INTEGRATED SOLAR SOLUTIONS FOR DETACHED HOUSES
35,000 tonnes	Total

Roof-integrated solar cell solutions for detached houses

Nearly 1,700 home-owners in the Sonderborg area already harvest energy from the sun with their own solar cells.

Most facilities were acquired with subsidies from 2009–2013 and the number of new units has since been reduced dramatically. However, since 2008, the price has fallen by 75%, and prices are expected to continue to decline, so it is profitable to put up new units without subsidies.

Experience shows that not all types of houses are suitable for solar cells, but that integrated solar cell solutions in detached houses create a visually attractive and energy-efficient functional result. The solution should be implemented when the roof of the house need to be changed, thus reducing the total cost by up to 40%.

Production of one's own green power simultaneously increases experience while saving energy (behaviour) as well as subsequent acquisition of one's own battery solution, electric car and heat pump solution (in rural areas). At present, there are no regulatory limitations on the solar cell capacity that home-owners can install on their own roof.

In keeping with the continued reduced prices of solar cells and increasing renovation of approximately 10,000 detached houses built after 1962, we expect that approximately 20% of home-owners will have established their own roof-integrated solar cell solution by 2029.

Heat pumps must phase out 5,100 oil and gas burners outside the district heating areas

The Sonderborg area has approximately 5,200 owner-occupied homes outside the district heating areas.

In addition, approximately 2,500 summer and holiday homes, primarily on Sydals, on the east coast of Als and in Rendbjerg.

Of all these, 1,850 have oil burners, 3,300 natural gas and an unknown number have biomass heating or electric heating.

Several home-owners in rural areas have switched to heat pumps and are happy every day with the increased comfort and lower heat bills. Air/water and geothermal solutions in particular are going to be geared up in all-year housing.

The air-air heat pump is a good solution at an attractive price for summer and holiday homes.

As the power becomes 100% carbon neutral, heat pumps represent a carbon neutral, affordable, long-term and safe heating solution for home-owners outside the district heating areas.

The goal is that all oil burners and 50% of the area's existing gas burners will be converted to heat pumps and that the remaining gas burners will use local biogas in 2029.

Reduced power consumption

The Sonderborg area's power consumption has declined for a number of years due to increased awareness, changed behaviour, switching to LED lighting and more energy-efficient appliances.

Home-owners' traditional power consumption (excluding power for heat pumps, electric cars) has to be reduced by another 10% by 2029. The efforts include campaigns, changed behaviour and purchasing more energy-efficient lighting and devices.

The initiative is supported by ZERO-driver-education in the area's primary schools, where children and young people learn about electricity production and consumption by testing home appliances, for example. The technological development and continued strengthening of EU legislation for the energy consumption of appliances, etc. contributes to achieving the goal.

In practice, Sonderborg District Heating is carbon neutral. Now we just have to have more consumers involved.

Jan Due Kristensen, Head of Department, Sonderborg District Heating.

Sustainability in the toolbox

Future craftsmen, trained at EUC Syd, have sustainability in their toolbox. Energy and climate-friendly solutions are part of the curriculum, and for the apprenticeship exam, students must always explain the sustainability of their project.

'The way of thinking is a direct consequence of our long-standing cooperation with ProjectZero, which EUC Syd is a very active part of. Skills is the key word for green transition to succeed in practice', explained Deputy Director Hans Lehmann of EUC Syd.

Currently, EUC Syd is organizing targeted training that will make skilled craftsmen more capable of choosing sustainable solutions in the future.

There are two pillars: Materials theory and business sense. The first is about choosing materials that are produced environmentally. The second is about seeing the possibilities at the customer's when, as a craftsman, you are there to carry out a task anyway.

EUC Syd is itself a large company and, like ProjectZero, the Board has set the goal of the educational institution being carbon neutral by 2029.

It is a big job, which management has systematically broken down into numerous small components that will come into place in the coming years.

'It is also a major organisational challenge, because we are going to do almost everything in a new way. But it also gives good energy to have a community around a case', added the deputy director.

A concrete example is EUC Syd's international work. It has now been changed so that EUC Syd participates only in projects dealing with climate, energy and sustainability.

Half-price heat

An oil bill of DKK 22,000–23,000 annually has been replaced with an electricity bill of half that amount.

The calculus is that simple for Anders Wollsen, who has got a new heat pump in his 1950s house a few kilometres from Sonderborg.

'It will pay off in 10 years, and I'm sure it'll be easier to sell the house with a heat pump than with an oil burner', said Anders Wollsen.

Together with his wife, he has lived in the house since 1982. There has been an extension and several small renovation projects over the 37 years. Energy savings have also been considered.

About three years ago, the house was cavity-wall insulated and the outer walls have been doubled.

The new heat pump was delivered by a local installer, and Wollsen is pleased with the solution. It took a couple of days to regulate the floor heating, and since then everything has just worked.

The pump is placed behind the house in a soundproof box and does not bother anyone. The water tank has taken over the oil burner's space and there is hot water in the taps, radiators and floors.

The energy nerd heats up his house for DKK 200.

An old hovel in Tovrup, outside Sonderborg, after one and a half years of hard work by owner and plumber Thomas Leimand, has become a pioneering energy-efficient house.

The 122 square meter residence is warm and cosy all year round, and the heating bill comes to a paltry DKK 200 per month.

At its heart is a combination plant with geothermal, ventilation and intelligent control. There is underfloor heating throughout the house, and Leimand has laid three times as many pipes as one normally would. This means that the hot water covers a very large surface and thus he better utilises the heat.

'I did all the work myself, so it wasn't so expensive. For a non-craftsman, such a unit will cost about DKK 200,000, and I really think it could pay off as an alternative to an oil burner', said Leimand.

He has taken account of every square centimetre of the house, with respect to energy efficiency. There are of course LED lights everywhere, including in the appliances Leimand has bought for the kitchen.

And then he has had a special mania for thermal bridges. He found every single one using a thermal camera, and then shut them down so that there is no cold leaking in anywhere.

Housing associations

Continued energy efficiency and green energy supply based on active tenant participation

Through several EU projects, housing associations have obtained experience and skills to build on and involve more people in. The housing associations' efforts will be more data-driven in the future, focusing on energy efficiency and transition to district heating and the use of renewable energy.

Tenants are introduced to the most effective measures, while we continue to inform them and strengthen their involvement in order to create even greater support for the initiatives. Overall, the efforts mean less energy consumption and greener energy in the housing associations.

Good data is the basis of energy efficiency

Based on present projects that collect energy data from housing associations, the data collection must be rolled out in all departments in order to benchmark buildings. Ongoing projects show positive results, and housing associations are interested in upscaling experience to offer residents the best possible housing comfort in the future.

Benchmarking must be used to streamline the housing blocks' operations. Caretakers and administration must be involved in the projects to ensure the effect.

Data collection of energy consumption enables housing associations to respond to energy waste due to damage or improper use of installations.

A significant benefit of data collection is that data can document the effects of the implemented energy renovations, making the benefits of energy renovation more visible to residents. It should also help to raise awareness of individual energy consumption.

Residents must be able to compare their energy consumption with the average in their block. This will make it clear what the residents themselves can do to save energy and money.

Digital heating control is already being tested in selected blocks. This experience will be used to roll out digital heat control to even more blocks to ensure the best indoor climate and heat management.

Digital heat control will be part of renovation projects, but will also be carried out in blocks as independent projects.

Green energy in housing associations

Housing associations in the Sonderborg area have for many years been working on energy optimisation and housing stock maintenance. Efforts will be increased up to 2029 in order to save up to 30% of current energy consumption. There are big differences in the potential of the individual blocks, but in collaboration with the residents, housing associations will initiate the projects that are profitable.

The housing associations in the Sonderborg area support development of district heating and have historically always converted to district heating when possible. Therefore, the planned establishment of district heating on Nordals is expected to make several departments convert their gas burners to district heating as soon as possible.

There is a big difference between the centrally heated blocks and those with individual gas burners and thus, the extent to which residents will notice the transition. In the blocks outside the district heating areas, work is already underway to replace gas burners with heat pumps. This work will continue as part of Roadmap2025, so that fossil fuels are eventually phased out in heating.

> ***Our energy cluster of more than 250 companies develops energy-efficient products and consults on energy efficiency around the world.***
>
> *Pernille Refshauge, Business Manager, Sonderborg Municipality.*

An investigation will also be made of whether it is possible to set up solar cells to operate the heat pumps in order to produce the energy locally.

Housing associations are on the forefront in establishing solar cells in order to produce an increasing share of their own energy consumption. Often, in the case of roof renovations, solar cells are installed, which can help cover the block's own consumption.

The production of green energy in the housing blocks will be implemented on the basis of current projects focused on financing solutions for housing associations in order to ensure a cost-effective transition for their residents.

Carbon reduction Housing Associations

2,000 tonnes RESIDENT INVOLVEMENT

2,500 tonnes BENCHMARK

3,500 tonnes ENERGY EFFICIENCY, DIGITAL HEATING CONTROL, SOLAR CELLS FOR HOUSING BLOCK CONSUMPTION

1,000 tonnes GREEN HEAT IN THE HOUSING ASSOCIATIONS

9,000 tonnes
Total

Double up – same energy consumption

Being a carpenter yourself, a sun room and interior decoration of a couple of attic rooms are no problem. So Henning Bonde has almost doubled the area in the townhouse on Lupinvej 7, without paying more for heat.

B42 built the townhouses in the 1950s, when insulation was not the big issue. Henning Bonde took over the lease from his in-laws, and when there were children, the creative craftsman got going.

In the attic there was a large drying room, and only a couple of walls had to be installed and insulated to make two cosy children's rooms.

The satisfied Lupinvej tenant's next idea: a lower sunroof. So it was insulated and with small energy improvements that Bonde himself implemented, the heating bill in the townhouse is no higher than that of the neighbours – just DKK 7000 kroner annually.

The rent is also low, and the block's economy is good, so Bonde now proposes that the block incorporate energy renewal into the plan whenever a tenant moves out.

'Then the old floors must be broken up and the floors and walls need to be insulated. It will provide very good energy savings, which quickly pay off. And no one needs to be rehoused. In this way, we can continuously recycle all the townhouses energy-efficiently, said Bonde.

Green profit on the mayor's road

Green investments have become a hit in the Søbo Housing Association's Block 11 on Borgmester Andersen Vej in Sonderborg. It started some years ago with solar cells on the roof of one of the long buildings.

'It was very good business. They provide more than expected, so every month we save on the electricity bill', explained Block Chairman Jørgen Brodersen.

The next step was LED lighting in the entire outdoor area and in the basements and carports. They draw electricity from the solar cells, and it has also proved to be a very good business. It has also had a pleasant side effect. Previously, there were a few cases a year of vandalism, but now a sensor turns on the lights in the carport, and the mischief under cover of darkness has ended on Borgmester Andersens Vej.

The third investment applied to the front doors into the 88 apartments. New models ensure that the heat does not leak into the stairway. On the other hand, there is a bit of ingenuity that Brodersen talks about with a wry smile.

'Now we can no longer hear if anyone is coming up the stairs. Of course, that's not so great. So we have to find out what is going on somewhere else', he laughed.

All green investments have been adopted at block meetings, and there is great satisfaction among residents.

'It is vital that we contribute to the environment; we have a common understanding of that. We also do a lot of waste sorting, and if there are some residents who cannot figure it out, we'll help them. It benefits us all', concluded Brodersen.

Housing Association are looking for facts

A new ventilation system can lower the heating bill, as can energy windows and insulation of wall and roof.

But how much? B42 Director Mikael Jensen is looking for the answer, but he has not found it yet.

'We get some estimates from consultants and suppliers, but no facts. At best, they are averages. We need to know exactly what the electricity and heat consumption was before a renovation, and what it is afterwards. Then we will have the real effect, but we have no access to those numbers today', said Jensen.

He has therefore taken the lead in obtaining data from residents of every public housing resident in all of Sonderborg Municipality. It is done anonymously, of course; the goal is not to pry into the Joneses' habits, it's to make the investments that have the greatest effect.

B42 is well underway with the process of reducing its energy consumption. The housing association prepared a climate and energy strategy in 2015, with one goal being to use 35 per cent less energy in 2022.

'We follow that and we have launched a great number of initiatives', the director said. 'We have purchased electric cars, we have retrained the staff in choosing energy-efficient solutions, and we have a fund each year giving DKK 1.5 million in grants for energy-saving projects that cannot make ends meet themselves.'

A key point is the daily behaviour of residents. B42 would like to help the tenants to get lower electricity and heating bills without feeling cold. This can be done through technology that shows the current energy consumption in a simple way. But B42 is planning to train interested residents and board members as energy ambassadors, who can then help the neighbours with energy-saving tips.

Private rental

More landlords need to see the good business case

For the past four years, ProjectZero has funded projects from the Property Owners' Investment Fund to implement projects focused on the area's private landlords. The experience of the project must be scaled into Roadmap2025 to intensify energy renovations in private residential rentals.

Existing legislation creates uncertainty about the landlord's opportunity to realize a positive business case. The barriers are dealt with in the newly developed digital tool "udlejerenergi.dk", which shows the path to successful energy transition in eight steps. The Roadmap2025 rental initiatives must address uncertainty and prime the landlords to see the business case for energy optimizing their rental homes. It creates value for themselves, for the tenants and for society.

Green guidance – with the right timing

The projects for private landlords must be seen as a progression, where the results of the individual project form the basis for the next. The purpose is to mature the sector and build the collective knowledge of landlords, tenants and consultants.

Experience shows that the right guidance at the right time is important to getting started with the right energy renovations. Therefore, the training of craftsmen, construction companies and financing partners must be strengthened with a focus on energy renovations in privately-owned properties, with a view to improving knowledge of the special rules and barriers that characterise the private landlords.

The project will be based on the experience of the former ZERO building training. An important part of the project is to identify when landlords need advice and more information, in order to get the right consultants, so landlords will find competent energy advice.

Both before and after an energy renovation, energy savings can be obtained by focusing on the property's operation. Often the heating or ventilation control is set incorrectly in relation to the building's use. It requires great technical insight to ensure the most energy-efficient operation – knowledge that may be difficult for landlords to keep up with.

> ***The interest in energy renovation is clearly present, But it must not be too complicated.***
>
> *Jens Munck, Centre Director, Nykredit*

Therefore, a training programme must be established focusing on operation and maintenance for private landlords who can prepare semiprofessional landlords to set up and maintain systems and thereby achieve energy savings for both landlords and tenants.

Certified leases should motivate landlords and tenants

A significant motivation for landlords' energy renovation is the increasing demand for energy-efficient rental housing. Therefore, it is essential that tenants can navigate between the different rental homes and choose based on energy consumption. Today, landlords announce monthly utility instalments without an opportunity to know the actual consumption. ProjectZero therefore aims at enabling landlords to have their leases certified based on an objective energy label focused on energy and indoor climate.

The certification can be used by landlords to market their leases. At the same time, the tenants are also given a better basis for choosing a residence. It should help to put the focus on the total costs for the residence.

The possibility of being certified is also expected to create a greater focus on energy transition and thus, the consultancy and operational optimisation projects will underpin landlords' need for guidance in translating plans into action.

It is now mandatory to have a valid energy label on all rental properties. Historically, many energy labels have been characterised by great uncertainty, but the quality has improved considerably in recent years.

In order to speed up the process in the Sonderborg area, a Sonderborg-model energy label should be developed – a more action-oriented model that can be used by landlords to implement the most profitable energy renovations.

The project is to be carried out as a collaboration between local energy advisors and the Sonderborg Landlords' Association and is expected to result in an inexpensive-to-implement energy label that can also form a basis for landlord–tenant interactions.

Carbon reduction Private Rentals

1,000 tonnes — GREEN OPERATION, GREEN PROFILE

4,000 tonnes — GREEN HEAT

500 tonnes — GREEN GUIDANCE, PROLIFERATION OF THE ENERGY MARKET

5,500 tonnes
Total

Receptive customers save energy

Insulation and energy windows are popular with private individuals who want to renovate or rebuild, according to Morten Rasmussen, head of Davidsen's DYI retail shop in Hørupshav:

'When we discuss a small project with a customer, we always go for energy savings, and we recommend the long-term solution, with 400 millimetre insulation and 3-layer windows. The customers are very receptive to it. They are used to listening to us as advisors.'

He added that the additional cost of choosing the most energy-efficient solution is often modest. It can be DKK 30 per square meter, so in the total bill it means very little for the customer.

''We talk to customers about the long-term economy and future-proofing their house. The interest rate is low right now and it is easy to borrow money, so almost all of them choose the good solution', said Rasmussen.

Energy windows can provide nice savings, but there is also comfort in it: less noise and better indoor climate.

On the other hand, the tight houses with three-layer glass can have problems with moisture, so another part of the advice is to talk about ventilation. Rasmussen finds that customers are very energy-conscious. Years ago, grey sheaths to insulate visible pipes were one of Davidsen's big loss leaders. That is almost over now, because everyone has got them. On the other hand, many LED bulbs and fixtures are flying off the shelves, even without the shop's advice.

'We notice that there is high awareness of choosing energy-efficient solutions instead of just going for the cheapest in the short term. I'm quite sure ProjectZero is contributing to people in this area focusing on using less energy', Rasmussen said.

Landlord with a sense for quality

Architect Heinrich Naeve was behind a number of beautiful, sturdy buildings in Sonderborg from 1901 to 1925. One of them is Jomfrusti 3 and 3A, which remained in his family until 2003, when private landlord Claus Østergaard bought the property and its 12 leases.

He was a banker, and invested money in the two beautiful properties in central Sonderborg. In 2017, Østergaard took the leap, resigned from the bank, and devoted himself to working on major renovations for the two properties. Since then, he has worked on Jomfrusti 3 and 3A, which are undergoing massive renovations.

The roofs have to be replaced, then the attic rooms must be furnished as new flats of 151 and 141 sqm, respectively, with stunning views of the city and its fjord. Østergaard himself is handling the exterior work, and like the old German architect, he has a sense for quality. He has participated in ZEROlandlord, which aims at getting private landlords in Sonderborg Municipality to rebuild their properties.

'In energy renovation itself, it's hard to break even. But if you combine it with something else, it's a great idea', Østergaard said.

The example from Jomfrusti 3 and 3A is easy to understand. In order to rebuild the roof, there must be a large scaffolding for several months in front of the property, at a cost of about DKK 200,000. While the scaffold is up anyway, it is an opportunity to drill holes and cavity insulate the property. It costs about DKK 60,000 and means better comfort and lower heat bills for the tenants.

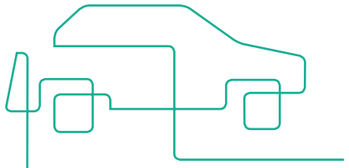
Claus Østergaard has the right to raise the rent by an amount corresponding to the rent's savings on the heat, but he has not done so.

'I have renovated the property for a year and it has bothered the tenants enough, so I would like to compensate them by saving a little on the heat', he explained.

The two new apartments will recoup the investment in new roofs, insulation and new joints. Then Østergaard believes and hopes that his property will increase its value. It is a kind of pension scheme.

Passenger transport

Electric cars take over Sonderborg



In the last 10 years, the number of cars in the Sonderborg area has increased by 5,000. Climate challenges put pressure on citizens' transport habits and behaviour. Many more should choose bicycles instead of the cars.

More people should use public transport, and more should carpool for work and leisure activities. The government's climate plan sends clear signals about the role of the electric car, and the phasing out of fossil cars has been kick-started.

Efforts will build on the Strategic Energy Plan for Green Transport, which Sonderborg Municipality and ProjectZero prepared in 2015.

Significantly more electric and plug-in hybrid cars

By the end of 2017, electric cars represented only 0.2% of the total fleet in the Sonderborg area. Significantly more electric cars are decisive in reducing carbon emissions in passenger transport. In the coming years electric cars will be cheaper and their range will increase, making the switch more attractive. The plug-in hybrid car is a good alternative to the electric car and is expected to attract those who are sceptical of the electric car's range or have high driving requirements.

The government's climate plan to phase out fossil cars from 2030 is expected to put pressure on car buyers and boost demand for electric cars. This development is to be supported in the Sonderborg area through active communication and behavioural efforts, dialogue with citizens and annual car events.
In order to visualize technological developments and the increasing number of electric car models, ProjectZero will support green car events where citizens can assess the offers, talk with local car dealers and test drive electric cars.

Test-an-Electric-Car will help to stir up prejudices about electric vehicles' range and prepare drivers to purchase electric cars. Special parking terms and free Ballebro-Hardeshøj ferry crossing will call attention to electric vehicles as the best choice. An increasing number of chargers in both public and private spaces will ensure that electric cars are charged in dialogue with the dynamic energy system.

There is a need to influence the legislature concerning tax and fee reductions in order to ensure that taxes favour electric cars over a long period of time. Thus, the total cost of ownership of electric cars will be attractive until battery technology has fallen dramatically in price.

We opt for electric bicycles

Roadmap2025 presupposes that more citizens will opt out of cars as the preferred vehicles and replace them with bikes - preferably an electric bike. Electric bikes has become very popular in recent years, and many smart models have come to market.

Electric bikes attract people of all ages who want to get more exercise or save money on driving. They are available in all price ranges and are expected to develop an even better price and performance over time.

In the Sonderborg area, there is a great potential for more people to choose electric bicycles as an alternative to cars.

We will tell the good stories of citizens, who focus on the electric bike as a light and time-saving means of transport that fits nicely into a busy day, and carry out campaigns to communicate its many benefits.

Local bicycle dealers and Sonderborg Municipality will arrange for people to have the chance to test an electric bike over a long period. Prior experience has shown that those who have had the opportunity to test an electric bike often buy one afterwards. Bike Forum is a very important partner in this area.

Continous optimisation of public transport

More residents need to switch over to public transport, there is especially untapped potential along Route 223, which connects the area's three main cities: Gråsten, Sonderborg and Nordborg. Public transport helps reduce road congestion, parking challenges and particulate pollution.

When citizens choose public transport, it is important that it is an attractive alternative to their own car. Shorter times between departures should make bus line 223 more attractive. This means less waiting time and better opportunities to get back and forth.

In addition, express routes should be established on the same stretch, where travel card analysis and prior experience should help in selecting stops to suit customers' needs.

The travel card data analysis will map the area's travel habits and provide indications of other routes where public transport needs to be improved.

It is not enough simply to increase the frequency and establish fast routes; this must also be integrated with targeted communication efforts. We must especially work with people's attitudes towards public transport and keep them updated on new routes and roadmaps.

In 2017, public transport reached an important green milestone. Converting 44 diesel buses to biobuses meant that the entire public transport within the Sonderborg area became carbon neutral.

The green transport platform provides a good basis for motivating aware residents to switch from cars to buses. It is important to keep young people using public transport. A newly acquired driver's license is often a negative springboard to private car ownership, from a transport point of view.

Carbon reduction Passenger transport

10,500 tonnes	ELECTRIC CARS AND PLUG-IN HYBRIDS
500 tonnes	CARPOOLING
1,500 tonnes	INCREASED CYCLING AMONG CHILDREN AND ADOLESCENTS
4,500 tonnes	TEST AN ELECTRIC BIKE
500 tonnes	SELF-PROPELLED BUSES
10,000 tonnes	IMPROVEMENT OF PUBLIC TRANSPORT
5,000 tonnes	TRANSPORT IN COMPANIES
-14,500 tonnes	PASSENGER CARS PROJECTIONS
3,000 tonnes	TRANSITION TO GAS BUSES

21,000 tonnes

Total

The petrol vehicle collects dust

An electric car was a second vehicle for Birgit and Andreas Aupke in Egernsund when they bought it a couple of years ago. Now the petrol model gathers dust and has only been filled up once in a year.

Andreas Aupke is a high-voltage engineer at Danfoss, with a weakness for technology and green solutions. But the family are certainly not climate fanatics.

'We had exactly the same scepticism as everyone else when we talked about electric cars. Do they have enough range now? And we have experienced the same as everyone else who has an electric car – that is not a problem at all', said Birgit Aupke.

It started with an offer that was too good refuse. An electric car with everything up to DKK 1950 per month paid. Then the family was sold on electric cars.

Shortly after, the used Nissan Zoe showed up for DKK 80,000 plus DKK 790 a month for battery rental. A trip to see their son in Aarhus makes a stop at a Bilka in Vejle, where the family shops while the car charges up, and recently the boot was loaded with 12 cases of soft drink for the young students.

'An electric car is much nicer to ride in. It drives very easily and there is no noise. I like classical music when I drive, and the sound is perfect', smiled Birgit Aupke.

They hear scepticism from friends and acquaintances, and the answer is always the same: Try a trip in our car. Then the resistance disappears.

In the car park there is also a red Ellert that Andreas Aupke bought when he was transferred from Danfoss in Gråsten to Danfoss Drives A/S in Tørsbøl some years ago. The smart little three-wheeled Ellert drove him safely to and from work. The technical side never failed, but Andreas Aupke had two punctures in three years.

Now he is back in Gråsten, and he is taking neither the electric car nor the Ellert to work; he is taking a bike. And Birgit has got an electric bike, so the couple often returns home from work to see three parked cars in the driveway.

Mads and Danny have been together for 10 years

For almost 10 years, Mads Nielsen and Danny Lange have driven together from Sonderborg to LINAK in Nordborg. They leave a bit past six every morning in Mads's car, and return in the afternoon, whenever the two engineers and friends think they are finished with the day's work.

They both went to university in Sonderborg and were both interns at LINAK in 2009. They both wrote final projects about LINAK and were both hired at the company when the exams were passed.

'Mads bought a car six months before we finished. Then we started driving together, and we have done that since', said Lange.

Now it is run as a regular routine. Nielsen sends an SMS at six o'clock as he walks down the stairs at home. Four minutes later, Lange is ready at his home, and then they head north.

In the afternoon, one of them sends a message on LINAK's intranet and suggests a time to drive home. The other either answers yes or suggests another time, and then they quickly agree.

The ride sharing saves carbon and money. The latter the two friends manage in very practical way: Danny pays to fill the tank once a month.

'But the most important thing for us is to talk together. We work in separate departments, and it is worth gold to go over some of our tasks together while we drive to or from work', said Nielsen.

In rare cases, Nielsen does not go to Nordborg, so Lange takes the bus or finds another colleague to ride with. LINAK has repeatedly called on employees to collaborate and therefore has a site on the company's intranet, where they can offer or seek a ride.

The bicycles have their own lobbyists

- More people must ride bikes
- Better conditions for cyclists

These are the two goals with Bikeforum Sonderborg, founded in 2017. The 17 members represent bicycle dealers, bicycle clubs, bicycle commuter clubs, village associations, Visit Sonderborg and Sonderborg Municipality.

BIkeforum has had input on the campaign "Let your child ride a bike" and a campaign for good behaviour in traffic, focusing on friendly cyclists. In addition, Bikeforum has created its own website where interested parties can leave ideas and comments.

Sonderborg Municipality actively participates in Bikeforum and also sends relevant cases for a hearing in the forum before the City Council takes a final position on them.

Businesses

Front-running companies must go for zero

Several companies must work actively for a carbon neutral footprint in 2029. ProjectZero connects the efforts to make it happen. The 15 largest companies will become role models, and the rest will follow suit.

ZEROcompany, with 50 of the area's leading small and medium-sized businesses, together with 160 ZEROshops, form the foundation of strengthened climate efforts in the companies. The goal is to get 90% of all local companies to participate actively in one of the 3 programmes.

The 15 largest companies must aim for zero in 2029.

The area's largest companies will be the new climate drivers. Companies must be motivated by global accountability, local participation and savings. Experience from Danfoss shows that it is worthwhile for companies to strengthen their efforts. Specifically, the major companies must be motivated by the following actions:

- Focus on the 17 Sustainable Development Goals
- Climate strategy and carbon accounting
- Network participation
- Strengthened energy efficiency
- Transition to renewable energy sources, including support for collective solutions for green power, gas and heat
- Strong employee involvement.

The big companies must collaborate on the common goal of becoming carbon-neutral by 2029. This is done through joint networking meetings. Companies must formulate climate strategies and do carbon accounting in order to achieve the objectives by 2029.

Climate ambitious ZEROcompany businesses

ZEROcompany needs to expand and to be more ambitious. The companies have shown the will and many have achieved great results. Now time has come for a bigger move. Companies should be motivated to establish an ambitious and measurable climate strategy with clear goals and milestones.

Specifically, ZEROcompany businesses must be motivated to work toward 2029 with:

- Climate strategy and carbon accounting
- Participation in network meetings
- Energy efficiency
- Plug & play package solutions
- Employee involvement
- Focus on the 17 Sustainable Development Goals

‘The low-hanging fruit has been harvested, but awareness has been created in Sonderborg, which makes zero possible.’

Peter Maagøe, partner, Viegand Maagøe

All shops must be ZEROshops

All 300 shops in our area must be ZEROshop certified by 2029 at the latest. Today, more than 160 shops participate in the programme, which rewards energy saving efforts of 10% and more. The programme is run in collaboration with the local electricians and trade union associations.

So far, ZEROshops have concentrated on using less power. Looking forward, we will expand the focus to include heat, better energy use and use of renewable energy wherever possible.

Companies may, according to their interest, develop carbon accounts, that will strengthen employee involvement. The shops' efforts must be made visible to the growing number of people expected to increase their green shopping.

By 2029, we will conduct joint campaigns for ZEROshop participants in order to enhance the visibility of the ambitious shops' participation in the programme. The campaigns are expected to strengthen the interest in participation, including also new shops.

Carbon reduction Companies

10,000 tonnes LARGE BUSINESSES

1,000 tonnes TILEWORKS

1,000 tonnes ZEROSHOP

2,500 tonnes ZEROBUSINESS

0 tonnes ENERGY ACROSS COMMUNICATION & BEHAVIOUR

14,500 tonnes

Total

Two Danfoss factories become carbon neutral

By 2029, the Danfoss plants in Nordborg and Gråsten will be carbon neutral. Flemming Lynge Nielsen, Head of Sustainability at Danfoss, guarantees.

'We helped to set up ProjectZero with the goal of making the Sonderborg area carbon neutral by 2029. Danfoss uses 15 per cent of the energy in Sonderborg Municipality, so if we do not participate, ProjectZero does not succeed. We have to take part', noted Nielsen.

Danfoss is about one third of the way down the road, and the last major stretch goes through renewable energy. What that should be is not yet settled, but Nielsen will soon have a plan for the Executive Board. He also knows that it must be economically viable, and the repayment period may not exceed 3-4 years. He guarantees that it will happen by building new plants, not by buying green power or quotas.

Since 2011, Danfoss has focused its efforts on using energy more efficiently. It makes sense, because that is what Danfoss sells to its customers worldwide.

The biggest project has been to put giant heat exchangers on all factory buildings. They extract hot air, utilize the heat and send cold air back in. It provides better indoor climate and much cheaper ventilation. Heat pumps have also been put on cooling water and Danfoss works on insulation and recuperation.

Heat consumption at the factory in Nordborg has fallen by 70 per cent and for all factories, energy intensity has fallen by 43 per cent. It is a key figure for Danfoss, which describes how much energy the company uses to produce goods.

A very central measuring point is money. Danfoss has invested DKK 180 million in using less energy; bringing

an annual savings of DKK 65 million. That is 44 per cent of the energy bill and the repayment period is 2.8 years. Both economists and climate people can appreciate that.

Helsam is double zero

Helsam, selling health products all over the country, is one of the active companies in Sonderborg's transition.

Helsam is a ZEROcompany, working to reduce its energy consumption and carbon emissions. Over a five-year period, Helsam has reduced 21% of the carbon emission at its Sonderborg warehouse and headquarters. The plan was to build a common culture and involve the employees so that there was - and is still - free range for all good ideas.

Helsam has LED lights and motion sensors, and reuses its own and others' cardboard boxes. The carbon savings have taken place while Helsam has increased turnover and the number of employees. Helsam owns eight shops throughout the country. One of them is in Sonderborg, and it is a ZEROshop with a silver label on the door.

It is the visible evidence that the shop in Jernbanegade has reduced its carbon emissions by more than 30 per cent.

Small plastic bags are made of potato starch and the shopping bags are made of recycled plastic. In addition, much of the inventory in the shop is made of sustainable bamboo, and of course there are also LED lights with sensors.

The health chain prepares an annual carbon account, which is published on helsam.dk. In all of Helsam's shops there is an employee who checks the daily electricity consumption, which helps to keep focus on saving energy.

Sonderborg firm will cover Europe with solar cells

On a sunny day with a weak breeze, Denmark buys 60 per cent of its electricity from Norway, Sweden and Germany. The numbers come online at the Sonderborg company Better Energy Solutions, and CEO Nicolai Andreasen is happy, as it shows what a huge market there is for the solar cells the company installs in Denmark, the Netherlands, Poland and Ukraine.

'In Denmark there is room for seven gigawatts of solar energy, whereas today we are below one. We can cover that if we get the necessary permits. It's good business, and there are plenty of investors who will join. We do not need subsudies; we need permits', said Andreasen.

Better Energy was formerly ATsolar, but as the small Sonderborg company went from making smaller plants for housetops to making real energy parks, it was merged with Better Energy to become Better Energy Solutions. The people in Fynsgade are building and running solar cells for Better Energy Solutions and for investors.

It is a rapidly growing market – so much so that Better Energy Solutions expects to double its revenue from 2018 to 2019.

In Sonderborg Municipality, Better Energy Solutions has just put 72,160 solar modules into a park in Glansager, which can produce power for 5,000 families. It covers 35.3 hectares, and Andreasen reports that the 7 gigawatts of solar cells in Denmark will use areas corresponding to 0.2 per cent. of Danish farmland.

'Many other countries have the same challenge as Denmark: buying too much electricity abroad. Therefore, we see a huge market throughout Europe. I think our biggest challenge will be to grow in a controlled manner', said Andreasen.

Heavy transport

Companies must ask for green transport solutions

Active green transport strategies

Active green transport strategies in companies, together with stakeholder advice and local cross-pressure, will drive the green transition and optimising of heavy transport.

Good planning and switching to electric or gas-powered vehicles will make transport work more efficiently. Heavy transport in the Sonderborg area has been improved in recent years and many lorries have been replaced by models with better EURO standards.

Green business strategy

Many companies use external suppliers for their transportation. Therefore, a guidebook should be prepared describing the requirements that a company can set for its suppliers. Thus, companies would be more aware of how they can affect the transition to green transport.

Companies, with the help of independent advisors, will develop active green transport strategies that increase the focus on reduced climate impact and strengthen stakeholders' motivation and collaboration. The efforts must be driven by an increased emphasis on green solutions, CSR and climate accounts.

The transport strategy must be integrated into the ZEROcompany concept so the local companies can be certified based on their transport efforts. The concept should benefit from existing business networks.

The possibility of establishing environmental zones in the city centre will be examined further. The environmental zones must motivate companies to convert lorries to more climatic and environmentally relevant solutions while reducing particulate emissions.

Climate tools for hauliers

In order to support local hauliers and companies, a catalogue must be prepared containing comprehensive guidance for optimising transport, 'total cost of' calculations for green transport solutions and best practice cases. The total cost of ownership should form the basis for the development of business cases.

There is not yet a large selection of green lorries in Denmark, but internationally, development is moving in this direction. In order to ensure that companies and hauliers are up-to-date on the technological opportunities, the industry must be invited to annual green lorry demonstrations.

Participants will have the opportunity to test and discuss alternative means of transport and can talk with manufacturers and providers about their own needs.

Companies and hauliers should be able to get impartial advice about their fleet and driving needs. Consultants will help companies map their driving needs and routes for improved route planning and use of lorries.

It is important that companies become more aware of their alternatives to the conventional lorry.

Electronic platforms must drive consolidation

Many lorries are currently driving half empty on the same routes. The reason is a large range of transport companies, offering the same package and freight deliveries.

The spread of electronic platforms for offering and ordering package and freight transport can consolidate and streamline transport work.
As a company, Sonderborg Municipality will go forward and show a good example of consolidation. The Municipality must make demands for its transport deliveries and spread consolidation as well as coordination across administrations.

Driving in Sonderborg city centre must be reduced through consolidation in collaboration with retailers. The packages can be delivered to a smaller package centre outside the city and subsequently delivered together into the city by electric lorries, for example. The city logistics concept can serve as an inspiration.

Internet commerce is increasing and new global players are planning a further boost. The Sonderborg area must take the lead in making green requirements and optimising and consolidating transport.

> ***We want to replace our current lorries with green alternatives to support Danfoss's green profile.***

Lasse Holm Juhler, Transport Manager, Danfoss A/S

Carbon reduction Heavy transport

1,000 tonnes	INFRASTRUCTURE FOR ALTERNATIVE FUELS TEST SCHEME FOR NEW TECHNOLOGIES
500 tonnes	BEST PRACTICE
500 tonnes	ENVIRONMENTAL ZONES
500 tonnes	GREEN BUSINESS STRATEGY TOOL KIT FOR CARRIERS
500 tonnes	CONSOLIDATION, INTERCONNECTION AND ELECTRONIC PLATFORM
1,000 tonnes	PROJECTION OF TRANSPORT IN LORRIES AND VANS
4000 tonnes	Total

Roads and Parks steps up on gas and electricity

Diesel is loud, stinks, smokes and emits carbon. So, the green and grey people at the municipal department Roads and Parks like to avoid it.

'We are constantly looking for cars and equipment that can run on electricity or gas. And if it fits into the operation, we will switch to electricity or gas', says Department Manager Carsten Schultz of Roads and Parks.

The biggest investment so far has been two biogas-driven lorries of 3,500 and 6,500 kilos. Paver John Møller runs the small one and he is very well pleased.

'It's a nice machine. It's less noisy than the old one and hauls just as well. I just have to plan in the morning where I am going, so I can refill it, if necessary', said Møller.

There is room for 35 kilos of compressed gas in the tank, and then the vehicle can go for about 300 kilometres. The big lorry has to be refuelled more often, and it's a bit more inconvenient in everyday life.

'Using gas vehicles is a pilot project and if it goes well, we will continually switch over to them, but we have to be sure that it will not be too difficult', said Schultz.

Roads and Parks has 50 of the small lorries and 10 of the big ones, so there is a lot of carbon to be avoided by switching.

The department also has three electric vehicles. One is a small bin lorry with compactor that drives silently inside the city.

When it comes to bush cutters, hedge trimmers, chainsaws and leaf blowers, Roads and Parks has also switched to electricity. They run on batteries and when they run out of power, there are extras in the vehicle. They work impeccably, and again there is a gain on both noise and the environment. On the other hand, an electric soil compactor failed. In the winter, it died after 15 minutes and Roads and Parks has gone back to the diesel model. For Schultz, economics and the environment must go hand-in-hand.

'Electric vehicles and power tools are a little more expensive to buy. On the other hand, they are cheaper to operate, so it comes out about even. So if it fits into the work, we always choose the green solution', guaranteed the department manager.

Full lorry and big smile

When we avoid unnecessary driving, we minimize costs for ourselves and our customers, and then we become more competitive.

That kind of common sense characterizes the work of Haulier Jes Iversen and his wife Heidi, who run a business with eight lorries in Glansager. Inside the office, Heidi manages customers and cars, and saves a lot of kilometres every day by shuffling the tasks around a bit.

'All the drivers have access to the common calendar. When one drives out with a container, he can see if he can bring something back. It is almost always possible to have a full lorry on the home trip', she explained.

She often asks customers if they can wait a couple of hours to get something picked up or delivered, because then she will have a lorry nearby. People usually say yes.

The couple is happy to coordinate with other hauliers. Often, all cars are out on the road, but if a supplier comes with cargo, he may be able to take something to one of Iversen's customers on the way back. Then there is less superfluous driving.

Four of the company's trucks are new, and here there are also carbon savings due to lower fuel consumption, AdBlue and an auto shutdown, to avoid idle motor running. Jes Iversen has checked out the market for gas vehicles, but it is not yet mature. They do not have the traction the haulier needs when the trailer is filled with soil and concrete.

'But we are constantly monitoring it. For us it is very simple: if it's economical, it is also environmentally beneficial. It always is interrelated', smiled Heidi Iversen.

Thinking carbon-free in Ragebøl

In December 2017, the first public gas filling station was opened at a local OK station in Sonderborg. Here, the biogas company Nature Energy offers certified biogas for lorries, buses and passenger vehicles and vans.

Nature Energy had just established a gas filling station nearby for the buses running for Sonderborg Municipality, so it was obvious for the company to expand with a public facility.

Certified biogas is carbon neutral and comes from Nature Energy's plants around the country. The company is also behind the new biogas plant in Glansager.

Nature Energy chose the Sonderborg location because there are many German gas vehicles. In addition, the company expects that in a few years a number of companies in the Sonderborg area will switch from diesel and petrol to certified biogas.

Agriculture

Cheaper operation and green profile for agriculture

Cheaper operation and green profile

Agriculture is one of the area's most important occupations and a major energy consumer. There is a great potential for energy savings in farm ventilation and heating and diesel consumption.

Any good farmer wants to save money on the operation, and the local farmers' associations are very interested in collaborating on advice. Together with the new biogas plants, efforts can provide efficient agriculture in the area with a significantly greener profile that can make it more competitive.

Energy advice for agriculture

The major agricultural association, LandboSyd, is ready for a strategic partnership with ProjectZero on energy efficiency for its members. LandboSyd is already a consultant for 95 percent of local farmers.

The first step is accounting and energy analyses, focusing on the farmers with the highest energy consumption. They are visited by a consultant from LandboSyd and an energy consultant and subsequently receive a report with the solutions that provide the highest energy efficiency for the money.

The experience of the project must be presented in a final report, and the steps the farmers may have taken after completion of the project must be followed . ProjectZero follows the project and collects good cases that will inspire other farmers.

In addition, farmers who have realised energy-efficiency benefits may become part of the ZEROagriculture concept.

> ***Sonderborg Forsyning will be carbon neutral by 2029. We are already at 74%.***
>
> *Lars Riemann, Managing Director, Sonderborg Forsyning.*

ZEROagriculture concept

ZEROagriculture is conceptually based on the other ZEROconcepts and addresses all farmers in the Sonderborg area.

Anyone who has reduced their carbon emissions by at least 10% can participate in ZEROagriculture. This concept, like the other ZEROconcepts has a scaling of savings, with the green diploma for a 70% reduction being the highest. Under ZEROagriculture, it will be possible to purchase online energy advice called iPad consultation. iPad consultation focuses on LED lighting and ventilation.

Ventilation is one of the energy-heavy items in agriculture, and large savings can be made with short payback times. LED lighting can cause major savings in agriculture, as there are really many burning hours. The lights can also be connected to a timer, eliminating unnecessary burning hours.
The farmers who deliver to a biogas plant will also be rewarded in ZEROagriculture. In ZEROagriculture, the four areas of action will include:

- Heat sources
- Electrical installations and LED lighting
- Supplying to biogas
- Energy efficiency of buildings.

The farmers are recognised for each of the categories on their diplomas.

> ***Agriculture can contribute somewhat to the transition, and we would like to.***
>
> *Karsten Gram, Project Consultant, LandboSyd*

Biogas in the South Sonderborg area

As described on page 44, two large biogas plants are planned in the Sonderborg area. The local farmers play a central role as suppliers in the area's future green gas production. Biogas integrates the agricultural sector with the area's energy system and allows sustainable manure management. At the same time, manure degassing significantly reduces the Sonderborg area's methane emissions.

In addition, the locally produced gas is being used for the Sonderborg area city buses and other municipal vehicles, which is a good example of agricultural contribution to circular, locally based resource use and energy production.

The first biogas plant is expected to be established in 2019 and the second in 2020. Together, the plants can produce up to 45 million m3 of biomethane and handle approximately 800,000 tonnes of local biomass, the largest proportion of which will be manure from local farms.

In addition, expanded waste sorting and the use of local food waste are being planned.

Carbon reduction Agriculture

1,500 tonnes — PACKAGE SOLUTION VENTILATION

1,500 tonnes — TEST AREA GREEN TRACTORS

5,000 tonnes — ENERGY CONSULTATION LANDBOSYD; IPAD ENERGY CONSULTATION

0 tonnes — LEARNING AND TRAINING

8,000 tonnes
Total

4 kilometres of hose in the manure pits

Geothermal heat is smart, but manure cooling is even better. Farmer Jens Ole Bladt from Kongshoved in Kegnæs knows this. He uses the heat from 1100 sows and 10,000 piglets in the barns. There are four kilometres of hoses in the manure pits and three large heat pumps that use the heat from the manure to heat the barn.

'It has been a very good investment, which has paid off in two years. Together with a sequence of initiatives, we have reduced our oil consumption from 60,000 litres a year to 5–8000 litres', said Bladt.

The heat pump uses power, but over the years, Kongshoved has nevertheless reduced its power consumption by 30 per cent. Bladt raises 45,000 piglets a year in the large stables. The newborn pigs crawl into a den where the ideal temperature is 30 °C, thanks to some special heat lamps and temperature-control sensors.

Here too, there are high savings, and it is ideal for the pigs that the temperature is constant. The lamps are incandescent bulbs, but Bladt is investigating other technologies that use less power. The light in the barn comes from LED fixtures that are lit 18 hours a day and spend far less energy than their predecessors. Here the investment has paid off in two and a half years.

'Many years ago I made my first energy report, and from that we have taken the lowest-hanging fruit. I like experimenting with technology, so I've tried this and that', laughed Bladt.

He has thus also raised heat out of the chimney with a spiral and is continuously working to optimise ventilation systems with new technology that uses less energy. We end the tour in the courtyard, where two large grain silos also represent big energy savings. They are airtight, thus saving Bladt the cost of drying the grain. And then there is the advantage that there can be no pests or mould in the feed as there is no oxygen in the silos.

Energy advice on iPad

Pig farmer Søren Frost from Augustenborg said yes, please, when ProjectZero offered energy advice via iPad.

'It was easy. I was sent a link to a form to be filled out on my Ipad. It was targeted to pig farming, because it was clear that they knew what we used power for. I was supposed to review all my installations and write down the energy consumption', explained Frost.

It took a couple of hours, which Frost could spread over a week's time. He sent in the form and shortly thereafter received a report from the energy consultant. They reviewed the report by telephone.

'It was a fine job, and we went over it point by point. The biggest savings I can achieve is with a new ventilation unit. It's a big investment that I can't manage right now', said Frost.

He produces 16,000 piglets a year with energy costs of DKK 180,000. He has previously saved a nice amount by switching from neon to LED tubes and buying new heat lamps. He has also switched ventilator motors and invested in a pellet stove.

'It's nice to have such a report with an overview of the possibilities. We must constantly see if we can save a little on the costs', concluded Frost.

Energy

Speeding up local renewable energy production

ProjectZero is speeding up on local renewable energy production up to 2025. Several solar plants, two large biogas plants and the Lillebælt Syd offshore wind turbine park, together with green district heating, will ensure the green energy supply of the future. At the same time, we are focusing on increasing flexible electricity consumption by residents and companies to ensure that locally produced electricity is used locally.

The integration of the heating and electrical systems must ensure that we use the renewable energy when it is produced. Biogas production from two large plants must ensure optimal use of livestock manure and waste as well as a green gas supply.

Biogas in the South Sonderborg area

Biogas production is an important part of the Sonderborg area's transition and efficient use of local resources. In recent years, ProjectZero has collaborated with Nature Energy, local farmers and Sonderborg Municipality to establish biogas plants in the area. Specifically, two large biogas plants will be built. They will process manure from local agriculture and produce up to 45 million m3 of green gas per year. The biogas is being upgraded to natural gas quality (biomethane) and is fed into the natural gas network.

In the autumn 2018, local farmers decided to deliver to the plants, after which the construction phase of the Eastern Glansager plant could be started. The plant is expected to start operating at the beginning of 2020 and produce up to 21 million m3 of biomethane per year.

Planning for the western facility is expected to start in the autumn 2018. An appropriate location must be identified, an environmental report must be prepared and an environmental permit must be granted to the plant. Plant number two is expected to be operational in early 2022. In the longer term, biogas should be further upgraded with hydrogen, allowing more flexible power consumption and enabling double the total production of biomethane at the plants. This technology is expected to be mature after 2025 and with two large biogas plants, Sonderborg will be well prepared.

Large solar panels

Solar cells prices have fallen sharply in recent years, and large solar cells will soon be able to produce power without state aid. In the Sonderborg area, 100 MW of fields-based solar cells are expected by 2025. They will produce up to 100,000 MWh of carbon neutral electricity annually and will help provide area residents and companies with green electricity.

By the end of 2018, the first 25 MW solar power plant will be connected to the network. Local stakeholders and businesses and the municipality's proactive planning have ensured the rapid realisation of the project. At the same time, Sonderborg Municipality is in the process of drawing up a municipal plan designating areas that can be used for large solar cells.

In Better Energy Solutions, Sonderborg has a solar cell company that in recent years has grown dramatically on solar cells in the area, and the good collaboration both in Sonderborg and internationally is a basis to build on.

Lillebælt Syd Wind Farm

The Lillebælt Syd wind farm is one of the core projects in Sonderborg's transition. Over the last ten years, the project has matured and is at present well-rooted in Sonderborg Forsyning, who in cooperation with the City Council ensures the project's progress.

The environmental impact assessment was initiated in 2017 and is due to be completed by the end of 2018. The approved project area can accommodate up to 160 MW wind turbine capacity.

In the project period from 2020 to 2025 the focus will be on finding investors and a project developer with the capacity and know-how to complete the project. It is still a matter of maintaining the support of residents, companies, etc., both inside and outside the Sonderborg area.

In Roadmap2025, the project will include a wind turbine capacity of 120 MW, corresponding to a production of 450,000 MWh and a carbon reduction of 193,500 tonnes.

‘Transition to the energy system of the future is best and least expensively resolved in collaboration.’

Charles Nielsen, Director, TREFOR Infrastructure.

Carbon reduction Energy

193,500 tonnes COASTAL WINDMILLS

26,500 tonnes SOLAR CELLS FIELD PLANT

36,500 tonnes BIOGAS IN WESTERN SONDERBORG

36,500 tonnes BIOGAS GLANSAGER

-8,000 tonnes REDUCED LAND WIND CAPACITY

10,000 tonnes INCREASED SORTING OF PLASTIC WASTE

295,000 tonnes

Total

Energy Valley at Glansager

Glansager is well on its way to becoming Sonderborg's Energy Valley, where one big energy plant after another is shooting up.

There are 72,160 solar cells standing in lines and rows, and will produce electricity equivalent to the annual consumption of 6,000 families from the end of 2018. The developer is Better Energy Solutions in Sonderborg, who with one stroke doubles the amount of solar power in the Municipality.

Next to the recycling site, the Nature Energy company is in the process of constructing a biogas plant that will produce up to 21 million cubic metres of biomethane each year.

It can supplant a large part of the natural gas currently used in the Sonderborg area. Local farmers have committed to supply 250,000 tonnes of manure to the plant.

In the same area, Sonderborg District Heating has a solar heating plant that supplies half of the heat to a suburb of Sonderborg.

In addition, the geothermal plant in Spang is also close by, drawing hot water from 1200 meters underground.

Sonderborg District Heating's bio-gasification plant is also located in Glansager's Energy Valley. There, wood chips and other biomass is converted to gas, which produces both electricity and heat.

Brickwork together on new technology

For the past 25 years, the 14 Danish tile works have worked together to develop new technologies that can reduce energy consumption. Director Andreas Christensen of Vesterled Teglværk – one of the four tile works in Sonderborg Municipality – says.

'We always do joint projects in our industry. We get more out of joining forces', he said.

A kiln is a huge investment and lasts 30–40 years. When it needs to be replaced, new technology has emerged that will be more energy efficient. When Vesterled Teglværk changed its kiln 10 years ago, energy consumption fell by 30 per cent. One of the means was to use the kiln's surplus heat.

'We've picked all the low-hanging fruit. Now we are in a joint development project, experimenting with a whole new technology, using microwaves to bake the clay. If we can combine it with wind turbines, we can produce bricks without using fossil fuels', said the director.

The industry's joint testing station at Technologisk in Aarhus has baked the first stones, and the technique works, but it is a long ways from operating on a large scale.

Andreas Christensen does not dare say how many years it will take. He is only sure that the tile works here have found the fossil-free production of the future.

The Municipality

Long joint effort for green transition in Sonderborg

Green transition as a lighthouse

Green transition is on everyone's lips in these years. Sonderborg Municipality has been working actively on it for more than 10 years. The motivation is to create a better future for citizens and businesses. The Municipality is looking for growth and new green jobs.

At the same time, the area has noticed the effects of climate change with rising water levels and heavy rain that has flooded roads, homes and cottages and has undermined bridges and the railway to Sonderborg. It is a very concrete reason to maintain the effort and show the way to green transition.

By designating ProjectZero as one of the Municipality's three lighthouses, the City Council has shown its active support for Sonderborg's transition. Roadmap2025 has been launched by the City Council, and the city's political and administrative management has actively participated in the development process.

The Roadmap2025 report was approved by the City Council by the end of 2018 and will be integrated into the forthcoming municipality plan and action plans.

Green planning

The municipality's planning will create and expand the framework for green energy production in Sonderborg. The focus here is on solar, wind and district heating, which the Municipality is planning in close dialogue with local stakeholders. The Municipality developed a green heating plan in 2015 and approves continuously project proposals that implement the plan.

This applies, for example, to a new heating plant on Nordals and the expansion of district heating to Guderup, as well as to a forthcoming effort to establish heat pumps outside the district heating area.

The municipally owned utility company Sønderborg Forsyning is developing the Lillebælt Syd project with 160 MW offshore wind turbines, which will secure power to the Sonderborg area, focusing on transition to electric cars and heat pumps.

Roadmap2025 points to several solar cells, and already the Municipality is experiencing a significant demand for space for large plants, which is not available under the current municipal plan. That will be changed in 2019, when the new municipal plan will designate land for large solar plants that can be placed appropriately in relation to the landscape, nature and urban development.

The Municipality as an enterprise is halfway to zero, and we will reach it by 2029.

Erik Lauritzen, Mayor, Sonderborg Municipality.

Carbon neutral Municipality

Sonderborg Municipality as an enterprise shares goals with ProjectZero and is working to become carbon neutral by 2029. In recent years, the municipality has:

- Switched to LED street lights
- Energy-optimized municipal buildings
- Installed solar cells on municipal buildings
- Converted to district heating and heat pumps
- Purchased electric cars and bicycles
- Encouraged municipal employees to ride their bicycle to work.

Over a 10-year period, the effort has halved the municipality's carbon emissions, and work continues. For the City Council it is important that the Municipality is a role model in the green transition.

Transition to green transport
In 2016, the Sonderborg Municipality approved the Strategic Energy Plan for Green Transport, which outlines four actions in a series of initiatives. Transport is a challenging area when it comes to green transition. The Municipality will establish a transport council to coordinate and prioritise transport efforts in cooperation with other stakeholders and actors.

Nature projects that link carbon
In order to contribute actively to net zero emissions, Sonderborg Municipality will implement projects that store carbon. At the same time, the projects are beneficial in terms of recreational values. The Municipality also focuses on publicising restoration stories for residents and tourists visiting the facilities.

Sustainability attracts

Sonderborg needs to attract people with skills that suit the many green companies. In this venture, it is important to offer attractive cities and rural areas. The Sonderborg Municipality is committed to maintaining and developing sustainable urban and rural communities. It must be attractive to live in cities and in the country at the same time as – and because – the green transition is carried out.

The City Council has put sustainability high on the agenda by adopting a cross-cutting sustainability policy. They are thinking broadly, as the sustainability policy is based on four dimensions: environmental, economic, social and cultural.

The cultural dimension is new in this context. It was chosen based on an awareness that the cultural heritage and cultural offerings are essential for the settlement in the area, especially for the population that the Municipality needs to attract. This also emphasizes that the Municipality is aware that sustainability and carbon neutrality must be done without compromising the area's social and cultural values.

Green education

The City Council focuses on developing the area's education, and green technology has a special place in that venture. Educational institutions will increasingly attract students and develop knowledge about energy efficiency, energy technology and carbon reduction. Sonderborg Municipality collaborates with ProjectZero, youth education, the House of Science, Universe and Sonderborg Forsyning on climate, innovation and sustainability.

Cheap green energy creates growth

The City Council wishes ProjectZero to be further developed and broadened. During the period 2016-2018, Sonderborg Municipality has collaborated with Aabenraa, Haderslev and Tønder municipalities on a joint strategic energy plan for Southern Jutland.

The purpose has been to strengthen the entire area as much as possible for the ongoing energy system transition with focus on "green energy". It is understood that well-functioning and cheap energy supply is a prerequisite for growth and development in the future.

The collaboration must increase the quality of energy planning and provide the basis for investments in energy production expansion to be appropriate and financially advantageous across municipal boundaries.

Sonderborg children do something about the future

Many of the 4,500 Sonderborg schoolchildren who learned about one of the UN's Sustainable Development Goals have now undertaken one or more tasks they want to work with in everyday life to promote a global goal.

This is one of the many results that came from Sonderborg becoming the first Danish UNESCO Learning City in 2016. Worldwide, 115 cities have committed to working on sustainability through education and public involvement.

Julie Juel Andersen coordinates the Municipality's efforts, and her main partner is the House of Science, which develops educational materials on climate and sustainability from ABC to PhD.

The House of Science is a collaboration between the Municipality, Universe, Sonderborg Forsyning, ProjectZero, youth education and higher education.

'The children in Sonderborg Municipality are really creative and thanks to ProjectZero, they are very much aware of climate issues. They understand hydrogen buses, biogas and waste and come up with some amazing ideas', said Andersen.

The first few years were mainly about knowledge; now Sonderborg is going into action. Children, adolescents and adults can sign up to work for a global goal and describe what they want to do.

'It is not enough to create ideas. We also need to do something in practice, and the idea is that our children and young people will become ambassadors for the UN's sustainability goals and affect their surroundings', Andersen explained.

She is the general manager of the Municipality's business unit, and it is no coincidence that the UNESCO Learning City file landed there. The overall goal is to give children and young people the right skills. Knowledge here is absolutely crucial for the youth and the companies that will hire them one day.

Finished with diesel in the bin lorries

Next generation of garbage trucks in Sonderborg must run on gas, hydrogen or electricity. The days of harmful diesel particles have to end, and carbon emissions from collecting sorted waste need to be significantly reduced.

The Municipality has so stipulated in its new waste plan, and the local party Fælleslisten's Aase Nyegaard, Chair of the Technology and Environment Committee, is happy about it.

'A lot needs to be done before Sonderborg can become carbon neutral, and it is important that the Municipality is at the forefront. It may well cost a little extra, but the City Council is ready for it', Nygaard said.

Otherwise, it is important in the waste plan that municipal citizens sort food waste for application in a biogas plant.

At the moment, plans are being made to construct two new biogas plants in Sonderborg Municipality. She adds that the Municipality is working in all areas to reduce carbon production, including transport.

'We are offering electric bicycles to home carers who work in the towns, and the Municipality has electric cars and hybrid cars and we continue to find areas where we can emit less carbon', explains Nyegaard.

Biogas plants got the whole package from the Municipality

- An EIA report
- The local plan
- An appendix to the Municipal Plan
- An EIA of the two plans
- Environmental approval.

The Municipality finished that work in less than a year and a half to ensure that a new biogas plant in Glansager can become a reality as soon as possible.

Sonderborg City Council started work in May 2017, when the developer Nature Energy was not sure that the project could be completed. There was no agreement with the local farmers who would supply manure and other biomass to the plant. The work was done parallel with the planning and environmental approval and finally finished the same week that the City Council adopted the completed local plan and the appendix to the Municipal Plan.

'We have worked fast to get things done. It is in line with the Sonderborg Municipality vision of being carbon neutral', explains Case Manager Anne Mette Andersen from the municipal Industry and Waste department.

At the same time, she guarantees that environmental requirements are not compromised. On the contrary. They follow a national standard, and moreover Sonderborg Municipality has imposed stringent requirements for the biogas company concerning information to its neighbours in connection with possible accidents and planned repairs.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Process & Tools

Plan, organization, action and monitoring are the keywords for green transition

The development of Sonderborg's Roadmap2025 is based on methods developed in the EU SmartEnCity project, which is an EU Horizon2020 project focused on how small and medium-sized European cities can change their energy system. Read more at www.smartencity.eu.

The project runs in parallel a network of cities that have joined the EU Covenant of Mayors for Climate & Energy EUROPE, and are actively working to develop a City Journey – the city's transition journey, which will create a smart, sustainable, good city to live in. A number of ambitious Danish cities have established Energibyerne.dk through the network, whereby they share experiences and inspiration and seek to influence the drafting of Denmark's national framework. Read more about the network at www.smartencitynetwork.dk.

SmartEnCity tools are based on continuous introduction of renewable energy, integrated energy planning, coordinated actions and monitoring. The transition is based on stakeholder participation, coordinated in a municipal or local public-private structure.

In this section, we describe the Roadmap2025 process as implemented in Sonderborg in 2018 and the following tools used by the SmartEnCity project:

- Systemic plan for renewable energy integration
- The Platform – the organisational anchor
- Execution based on Plan – Do – Check – Act
- Monitoring principles and tools

The Roadmap2025 process

The Roadmap2025 project aims to develop and anchor a robust 2025 action plan for Sonderborg's road to zero by 2029. The ambition is to achieve a 75% carbon reduction in 2025 (in relation to the ProjectZero project starting point in 2007).

The process is carried out in 8 steps:

1. Approval of Roadmap2025
2. Scenario workshop
3. Kick-off workshop
4. Sector-focused working groups
5. Evaluation and calculation
6. Midway discussions
7. Reporting
8. City Council authorisation

The individual steps are briefly described in the following.

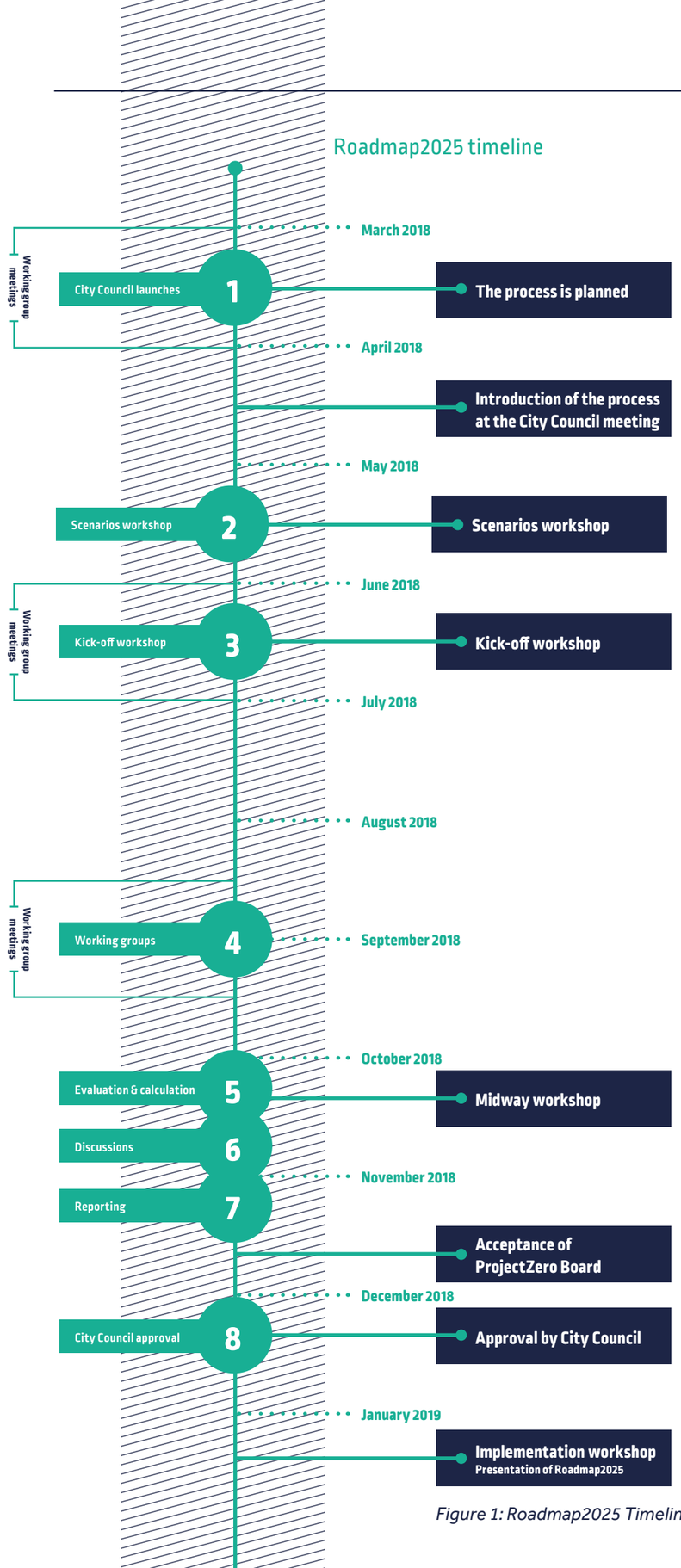


Figure 1: Roadmap2025 Timeline

Step 1: City Council approval of the Roadmap2025 project

In Sonderborg, ProjectZero is anchored in a public-private partnership that generally supports and coordinates Sonderborg's transition to carbon neutrality by 2029. ProjectZero is one of the city's three lighthouse projects and part of the Municipality's vision. Therefore, it was crucial that it was Sonderborg's City Council that approved the launch of the Roadmap2025 project in April 2018. The results must be integrated into the municipal plan in order to contribute to the good life and sustainable Sonderborg in green growth.

Step 2: Scenarios workshop

Nearly 40 local stakeholders attended the scenario workshop in May 2018. The participants, together with an external facilitator, developed four scenarios, which have subsequently been used to test and pressure test the drafted project proposals. The four scenarios each have a distinctive name:

- *Scenario 1:* Trump à lumpa land (Black development)
- *Scenario 2:* The long, expensive effort on the little green island
- *Scenario 3:* Fast track transition - Smart, circular and shared
- *Scenario 4:* Dollar green transition - Green, as in $

Step 3: Kick-off workshop

Nearly 90 local stakeholders and experts attended the kick-off workshop at the end of June 2018, which initiated the actual Roadmap2025 process. Participants received a presentation of the four scenarios and Sonderborg's energy balance sheet before being sent out to the eight working groups to begin development of the Roadmap2025 projects. At the workshop, the template that should ensure a holistic preparation of the project proposals was also presented.

Step 4: Sector-focused working groups
Eight working groups with more than 100 participants worked over the summer of 2018 with the respective sectors:

- Owner-occupied housing
- Housing associations
- Private rentals
- Private transport
- Businesses
- Agriculture
- Heavy transport
- Energy production

The working group participants represented both the sector and sector-related stakeholders who had insights and business-driven motivation to participate. Several of the working groups have used external consultants to illustrate the themes or consequences of project proposals.

Step 5: Evaluation and calculation
The working groups prepared 56 project proposals, all documented in the draft Roadmap2025 template. The proposals were consolidated into 40 integrated concept proposals that are consistent with the EnergyPLAN tool (see below), so that we could see how far the proposals contributed to the transition in 2025 and 2029.

Step 6: Midway discussions
At the beginning of October 2018, 35 representatives of the working groups and external experts met for a midway workshop to test the scenarios and discuss the draft project proposals, their impact and implementation and any further measures if Sonderborg is to reach the 2025 goal and become carbon neutral by 2029.

A seperate number of workshops were held focusing on the dynamic energy system of the future. The participants represented both regional power utilities, local businesses and external experts. The purpose was to illuminate the challenges and potentials of the future's dynamic and market-driven energy system.

Step 7: Reporting
The Roadmap2025 report represents the project's primary documentation. Already in the summer of 2018, the target groups, messages and format for the report were set for targeted production of content over the autumn. The report should reflect the conclusions of the eight working groups, Sonderborg's thinking, how the outcome of the process will be integrated into municipal planning and the tools used.

Step 8: City Council approval of Roadmap2025
Sonderborg City Council approved the Roadmap2025 report and its recommendations to the City Council in mid-December 2018. The City Council's approval is important to ensure integration into municipal planning and to emphasise the City Council's many roles in executing Roadmap2025.

Prior to this approval, at the beginning of December 2018, ProjectZero's Boards approved the Roadmap2025 report as an action plan for the sector efforts up to 2025. The eight working groups will thus be able to continue the work and follow up on the proposals.

Based on the completed process, ProjectZero recommends that similar projects organise the process early and identify the relevant stakeholders so that the project and process are provided with the necessary insights and skills to carry out the task.

SmartEnCity tools

1. Systemic plan for integration of renewable energy

In the traditional energy system, consumption changes have generally been solved by increasing or decreasing production. Energy storage has been a minor issue because oil and coal have high energy density.

If the primary sources of energy are sun and wind, this changes. The balance of the energy system must therefore be moved from the production side to the consumer side and energy storage becomes more complicated and costly.

Flexibility in the energy system becomes a key parameter. Flexibility implies integration of heating and gas systems in order to balance the overall system in the most economical and efficient manner.

This makes the energy system more complicated and the risk that the individual city or municipality optimises its own production and consumption system improperly in relation to the overall energy system (suboptimisation) increases.

To counter this and to achieve the most efficient integration of renewable energy, in Roadmap2025 we have used the EnergyPLAN calculation program, developed by Aalborg University. Energy PLAN is a computer program that contains all the production and consumption units in current and future energy systems, and calculates the balance of the overall system hourly.

By setting up alternative future technical scenarios, it is possible to compare different methods of renewable energy integration and storage, thus making the overall energy system flexible in the most economically efficient manner. The result is a "smart" energy system (see Fig. 2), where flexibility is introduced in a sequence determined by what gives the lowest cost:

Smart consumption 1. **Rescheduling power consumption.**
Power consumption for refrigerators and freezers and industrial processes can often be moved away from peak times without great expense. The funds are rewarded by payments for electricity and power transmission (new billing systems).

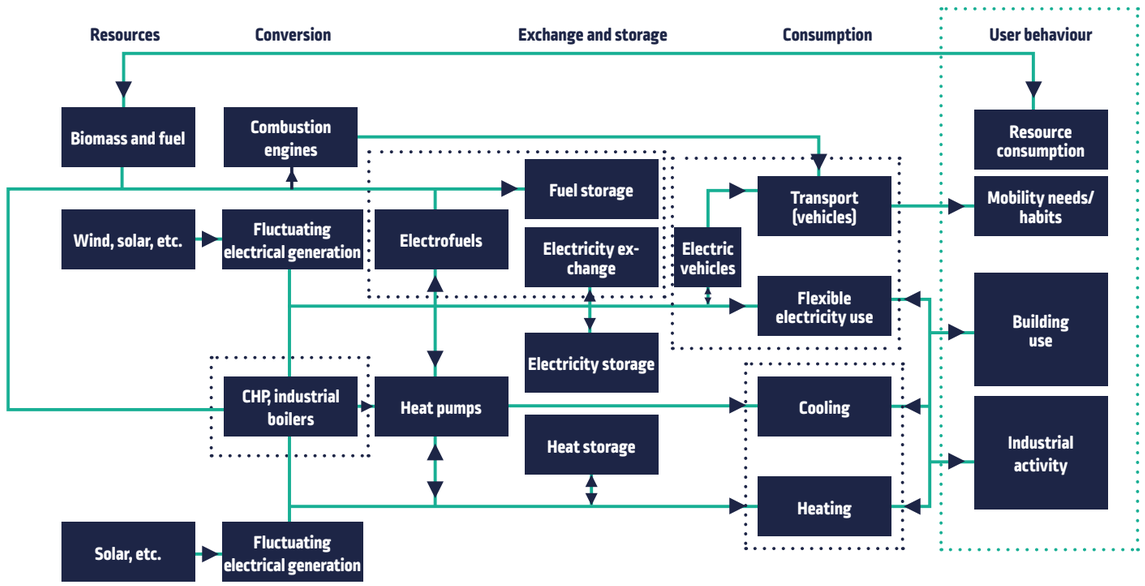


Figure 2: "Smart" Energy System

***Smart consumption 2.* Use of buildings as heat storage.**
Using buildings as heat storage in district heating areas is usually not necessary, as storage capacity is sufficient in the district heating network and accumulation tanks for day-to-day levelling, but reducing buildings' energy consumption reduces peak load. The use of buildings as heat storage outside district heating areas is necessary for flexible electric heating.

***Smart consumption 3.* Power to heat.**
In energy systems with a lot of wind and solar energy, only a fraction of the electricity produced during peak periods is stored in batteries and returns as electricity, for example.

Therefore, the most cost-effective electricity use is to provide heat for heat pumps. It must be possible to store heat pump production so that its consumption becomes flexible. Large heat pumps in district heating systems provide the highest degree of flexibility.

> ***The knowledge of all eight themes is based on local stakeholder involvement.***
>
> *Peter Rathje, Director, ProjectZero*

***Smart consumption 4.* Power to mobility.**
Electricity provides the most energy-efficient form of transport. Therefore, the greatest possible share of transport should use electricity as its fuel. Consumption is made flexible by building infrastructure and providing incentives to charge outside of peak periods.

***Smart consumption 5.* Power to fuels and chemicals.**
Transition of air transport, etc. assumes that liquid transport fuels will be produced, e.g., by converting electricity to hydrogen (electrolysis) and using hydrogen with carbon for the production of gas, methanol, DME or together with nitrogen to make ammonia.

Based on the completed process, ProjectZero recommends that early in the process, a common vision is fostered among stakeholders of how to create smart consumption and that the prioritisation follows the above.

2. Platform – the organisational anchoring

In Sonderborg, the climate action is rooted in ProjectZero, whose secretariat plans, coordinates, drives and reports on Sonderborg's transition to a carbon neutral municipality by 2029. The project is based on a public-private partnership with the active participation of the Danfoss Foundation, Syd Energi, Sonderborg Forsyning, the University of Southern Denmark and Sonderborg Municipality. The Nordea Fund and DONG Energy (now Ørsted) contributed with experience and financial resources in the project's start-up phase.

ProjectZero is one of the City Council's three lighthouse projects, which together emphasize the commitment to stake, prioritise, act and implement.

The secretariat and its five permanent employees are legally employed in Project Zero A/S, a fully-owned subsidiary of the Project Zero Fund.

The Board of Project Zero A/S represents local stakeholders in energy, provision, the City Council, housing associations, banks, large companies, education, etc. The fund's board represents the founders. Together with the support of the City Council, ProjectZero boards thus provide the project with community insights, relationships, decision-making and executive power.

The secretariat's employees serve the focused sectors and the related stakeholders.

Roadmap2025 development has focused on eight sectors and their particular challenges and potentials. Each sector has its own working group, recruited from among the sector's stakeholders, with a designated chairman. The ProjectZero Secretariat staff have administratively supported the working group meetings with analyses, etc.

Several stakeholders have participated in the scenarios, kick-off, working group meetings and midway discussions and are well suited to quality assuring the implementation of Roadmap2025.
Based on the completed process, ProjectZero recommends that similar projects are based on a strongly rooted top-down organisation, while allowing local grassroots to actively engage in the process.

3. Execution based on the Plan – Do – Check – Act

Sonderborg started its ProjectZero transition journey to zero as early as 2007. Since the start, specific ZERO platforms have been developed to ensure that sectored stakeholders find it easy and attractive to take the first steps on the climate change path. The staircase symbolizes the journey that a home-owner, a landlord or a company must start and implement to contribute actively to a carbon neutral Sonderborg by 2029.

With Roadmap2025, the programmes provide valuable concept-driven suggestions that can be integrated into them, so that the customer journeys for the individual sectors are based on the commitment of local stakeholders and are made robust and business-driven.

In order to achieve the full scale and effect of the project concepts and proposals, the execution will be based on the 'Plan - Do - Check - Act' model.

The drafted Roadmap2025 constitutes the first repetition of 'Plan' and with execution it implements 'Do'. There is a need to continuously monitor ('Check') results and impact creation and, if necessary, adjust the ('Act') action plan. The need for ongoing adjustments is known from previous implementations of the ZERO housing project, for example, which with the customer journey now forms the fourth edition of the home-owner platform.

Based on the process and previous experience, ProjectZero recommends that early in the process similar projects plan the initiation, execution and full scale implementation of the drafted concept and project proposals.

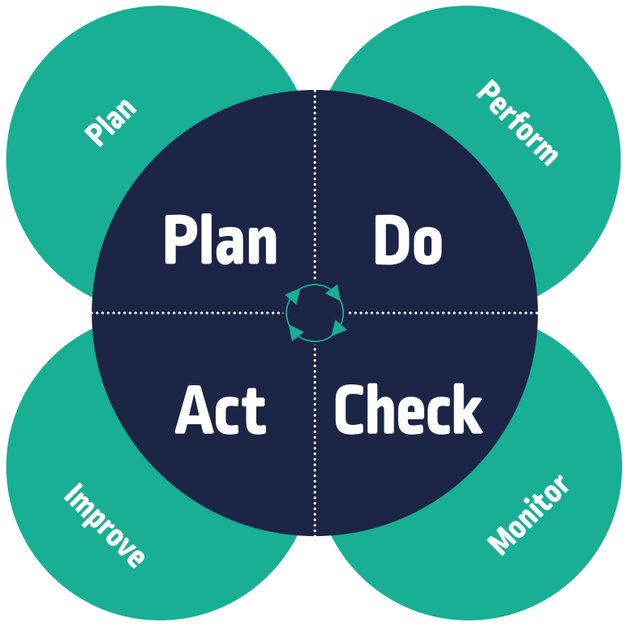


Figure 3: Plan – Do – Check – Act Model

4. Monitoring principles & tool

It is important for the motivation of transition stakeholders that it is possible to see if the effort is producing the desired results. At the same time, the results must be comparable nationally and at the European level.

A monitoring system has therefore been established in Sonderborg, to enable annual monitoring of the energy system transition based on energy consumption and supply. The main system is an Excel-based energy balance sheet, where energy consumption is calculated according to guidelines established by the Danish Energy Agency. The principle is illustrated in Fig. 4.

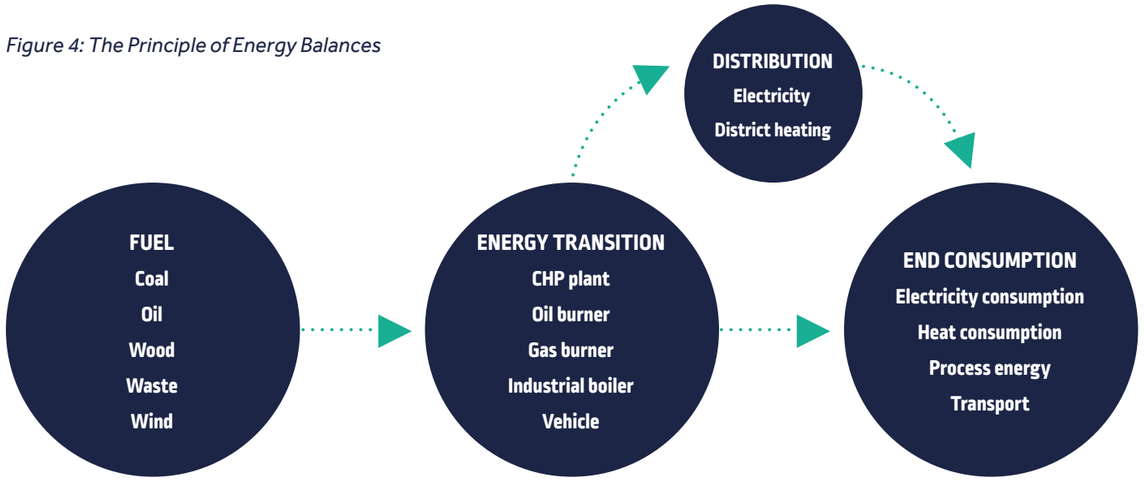
The energy balance sheet is further divided into subgroups, so that for each of the eight activity groups it is possible to follow the development of each activity under the group, including whether the activity is municipal.

Each year, ProjectZero issues a public report, so the development or lack thereof is visible to stakeholders.

Report to the Covenant of Mayors
Every second year, status is reported to the Covenant of Mayors. The reporting takes place according to a set of guidelines that apply to all participating cities, so that key ratios can be compared.

Based on the completed process, ProjectZero recommends that early in the process similar projects develop a monitoring tool that conforms to international standards and can monitor the sectors used and report to the Global Covenant of Mayors.

Figure 4: The Principle of Energy Balances



The following EU and research projects have contributed with knowledge, experience and methods for the development of Roadmap2025:

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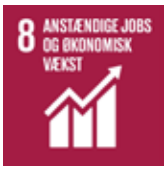
Sønderborg

The City Council of Sonderborg approaches the UN Sustainable Development Goals by giving initial priority to these 7 goals:



The long haul

ProjectZero was established in 2007 as a public-private partnership by the Bitten & Mads Clausens Fund, SE, Sonderborg Municipality, DONG Energy (now Ørsted) and the Nordea Fund. Sonderborg Forsyning entered into the partnership in 2014.

In October 2018, Sonderborg Municipality received the EUCommission's Covenant Cities in the Spotlight award. A total of three prizes were awarded, by the size of the city, among approximately 7,000 cities and regions.

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