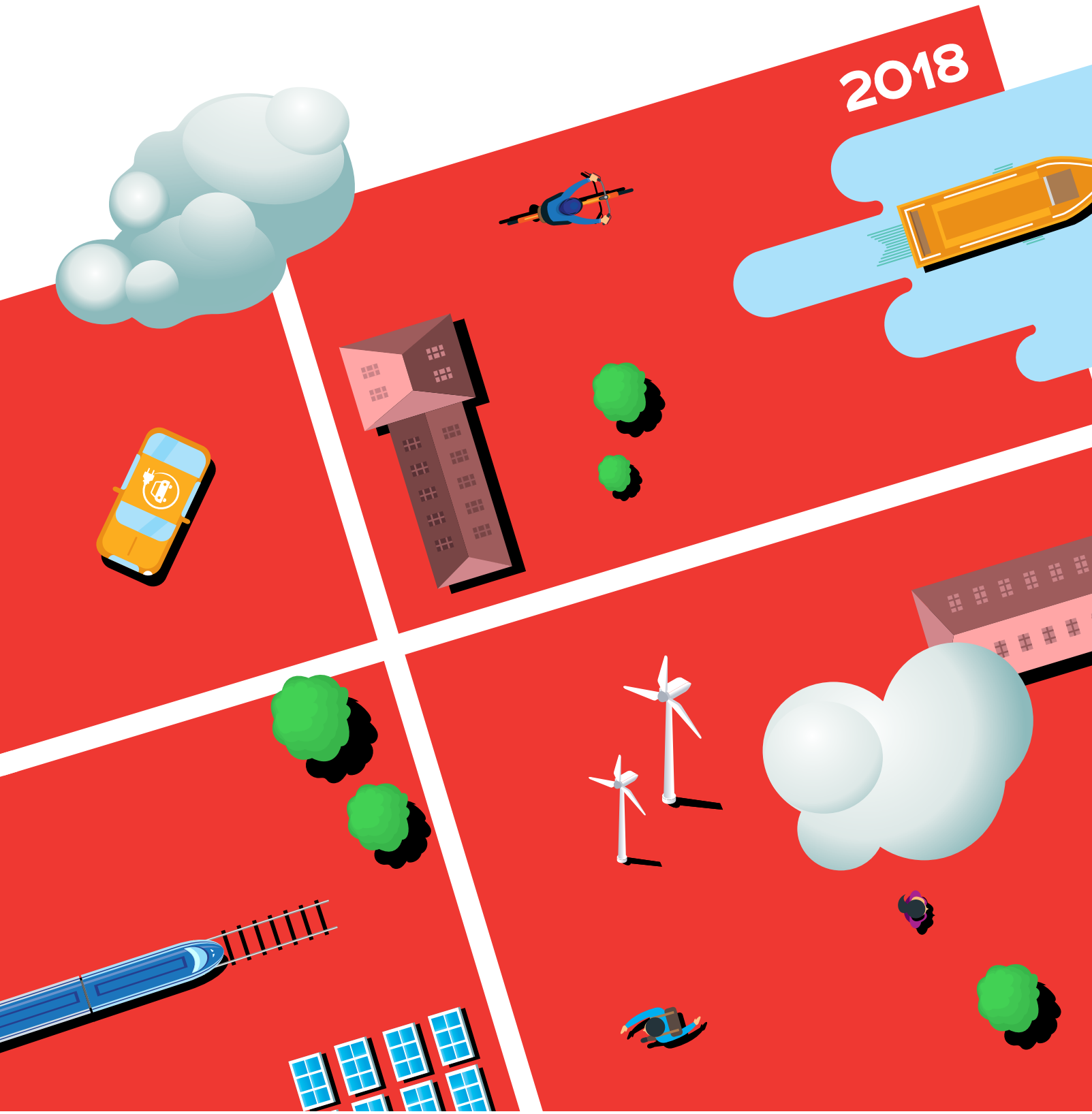
KLIMA100



100 climate solutions from Danish municipalities

SUSTAINIA

Realdania

12

CATEGORIES

80

MUNICIPALITIES

100

SOLUTIONS

Who is behind Klima100?

THE PAPER AND INK USED TO PRODUCE KLIMA100 ARE BIODEGRADABLE AND CRADLE TO CRADLE CERTIFIED

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A special thank you goes out to all the municipalities that submitted projects for Klima100. You have all been a great source of inspiration.

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100 climate solutions from Danish municipalities

Climate Solutions

RESPONSIBLE PROCUREMENT AND CONSTRUCTION

GREEN BEHAVIOR AND EDUCATION

RENEWABLE ENERGY

GREEN LAND USE AND RECREATION

CLIMATE-PROOF CITIES

ENERGY EFFICIENCY AND TECHNOLOGY

CLIMATE ACTION PLANS

STORM SURGE PROTECTION

CLIMATE ADAPTATION OF STREAMS AND LAKES

TRANSPORTATION

SUSTAINABLE COMMUNITIES

CIRCULAR ECONOMY

Foreword

→ Danish municipalities act on climate change

When Denmark receives international recognition for our green successes it is mostly our companies and national action plans and results that get praised. It is often forgotten that the sum of all our local climate initiatives also contribute to Denmark's widespread reputation as a green country. And that many of our national, green flagship projects were originally tested and refined locally on a much lower scale.

In Klima100, we shed a light on and honor 100 of the best climate solutions from municipalities across Denmark. **Never before has such a comprehensive picture of Danish local climate action been painted.** Klima100 proves that our municipalities do not lack ambition, inventiveness, or the will to act when it comes to fighting climate change locally.

A total number of 162 projects and plans applied for Klima100, one third of them within the climate adaptation category. This indicates that safeguarding against climate change-induced wild weather is right at the top of the climate agenda in the municipalities. It is particularly inspiring to see how adaptation projects across the country have added benefits in other areas - for instance by creating urban spaces for play, exercise and rehabilitation.

The nominated projects also reveal that the Danish municipalities work purposefully to reduce their climate footprint. These initiatives include everything from phasing out fossil fuels and providing cleaner transportation, to creating behavior-changing campaigns and making buildings more energy-efficient. **A number of municipalities also demonstrate how climate action can provide local growth and green jobs.**

That we received 162 applications from 82 of Denmark's 98 municipalities illustrates just how many different initiatives and areas of climate action the municipalities prioritize. However, we received remarkably few applications within areas such as transportation, green public procurement, and agriculture. These areas represent substantial untapped potential and are in need of transitioning faster.

The municipalities are capable of taking Denmark a long way on the path towards becoming greener, but national politicians must provide the right frameworks. The municipalities' many innovative local solutions within climate adaptation can to a large extent be attributed to requirements set at a national level. National leadership, the right legal frameworks and higher levels of ambition are therefore necessary for the municipalities to unfold their full potential in creating greener and more prosperous local societies.

Klima100 brings attention to Danish green ideas and solutions that are already out there in the municipalities. It is our hope that municipalities and their partnering organizations can learn from each other and collectively take the next step towards a greener Denmark. **We hope that Klima100 will mark the beginning of a new level of green knowledge sharing amongst Danish municipalities, and we look forward to closely following the Klima100 projects and the municipalities' climate initiatives in the years to come.** Enjoy the read!

"THROUGH THE KLIMA100-INITIATIVE, I HOPE THAT WE CAN GIVE RECOGNITION TO THE MUNICIPALITIES FOR THE MAJOR DIFFERENCE THEY ARE MAKING FOR A GREENER DENMARK - THEY DESERVE IT".

Anne Skovbro
Chief Philanthropic Officer, Realdania

"KLIMA100 ILLUSTRATES THE GREAT, GREEN IMPACT OF THE INDIVIDUAL DANISH MUNICIPALITIES AND THE ENORMOUS POTENTIAL FOR THEM TO CREATE LOCAL GROWTH AND WELL-BEING THROUGH CLIMATE INITIATIVES".

Rasmus Schjødt Pedersen
CEO, Sustainia

Introduction

→ Klima100 inspires a greener Denmark

For the first time ever, 100 of the best climate solutions from Danish municipalities have been collected in one place. Klima100 presents the most innovative examples of how Danish communities are mitigating and adapting to climate change, while working towards a greener future.

Klima100 offers 100 of the most innovative municipal solutions within climate adaptation and mitigation that can be scaled and implemented both locally and globally. Klima100 provides an overview of how Danish municipalities from the North Sea to the Oresund are adjusting to some of the climate challenges being experienced the world over.

The 100 projects range from energy efficiency measures in municipal buildings and private homes, to nature preservation and recreational climate adaptation, to ambitious climate action plans that show the way to a fossil free future. **Klima100 guides from the wind-blown coasts, through streams and creeks, to solar parks and recycling centers, through the narrow streets and wide boulevards, to the patios and backyards.** Though the municipal climate projects vary in size, sector and stage, the high quality of the projects binds them together in this publication. Klima100 is living proof that the green transition can happen at all levels, and that municipalities have a great opportunity and potential to guide Denmark towards a greener future.

Klima100 is not only about our climate however. Climate change is intertwined within all of the challenges that the United Nation Sustainable Development Goals aim to solve, and all projects in this publication demonstrate how social and economic challenges can be addressed in climate initiatives. Last but not least, Klima100 illustrates a nationwide local engagement in climate challenges and the municipalities' dedicated efforts to solve them.

ABOUT KLIMA100

→ **WHO?**
Realdania is the initiator and funder of Klima100, which is researched and written by Sustainia.

→ **WHY?**
By identifying and presenting the most innovative local climate projects, Realdania and Sustainia wish to show the potential of a sustainable future in Denmark. We invite municipalities nationwide to get inspired by each other, enabling the dissemination of best practice.

→ **HOW?**
The 100 solutions in Klima100 were selected after reviewing 162 submitted projects from 82 municipalities. Sustainia has been responsible for the selection of the 100 projects, based on a four-step process with seven evaluation criteria (p. 162). The selection process was aided by an Advisory Board (see p. 168), as well as Klima100 knowledge partner CONCITO.

From Global Goals to local action

The UN's 17 Sustainable Development Goals will be used to guide global development to 2030, and were used as part of the application criteria for Klima100. Accordingly, Klima100 shows how Danish municipalities' climate projects are also contributing to solving some of the world's biggest challenges. On each page, we will emphasize how each project contributes to the goals. Read more on each of the goals below:

End poverty in all its forms everywhere.

End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

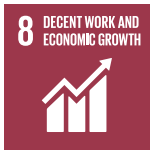
Ensure healthy lives and promote well-being for all at all ages.

Ensure inclusive and quality education for all and promote lifelong learning.

Achieve gender equality and empower all women and girls.

Ensure access to water and sanitation for all.

Ensure access to affordable, reliable, sustainable and modern energy for all.



Promote inclusive and sustainable economic growth, employment and decent work for all.

Build resilient infrastructure, promote sustainable industrialization and foster innovation.

Reduce inequality within and among countries.

Make cities inclusive, safe, resilient and sustainable.

Ensure sustainable consumption and production patterns.

Take urgent action to combat climate change and its impacts.

Conserve and sustainably use the oceans, seas and marine resources.

Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

Promote just, peaceful and inclusive societies.

Revitalize the global partnership for sustainable development.

Insights from Sustainia

→ Trends across the seven criteria

After Sustainia's analysis of the 162[1] nominated projects, we can infer several common themes and trends. Some may surprise, while others will confirm already well known strengths and suspicions. Our analysis shows that despite a significant number of positive municipal climate trends, there are still areas with a big untapped potential for climate action.

In this section, we will firstly present an overview of selected trends based on the seven criteria used to assess the cases (see p. 162). In the second section, we will dive further into some of the remarkable trends and convergences seen among the submitted projects. Lastly, we will point out some of the areas especially in need of more ambitious solutions in the future.

1) Climate action

↑ Mirroring the ambitions of many large international cities, increasing numbers of Danish municipalities have set up **ambitious goals to become carbon-neutral.** Using different approaches and frameworks, Ærø, Copenhagen, Sønderborg and Aarhus are examples of municipalities with official targets to become carbon-neutral in the years between 2025 and 2030.

↓ There is a high degree of awareness across the municipalities about greenhouse gas emissions and their effect on our climate. Despite this, only a **few of the completed projects in Klima100 are able to fully prove their reduced emissions.** Pilot projects are excused due to their stage and scale, but the larger climate initiatives have better prerequisites for presenting data based results.

Read more:

Green energy plan generated self-sufficiency and growth

Local rainwater harvesting solutions

100% renewable energy across the capital region

Roskilde leads the way with electric buses

Neighbors share to reduce consumption and waste

31 of the 100 projects quantitatively measure achieved or predicted reductions of greenhouse gas emissions.

CONCITO suggest that Denmark should **set a goal to achieve net zero-emission by 2050** at the latest, and to ensure that Denmark's climate goals align with the Paris Agreement's ambition of keeping global temperature rise well below two degrees Celsius.

CONCITO, Report: *Klimaperspektiver.* 2018.

1. Sustainia and Realdania made a nationwide campaign asking municipalities to submit their climate projects. Sustainia has done outreach to all municipalities through phone and/or email. However, it cannot be ruled out that the format and organizations behind the campaign has resulted in some areas, sectors and types of projects appearing more frequently than others.

2) Co-benefits

↑ Several municipalities are capable of developing climate solutions that solve more than one challenge simultaneously. For example, some CO_2-reducing projects create added value by **promoting a more active lifestyle and providing better access to recreational areas,** creating landscapes with more green spaces and increased biodiversity, or securing more cohesiveness and common understanding within the community.

↓ It was clear that many of the Danish municipalities have embraced the UN Sustainable Development Goals (SDGs) and work with them strategically. However, many of the applications we received from municipalities indicated a challenge with interpreting and communicating the SDGs. **The SDGs provide an opportunity for Danish municipalities** to connect the added value in their projects to the 17 Global Goals.

Read more:

City park brings new life

Rehabilitation and climate adaptation in one place

Turning waste into gold

"Climate bikes" replace cars in everyday life

From grey concrete to a green oasis

Analysis indicates that the annual use-value of recreational nature areas is in the tens of thousands of EUR per hectare. **The use-value of parks located near cities range from 4,000 EUR to several hundreds of thousands EUR per hectare.**

The Danish Economic Councils, Report: *Den rekreative værdi af naturområder i Danmark. 2014.*

Achieving the UN Sustainable Development Goals can create **market opportunities amounting to an estimated 10 trillion** EUR a year in 2030 alone across the agriculture, food, cities, energy, resources, and health sectors.

The Business and Sustainable Development Commission, Report: Better Business, Better World: *The Business Case for the Sustainable Development Goals.* 2017.

3) Innovation

↑ Klima100 contains several examples of municipalities being **innovative when it comes to testing and unrolling new approaches to climate action.** These include, among other things, new technology that sends electricity back to the grid, surveillance of municipal energy consumption in real time, or making it possible to collect data to assess the socio-economic effect of climate adaptation projects with added value.

↓ There are several similarities among the projects submitted for Klima100 and although **it is essential that the municipalities inspire and learn from each other,** it is also necessary to ensure that innovative pilot projects are initiated, where experimentation and innovation is paramount.

Read more:

The road to climate protection and heat production

Mapping real-time consumption to plan efficiency updates

Learning and technology accelerate the green transition

Testing and scaling new technology to create a smart city

Streams reopen for the benefit of citizens and drainage system

Among the Klima100 climate projects, there is both a **"world's biggest", a "world's first", and a "world's longest reach".** Read more on page 49, 129, and 128 respectively.

Insights from Sustainia

4) Collaboration

↑ Through long-term, cross-municipal cooperation and partnerships, several of the projects demonstrate **how to successfully develop cross-sectoral climate solutions.** For example, some of the Klima100 projects demonstrate how utility companies, municipalities, and individual citizens have a common interest in reducing flood risk in the local community. Another case highlights how several municipalities financed solutions together, to climate-proof an area that crossed municipal borders.

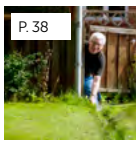
↓ Danish municipalities show great willingness to cooperate, but there's space for even more projects conducted across municipalities, or even country borders. With more cross-border municipal collaborations, **there is a bigger opportunity to solve larger-scale challenges** which cross municipal borders, such as creeks, natural areas and coastal stretches.

In 2016 **Copenhagen Municipality and New York City entered a partnership** on sharing valuable experiences on coastal and cloudburst protection. The project was also featured in the 2017 Cities100 publication.

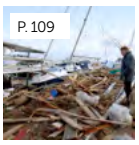
Sustainia, C40 and Realdania: *Cities100.* 2017

Nine out of the 100 projects showcase cross-border municipal cooperation.

Read more:



Climate contractors guide citizens in local adaptation



Jointly financed erosion protection

Partnerships accelerate climate change adaptation

Common challenges require common solutions

Streams reopen for the benefit of citizens and drainage system

5) Citizen engagement

↑ Establishing roots in the local community is paramount in most communities. In turn, a handful of projects distinguish themselves by utilizing innovative co-creation processes that include citizens from the start, giving them ownership and involving them in all stages, from development to implementation. This creates a greater awareness among the citizens about what they themselves can do to counteract climate change, while the municipalities develop solutions that to a larger extent meet the community's need.

↓ It is an ongoing challenge to find the right means to involve and engage the citizens face-to-face. Many of the projects with relevance to citizens **could benefit from using more than just traditional public meetings** at the beginning of the process, followed by information on the completion of the initiative. Introducing new methods for citizen engagement holds a great potential for including people even more in the actual development and execution of the various projects.

Studies show that early citizen engagement in the planning process can **enhance citizen motivation and ownership** of the project, thereby creating climate-friendly solutions that meet citizens' needs.

Gausset, Q & Hoff, J, Book: *Community Governance and Citizen-Driven Initiatives in Climate Change Mitigation,* Taylor and Francis. 2015

Humans are to a great extent affected by the behavior of the people around them, also in regard to climate action. Therefore, there is a **large potential for behavioral changes** among the green solutions developed in cooperation with the local community.

Sustein, C. & R. Thaler, book: *Nudge: improving decisions about health, wealth, and happiness.* New Haven and London: Yale University Press. 2008

Read more:

Annual campaign builds climate change awareness

Local voices translated into local cloudburst solutions

Aarhus' Green Embassy helps foster green communities

"Climate bikes" replace cars in everyday life

Local voices add value to climate adaptation

6) Scalability

↑ The collection of pilot projects in Klima100 shows that there is **a will to experiment in the municipalities,** test and try out new methods, such as making the transport sector greener, using urban space for agriculture and encouraging climate friendly behavior.

↓ When trying out new climate solutions, many municipalities start small, which is sensible as it is less cost-intensive. However, the smaller-scale implementation trend means **there is a big unused green 'scaling-up' potential** from projects that have successfully reduced CO_2 emissions, for example. Often, projects that utilize partnerships are shown to be effective in scaling, since the responsibility, costs and risks are split among the partners.

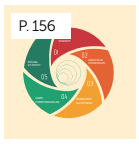
Read more:

School bus makes children experts in waste

Local food production in urban surroundings

Rainwater basins become recreational spaces

Courtyard gardens protect against cloud-bursts



Sustainable business models lead the way

The project Sustainability at Children's Level (Bæredygtighed i børnehøjde) in Skanderborg started out with two institutions but has grown to include 11, over two years (p. 43).

'The Energy Central' (Energicentralen) in Viborg was **one of the first of its kind in Denmark,** and since then the technology and use of ground water cooling and heating has become more widespread, for example in Copenhagen Airport (p. 86).

7) Knowledge sharing

↑ Many municipalities excel at sharing knowledge and experiences from successful projects. **Several of the Klima100 projects are already internationally acknowledged** and many municipalities are especially good at presenting projects domestically and abroad, as well as welcoming national and international guests to see the projects.

↓ Some municipalities could to an even larger extent provide value for other municipalities by **raising awareness of their valuable experiences from successful projects,** for instance within efficient climate adaptation, going 100% renewable, or significant emission reductions. This will ensure that other municipalities do not each have to reinvent the wheel with every project they undertake.

Read more:

Managing surface rainwater adds extra benefits

Cooperation will foster a fossil-free island

Cloudburst management improves quality of life

Envisioning a carbon-neutral city by 2029

Business and climate initiative for entrepreneurship

As a part of the flood risk reduction project in Strandøre, they compiled a **catalog of ideas, collecting knowledge, experience and recommendations** from the process and citizen engagement. This information is now available for the benefit of other climate projects (p. 140).

Middelfart's 'Climate Lab' (Klimalaboratorium) is a **show window for innovative climate solutions** targeting provincial towns and communities. The solution is shown at a 1:1 scale to inspire all interested parties (p. 93).

Insights from Sustainia

→ Spotting patterns among the candidates

In addition to trends across the evaluation criteria, there are a number of key trends among the Klima100 candidates that we will present on the following four pages.

Energy efficiency: a smart move

Energy Efficiency was the second most popular category among the 162 municipal solutions that applied to appear in Klima100. It is thus clear that Danish municipalities emphasize this as a priority issue, especially in terms of **reducing energy consumption from electricity, heating and cooling.** We also find that a plethora of municipalities seek to save energy through energy renovations and retrofits in both public and private buildings. Conversely, municipalities such as Aarhus and Copenhagen choose to monitor and optimize their energy consumption through the use of big data and intelligent solutions. Other municipalities optimize their energy usage through utilizing surplus heat, for example from cooling plants. Finally, many projects demonstrate the switch to renewable energy at the local level, through the utilization of heat pumps and ground-source heat pump systems. In turn, municipalities are able to not only mitigate negative effects on the environment, but also achieve savings economically.

Cracking the code to green behavior

Motivating people to adopt a more climate-friendly lifestyle is essential for achieving significant CO_2 emissions reductions. However, **human mindset and behavior is a complex phenomenon and notoriously difficult to change,** especially when the consequences of our behavior and consumption patterns are often invisible to our everyday lives. In turn, changing citizen behavior requires more than the utilization of classic methods, such as public awareness campaigns and information dissemination. This is because it is difficult for many people to make much sense of climate change on a personal level due to the enormity of the problem, let alone relate it to their everyday lifestyle choices.

However, there are several solutions featured in the publication, such as the Green Embassy in Aarhus (p. 142), that really embrace citizen engagement, by encouraging citizens through active involvement to take ownership and develop their own green projects. In other municipalities, such as Gladsaxe, citizens received concrete guidance and are invited to take part in various activities such as designing climate-proof urban spaces, while the activities simultaneously encourage citizens to behave more sustainably (p. 145). Additionally, there are projects where the municipalities have been mindful of **how to motivate and engage children to take action** and gain a greater understanding of complex sustainability issues. This involves everything from how household waste should be sorted and how we consume, to how we travel from A to B.

Read more:

Ground source heat pumps bolster district heating

Surplus heat integrated into district heating

Mapping real-time consumption to plan efficiency updates

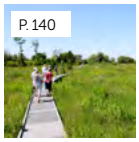
Cooling down a factory to warm up the city

Read more:

Annual campaign builds climate change awareness

Kids on a sustainability mission

The green transition starts at school



Local voices translated into local cloudburst solutions

Research shows that the **behavioral changes required to promote a sustainable future cannot be achieved by public awareness campaigns** and economic incentives alone.

Gausset, Q & Hoff, J, Book: *Community Governance and Citizen-Driven Initiatives in Climate Change Mitigation*, Taylor and Francis. 2015.

Adaptation: for more than just the climate

As climate adaptation represents almost almost one third of the 162 submitted applications, there is no doubt that this issue is high on the municipalities' agendas. There are several reasons for this, one being the national requirement for municipalities to complete climate adaptation plans before the end of 2013. Another obvious explanation, however, is that the frequency of downpours and extreme weather events has generally increased in Denmark[2]. This thus stresses **the importance of both fast action and long-term planning** for municipalities, in order to adapt and adjust to climate change in both the short and long-term.

From climate risk to local innovation

It is commonplace to develop climate adaptation measures to secure the most vulnerable areas, however many of the municipalities featured have opted to pursue ambitious and holistic climate adaptation projects, of which we should applaud.

Climate adaptation has been used by many municipalities as a two-pronged approach - not only for solving and managing climate related challenges, but also as a tool to create new and improved urban areas. In Middelfart, a climate adaptation project has transformed the parking lot of a nursing home into a 'green oasis' for residents to enjoy (p. 146). Moreover in Gladsaxe, the development of recreational areas has led to increased biodiversity and flood protection (p. 62). These projects aim to simultaneously **increase overall quality of life, integrate elements from nature and harness ecosystem services for climate adaptation** purposes. This includes the use of green and blue infrastructure - utilizing existing green spaces to store rainwater, diverting it to water bodies, or slowing water runoff and preventing overloading of drainage systems. Projects like these ensure that municipalities can improve quality of life for citizens, whilst simultaneously reducing flood risk.

Other municipalities have maintained the trend of developing more technical solutions. For instance, in Hedensted previous flooding incidents has led to the construction of a permeable asphalt road which is connected to a rainwater basin. The water is then fed into a geothermal heat pump system, which uses thermal energy found in the water to heat a local day care center (p. 77). Another example comes from Aarhus, where they have combined local rainwater drainage with existing water management systems to reuse collected rainwater for purposes such as laundry and flushing toilets.

The many inspiring examples reflect how municipalities are the driving forces behind Denmark's status as **one of the world's leading countries on climate change adaptation[3]**, while also using climate adaptation strategies as a catalyst to increase quality of life and nurture local communities.

Read more:

City park brings new life

Rehabilitation and climate adaptation in one place

Stream reopening creates new urban space

Rewilding for climate adaptation and biodiversity

Studies have shown that natural environments, such as trees and green spaces, can enhance residents' self-reported level of mental and physical well-being.

Kardan et. al., Scientific Report: *Neighborhood Greenspace and Health in a Large Urban Center.* 2015.

2. DMI, Report: *Danmarks Klimacenter rapport. Fremtidige klimaforandringer i Danmark.* 2014

3. Notre Dame Global Adaptation Initiative ND-GAIN Country Index ranks countries on their climate adaptation performance. Denmark is ranked as number 6.

Insights from Sustainia

Data drives green city development

The increased use of data and digital solutions is highly evident across the Danish municipalities, which simultaneously complements the local green transition, where the use of more intelligent solutions make the operation of cities more energy and resource efficient, as well as environmentally friendly. In spite of many municipalities acknowledging the potential of these new digital solutions, they had not previously been implemented on a mass scale in relation to climate action. However, Klima100 bears witness that a proliferating amount of municipalities are **cracking the code on using data for green purposes** such as climate adaptation, energy efficiency and city planning.

Municipalities are now identifying the most efficient measures in the fight against floods and environmental impacts by using more detailed hydrological data, as exemplified by the Usserød Å steam (p. 120). Conversely, in Høje-Taastrup, a data-driven tool and a platform is applied on two schools to use local user data and weather forecasts for monitoring the buildings and adjust the indoor climate (p. 85). In Vejle, the municipality has developed a number of Smart City projects to learn more about how to create greener and smarter urban areas. Among other things, the municipality monitors the city center's Wi-Fi signals to create an overview of the citizens' movements. They use the information to create better and more efficient green transportation opportunities and design a more climate-friendly city (p. 89).

Read more:

Unique test facility fills market gap

Big data facilitates domestic energy savings

Smart renovations for energy efficiency

Streams reopen for the benefit of citizens and drainage system

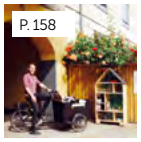
Putting circular at the center

The circular economy trend is quickly climbing up the agendas of municipalities. For instance, many work actively with increasing the recycling rate and waste is increasingly seen as a resource instead of a burden. Most prominent among the submitted applications for Klima100 are recycling projects that directly involve citizens. Billund Municipality for instance, has established a recycling depot with swap and repair areas, making upcycling a possibility and minimizing waste with the direct help of its citizens (p. 155). Alongside this, in Vejle gamification has become a big trend, by turning the exercise of household waste sorting into a sport among the citizens and public institutions (p. 161). **But if the circular economy phenomenon is to stay for the long term, there is a need for more partnerships.** A good example is the municipal collaboration "Bæredygtig Bundlinje" (Sustainable Bottom Line), which is going beyond just dealing with household recycling. In this project Allerød, Fredensborg and Copenhagen Municipality helped local firms to work systematically with green business models, which should reduce the firms material usage as well as improve their competitiveness (p. 156). However, the circular economy represents massive untapped potential. There is a **need for plans and initiatives that go way beyond just waste management and household recycling.** With bigger initiatives and cross-sectoral cooperation, municipalities can achieve noticeable results, which will have a positive effect on both the green and economic bottom line.

Read more:

Aalborg gets rid of throwaway culture

Business and climate initiative for entrepreneurship



Neighbors share to reduce consumption and waste

Swap what you have for what you need

The government's Advisory Board for circular economy:

It will benefit the transition towards a circular economy to set quantitative aims for procurement, construction, waste, and wastewater.

Anbefalinger til regeringen. 2017.

Five requests for future local climate action

The submitted climate solutions and identified trends outlined in the previous pages reflect the many exciting projects and solutions addressing climate change across Denmark, all of which result in positive spillover effects for cities and citizens. However, based on the submitted projects there are still a number of areas in the need of more attention and even higher ambitions.

Accelerating agricultural action

Based on the submitted municipal projects that we received, we noted a l**ack of green initiatives focusing on agricultural areas,** a sector which requires significant attention in tackling its climate and environmental impacts. In fact, none of the 162 submitted projects mentioned traditional agriculture and the environmental impact of food production as their primary focus.

Greening public procurement

Only two of the submitted projects had a main focus on green public procurement. It is a fast evolving area, and although knowledge is already being shared across various networks, Denmark would benefit from more innovative examples on green and responsible procurement by municipalities. The combined purchasing power of the municipalities has the **potential to set higher environmental standards for suppliers** and accelerate the green transition.

Transforming transportation

The Klima100 Transportation category consists of a number of projects that reduce the amount of CO_2 emissions and harmful particles in a variety of ways. However, the majority of submitted projects in this area are small and still in the early-stages of development. Therefore, if the submitted projects reflect reality there is **a need for initiatives of region-wide initiatives** that can help citizens shift their mode of transportation from privately owned cars to public, electric vehicles, for example. This is of course a common responsibility, which is also dependent on the national transportation and infrastructure policy as well as the technological development.

Grasping the Global Goals

All projects featured in the Klima100 publication have contributed in some way to the fulfillment of the 17 Sustainable Development Goals. Several municipalities **could benefit from familiarizing themselves even more so with the goals,** as they are set to dominate mainstream sustainability agendas from now until 2030. As part of the submission process, the municipalities were asked to assess which Sustainable Development Goals, besides from #13 (Climate Action), their project targeted. The submissions indicate that there is a need for tools to help the municipalities in using the Sustainable Development Goals strategically and how to relate their actions to the goals.

Documenting the reductions

Many of the Klima100 projects purport to have reduced greenhouse gas emissions. But by how much? **A common challenge for the submitted projects is documenting quantified CO_2 savings from their initiatives.** Better documentation can provide insights into how a project can be optimized and if the work on reducing CO_2 emissions is worth the investment. In addition, better documentation will make it easier to assess which solutions and projects are worth expanding across the municipalities.

The Danish Environmental Economic Council emphasizes that **agriculture is the sector that is socio-economically the cheapest to reduce CO_2 emissions in,** which is important considering it constitutes 21% of Denmark's greenhouse gas emission in 2015.

The Danish Environmental Economic Council, Report: *Formandskabet, rapport: Økonomi og Miljø 2018*, 2018.

Analysis by CONCITO shows that **public procurement in Denmark causes global greenhouse gas emission of around 20 million tonnes of CO_2 equivalent** per year, corresponding to 4 tonnes of CO_2 per person.

CONCITO, Article: *Kommunerne har en nøglerolle i den grønne omstilling*. 2015.

It should be noted that despite our valiant attempt, the Klima100 publication does not show a complete picture of Denmark's steps towards the green transition. Though the publication features 100 inspiring projects there are a great number of outstanding initiatives that do not appear in Klima100, since over 60 submitted projects were not included in the final edition, and a wide range of initiatives did not apply to appear in the publication.

Request from CONCITO

Denmark's green think tank

→ Municipalities to drive the green transition

Climate change is one of the most severe challenges facing our planet. ***We must urgently transform our society to create both a climate-neutral and climate-resilient future****. The historic Paris Agreement on climate change sets the course and targets. However, progress in implementing the agreement needs more momentum.*

Anna Esbjørn, Program Manager, CONCITO
Henrik Gudmundsson, Senior Consultant, CONCITO

The green transition

The Paris Agreement specifically calls on cities and local authorities to participate in the climate transition, as it is clear that nation states cannot solve such a challenge alone. To answer this call, cities and local authorities across the world have joined forces. C40, a network of some of the world's largest cities committed to addressing climate change, estimates that **40% of the Paris Agreement targets can be delivered by cities.** However, the net contribution from local governments may be even bigger.

Dealing with climate change does not have to be a sacrifice for cities. In fact, when integrated into existing processes and planning, the green transition will be an opportunity to achieve sustainable development, and a way of improving quality of life for all citizens. This perspective will therefore also help to increase engagement from citizens and businesses, reinforcing the chances of success. **Through the projects presented in this publication, readers will see that, to a large extent, citizen and business engagement is rooted locally.**

The essential question is therefore: do Danish municipalities have the political will, courage, and muscle required to take the next steps towards reducing emissions and adapt to the inevitable changes?

Municipalities at work

Today, climate adaptation plans have been adopted across all Danish municipalities, while the majority also have climate action plans. Adaptation plans have been especially driven by an agreement made in 2012 between Danish municipalities and the state. Additionally, many municipalities have developed concrete targets for their reduction efforts within the framework of the Danish Society for Nature Conservation's network, Klima Kommuner (Climate Municipalities), or the global initiative Global Covenant of Mayors.

However, in areas of heavy impact such as energy, transport, investments and consumption, the necessary structural changes are yet to be realized. **The many disconnected initiatives need to be consolidated into a singular, strategic green agenda, addressing areas with the biggest potential for reduction**. To achieve this, political ownership is paramount.

Now, all municipalities must work to ensure that city councils are well-equipped and ready to set the bar high and lead the way. This requires a strategic approach, where municipalities must ask themselves how they wish to govern and in what way climate targets can be communicated as delivering "the good life" among politicians, citizens and companies.

The main levers for effective and coherent local climate action include vision, framework conditions, collaboration, and resources. In this context, resources do not concern funding alone. Few municipalities in Denmark have sufficient competencies or capacity to manage climate projects as well as strategic efforts. **There is a need for input of knowledge, competency development and collaboration**, both within municipalities and across borders.

In Denmark, net emissions have decreased by 26% since 1990. However, recent projections show that if new measures are not taken, emissions will increase from 2020.

Analyses suggest that global emissions must be *halved* each decade until 2050 to have a chance of achieving the Paris Agreement goals. For highly-developed regions like the EU, and not least countries like Denmark, the requirements will be even steeper.

In the meantime, greenhouse gases are accumulating in the atmosphere at an unprecedented rate. Atmospheric CO_2 levels are now at their highest in 800,000 years. There is much evidence to suggest that this will lead to significant temperature rises and climate changes.

Which actions should be taken?

Within *energy,* municipalities should continue improving the energy efficiency of buildings and the transition towards renewable energy. Aside from municipal buildings, great savings can be made from supporting energy renovation of private homes. When it comes to renewable energy, they should promote the integration of heat pumps and geothermal in district heating, while solar and wind power are expanded. Biomass for energy is not a viable solution in the long run.

One of our heaviest sectors, the *transportation* sector, is unfortunately moving in the wrong direction. Research shows that today only around one third of Danish municipalities include climate impact in traffic planning. Through better planning, municipalities can help prevent unnecessary transport, promote green mobility, and adopt electrical vehicles.

Municipal procurement is an area of huge influence on municipalities' climate impact. Denmark's public sector purchases account for more than 40 billion EUR a year. Research points out that green procurement could potentially reduce emissions much more than direct reduction of municipal energy consumption. Besides, public demand is also an important driver for private innovation.

In terms of *climate adaptation,* municipalities have performed fairly well in identifying potential solutions with co-benefits. There is, however, need for a more holistic understanding of climate risks in the hydrological cycle. Climate adaptation must become more central for strategic urban development. At the same time, efforts should move across municipal borders in water catchments or joint coastal stretches.

It is particularly important that climate actions are not just siloed in. **Climate actions must become an integral part of municipalities' thinking, politics, administration and citizen engagement**. The climate agenda needs to be upgraded from a 'should do' to a 'must do', not necessarily through external demands, but as part of the modern municipality's green vision of their future.

Despite efforts so far, sea level rise is predicted to accelerate. It is estimated that in the next 100 years, the probability of floods in Denmark will increase by 35%.

Leadership and collaboration

Some believe cities should be driving the sustainable transition instead of countries, where progress is slow. However, it is not an either/or situation. **Central and local authorities must join forces to conduct the required structural changes**. In those areas where real advancement is achieved - such as the electric vehicle revolution in Norwegian cities - it often comes as a result of strong collaboration between the local and national levels.

It is about time that national governments such as Denmark's, formulate coherent policy to advance municipalities' climate related work, supporting visions, framework conditions, resources and collaborations. In this work, a new strategy launched by the Swedish government, Strategi för Levande städer, could serve as a source of inspiration. It contains concrete targets for the environment and sustainable development, accompanied by billions' worth of Swedish krona funds for support of local climate initiatives, solutions and investments.

In any case, **municipalities must - individually and collectively - become a much stronger driving force** in the green transition, by confronting the need for structural change.

CONCITO
DANMARKS GRØNNE TÆNKETANK

PARIS AGREEMENT

In 2015, the Paris Agreement was adopted by 196 states.

The agreement set the goal of keeping the global average temperature increase well below 2 degrees Celsius above pre-industrial levels, and preferably below 1.5 Celsius.

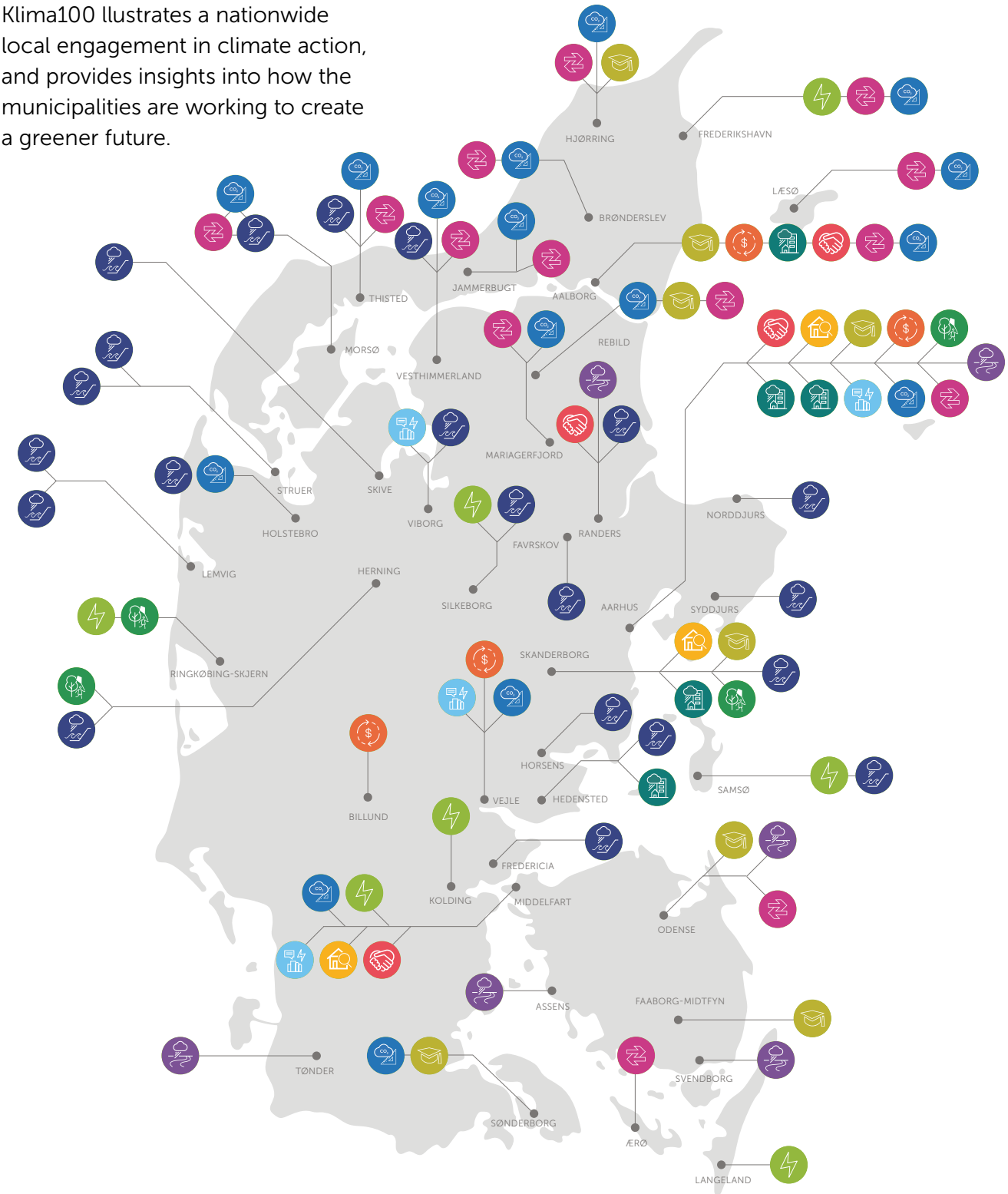
Every fifth year, the states must adopt ambitious new climate action plans.

The Paris Agreement also invites non-state actors, including cities and local authorities, to help achieve the agreed targets.

The green map of Denmark

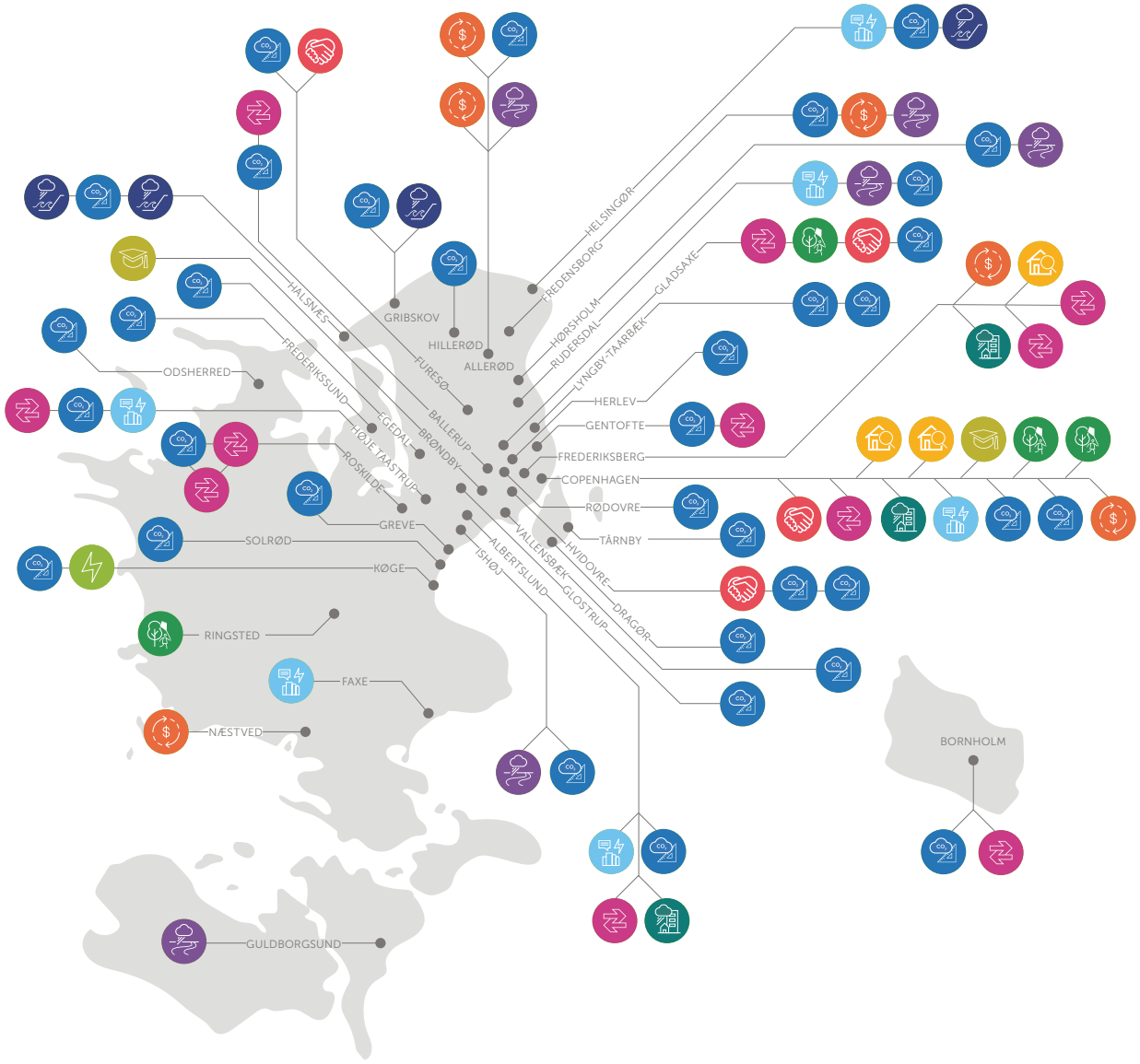
→ Mapping local Danish climate projects

Klima100 Ilustrates a nationwide local engagement in climate action, and provides insights into how the municipalities are working to create a greener future.



KLIMA100 PRESENTS SOLUTIONS WITHIN 12 CATEGORIES:

- RESPONSIBLE PROCUREMENT AND CONSTRUCTION
- CLIMATE-PROOF CITIES
- CLIMATE ADAPTATION OF STREAMS AND LAKES
- GREEN BEHAVIOR AND EDUCATION
- ENERGY EFFICIENCY AND TECHNOLOGY
- TRANSPORTATION
- RENEWABLE ENERGY
- CLIMATE ACTION PLANS
- SUSTAINABLE COMMUNITIES
- GREEN LAND USE AND RECREATION
- STORM SURGE PROTECTION
- CIRCULAR ECONOMY



RESPONSIBLE PROCUREMENT AND CONSTRUCTION

AARHUS

Sustainable urban development on market terms

P. 31

SKANDERBORG

New City Hall raises the bar in Danish construction

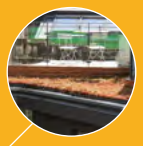
P. 28

MIDDELFART

New city hall aims for sustainability certification

P. 26

→ The Responsible Procurement and Construction category demonstrates how municipalities are not only utilizing procurement for solutions like environmental labelling and innovation, but also taking big steps to initiate procurement strategies into more complex projects such as major construction and energy renovation projects.



COPENHAGEN

Smart retrofitting solves multiple urban challenges

P. 33

FREDERIKSBERG

Frederiksberg kick-starts innovation

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COPENHAGEN

Light work for a better indoor climate

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COPENHAGEN

Green public procurement on the agenda

P. 30

MIDDELFART MUNICIPALITY

New city hall aims for sustainability certification

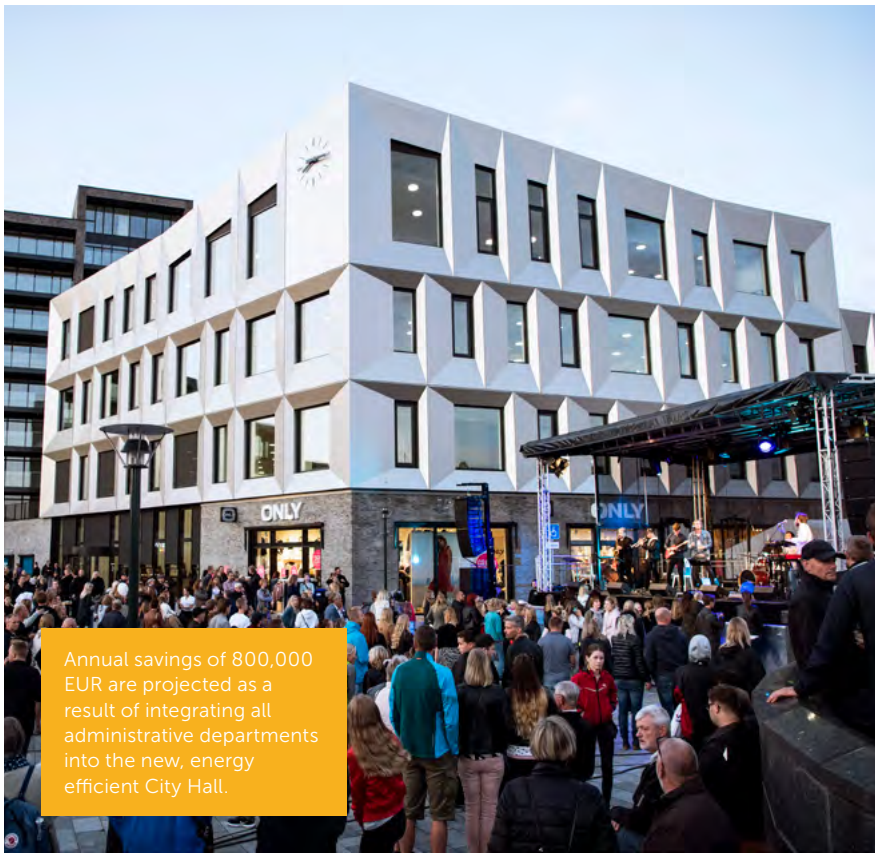
↓34%

CO_2 REDUCTION IS PROJECTED COMPARED TO THE 2015 STANDARD

→ Middelfart City Hall is expected to become the second city hall in Denmark to receive a platinum DGNB certification for green construction.

With the construction of its new City Hall, **Middelfart Municipality is setting a new standard in Denmark for sustainable public buildings.** The municipality has not only integrated the previously dispersed administration departments into one location, but also turned the City Hall into a local cultural center open to the public even after office hours.

The City Hall is built according to the Danish BR-2020 standard and is expected to cut CO_2 emissions by 34% with more sustainable construction materials and energy-efficient installations, compared to the 2015 standard. A life-cycle analysis of the building has been conducted and all materials have been assessed for future recycling. The construction materials chosen are also easy to disassemble, replace and reuse. **A total area of 700 m^2 of solar panels generates electricity for the building,** while the building's sunlight protection, seawater cooling system and heat recovery for district heating further reduce energy use. Soundproof windows, walls, carpets and ceilings have been installed to improve the office environment. Municipal staff are also encouraged to build sustainable habits through a new waste sorting system.



Annual savings of 800,000 EUR are projected as a result of integrating all administrative departments into the new, energy efficient City Hall.

UN SUSTAINABLE DEVELOPMENT GOALS

3 GOOD HEALTH AND WELL-BEING

A screening of all building materials used shows that almost 50% of the undesirable substances identified by the Danish EPA in the Danish building sector have been eliminated, and 8% significantly reduced.

7 AFFORDABLE AND CLEAN ENERGY

In addition to solar panels, a seawater cooling system with heat recovery, energy demand is optimized through automatic lighting, zoned ventilation and automatic window blinds.

13 CLIMATE ACTION

Located near the coast, Middelfart City Hall is at risk of flooding. The building is therefore designed to withstand extreme weather, including a 1-in-100-year flood.

Light work for a better indoor climate

→ Housing shortages and poor indoor climate calls for building renovation with citizens' health and well-being in mind.

A+

IS THE BUILDING'S NEW ENERGY CLASS, PREVIOUSLY ENERGY CLASS E

Living in Light is a Nordic project that explores how architectural design and environmental standards can be integrated into building renovation, **emphasizing natural light and air quality.** An example of such a renovation can be found in Valby, where an apartment building has been fully renovated with these values in mind. To the side of the building facing the courtyard, a glass extension has been built. The extension allows maximum natural light to flow into the apartments. The apartments have also been updated with indoor garden-like areas, increasing natural ventilation in the homes. Two extra floors have been added to the block, which has been fully energy optimized: solar panels are now in place on the roof, upgrading the building's energy class from E to A+.

The building, which dates back to 1899, has been renovated based on Active House principles, characterized by **daylight optimization, sustainable material use, healthy indoor climate, energy optimization and reducing energy and water consumption.** The renovation is also mindful of preserving cultural heritage. To ensure the building's existing historical features were preserved in line with its surroundings, the glass extension was built on the interior, courtyard-facing side of the building.

UN SUSTAINABLE DEVELOPMENT GOALS

3 GOOD HEALTH AND WELL-BEING

With a glass extension and balconies, residents can enjoy sunlight and fresh air which are essential to health and well-being, especially in the winter months when there is less daylight.

7 AFFORDABLE AND CLEAN ENERGY

While energy upgrades in some cases result in poorer indoor climate, Living in Light has managed to improve the indoor environment, while also improving the energy class from E to A+.

11 SUSTAINABLE CITIES AND COMMUNITIES

Living in Light creates better homes in existing buildings, instead of tearing down old buildings with worn structures yet significant historical value.

Two floors have been added to the building and the glass "membrane" has created an area that can be be used as an indoor "garden".

SKANDERBORG MUNICIPALITY

New city hall raises the bar in Danish construction

↑50%

OF ELECTRICITY CONSUMPTION IS EXPECTED TO BE SOLAR POWERED

→ Skanderborg Fælled is the first public building in Scandinavia to receive platinum level certification from DGNB.

Skanderborg Municipality's new City Hall, which also houses a multi-use hall with sports and concert facilities, demonstrates a holistic and ambitious approach to sustainability. The building's design has taken into consideration everything from energy efficiency and climate-proofing to sustainable construction material and citizen engagement. **The municipality's achievement has been recognized with DGNB platinum certification.**

The City Hall was completed in 2016 and is built according to a Danish BR2020 standard. The build has resulted in **reduced total energy consumption (electricity, water and district heating) of over 50%.** The building uses strategically-placed green sedum roofs to minimize energy loss and act as rain water deposits. Its windows are designed to create optimum light conditions, while 800 m² of solar cells produce renewable electricity. This project demonstrates how municipalities can spur innovation in the building sector. The City Hall is designed so that all rooms have at least three functions, allowing the area to be used more efficiently. This approach has reduced the volume of construction materials used by half. Additionally, the materials have been selected for their longevity and recyclability.

UN SUSTAINABLE DEVELOPMENT GOALS

Aside from solid insulation and solar cells, the building features energy-saving LED lights, timer control and PIR sensors to reduce the energy demand for lighting and heating.

Co-creation has been central to the project: representatives from civil society, employees, the city council and the police have all been involved in the process.

Skanderborg Fælled uses sedum on the rooftops, permeable pavements and green areas in the parking lot so that all rainwater, even during cloudbursts, can be contained within the property.

As well as the City Hall, the 20,000 m² area contains a police station, meeting rooms and a double sports center with capacity of 2-3,000 people.

COPENHAGEN MUNICIPALITY

Green public procurement on the agenda

↑26

PRODUCTS AND SERVICES INCLUDED IN THE NEW PROCUREMENT POLICY

→ With an ambitious new green public procurement policy, Copenhagen Municipality stimulates the demand for eco-labeled products and services.

The new procurement policy, which came into effect in November 2017, allows Copenhagen Municipality to demand products that bear an eco-label. Once the policy is implemented, the municipality will only buy products and services certified with the Nordic Swan Eco-label or EU Eco-label, within 26 selected categories. **The selected products and services are wide-ranging and amount to an annual value of approximately 40 million EUR.** Once the new policy, which is developed in close collaboration with Ecolabelling Denmark, comes into effect, the municipality will be able to purchase products and services with a cleaner conscience. In order to qualify for an eco-label, products must comply with an ambitious set of criteria which take into account the whole product life cycle.

Through the policy, Copenhagen demonstrates how public actors can motivate companies to produce sustainable products and services, thereby boosting the market. As a part of the new policy, the municipality and Ecolabelling Denmark will select two to four product areas in which the municipality will **directly engage with producers to develop more environmentally friendly products.** In 2018, the municipality will work with manufacturers to explore how toys and office furniture can be produced more sustainably.

UN SUSTAINABLE DEVELOPMENT GOALS

By purchasing eco-friendly products and services, the municipality helps reduce the use of noxious chemicals harmful to both the environment and health of workers and end-users.

Municipalities are pivotal actors in promoting responsible consumption and production. By demanding eco-labeling, the municipality is raising public procurement standards.

By entering into dialogue with producers, Copenhagen Municipality stimulates public-private partnerships and encourages the growth of environmentally friendly products and services.

54% of Danish people believe it is important that their municipalities demand eco-labeled products[1].

1. Copenhagen Municipality, press release: Ny grøn indkøbspolitik i Københavns Kommune, 2017

Sustainable urban development on market terms

→ Aarhus' new neighborhood, Lisbjerg, will be built according to sustainable principles and promote public transport and biking among residents.

25K

RESIDENTS WILL BE LIVING IN THE NEW NEIGHBORHOOD IN AARHUS

Lisbjerg is an urban development project in which a former field area has been transformed into a residential area, based on sustainable principles. A key objective of the project has been for Aarhus Municipality to **demonstrate that sustainable urban development is achievable on market terms.** In order to promote circular thinking among residents, as well as in contractors' choice of materials, the municipality has published inspirational catalogs. The catalogs are now used in all municipal tenders on the Lisbjerg building sites. Plans for the neighborhood are to develop high-density buildings with smart infrastructure, reducing the neighborhood's CO_2 emissions.

The project was initiated in 2014. The municipality is planning to establish the neighborhood gradually, over the course of 60 years. Aside from residential homes, Lisbjerg will also be home to commercial buildings, reducing the distance that residents need to travel. The municipality has worked on the development plan over a multi-year time period, involving citizens through various activities including workshops. In the future, **citizen participation will be prioritized with the ambition of inspiring residents to support and adopt principles into their everyday lives.**

UN SUSTAINABLE DEVELOPMENT GOALS

From its inception, the project has been designed to reduce CO_2 emissions by promoting public transport and biking. To achieve this, a light rail and a biking 'superhighway' have been established.

With its focus on reducing travel distance, ensuring high-density buildings, strengthening local communities and reusing materials, the project promotes the development of sustainable cities in several ways.

Increasing responsible consumption and production are key focus areas, as principles from circular economy are introduced and integrated at both contractor and resident level.

All tenders for new building works in Lisbjerg use principles from circular economy, such as in the choice of materials.

Frederiksberg kick-starts innovation

→ Frederiksberg seeks opportunities from a new public procurement directive and co-creates new solutions with private actors.

↑2

OTHER MUNICIPALITIES HAVE GONE ON TO USE THE FRAME-WORK AGREEMENT

Like many other Danish municipalities, Frederiksberg is struggling to manage heavy rains. The municipality has therefore decided to test the new Innovation Partnership procedure. This procedure enables the municipality to enter into dialogue with market players and creates an impetus for future-proof innovation, rather than resorting to known but insufficient solutions. **The project is a good example of how public institutions can use tenders to drive innovation and support the development of new climate adaptation solutions.** Frederiksberg is a frontrunner in this area, as only a handful of Danish municipalities have seized this new opportunity so far.

Frederiksberg has had conversations with 40 suppliers, ultimately choosing to enter into an agreement with two innovative consortia. In consultation with the municipality, these consortia have developed new solutions for punctual rainwater management. **The municipality has required that the solutions can handle a certain amount of water, while being both scalable and modular.** Additionally, it must be possible to construct the final solutions in line with the existing road structure at a low cost. The municipality plans to use the collected rainwater to water its trees, and solutions are expected to be implemented by summer 2018.

Through thorough documentation, Frederiksberg has enabled other municipalities and regions to duplicate contract models for the Innovation Partnership.

UN SUSTAINABLE DEVELOPMENT GOALS

The solutions proposed for punctual rainwater management improve infrastructure in Frederiksberg, while driving innovation in climate adaptation solutions and products.

The solutions for punctual rainwater management secure sustainable urban spaces, as well as making Frederiksberg more resilient to extreme weather and climate-related events.

The project has brought public and private actors together in a unique collaboration, which brings attention to co-creative solutions to climate change and incentivizes others to follow suit.

Smart retrofitting solves multiple urban challenges

→ The renovation of a 100-year-old property in Ryesgade raises the bar for sustainable urban retrofitting with the first residential DGNB certification.

Ryesgade 25 in Copenhagen demonstrates that it is possible to reduce energy use drastically when retrofitting a historical building, while offering increased comfort, enhanced user control of the indoor environment – and increasing the availability of attractive housing in urban centers. **The building is the first residential property in Denmark to have received DGNB certification.** The renovation is carried out with a wide range of thorough energy improvements, heat regain ventilation systems, a high performance solar cell roof and climate-proof elements to manage cloudburst and rain water.

With buildings accounting for nearly 40% of global energy consumption[1], renovation and retrofitting of the built mass is a prerequisite for achieving sufficient CO_2 reductions to handle climate change. **Overall, the renovation of Ryesgade 25 results in a 71% CO_2 reduction,** making the project a strong example of how to achieve high energy savings through well thought-out, holistic solutions[2]. By involving residents in the development process, it has been possible to collect data on energy consumption and indoor climate.

The part less worthy of preservation - a worn and unused ceiling - has been replaced with new roofs and new, sustainable housing.

↓31.8

TONNES CO_2-REDUCTION PER YEAR THROUGH ENERGY IMPROVEMENTS

UN SUSTAINABLE DEVELOPMENT GOALS

7 AFFORDABLE AND CLEAN ENERGY

The building's new integrated 146.4 m² solar system covers the entire property's electricity consumption, promoting sustainable consumption for the benefit of building owners and the climate.

11 SUSTAINABLE CITIES AND COMMUNITIES

During the renovation, the unused attic space and courtyard area have created additional apartments that contribute to densification of the city and sustainable urban development.

13 CLIMATE ACTION

The retrofitting project has integrated climate adaptation elements such as green roofs and a secured basement and ground floor, enabling the property to handle cloudburst and heavy rain.

1. Dansk Byggeri, Byggeriets Energianalyse, 2017

2. Ekolab: http://ekolab.dk/wp-content/uploads/Energi-og-indeklimatiltag-i-Ryesgade-25.pdf 2017

GREEN BEHAVIOR AND EDUCATION

HJØRRING

Play turns children into expert sorters

P. 42

AALBORG

School bus makes children experts in waste

P. 37

REBILD

Annual campaign builds climate change awareness

P. 36

SKANDERBORG

Kids on a sustainability mission

P. 43

AARHUS

Climate Planet tells thrilling story of Planet Earth

P. 40

MUNICIPAL COLLABORATION

Climate contractors guide citizens in local adaptation

P. 38

SØNDERBORG

The green transition starts at school

P. 45

→ The projects selected for the Green Behavior and Education category have one thing in common: they promote sustainable behavior through education and communication. Through initiatives such as awareness campaigns, school 'waste' buses, rain trails, and gardening patches; municipalities are educating citizens of all ages on how to act sustainably and take care of our planet.

BRØNDBY

Managing surface rainwater adds extra benefits

P. 39

COPENHAGEN

School gardens connect nature, play and learning

P. 44

REBILD MUNICIPALITY

Annual campaign builds climate change awareness

1,700

CITIZENS TOOK PART IN THE EVENTS DURING KLIMA REBILD 2018

→ For two weeks a year, extra focus is placed on climate change with a wide range of activities for Climate Weeks in Rebild Municipality.

Under the name Climate Rebild (Klima Rebild), a large number of institutions, companies, interest groups and volunteers have worked to promote sustainability in the municipality. Each spring, Rebild holds a two-week climate campaign. The campaign, Climate Weeks (Klimaugerne), aims to initiate discussions, activities and actions around climate change. Since the start of Klima Rebild in 2014, the Climate Weeks has been extended from 12 events over one week to more than 40 events spanning two. **In 2018, Climate Rebild included 'swap markets' which welcomed over 430 visitors, an electric bike tour and a tree planting session, planting 30,000 trees in Nørager's new climate forest.**

Themes for Climate Weeks have related to food, agriculture, forestry, construction and recycling - all with sustainability in mind. A central part of the project is to put climate and sustainability on the agenda in daycare centers and schools to **prime the next generation for making climate-friendly choices.** Recently, Climate Rebild has initiated a collaboration with The Danish Center for Environmental Assessment to measure the impact of these efforts, including life cycle assessments for a number of actions.

Climate Weeks' focus on food waste and how a climate-friendly menu can look, inspiring citizens to make supper based on sustainable principles.

UN SUSTAINABLE DEVELOPMENT GOALS

Climate-friendly food is on the school schedule and recipes have been collated in the cookbook Climate-Happy-Food (Klima-Glad-Mad). Local restaurants are also working to limit food waste.

Rebild's local companies inspire each other with sustainable production and host networking events on sustainable construction. The municipality is focusing on recycling and waste reduction.

Events are held with topics such as nature conservation, agriculture and forestry. The Nature Agency and private forest owners share their knowledge about trees as a resource.

School bus makes children experts in waste

→ Aalborg Municipality has made education about waste and resources fun and engaging for the city's children and young people.

54

OF AALBORG'S 62 SCHOOLS VISITED THE BUS IN THE SCHOOL YEAR 2016/2017

Aalborg Municipality is well underway with their aim to educate their younger citizens with a solid understanding of the circular economy and recycling. The waste and recycling bus educates the municipality's students about waste, recycling and sustainability. The vision is to influence students' behavior and approach toward waste management and to **teach all children that waste is a resource that must be utilized efficiently and with respect.**

The teaching method varies according to the different age groups and includes physical and practical activities based on the children's everyday life. For the youngest children, two toy bats, Frede and Frida, help them locate and tell stories about waste. For the eldest children, the focus is on gamification and learning about raw materials. The education process is being developed and adjusted as new knowledge emerges and new waste and recycling initiatives are tested. In the first two years of the project, the bus has achieved impressive results. In 2017, **3,600 children were educated in sustainable waste management** and another 7,500 children and adults had been in contact with the bus at various fairs and events.

UN SUSTAINABLE DEVELOPMENT GOALS

The course has a special focus on water and ground-water contamination. Ensuring local water quality now and in the future is therefore an integrated part of all teaching processes.

The project focuses on waste and recycling, and the course both provides instruction and initiates dialogue about how children can act sustainably every day.

Part of the project focuses on the problem of plastic waste in oceans. This focus is closely linked to teaching how to recycle and reuse household plastics.

In the Chase of Raw Materials, elder students learn where the raw materials of their smart-phones come from and why it is worth reusing them.

MUNICIPAL COLLABORATION*

Climate contractors guide citizens in local adaptation

60-80

CLIMATE CONTRACTORS ARE EXPECTED TO GRADUATE OVER TWO YEARS

→ By joining forces with newly graduated climate contractors, a number of municipalities are ready to involve citizens in water management.

The predicted future increase in the frequency and severity of rainfall presents a challenge for drainage capacity. The need is increasing for landowners to have separate drains and handle rainwater on their own sites. But for most people, the answer to how they can secure their homes is far from obvious, including how they can actively contribute to climate adaptation. **The project Together on Climate Adaptation (Sammen om Klimatilpasning) has succeeded in developing important tools to create a common understanding and commitment** which can lead to increased awareness of recreational rainwater solutions in our own gardens.

By educating local sewage contractors and landscapers as climate contractors, knowledge is disseminated amongst the local population. This **sharing gives landowners access to competent advice and well-developed solutions where water is made into a resource, rather than a problem.** At the same time, the establishment of partnerships between municipalities, utility companies and landowners stimulates the development of blue-green areas and beautiful gardens. Climate events and online communities offer landowners the chance to share their experiences and inspire further climate protection.

29 newly educated climate contractors are ready to guide homeowners like Kurt, who is in the process of maintaining his new local rainwater drainage.

* Odense, Middelfart, Faaborg-Midtfyn, Nordfyn and Kolding municipalities

UN SUSTAINABLE DEVELOPMENT GOALS

Together on Climate Adaptation promotes a new green business area through educating climate contractors in the adaptation of homes, rainwater treatment and sales through social media.

In addition to increasing knowledge about climate adaptation for both climate contractors and landowners, the project reports real-life climate adaptation projects on social media.

Ten partners have joined the project, a collaborative effort which makes it easier for municipalities, companies, and landowners to handle rainwater on their own sites.

Managing surface rainwater adds extra benefits

→ In Brøndby, rainwater is utilized locally, contributing to community engagement and adding value to the soil rather than running into the drains.

13

RAINWATER SOLUTIONS MAKE UP REGNRUTEN IN BRØNDBY MUNICIPALITY

UN SUSTAINABLE DEVELOPMENT GOALS

By adding more nature and recreational opportunities in urban areas, climate adaptation indirectly contributes to increasing the quality of life and health of citizens.

By promoting local solutions for the treatment of rainwater, pressure on the sewer system is reduced, in turn reducing the frequency of wastewater overflows to bodies of water.

Through Regnruten, citizens can see that, through collaborating, they can contribute to the prevention of floods in the area and help create a better local environment.

In Brøndby Municipality, increased rainfall is considered an opportunity to engage citizens and beautify the city while adapting to climate change. This is reflected in the project **RegnRuten (Rain Route), both as website and a physical "rain route" in Brøndby.** The physical route runs around several areas where rainwater is directed to plant beds, grass areas and basins. The route helps create synergy and environmental co-benefits in the form of a greener city with a focus on water as a recreational resource.

On RegnRuten's website, various solutions are showcased for inspiration, **indicating how citizens and organizations can turn the drainage pipe away from the sewer and create a greener local environment.** On the website, interested citizens can find how-to guides, and apply for advice and financial support from the municipality to use the rainwater locally on their own plots. In this way, the project's value, made in cooperation with the utility company HOFOR, is not only found in the planned local rainwater drainage solutions, but in enabling people in Brøndby to contribute to managing the rainwater. Once a new project has been completed, lessons learned will be applied to the further development of RegnRuten and, in turn, shared with other projects.

RegnRuten inspires adaptation solutions for everything from private gardens to public roads and institutions, like here at Brøndbyvester School.

© Søren Hansen


CLI PLANET

Climate Planet tells thrilling story of Planet Earth

→ A multidimensional experience at Aarhus Harbor opens up the discussion on challenges and solutions to climate change.

40K

PEOPLE VISITED CLIMATE PLANET WHEN IT WAS ON DISPLAY IN AARHUS

UN SUSTAINABLE DEVELOPMENT GOALS

Climate Planet's interactive visualization aims to develop visitors' knowledge and skills needed to promote and mobilize sustainable development.

Climate Planet contributes to increased knowledge and capacity for managing and navigating climate change.

Climate Planet has resulted in collaborations across Aarhus municipality, between municipalities in Denmark and across national borders, as the globe travels from one city to the next.

Inside a giant globe construction on Aarhus Harbour, children and adults explore climate issues and learn solutions to combat climate change. The giant globe, which is the height of a five storey building, is called Climate Planet. **Its mission is to move climate change issues to the top of the agenda in a multi-dimensional experience.** In a 40-minute film, the audience is taken on a visual journey using global weather data to depict global climate change, starting at the Big Bang and reaching far into the future. Through live satellite transmissions, visitors see accurate images of Planet Earth and witness how it is affected in real time by changes to temperature, climate and extreme weather events.

Climate Planet is a partnership between Aarhus Municipality and local organizations. The project supports the municipality's masterplan for climate action by involving and mobilizing local citizens. Climate Planet is catalyzing debate about climate change challenges. As a corollary, it has also triggered discussions on how to provide solutions to climate change issues. **In Aarhus alone, the enormous globe was visited by 40,000 guests,** with 100 chosen guests producing a personal climate action plan. After showing in Aarhus, Climate Planet has travelled to Copenhagen and, most recently, to COP23 in Bonn.

The Climate Planet, measuring 24 meters in diameter, was on display on Aarhus Harbor in 2017 when Aarhus was the European Capital of Culture.

Play turns children into expert sorters

2,500

CHILDREN AND ADULTS TRIED THE SORTING BEETLE IN 2017

→ The Sorting Beetle inspires and educates Hjørring's children and adults on how to convert waste and garbage into new resources, just like wild beetles.

Hjørring Municipality seeks to engage and meet people where they are. With their converted camper van, The Sorting Beetle (Sorteringsbillen), Hjørring Municipality employees can drive around to children and families to explain how to sort their waste and why. **The camper van is a rolling creativity workshop which visits local schools, institutions and markets.** It features a range of activities where children of all ages can try anything from sorting games to creating imaginative figures or jewelry out of waste. All activities add to the narrative of waste as a resource.

The camper van is also designed as an exemplary sorting kitchen made of recycled materials, which inspires people to use waste as a resource at home and reflect on everyday choices - especially when cooking. **The Sorting Beetle engages with children at their level, and makes them ambassadors in their own families by providing information on waste sorting, recycling and upcycling** through play and fun games. The children's ideas and creative products are showcased to inspire others - not only in The Sorting Beetle, but also at Hjørring Library and at the project partner, AVV's, visiting center.

UN SUSTAINABLE DEVELOPMENT GOALS

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

By teaching children and citizens about using waste as a resource, the project encourages reduced food waste, increased waste sorting and an increased focus on sustainable consumption.

13 CLIMATE ACTION

Improved waste sorting and recycling contributes to a reduced carbon footprint. Of visitors to The Sorting Beetle, a total of 89% have mastered how to sort difficult types of waste[1].

15 LIFE ON LAND

The Sorting Beetle focuses on waste treatment and the time it takes for waste to degrade in nature. Waste as a useful resource is an integral part of the education process.

With activities and games in The Sorting Beetle, children become responsible ambassadors for waste sorting, recycling and upcycling.

1. Ministry of Environment and Food, Project: Sorteringsbillen - rullende udstilling og krea-værksted, 2016

SKANDERBORG MUNICIPALITY

Kids on a sustainability mission

→ Through play, children in Skanderborg are learning the importance of sustainable behavior and how they can contribute to a greener world.

In Skanderborg, sustainability is discussed not only at top level, but also by the municipality's children. For the third consecutive year, nurseries in Skanderborg have joined forces in the fight against climate change. Their ambition is to **turn the municipality's little ones into the green climate action heroes of the future.** Through games, songs, contests and stories, the children learn about how to reduce food waste, sort waste, and respect nature, as well as how to upcycle old products into toys and art.

This year, 11 nurseries are participating in the project. To ensure that they can all learn from each other's experiences, the nurseries contribute to an inspiring ideas catalog filled with brilliant ideas for child-friendly activities. The ideas catalog is shared among all the nurseries and is freely available online. As an outcome of the project, several nurseries have integrated climate initiatives into their day-to-day operations. The result? **The nurseries have reduced their energy bills, improved recycling rates, reduced food waste and introduced more sustainable options on the lunch menu.** However, knowledge sharing is not limited to the institutions alone: the children come home with new habits and knowledge, thereby having a positive impact on the actions of their parents as well.

In 2017, the final exhibition was held at the town hall. The mayor opened the exhibition, which involved children from all the nurseries in the project.

↓22

TONNES OF CO_2 IS EXPECTED TO BE SAVED BY 11 NURSERIES IN 2018

UN SUSTAINABLE DEVELOPMENT GOALS

4 QUALITY EDUCATION

Engaging children in their own futures is essential to achieving a more sustainable world. Through this project, kids learn from a young age how sustainable lifestyles can be achieved.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Children are encouraged to reduce their food waste through competitions. A nursery that reduces food waste by 2% corresponds to a saving of 10kg of food per child.

17 PARTNERSHIPS FOR THE GOALS

The children have learned about waste management by visiting the local waste company, hearing stories from the local museum and putting on exhibitions at nursing homes.

COPENHAGEN MUNICIPALITY

School gardens connect nature, play and learning

→ In Copenhagen's school gardens, children are getting out of the classroom and growing vegetables in their own garden while learning about sustainability, ecology and health.

3,000

CHILDREN USED SCHOOL GARDENS IN 2017

In Copenhagen Municipality, from April to harvest time, life flourishes in the six school gardens, which are tended by classes as part of the curriculum. The Association of Copenhagen School Gardens has a total of six gardens, where preschool and school children can get their hands dirty in the gardens, listen to birds singing and make bonfires. **Each child has its own little garden, with experienced gardeners teaching them about processes from seed to harvest, as well as sustainability, cooking and compost.**

Through learning by doing, the children learn how to behave respectfully in nature, as well as learning where food comes from. The children are taught about the diversity of animals and plants and their own role in the circle of life. The combination of physical work (spreading manure, sowing, pruning, feeding chickens, picking fruit) and teachers' ability to link activities to the curriculum and theory of nature, environment and food, prove a highly potent learning cocktail. **In 2018, 34 school classes have gardening on their timetable and a total of 3,000 children from schools, kindergartens and clubs participate in the projects.** Even more school classes are waiting to take part in the initiative. To accommodate this demand, the city of Copenhagen is working together with the organizations Tagtomat and Kompostbudene to establish two additional school gardens.

UN SUSTAINABLE DEVELOPMENT GOALS

The school gardens are not self-sufficient, but they contribute to sustainable food production by bringing more of our production closer to where we live.

The school gardens help to promote biodiversity in the city and provide access to green areas and nature, with space for play for the city's smallest citizens.

The school gardens are organic and sustainable. Through the course, children are introduced to where produce comes from and how it makes its way from farm to fork.

The school gardens in Copenhagen are approximately 50,000 m² and allow children to learn in a concrete and meaningful way about gardening, nature and food.

© Københavns Skolehaver

The green transition starts at school

↓17

PUBLIC SCHOOLS EXPECT CO_2 REDUCTIONS BY 2020

→ The school program attracts pupils and students to science, while educating the wider population about climate, innovation and sustainability.

In 2009, Sønderborg Municipality, the Universe Park and ProjectZero created the learning initiative House of Science. Since then, the local utility company (Sønderborg Forsyning), youth education programmes and the University of Southern Denmark have joined the partnership. **The project demonstrates close cooperation with all local actors** and is rooted in local communities, with citizens also able to participate in House of Science activities.

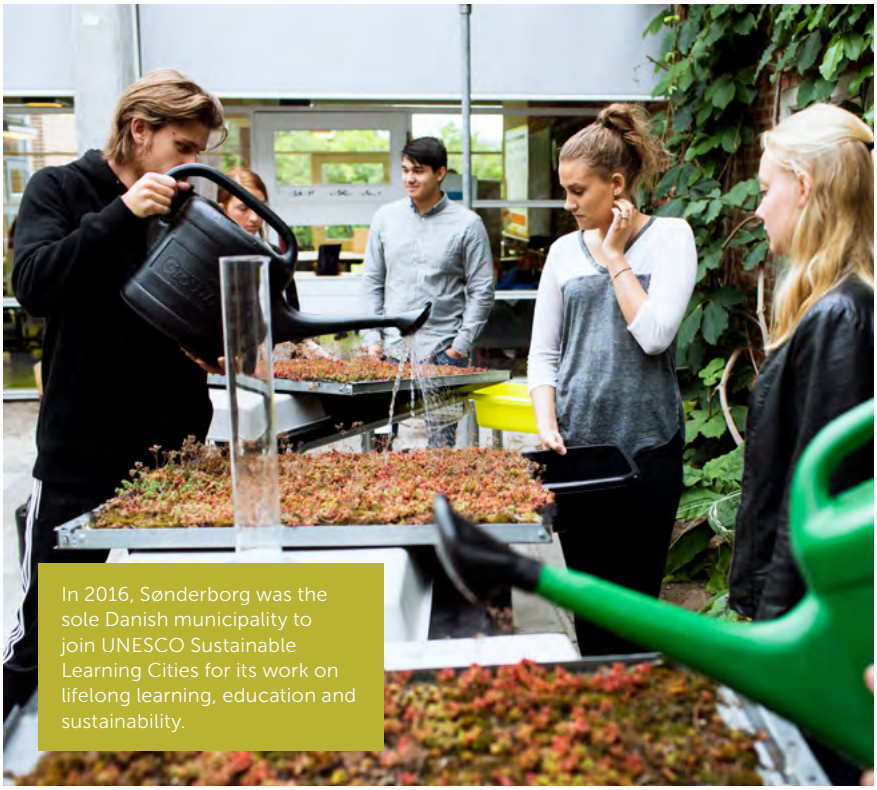
Aligned with Sønderborg Municipality's education strategy focusing on lifelong learning, through the motto "from ABC to PhD", House of Science delivers educational courses and materials, developed in collaboration with teachers and students under the topics "Climate, Innovation and Sustainability". The UN Sustainable Development Goals are integrated into the teachings, which include courses such as Green Generation - Clean Water and Girls' Day in Science, which focuses specifically on providing science education for girls and encouraging them to consider higher education in science. **Through the House of Science curriculum, children and young people are motivated and excited with the latest scientific knowledge.** The initiative also involves local businesses to demonstrate the importance of science in society and sustainable development.

UN SUSTAINABLE DEVELOPMENT GOALS

The aim of The Green Curriculum (Den Grønne Læseplan) developed by House of Science, is to provide children and young people with knowledge and skills to create sustainable futures.

During Girls' Day in Science, 100 7th grade girls collaborated with 15 young female role models on an innovation task aimed at changing the girls' opinions on engineering.

Through school programmes, House of Science prepares students to participate in Sønderborg Municipality's ambition of achieving 100% CO_2 neutrality by the year 2029.



In 2016, Sønderborg was the sole Danish municipality to join UNESCO Sustainable Learning Cities for its work on lifelong learning, education and sustainability.

RENEWABLE ENERGY

RINGKØBING-SKJERN

Energy plan paves the way for 100% renewable energy

P. 55

FREDERIKSHAVN

Green energy plan generates self-sufficiency and growth

P. 48

SILKEBORG

Record-breaking solar heating plant

P. 49

SAMSØ

Cooperation will foster a fossil-free island

P. 53

KOLDING

Local district heating with ground source heat pumps

P. 52

MIDDELFART

Ground source heat pumps bolster district heating

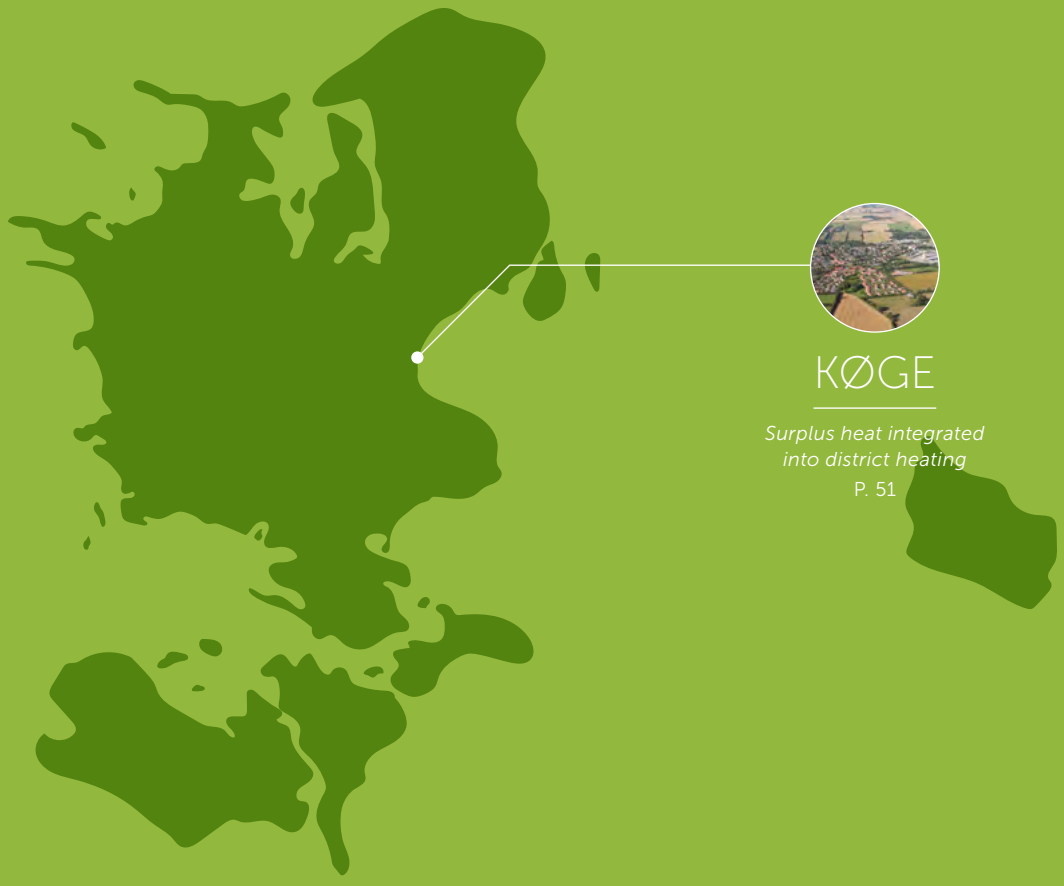
P. 50

LANGELAND

An abundance of renewable energy

P. 54

→ Many of the projects in the Renewable Energy category emphasize new partnerships across and between municipalities, citizens and businesses. The projects are primarily focusing on energy efficiency and optimization, utilization of wind and solar resources, and thermal heat pumps. Furthermore, the solutions also help to expand and complement the existing grid supply.



KØGE

Surplus heat integrated into district heating

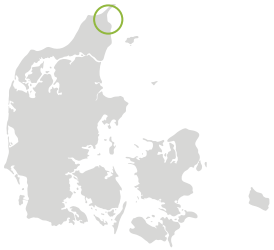
P. 51

FREDERIKSHAVN MUNICIPALITY

Green energy plan generates self-sufficiency and growth

↓15.9%

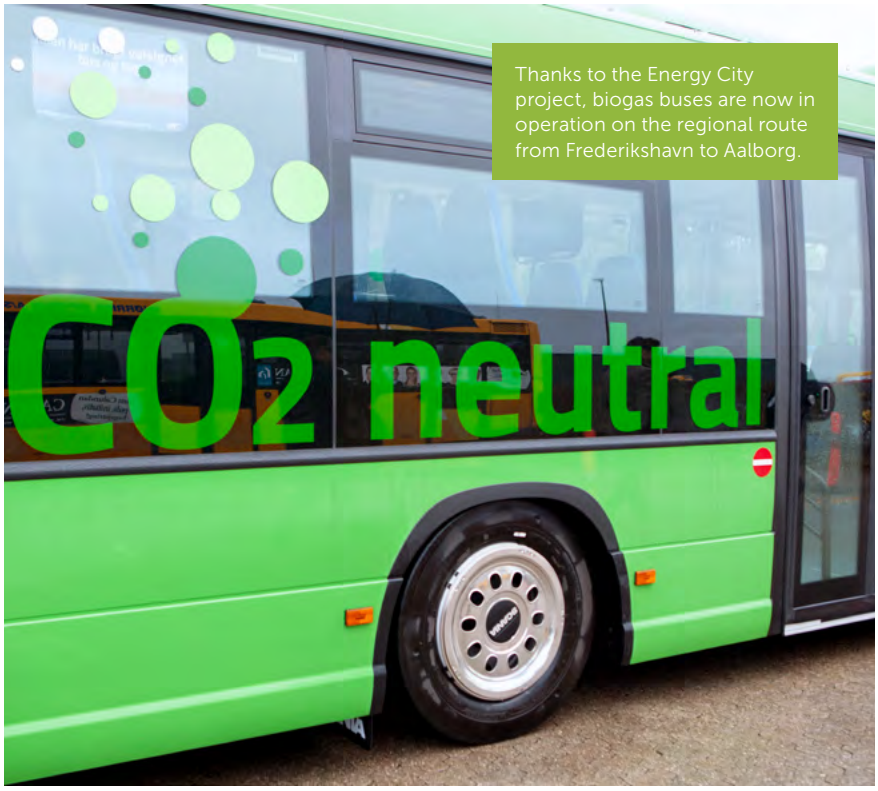
REDUCED CO_2 EMISSIONS BETWEEN 2010 AND 2015



→ With green growth as a goal, Frederikshavn Municipality aims to be running on 100% locally produced renewable energy by the end of 2030.

Over a decade ago, the City Council in Frederikshavn Municipality launched the Energy City project, aimed at tackling climate change as well as creating green growth and local jobs in the energy sector. **Today, the project is well underway and likely to make the municipality self-sufficient with 100% renewable energy by 2030.** By phasing out natural gas, expanding the municipal wind turbine plan as well as undertaking energy renovation and optimization of municipal and private buildings, the municipality has already managed to reduce 5.8% of its energy consumption and increase the proportion of renewable energy to over 27%.

Citizen and company involvement is a key element in this green energy success story. One initiative, Energy Trail Knivholt, is both a physical and virtual showroom which informs citizens about the benefits of green energy, **such as how heat pumps and household wind turbines can generate long-term savings.** Simultaneously, local companies showcase and test energy solutions on the trail, which soon will be complemented by a Center for Sustainable Development in Frederikshavn. Other initiatives in the Energy City project include new public biogas buses and several charging stations for electric cars, which also reduce the municipality's climate footprint.



Thanks to the Energy City project, biogas buses are now in operation on the regional route from Frederikshavn to Aalborg.

UN SUSTAINABLE DEVELOPMENT GOALS

Development of wind farms, joint pipelines between heating plants and better use of industrial surplus heat have increased the municipality's energy efficiency and use of renewable energy.

By switching to biogas-driven buses and garbage trucks and installing more charging stations for electric cars, the municipality has become more sustainable on the roads.

The cooperation initiatives of the Energy City project include a city network, a network of 10 local district heating plants, a youth climate club council and close cooperation with Aalborg University.

Record-breaking solar heating plant

→ In 2016, Silkeborg became home to one of the world's largest solar heating plants: a 157,000 m² plant supplying 20% of the city's demand for district heating.

↓46%

OF SILKEBORG HEATING'S CO_2 EMISSIONS WERE REDUCED IN ONE YEAR

Silkeborg Municipality and the local energy company Silkeborg Heating have joined forces in an ambitious project to make the municipality's goal of a carbon neutral heating system a reality by 2030. Silkeborg Heating supplies 22,000 customers - including homes, companies and institutions - with district heating. To help achieve the municipality's green ambitions, Silkeborg Heating has established a solar heating plant, which **covers 20% of the heat demand in the district heating network of Silkeborg.** The solar heating plant was completed in late 2016. After one year, Silkeborg Heating had reduced its CO_2 emissions by 46%.

The solar heating plan covers and area of 157,000 m², and with its establishment, Silkeborg became home to **one of the world's largest solar heating plants.** With a life expectancy of more than 25 years, the solar heating plant is expected to provide a total CO_2 reduction of as much as 392,500 tonnes, as solar heat production ultimately replaces natural gas. Following the success of the project, an expansion of the plant by a further 12% is currently under consideration.

The impressive solar heating system consists of 12,436 standard solar panels. The total cost of the project is around 33.5 million EUR.

UN SUSTAINABLE DEVELOPMENT GOALS

The solar heating plant provides citizens with access to clean and sustainable energy. With an annual yield of 80,000 MWh, the system will be able to provide heat for 4,400 households.

Silkeborg Heating's solar heating system plays a crucial role in fulfilling the municipality's goal of having a carbon neutral heating supply by the year 2030.

The project demonstrates how, in cooperation with local utility companies, municipalities can kickstart the green transition and provide citizens with access to sustainable energy.

MIDDELFART MUNICIPALITY

Ground source heat pumps bolster district heating

↓50%

SAVINGS ON HEATING BILLS COMPARED TO TRADITIONAL HEATING[1]

→ Middelfart is using the natural warmth of the Earth as a decentralized heating option to heat houses in the municipality.

In Båringe and Brenderup in the Middelfart Municipality, a number of vertical geothermal heat pumps are being installed to **supplement the existing district heating.** The pumps are connected to horizontal and vertical plastic hoses in the ground, which are expected to contribute to cheaper heating and make converting to green energy a possibility for more people.

With "Termonet" technology, geothermal heat energy is to be extracted and distributed in a smart grid. This merging of district heating and **individual heat pumps has the potential to spread the coverage of the district heating grid from 64% at present to almost 100%.** The project, created in collaboration between the municipality, Ewii Production and TREFOR, will reduce the amount of fossil fuels used in the heat supply. At the same time, there is potential for utilizing Termonet technology in order to cool data centers in computers or cool homes, if implemented in a warmer climate.

UN SUSTAINABLE DEVELOPMENT GOALS

Geothermal heating can replace conventional heat sources and thereby reduce the use of fossil and organic fuels. In turn, this reduction leads to reduced CO_2 emissions.

Installing ground source heat pumps is a way of upgrading existing heating infrastructure to be more sustainable, with low levels of CO_2 per unit of value added.

The project has thepotential to make rural and urban areas self-sufficient with sustainable ground source heat from a decentralized plant.

Middelfart Municipality is building new thermal power plants. These will become integral to the area's settlements and harvest warmth from the ground.

© Finn Granhøj

1.Middelfart municipality, PPT: Strategic public planning for heat pumps, 2017

Surplus heat integrated into district heating

→ Surplus heat from a pectin production factory is being repurposed for heating the homes of citizens in Køge and Solrød Municipality.

↑39K

MWH DISTRICT HEATING IS BEING GENERATED FROM THE SURPLUS HEAT

The company CP Kelco is repurposing waste heat from its production process by using a heat pump, while reducing noise pollution in the area. **The world's largest pectin factory, located in Køge, is also Denmark's largest natural gas consumer.** Previously, the surplus heat from this industrial production was a major untapped resource.

The plant's heat is supplied to the district heating network in both Køge and Solrød Municipality, generating enough heat to cover Køge's heating demand during the summer period. **By replacing the conventional district heating with surplus heat, CO_2 emissions are reduced.** The project benefits not only the local environment and the climate but also the company's bottom line, as the heat is sold to the utility company VEKS. It has been agreed that the price of the heat at any given time will be kept below the price of heat produced by other means. With this agreement in place, the project can ultimately provide consumers with environmentally friendly heat at a lower cost than conventional heat.

The factory utilizes surplus heat from its production processes, from which the surrounding houses can later benefit.

UN SUSTAINABLE DEVELOPMENT GOALS

Reusing surplus heat is an example of circular economy practices in the energy industry; it also shows a correlation between industrial production and reduced energy demand.

The project represents an investment in district heating infrastructure. It will benefit sustainable development and lay the foundation for a well-developed, coherent district heating system.

Pectin is produced from an array of ingredients including citrus peel. The residual product is subsequently gasified and made into biogas. The remaining pulp is then used as fertilizer on the fields.

KOLDING MUNICIPALITY

Local district heating with ground source heat pumps

→ Residents in the small town of Vester Nebel will be able to connect their houses to a local ground source heat pump network instead of using natural gas.

How can we provide green heating to villages outside district heating networks? With Vester Nebel's new collective heat pump system, the Kolding Municipality offers a solution. **In cooperation with TREFOR, the municipality has set up ground source heat pumps, which can supply up to 70 homes with stable geothermal energy.** The energy is provided at a subscription price corresponding to the cost of district heating in the rest of the municipality. The geothermal plant supplies 240-320 kW, enabling residents to wash their dishes in approximately 50-degrees celsius hot water.

Instead of oil-fired-boilers, which are a prominent heating solution in rural areas, or natural gas, which heats a large part of Vester Nebel, **the residents of the 70 newly built houses can take a hot shower with a more sustainable heat source.** The heat pumps are powered by the Danish electricity supply, which already consists of more than 50% renewable energy[1]. The collective plant proves that even the houses located outside the established district heating network can have access to reliable, sustainable, and cheap heating.

The heat pump system consists of three circuits and can supply 240 kW with a peak and reserve load of 320 kW.

↑70

HOUSING UNITS ARE PROVIDED WITH 50°C WATER, USING DISTRICT HEATING

UN SUSTAINABLE DEVELOPMENT GOALS

The energy-efficient, collective heat pump system is powered by the Danish electricity grid. The grid already consists of more than 50% renewable energy, most of which comes from wind turbines.

With cost, efficiency, and sustainability as core aims, Kolding Municipality has solved a local energy challenge with climate-friendly heating infrastructure, which can easily be replicated by other communities.

Kolding Municipality is part of the Energy Alliance, a collaboration between the Triangle Region municipalities, which shares knowledge about green energy solutions such as this.

1. Danish Energy Agency 2016

SAMSØ MUNICIPALITY

Cooperation will foster a fossil-free island

→ Through cross-sector cooperation, Samsø - already self-sufficiently powered by renewable energy - anticipates complete independence from fossil fuels by 2030.

Having already made the island 100% self-sufficient with renewable energy, Samsø is now taking on a new challenge: making the island completely free of fossil fuels. Despite Samsø's status as a Renewable Energy Island (Vedvarende Energi-Ø), fossil fuels are still largely consumed - especially for transport, but also for heating homes. **With Samsø's new master plan, drawn up in close cooperation with the NGO, the Energy Academy (Energiakademiet), the foundations have been laid to completely wean Samsø off fossil fuels by 2030.** In a unique collaboration, Samsø's citizens and organizations have been involved in the project, which has helped optimize household energy efficiency.

Samsø has sourced 100% of their electricity needs from renewable energy **by installing four new district heating plants and 21 wind turbines, as well as bringing in many other technology replacements.** By 2030, the island expects that all transport will be be powered by renewable energy and that installations of major electricity-to-heat-solutions will be able to supplant biomass from district heating plants. This biomass can be used to form biogas which, in turn, will power the municipally-owned ferry.

In Samsø, it is time to raise the bar. The Samsingers will make the island fossil free by 2030.

© Birger Jensen

100%

OF SAMSØ'S ELECTRICITY CONSUMPTION COMES FROM RENEWABLE SOURCES

UN SUSTAINABLE DEVELOPMENT GOALS

From 1997 to 2015, the share of renewable energy in total energy consumption on Samsø rose from 13% to 99.6%. This increase was due to a shift to sustainable energy sources, such as wind and solar.

The local community of Samsø has taken ownership for creating a sustainable island community. This means that the citizens today work with all the island's resource circuits.

From 1997 to today, Samsø's master plans for the island's sustainable conversion have fostered cooperation between the municipality, organizations, companies, citizens and international partners.

An abundance of renewable energy

→ Wind turbines and solar panels make Langeland Municipality more than self-sufficient, allowing renewable electricity exports.

↑162%

OF ELECTRICITY DEMAND IN LANGELAND IS MET BY RENEWABLE ENERGY

In the South Funen archipelago, Langeland Municipality is known for its beautiful greenery. But not everyone knows that Langeland's energy is also green. **The island's many wind turbines and solar cells produce so much renewable energy that the supply level is between 140% and 162% of Langeland's demand**[1]. While the municipality already exports its surplus production, plans are underway to expand energy production even further. As part of the 2013-2025 municipal plan, a rehabilitation of older, poorly placed wind turbines is planned. Langeland aims to combine this update with an expansion of both wind and solar energy in southern Langeland. With this expansion, it will be possible to increase wind energy production by approximately 13,600 MWh.

In Langeland, many private households have invested in renewable technologies such as solar panels, geothermal heating and/or mini wind turbines. Furthermore, the **Langeland Electricity utility has a fund dedicated to energy procurement and distribution projects on the island.** The fund also supports Langeland's local cultural scene, enabling the construction of 12 art towers located around the island[2].

In Langeland, total renewable electricity production in 2017 was 120,616 MWh, equivalent to 162% of the municipality's total electricity demand.

UN SUSTAINABLE DEVELOPMENT GOALS

In 2017, Langeland's wind turbines produced 118,410 MWh, and their solar cells 2,206 MWh, making the island's 74,561 MWh consumption self-sufficient.

In Langeland Municipality, more than 15% of private employees work in the wind turbine industry.[3]

The Langeland Electricity Fund supports activities that will strengthen the municipality's community, its local artists and the creative environment.

1. Energy-Supply DK, Article: *Langeland knækker den grønne kode.* 2017
2. Fonden Langelands Elforsyning, website: *Om Fonden Langelands elforsyning.*
3. Danmarks vindmølleforening, article: *Faktablad Ø2 Produktion og beskæftigelse ved vindenergi.* 2014.

Energy plan paves the way for 100% renewable energy

→ In Ringkøbing-Skjern, harnessing the potential of wind is key for the municipality to achieve 100% self-sufficiency with renewable energy by 2020.

↓483K

TONNES OF CO_2 EMISSIONS REDUCED BETWEEN 2007 AND 2015

Denmark's geographically largest municipality, Ringkøbing-Skjern, is well on the way to becoming 100% self-sufficient with renewable energy by 2020. By utilizing the area's vast wealth of natural resources, the municipality has already managed to increase its renewable energy supply from approximately 20% in 2007 to 58% in 2015. **In particular, wind energy production has increased by 479%,** from 888 to 4,257 TJ/year. In Denmark, Ringkøbing-Skjern is thus the municipality producing the most electricity (in absolute terms) from onshore wind turbines. The large amount of wind energy creates benefits for not only locals but the entire country, as much of it is exported to the rest of Denmark.

The energy plan, Energi2020, is developed in close collaboration between the City Council, the Energy Council, the Energy Secretariat and a number of voluntary and professional energy groups. Based on recommendations, meetings and workshops with citizens, the City Council has defined and decided specific areas of actions and priorities. These efforts do not only involve the municipality legislation and administration, but also citizens, companies and institutions. **This partnership approach increases local ownership** of the many energy projects in terms of development, investment and production.

UN SUSTAINABLE DEVELOPMENT GOALS

7 AFFORDABLE AND CLEAN ENERGY

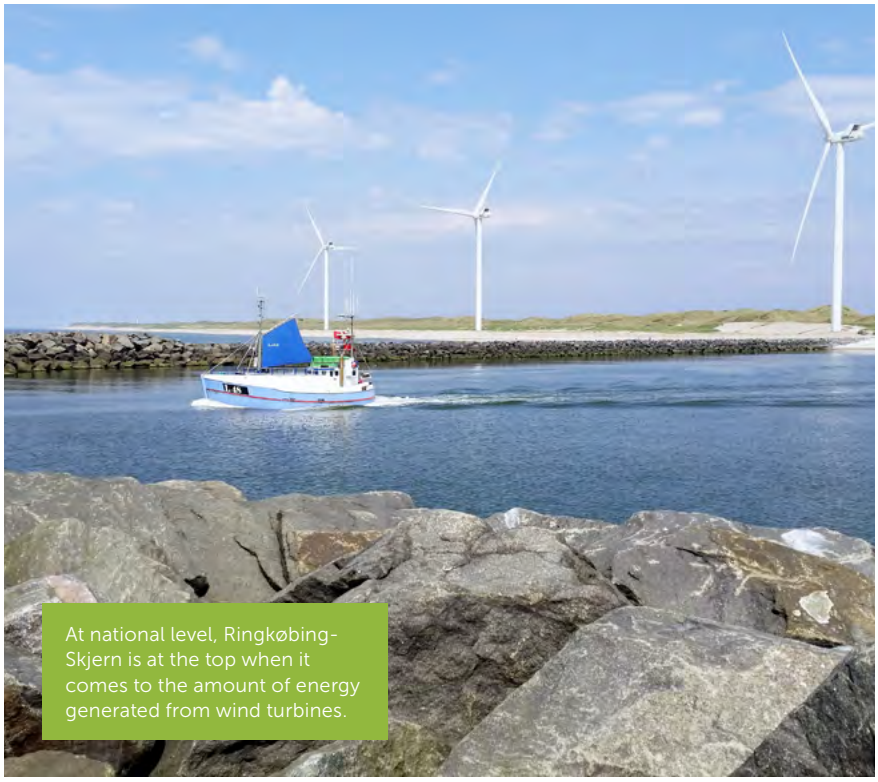
The project increases the production of sustainable energy, especially wind and solar, resulting in a CO_2 emissions reduction from 11.1 to 2.8 tonnes per year per capita between 2007-15.

8 DECENT WORK AND ECONOMIC GROWTH

The project creates jobs and boosts employment growth: 4,137 people now work in the energy and climate sector. In addition, Ringkøbing-Skjern has the lowest unemployment rate, at just 2.4%.

13 CLIMATE ACTION

As part of Energi2020, more than 400 homes underwent energy audits, leading to significant energy savings in the municipality. A further 1,000 energy audits have already been scheduled.



At national level, Ringkøbing-Skjern is at the top when it comes to the amount of energy generated from wind turbines.

GREEN LAND USE AND RECREATION

HERNING

Climate proofing creates lakeside nature experiences

P. 61

AARHUS

Rehabilitation and climate adaptation in one place

P. 67

RINGKØBING-SKJERN

First, there was nature, then people

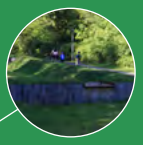
P. 65

SKANDERBORG

Rainwater basins become recreational spaces

P. 60

→ The projects in the Green Land Use and Recreation category all utilize rainwater as a resource for developing new green and blue recreational spaces. Through adaptation projects in parks and nature reserves, areas become better suited to dealing with large rainfalls whilst simultaneously creating value for citizens, fauna and flora. The majority of the solutions are developed in close collaboration with citizens.



GLADSAXE

Climate adaptation and recreation go hand in hand

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RINGSTED

City park brings new life

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COPENHAGEN

Local food production in urban surroundings

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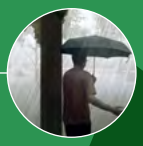

COPENHAGEN

Cloudburst management improves quality of life

P. 63

Local food production in urban surroundings

↑2-4

TONNES OF CROPS CAN BE PRODUCED ANNUALLY BY IMPACT FARM

UN SUSTAINABLE DEVELOPMENT GOALS

Impact Farm enables efficient food production with few resources and demonstrates that there are alternative ways of locally producing nutritious food in big cities.

The project shows how urban areas can make constructive use of neglected space by both producing sustainable food and cultivating new communities.

Impact Farm is inspired by the cradle-to-cradle philosophy. It is designed to impart a minimal ecological footprint and ensure a long lifespan thanks to the possibilities of recycling.

→ In one of Copenhagen's underused urban spaces, Impact Farm demonstrates what a more resilient food system could look like in the future.

In Nørrebro, the design company Human Habitat and project owner, Miljøpunkt Nørrebro, have collaborated to find a solution to the future food challenge. The result is Impact Farm, a two-storey greenhouse spanning about 50 m². As well as a social venue in the middle of a metropolitan area, Impact Farm is a highly efficient agricultural system, producing between two and four tonnes of crops a year. This is made possible by its hydroponic system: the crops are cultivated without soil, enabling cultivation to expand upwards across multiple levels. **Impact Farm is partly self-sufficient, powered by solar energy. Moreover, the water - sourced from rainwater collection** - is recirculated within a closed loop system, thus using up to 90% less water than an average field farm.

But it is not only water which embodies circularity in Impact Farm; **the principles of the circular economy are central to the entire project.** All materials are recyclable and, as far as possible, sustainably produced. In addition, the small urban farm is designed to be easily disassembled. It is built in a shipping container and can be easily packed up and moved to a new location, making it possible to raise awareness about innovative possibilities for producing food locally in an increasingly urban world.

In 2018, Impact Farm will be located at University College Copenhagen, where the urban greenhouse will be integrated into course content.

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SKANDERBORG MUNICIPALITY

Rainwater basins become recreational spaces

2,000

CITIZENS IN LÅSBY WILL BE PROTECTED FROM RAINSTORMS

→ Låsby Sea Park is a small climate adaptation project combined with significant citizen involvement to meet rainwater management and recreational needs.

On Christmas Eve in 2013, Låsby was hit by heavy rain, flooding the local nursing home with 5.5 million liters water. Låsby is located lower than its surrounding territories, meaning that all rainwater in the region ponds in the city during cloudbursts. In Skanderborg Municipality, such risk has been tackled with optimism. **Through a comprehensive citizen consultation, 900 ideas for how the vulnerable area can be climate-proofed have been developed.** Based on citizens' demand for activite recreational spaces around water, the municipality has built a sea park (Låsby Søpark) with rainwater reservoirs, which can accommodate heavy rain. Located on an old industrial site, the rainwater reservoirs are designed to look like natural lakes with a permanent water mirror. Here, all water flowing towards Låsby from the 250 hectares of surrounding fields is retained and drained, thereby protecting the 2,000 citizens in Låsby against increasing flood risks.

Låsby Sea Park is an example of successful and valuable citizen engagement. What was initially a project to create a lake for rainwater drainage has become a local hotspot for sports lovers, while all residents can enjoy passing their time in the park. At the core of Låsby Sea Park is life and activity, with a **playground, skating area, a beach volleyball court and CrossGym training equipment.**

Climate adaptation and exercise go hand in hand at Låsby Sea Park, which attracts yoga practitioners and crossfitters.

UN SUSTAINABLE DEVELOPMENT GOALS

The project manages water throughout the entire rain cycle - from downpours in the surrounding areas to rainwater collection in and around the city for recreational use.

Låsby Sea Park contributes to mitigating local cloudbursts, which has previously been a major challenge with significant health- and economy-related consequences.

Låsby Sea Park strengthens the city's resilience and adaptability to increasing climate risks and natural disasters.

Climate proofing creates lakeside nature experiences

→ Herning has transformed a green area into a water park, which both collects rainwater and acts as a recreational nature experience for citizens to enjoy.

↑65

MILLION L OF WATER CAN BE STORED BY THE LAKE LILLELUND ENGPARK

With this project, Herning Municipality has demonstrated a good example of how to handle an expected increase in rainwater, while improving existing green areas that otherwise go unused. The municipality has thus increased the value of a desolate area. The lake is located between two districts and is ideal for both outdoor recreation and efficient green/blue climate adaptation. By creating **the lake which can store 60,000 m³ of water, Herning Municipality has reduced the water level in nearby streams by up to 30 cm,** lowering the flood risk in both Herning and Holstebro Municipalities.

The municipality has also set up an interactive climate bar where visitors **can record their observations on plant and animal life, and take readings of current climate data** such as precipitation, water levels and temperature. From the lake's construction, excavated soil has been used to build playground hills, which can be used for everything from mountain biking to tobogganing in winter. Different open spaces across the area are available for picnics, while shelters are available for campers to stay overnight.

Lillelund Engpark lake invites visitors into the blue and green landscape for outdoor activities, exercise, teaching and more.

UN SUSTAINABLE DEVELOPMENT GOALS

The project encourages movement and exercise year-round. Visitors can take a trip around the lake on the "Heart Path", created in collaboration with the local Heart Association Committee in Herning.

When extreme rain events flood the sewers, the wetlands become polluted with sewage. The lake in Herning Municipality will help reduce the risk of floods and, with it, pollution.

The new lake increases resilience against climate change by protecting the city against the increasing amount of rainwater expected in the future.

GLADSAXE MUNICIPALITY

Climate adaptation and recreation go hand in hand

→ Gladsaxe has created more opportunities for getting active in one of Denmark's largest climate adaptation projects, with the added benefit of making citizens healthier.

In the Høje Gladsaxe housing project, climate adaptation and recreation go hand in hand. And **with an area of 142 hectares, the equivalent of 200 football fields, the climate adaptation project is one of Denmark's largest.** The project handles rainwater from surrounding roads, sports facilities and 2,700 households. The project's value lies in the size and number of applications envisaged as part of the climate adaptation process. The vision for the project is that, in addition to rainwater management and flood reduction, the area will see more recreational areas, higher biodiversity, and more room for activities.

One sub-project is the Gladsaxe Sports Center, an outdoor center with nine rainwater basins designed for various activities, such as skateboarding and paddle tennis. **The pools are mostly recreational areas for activity and play, but can double as rainwater reservoirs should a cloudburst hit.** A waterway path also combines rainwater treatment with a green cycle-route through the city, while a housing association has decoupled all rainwater from the drainage system by handling rainwater in green areas. With these projects, the municipality reduces the flood risk using green surface solutions, while providing citizens with more opportunities to get active outdoors.

The water pipeline path is one of the projects in Høje Gladsaxe; it ensures that rainwater is led away from the sewer system to become groundwater.

↓99

TONNES OF CO_2 WILL BE REDUCED ANNUALLY THROUGH INCREASED BIKING

UN SUSTAINABLE DEVELOPMENT GOALS

In addition to directing rainwater to trickle, which rises the greater groundwater formation. The municipality ensures that in winter rainwater is led to the sewers, avoiding harm to nature from salt used on the roads.

A number of the municipality's projects seek to create space for locals to meet and get active: the Girls Room is a popular gathering point for the area's young girls.

The area's biodiversity has increased as a result of the many new green and blue areas. The project has also helped to create a more natural water circuit.

Cloudburst management improves quality of life

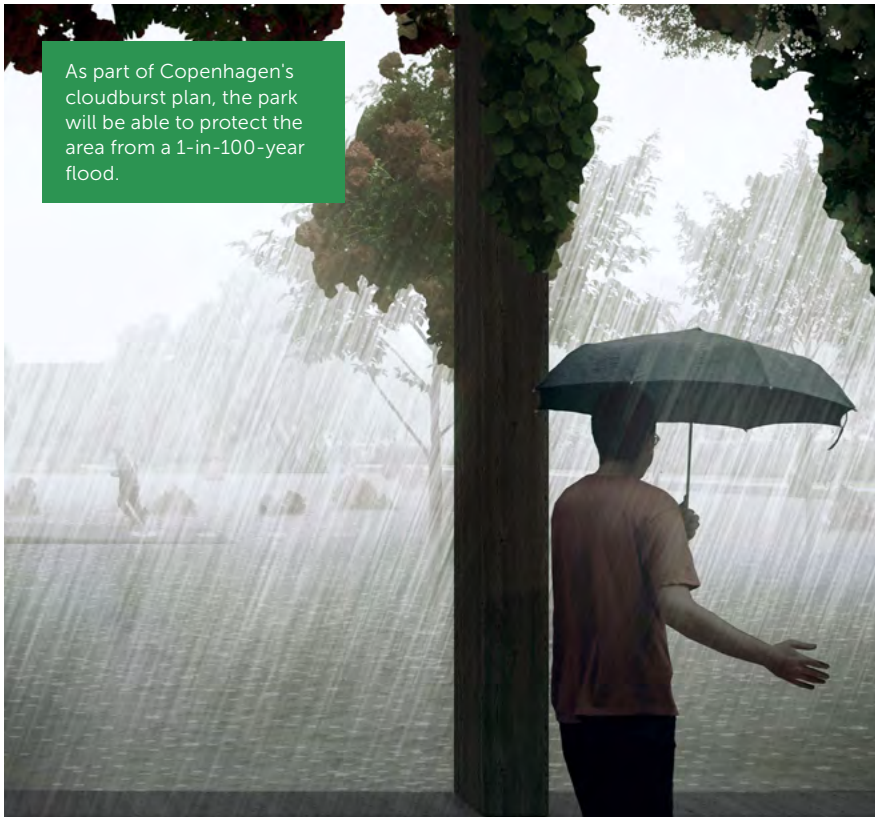
→ Copenhagen is designing resilient architecture that withstands the effects of climate change, destructive cloudbursts and flooding without sacrificing public space.

24K

M³ OF WATER CAN BE RETAINED BENEATH THE PARK'S GROUND

After a thorough renovation which includes climate adaptation measures, the park, Enghaveparken, plays a key role when cloudbursts hit the Vesterbro area in Copenhagen. The park, designed with its history, architecture and visitors in mind, **has the capacity to hold 24,000 m³ of water.** During periods of heavy rainfall, the recreational areas gradually flood as the water rises. At the entrances, sluices are constructed in the form of dikes that rise by simple mechanics when the park is underwater, and depressions to ensure that large quantities of rain are kept within the park.

This adaptation also includes a large dike surrounding the park, collecting rainwater from the park and nearby rooftops and buildings. This water is circulated around the park via the central water garden and along the dike. The water will be treated biologically through an active planting bed. The park further utilizes a large amphitheater to hold water, which functions as a social space under normal circumstances. **As a whole, the park's design is based on sustainable principles, which boost biodiversity and provide a wide range of recreational spaces.** The adaptation measures have turned water into a resource to improve urban life and create added value in a popular park.



As part of Copenhagen's cloudburst plan, the park will be able to protect the area from a 1-in-100-year flood.

UN SUSTAINABLE DEVELOPMENT GOALS

Through the many improvements, Enghaveparken supports an active outdoor urban life which benefits the community, while delivering improvements to public health and quality of life.

Enghaveparken is designed to retain 24,000 m³ of water during a cloudburst or heavy rain. This water does not add pressure to already flooded areas, making it a solution for climate adaptation.

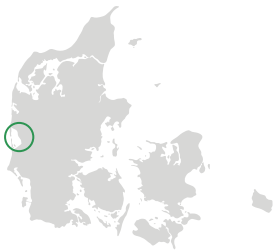
The improved green spaces, insects and bird houses contribute to improve the city's biodiversity, while allowing its visitors to explore local nature and ecosystems.

First, there was nature, then people

→ For a climate adaptation project in Ringkøbing-Skjern, a nature area with a lake, insectarium and sea of flowers are all developed before the housing.

1,000

HOMES ARE TO BE BUILT IN THE MIDDLE OF NATURE IN 2018



By Ringkøbing Fjord, Naturbydelen, the nature district of Ringkøbing, is being established on an 84 hectare site. The site has been used for agriculture over the past century, but will eventually contain 1,000 new houses. Unlike other new construction projects where homes and streets are established first, here **grass is sown and trees planted prior to housing construction.** The area is a diverse natural area, containing an insectarium, fruit plantations, nature playgrounds, meadows, a creek, a lake (with a rope ferry) and a new forest with trails providing access to shopping, schools and more in Ringkøbing city. The first homes will be ready for occupation by summer 2018, where residents will be able to open their back door directly into wild nature.

Naturbydelen has been created in cooperation between the municipality, local partners and the philanthropic association, Realdania. From the outset, local rainwater drainage has been integral to nature development in the area: **watercourses and lakes have been created, which both enhance the nature experience for humans and improve conditions for wildlife in the area.** At the same time, the future buildings are secured from day one against intense cloudbursts with a local rainwater drainage system. This innovative project was nominated for the Danish City Plan Award 2017.

UN SUSTAINABLE DEVELOPMENT GOALS

Naturbydelen will be characterized by short distances between buildings and private and public spaces, and with natural areas as a replacement for pavements and concrete.

The approach taken in the Naturbydelen project largely protects the local nature while supporting and restoring sustainable ecosystems and local biodiversity.

A number of local partners participated in the development of the project: for example, the nature playground was established in cooperation with the surrounding landowners' associations.

In Naturbydelen, the natural surroundings and drainage system were created first, with the buildings later adapted to their natural surroundings.

RINGSTED MUNICIPALITY

City park brings new life

↑5,600

M³ OF RAIN CAN BE DELAYED BY RESERVOIRS AND WETLANDS IN THE PARK

→ With the development of a new recreational park, citizens can now enjoy a new open space which also adapts the neighborhood to future climate threats.

Ringsted Municipality has established a city park in collaboration with Ringsted Supply, protecting an area vulnerable to flooding and allowing citizens to enjoy the lungs of the city. The project in Benløse is designed to be **capable of delaying the flow of rainwater from a nearby residential area during a 1-in-100-year flood** before discharging the water to Benløse stream. Rainwater is delayed by and stored in eight newly built reservoirs in the park, then transported through open grooves. To ensure the water, which runs through the park, the forest and the meadow, is clean, it is treated by a water filtration plant before distribution.

Three of the reservoirs are designed with dual function. In dry periods, for example, one reservoir can be used as a football field, while another functions as a natural biotope and "insectarium" for kids. The remaining five reservoirs are turned into meadows which enhance insect biodiversity. **Citizens' experience of the spaces and feedback have been key to the municipality.** Locals were consulted on the design of the project to ensure that it meets their needs and expectations. In addition, locals have received regularl updates about the project via the municipality website. Nearby daycare centers have also been actively involved and, among others, helped set up the insectarium.

At the park's opening, children and adults alike were excited to explore the green and recreational areas.

UN SUSTAINABLE DEVELOPMENT GOALS

Green areas have a positive impact on our mental and physical health. With a playground, walking paths, outdoor exercise machines and quiet nooks, the park helps boost healthy lifestyles in Benløse.

The park is designed to protect two daycare centers, a shopping mall and ten apartment blocks against a 1-in-100-year flood, as long as the rainwater on these properties is diverted to the public system.

The park's design caters not only to citizens, but also to insects and birds. In addition to the biotope reservoir, animals and insects can enjoy a water channel and wetland area.

Rehabilitation and climate adaptation in one place

→ The park surrounding the Marselisborg Rehabilitation Center is the first of its kind to combine rehabilitation activities and cloudburst protection.

Managing heavy rainfall from cloudbursts is still a challenge for many cities around the world. In Aarhus, SPARK is part of the answer to this ever-increasing risk. The project is a park surrounding Marselisborg Rehabilitation Center with multiple functions as a place for recreation, nature, rehabilitation and climate adaptation. SPARK is part of a wider **urban development plan to repurpose a 100-year-old hospital into a new, innovative rehabilitation center, combining climate adaptation and outdoor activities for patients.**

Part of the Marselisborg Rehabilitation Center is located on a hill top, meaning that the low lying areas surrounding it are more prone to flooding. The climate adapted area is comprised of a built area of approx. 25,700 m² and a green area of 42,050 m² which can handle 892 m³ water during a ½ year rain event, in which 14,2 mm will fall in 10 minutes. During a 1-in-100 year rain event, SPARK can handle 3,427 m³ water. **The result of SPARK will be the weather proofing of a 4,500 m² basement, local job creation, and, for the benefit of patients, as the center will offer an increased number of rehabilitation courses per year.**

↑3,427

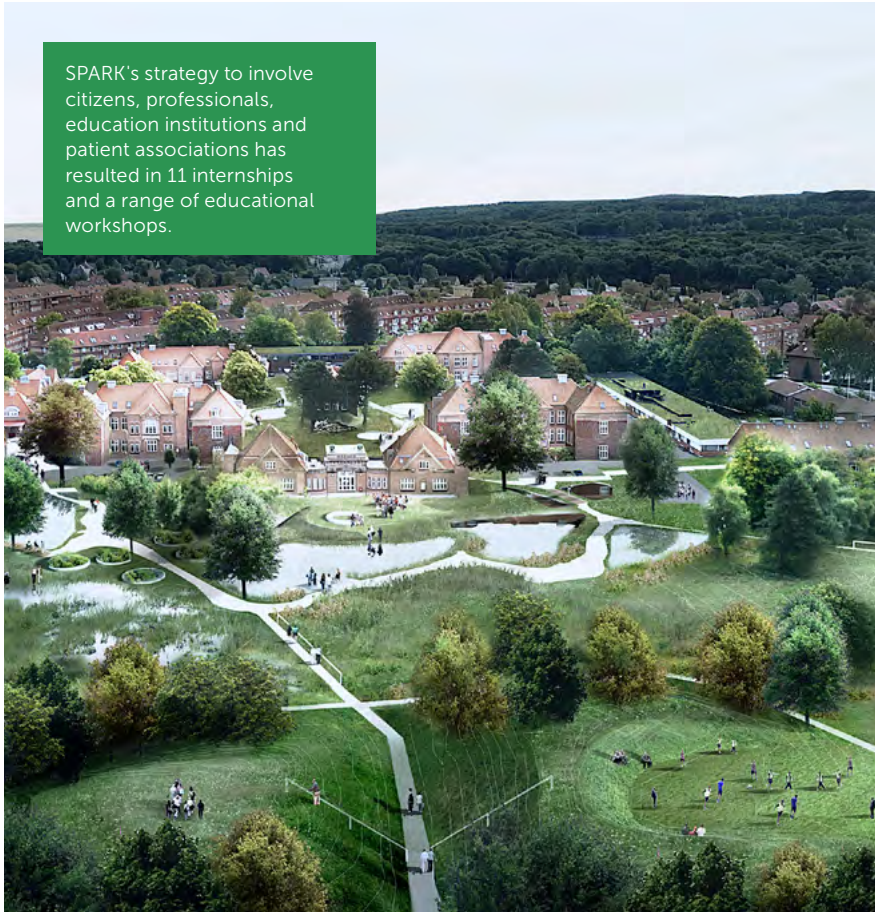
M³ OF WATER IS EXPECTED TO BE RETAINED IN THE PARK

UN SUSTAINABLE DEVELOPMENT GOALS

The SPARK project has the capacity to facilitate a minimum of 2,500 outdoor rehabilitation courses every year, and around 15,000 citizens have access to this unique recreational space.

In 2017, 900 people from local institutions participated in SPARK activities. SPARK makes a strong case for integrating a social inclusion and rehabilitation aspect when developing adaptation projects.

Climate adaptation helps to protect both hospitals and surrounding buildings against floods whilst relieving pressure on the local drainage system.



SPARK's strategy to involve citizens, professionals, education institutions and patient associations has resulted in 11 internships and a range of educational workshops.

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CLIMATE-PROOF CITIES

AALBORG

Stream reopening creates new urban space

P. 70

AARHUS

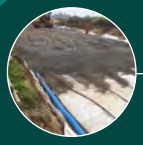
Recycling rainwater protects groundwater and reduces flooding

P. 72

AARHUS

Local rainwater harvesting solutions

P. 76



HEDENSTED

The road to climate protection and heat production

P. 77

SKANDERBORG

The road that collects and stores rainwater

P. 74

→ When it comes to climate-proofing urban spaces, several projects in this category demonstrate how municipalities can utilize rainwater as a means to optimize the city both physically and socially. Rainwater is also used here as a resource to generate heating, maintain recreational areas or supplement the water supply.

FREDERIKSBERG

Urban trees aid rainwater management and air quality

P. 73

COPENHAGEN

Courtyard gardens protect against cloudbursts

P. 75

ALBERTSLUND

Renovated canal protects city center from cloudbursts

P. 71

AALBORG MUNICIPALITY

Stream reopening creates new urban space

↓50-70

CM LOWER WATER LEVEL THAN BEFORE DURING AN EXTREME RAIN EVENT

→ By reopening the stream, Østerå, a new recreational blue-green zone is created through Aalborg, which also makes the city more robust against extreme rain events.

For more than 100 years, sections of the 15 km long stream have passed through the city of Aalborg, kept underground by concrete. With more frequent and powerful cloudbursts, the stream has not had the capacity to direct rainwater away from the sewer systems, which has led to flooding. Through several different stages, **plans are underway to reopen parts of the stream's watercourse, enabling the canal to ease the sewage system at times of large runoff.** At the same time, the project will create a coherent recreational path through urban areas under that are development. Along the pathway created by the reopened watercourse there will be attractive green spaces which call on locals to get active.

Closely linked to the reopening the watercourse is work on sewer separation in the Aalborg Municipality. **The areas discharging surface water to the stream are prioritized for sewer separation, in order to ensure that concentrated wastewater flows to the sewage treatment plant,** while cleaner rainwater flows into the streams and fjord instead. This ensures a clean aquatic environment, recreational values promoted around the stream and a city protected from floods.

Besides easing the sewer systems, the reopening of the stream will create a recreational exercise route.

UN SUSTAINABLE DEVELOPMENT GOALS

Sewer separation allows for the reopening of the Østerå stream, previously enclosed underground due to low water quality. Now, biological diversity will also be improved with the open and clean watercourse.

By increasing capacity for rainwater drainage from the stream's catchment area, the project makes Aalborg more robust against extreme rain events which are likely to be more frequent in the future.

Work is underway to remove the last blockages for fish and fauna in the watercourse, improving biological diversity. Studies show that the density of trout in the stream has risen already.[1]

1. Source: Aalborg Municipality, poster: Østerå - Genåbning af Aalborgs Å

ALBERTSLUND MUNICIPALITY

Renovated canal protects city center from cloudbursts

→ With the renovation of its existing canal and drainage system, Albertslund Municipality has safeguarded the city center from rainstorms.

Previously, Albertslund city center was highly vulnerable to cloudbursts. The municipality has tackled this issue with a now completed three-year project. The secret lies in an already established one-and-a-half kilometer long open canal, which was first created for aesthetic purposes. Today, it also diverts rainwater from the northern part of Albertslund, draining away water which would otherwise flood the city center. With increased capacity, better control over water flow and a steeper gradient, the canal **can now drain away 90% of the water from northern Albertslund, much more than the previous amount which only accounted for 5%.**

In addition to renovating the canal, a wetland has been established to slow and store rainwater from the North. The wetland **prevents flooding of surrounding creeks and lakes including St. Vejleå.** The green area of Kongsholmparken, where the new wetland is located, can hold 55,000 m³ of water.

↑90%

OF RAINWATER FROM NORTHERN ALBERTSLUND WILL FLOW TO THE CANAL

UN SUSTAINABLE DEVELOPMENT GOALS

The canal renovation project creates a climate-proof urban space with water as an integral element, which has increased accessibility to and biodiversity in the park, Kongsholmparken.

The wetland in Kongsholmparken helps to filter rainwater, thereby improving the quality of water in the surrounding lakes and streams and, eventually, in Køge Bay.

In connection with the wetland, several new natural habitats have been created including two water basins, restored streams and four amphibian habitats, together boosting biodiversity.

To improve water flow, the canal has been dug deeper in the west end, while gently rising towards the east.

AARHUS MUNICIPALITY

Recycling rainwater protects groundwater and reduces flooding

→ In Aarhus Municipality, a holistic approach to water management is having a positive impact on the way people think about "waste" water.

40%

OF TOTAL WATER CONSUMPTION CAN BE COVERED BY COLLECTED RAINWATER

Throughout much of Denmark, local rainwater drainage systems have been used in new urban developments as a flood defense measure, but rarely has this same water then been cleaned and reused afterwards. This is exactly what is happening in Aarhus. A collaboration between the municipality, the water utility and an engineering firm has **led to a central non-potable water store, where rainwater is collected, purified and redistributed for local use.** The centralized water store has the capacity to handle a 1-in-10-year rain event, and incorporating the grey-water storage in the connected building raises this to a 1-in-100-year rain event.

In practice, rainwater is collected in streams and is led through smaller lakes to a central collection reservoir. A filter removes particles and keeps plants and animals out, before water is moved from the reservoir to the treatment plant. From there, the purified **water is distributed to people's homes where it is used for flushing toilets and doing laundry. The local "waste" water now covers 40% of water consumption in the area.** An important part of the project is to establish quality standards for non-potable water used for toilets and laundry. Aarhus Municipality has played a central role in ensuring that there is no risk to citizens' health.

The project demonstrates that "waste" water can become a new resource that reduces demand for groundwater.

UN SUSTAINABLE DEVELOPMENT GOALS

Although Aarhus is not a water-stressed city, protecting groundwater reserves by reusing rainwater shows commitment to responsible water management.

The solution helps citizens take care of their clothes: non-potable water is not as hard as groundwater, which can reduce the need for soap and increase the life of washing machines.

The collection reservoir has become a natural and recreational feature of the urban landscape in the city of Aarhus, as well as a place where plants and animals can thrive.

FREDERIKSBERG MUNICIPALITY

Urban trees aid rainwater management and air quality

→ In Frederiksberg municipality, a tree planting project is an easily replicated climate adaptation project that also improves air quality.

Frederiksberg Municipality has planted trees on the roadside to mitigate the consequences of cloudbursts. In 2017, **three projects with urban trees were completed which can handle 984 m³ of water in total.** In 2018, nine more projects will be finished, expected to handle a further 1,295 m³. During regular showers, rainwater is naturally directed to the plant bed around the tree, reducing the need for irrigation, but it's during exceptional cloudbursts that the system truly demonstrates its flood prevention properties. The water permeates through the soil and down to a sub-surface cloudburst reservoir, reducing strain on the drainage system. The trees also help to reduce urban heat island effect in summer and improve air quality throughout the year.

During the project's development, it was **important to find a solution which was both modular and scalable.** The solutions are adapted to dense urban spaces where permeable coverage and tree planting function in synergy. Such a solution will be applicable to most streets in densely populated cities.

984

M³ OF WATER IS HANDLED IN THREE FACILITIES

UN SUSTAINABLE DEVELOPMENT GOALS

The tree project creates jobs and reduces municipal costs by 29 EUR per tree per year. At the same time, the trees help retain rainwater and thereby reduce the risk of cloudburst damages.[1]

The trees improve air quality and reduce urban heat island effect in densely populated urban areas. According to the municipality, an urban tree with a volume of 1.5 m³ can store 1.5 tonnes of CO_2.

Biodiversity is declining in cities overall, but projects that incorporate green elements in cloudburst protection solutions can help protect and even increase local biodiversity.

Trees have natural interception, absorption, and evapotranspiration properties which help to delay surface run-off and aid vegetation growth.

1. Calculations from Frederiksberg Municipality, 2017

The road that collects and stores rainwater

→ In the town of Galten, Skanderborg Municipality has designed a permeable road, Permavejen, that permits rainwater to pass through the asphalt and transports it to the nearby park.

On Permavejen in Galten, protection against climate change is implemented while also fulfilling a need for recreational urban space for the city's inhabitants. **The road is made of permeable asphalt, meaning that in the event of rainfall, the water flows through the asphalt rather than overflowing.** The road is constructed with a membrane which creates a pool beneath the road, ensuring that any contaminated water does not contaminate groundwater. At the same time, the reservoir makes it possible to handle a quantity of surface water equivalent to a 1-in-100-year-flood.

The rainwater is thus stored and gradually led into the traditional rainwater system over time. **The reservoir is an integrated part of the cityscape, with recreational facilities such as skate parks, tennis courts, amphitheaters and living areas.** The road protects the Galten town center and stores from the influx of rainwater 18 hectares upland, while the recreational area enriches the municipality, ultimately making it a better place for citizens to live.

18

HECTARES OF LAND ARE PROTECTED AGAINST FLOODING BY PERMAVEJEN

UN SUSTAINABLE DEVELOPMENT GOALS

The membrane beneath the road leads rain and wastewater into a temporary storage space, while simultaneously protecting groundwater from contamination from overflowing sewers.

Permavejen is an integrated water management approach. In addition to managing water levels on asphalt, it increases the city's sustainability and minimizes flood-related economic losses.

The project is adapting the city to climate change by making the city more resistant to heavy rain, while the recreation area improves quality of life for the city's inhabitants.

Permavejen lets rainwater pass through asphalt, catching it in a membrane that acts as a rainwater pool beneath the road.

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COPENHAGEN MUNICIPALITY

Courtyard gardens protect against cloudbursts

→ Copenhagen Municipality and its citizens will co-construct luxuriant courtyard gardens that have the added benefit of managing the city's rainwater.

100

YEAR RAINSTORMS ARE WHAT THE COURTYARD GARDENS ARE DESIGNED TO MANAGE

The Courtyard Gardens of the Future (Fremtidens Gårdhave) is a city development project designed to explore how Copenhagen's courtyards can contribute to local rainwater management. **The goal is to develop innovative and recreational rainwater management solutions with a bottom-up approach that caters to residents' needs**, and with a design that integrates the courtyards into their neighborhood. The project has involved two stakeholder groups - committed residents and professionals - in the co-creation and development of new solutions for the community's future courtyards, ensuring that the project is both inclusive and innovative.

The courtyard gardens demonstrate that rainwater can be retained and detained in **rain beds, lakes and canals which form part of the beautiful gardens where residents can relax** and hang out with others. For example, low lying areas in the courtyard on Askøgade can slow and hold rainwater during a cloudburst. Meanwhile, in the courtyard on Straussvej, the lawn area is bordered with recycled concrete, forming a "pool" that can retain rainwater.

The Courtyard Gardens of the Future focus on creating a model for sustainable community green spaces with greenhouses and urban gardens.

UN SUSTAINABLE DEVELOPMENT GOALS

Courtyard Gardens of the Future creates secure, inclusive and accessible green spaces. Each courtyard is designed with a bottom-up approach based on the needs of the residents.

The courtyard on Straussvej has been designed based on the responsible use of resources. 90% of the construction materials are recycled, and rainwater is treated to a high quality for use in the area.

Together, the projects are examples of how collaborations and partnerships between government authorities, citizens and experts can add value to communities and drive innovation.

Local rainwater harvesting solutions

→ A climate protection project in Risvangen, Aarhus Municipality, has reduced CO_2 emissions and water pollution by engaging citizens from day one.

↓3.2

TONNES CO_2 REDUCTION PER YEAR DUE TO WATER SEPARATION IN RISVANGEN

In the residential area Risvangen in Aarhus Municipality, a **new approach to climate change ensures dry basements, better recreational areas and reduced CO_2 emissions.** The municipality chose Risvangen for demonstrating alternative solutions to the separation of rain and wastewater. The area's approximately 1,000 residents were involved from the beginning, where they were invited to visit 14 selected demonstration gardens. In addition, more than half of the homeowners took up an offer to be visited by a sewer contractor. The visit enabled them to make an educated decision as to whether they would prefer to connect to water drainage or install water treatment plants in their own gardens.

The project has also focused on creating added value for citizens in terms of recreational areas. **The result is a patchwork of solutions where rainwater is withheld, evaporated, recycled and/or diverted** to a small forest stream in Risskov, at a pace manageable. Separation of wastewater and rainwater also saves CO_2 emissions, as water is no longer directed to the biological treatment plant, which requires resources for cleaning. This creates an annual reduction in CO_2 emissions of 3.2 tonnes.

A sewer contractor from Aarhus Vand (Aarhus Water) is invited for coffee at a resident's home to discuss how water can be handled in the garden.

UN SUSTAINABLE DEVELOPMENT GOALS

Citizens have been actively involved in project planning to ensure added social value. For example, a cloudburst reservoir can simultaneously serve as a football field.

The project helps to adapt the city of Aarhus to future climate change through robust rainwater management solutions which have been developed at community level.

Separation of the mixed and purified wastewater contributes to an 85% reduction of nitrogen and 70% reduction of phosphorus, thus protecting water-based ecosystems.

HEDENSTED MUNICIPALITY

The road to climate protection and heat production

→ A newly established "climate road" not only accumulates rainwater, but also exploits the water's heat potential to heat a nearby public institution.

The Climate Road (Klimavejen), established in collaboration between VIA University College in Central Denmark Region and Hedensted Municipality, both collects rain and reaps the benefits of the stored heat of the water. **The road is built of permeable asphalt, which lets water seep down through 800 meters of geothermal heating tubes.** The tubes collect the water's heat energy before redirecting the water to a nearby rainwater reservoir. Climate Road's geothermal plant is connected to a local daycare center and is able to satisfy its annual heating needs - equivalent to approximately 75,000 kWh annually.

With this heating boon, **Climate Road is helping to climate-proof the area as well as reducing the daycare center's heating bill through sustainable heat energy.** The project will be monitored by VIA University College and will be used for teaching at the institution. The project will also become part of a teaching plan on sustainable urban development at schools.

↓50%

REDUCTION OF CO_2 EMISSIONS RELATIVE TO HEATING WITH OIL

UN SUSTAINABLE DEVELOPMENT GOALS

As an integral part of the project, Climate Road is part of a teaching process for sustainable urban development in the municipality and at VIA University College.

The geothermal heating tubes make use of a natural heat source and the heat-storing capacity of rainwater in order to heat the local daycare center.

The project will investigate whether heat supply through the road network can supply the surrounding dwellings with heat in the future, and make the city self-sufficient when it comes to heating.

800 meters of geothermal heating tubes run under the permeable asphalt road and accumulate heat energy absorbed by the rainwater.

ENERGY EFFICIENCY AND TECHNOLOGY

VIBORG

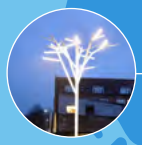
Cooling down a factory to warm up the city

P. 86

AARHUS

Smart renovations for energy efficiency

P. 88



VEJLE

Testing and scaling new technology to create a smart city

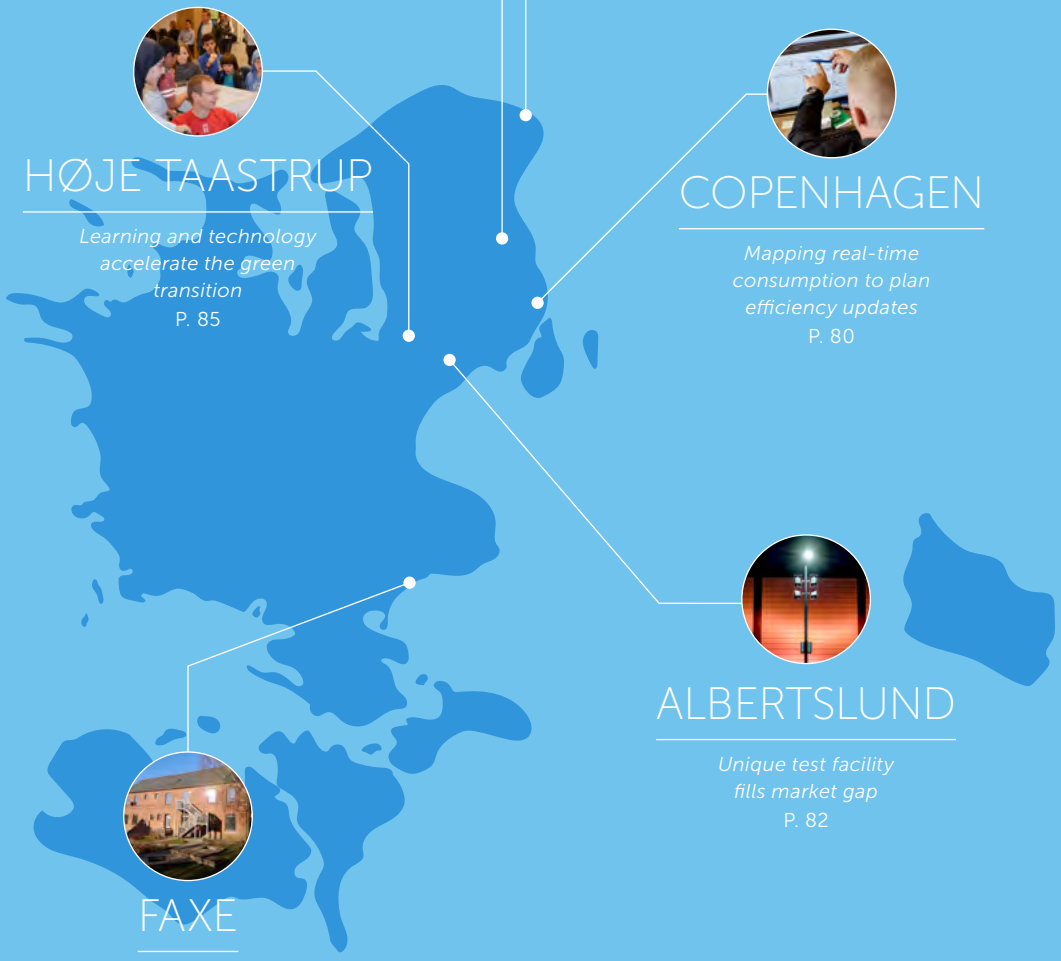
P. 89

MIDDELFART

Big data facilitates domestic energy savings

P. 83

→ This category demonstrates how monitoring, continuous adjustments and big data can produce major energy efficiency improvements. New innovative technologies allow municipalities to exploit data, utilize surplus heat and help change citizens' behavior. Many of the projects included in this category have achieved major energy savings through renovating and optimizing street lights, private homes and public buildings.



HELSINGØR

Personal advisors boost energy renovations

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RUDERSDAL

Optimization and good behavior reach energy goals

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HØJE TAASTRUP

Learning and technology accelerate the green transition

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COPENHAGEN

Mapping real-time consumption to plan efficiency updates

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ALBERTSLUND

Unique test facility fills market gap

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FAXE

Building with the climate and residents in mind

P. 81

COPENHAGEN MUNICIPALITY

Mapping real-time consumption to plan efficiency updates

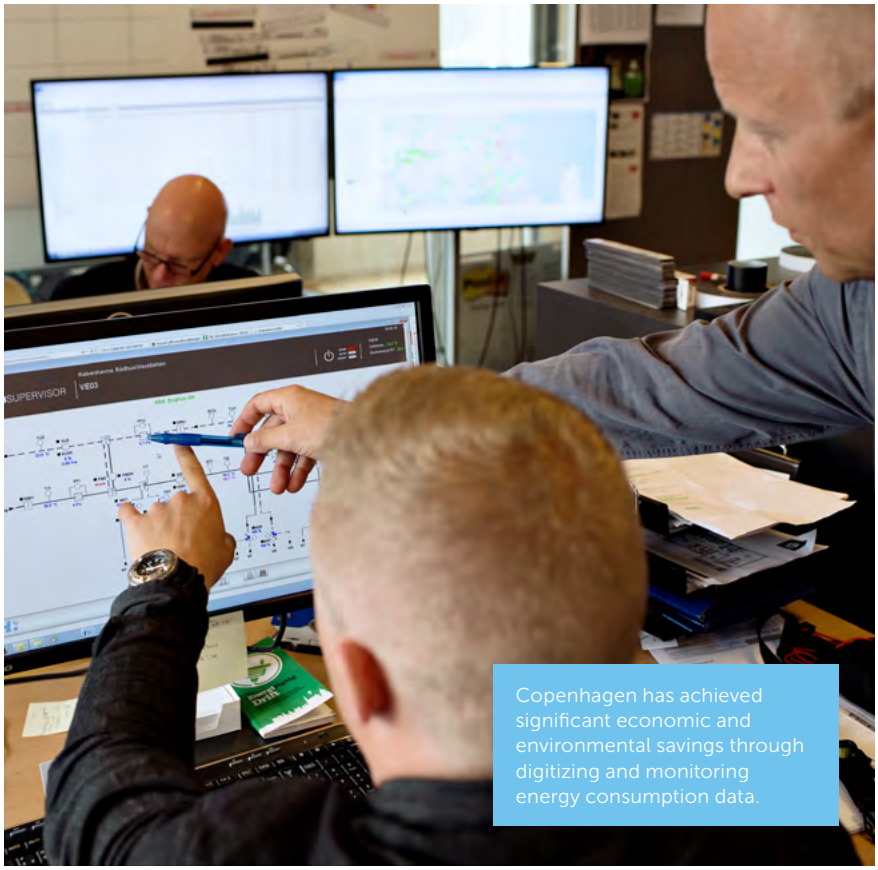
→ Copenhagen is the first city to digitize energy consumption data in municipal buildings in order to save energy and plan for efficiency upgrades.

↓2.5K

TONNES CO_2 SAVED THROUGH ENERGY REDUCTIONS IN 2016 AND 2017

Copenhagen Municipality is working with utility companies to instal extensive energy and water surveillance systems in all municipal buildings, providing data that can be studied and analyzed from one central platform. Using high-resolution data from smart electricity, heating and water meters, **the city can identify leaks in real time** and plan strategic upgrades for inefficient buildings.

The scheme, which has a payback time of just six years, is unique in that it combines information from many building management systems on one platform. In the first quarter of 2018, the system retrieved consumption data from 550 properties and 482 of the municipality's technical facilities. In 2017, the City of Copenhagen saved equivalent to 1,559 tonnes of CO_2 on electricity and district heating. In the same year, the system helped to **reduce water leakage by 5,300 liters per hour.** When the system is fully operational by 2020, 40% of energy consumption in the municipality's properties is expected to be reduced compared to 2010, saving around 4 million EUR per year through improvements to efficiency.



Copenhagen has achieved significant economic and environmental savings through digitizing and monitoring energy consumption data.

UN SUSTAINABLE DEVELOPMENT GOALS

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

By digitizing and centralizing surveillance, the energy consumption of municipalities is guaranteed to be as responsible and minimal as possible.

13 CLIMATE ACTION

The project helps to achieve the goal in the municipality's climate plan of reducing energy consumption in buildings by 40%, and thus reduce related CO_2 emissions.

17 PARTNERSHIPS FOR THE GOALS

Development and operation takes place in close cooperation between the municipality, utility companies and other property owners in order to share knowledge about energy monitoring and management.

Building with the climate and residents in mind

→ Faxe has successfully implemented a sustainability strategy for municipal buildings, ensuring each square meter is sustainably and efficiently used.

↓50

TONNES OF CO_2 EMISSIONS EXPECTED TO BE SAVED ANNUALLY

Faxe Municipality has achieved the ambition of making municipal properties cost- and energy-efficient. As part of the strategy, **the municipality has let go of buildings that are worn out or not in use.** In some cases, properties are sold to, and then renovated by, private owners, while those with the poorest energy ratings have been demolished in a responsible manner.

Besides demolishing and selling small properties with old heating systems, the municipality has also prioritized making better use of spaces, improving their energy efficiency by installing modern heating systems and adapting them for various users. **By integrating more user groups and their needs into fewer buildings, the municipality offers climate-friendly buildings of higher architectural and interior quality.** All user groups were consulted with and, as a result, they now have access to better facilities. One example is the Youth Club, which previously had an entire house to its disposal but was only spending a couple of hours a week there. The Youth Club has now been relocated to a meeting space in a school where youngsters can meet and gather for after-school activities.

UN SUSTAINABLE DEVELOPMENT GOALS

7 AFFORDABLE AND CLEAN ENERGY

The project invests in energy-efficient solutions which boost the energy ratings of municipal buildings. For example, solar panels and a heat recovery system have been installed in one school.

11 SUSTAINABLE CITIES AND COMMUNITIES

Head of public institutions, staff and users have been involved in the planning process to ensure all parties' needs are met and that stakeholders' voices have been heard.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

The municipality has gone beyond merely selling run-down buildings to mitigate bad energy ratings, but have instead demolished them to eradicate the negative environmental impact entirely.

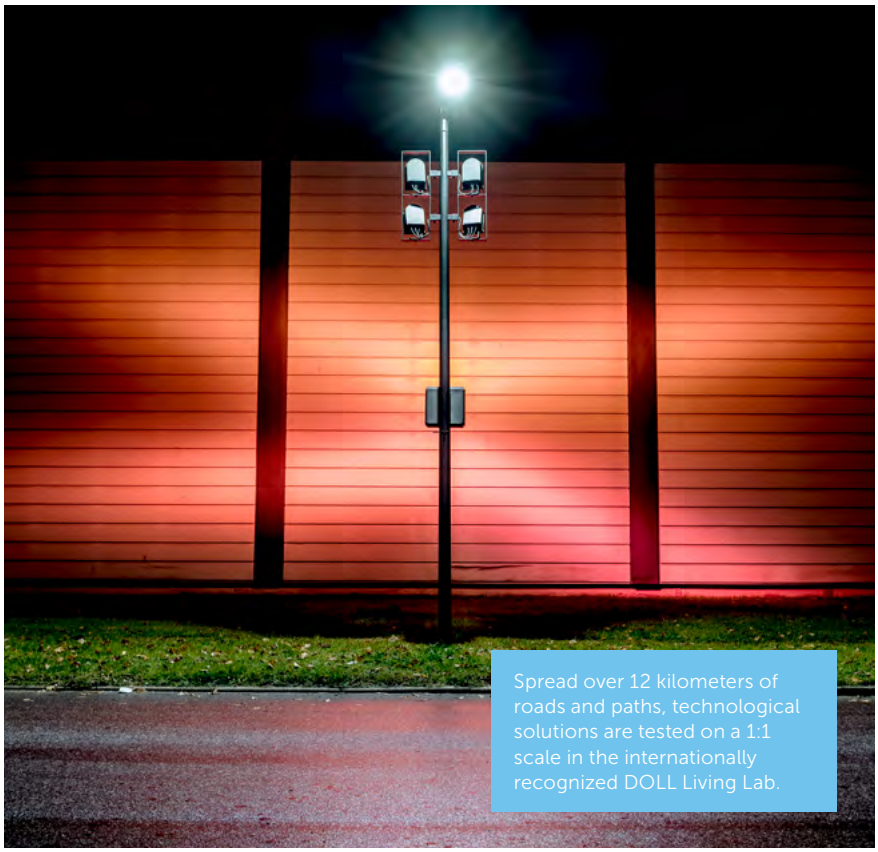
Faxe Municipality optimizes the use of old buildings by, for instance, turning this old village school into a nursery.

Unique test facility fills market gap

→ Technical solutions are being tested and demonstrated in DOLL, Europe's largest and leading test facility for outdoor lighting and smart city solutions.

Albertslund Municipality, DTU and Gate 21 have created the DOLL Living Lab, a national testing facility for energy and resource-efficient lighting and urban space solutions. DOLL has helped to **solve one of the biggest challenges within the smart city field: communicating different solutions across manufacturers** and product groups. DOLL's primary focus is the intelligent use of LED lighting, where projects have a total expected CO_2 saving of 100,000 tonnes compared to traditional lighting. At project level, DOLL can document very precise savings, however, its unique value lies in its ability not only to enable technologies to communicate, but to create cooperation and innovation between the many projects and partners. This means that DOLL's real contribution emerges when multiple technologies are implemented together, creating synergies and strong holistic effects.

DOLL **cooperates locally, nationally and globally and is visited by 1,500 guests annually.** Two thirds of Denmark's municipalities have visited DOLL, which guides other municipalities on how to identify and develop the best solutions to a specific societal context and helps them to make the best-qualified decisions on development, implementation and investment.



Spread over 12 kilometers of roads and paths, technological solutions are tested on a 1:1 scale in the internationally recognized DOLL Living Lab.

↓75%

CUT TO ENERGY CONSUMPTION CAN BE ACHIEVED BY THE TECHNOLOGIES TESTED

UN SUSTAINABLE DEVELOPMENT GOALS

DOLL encourages street lighting manufacturers to develop intelligent products with network infrastructure which can house intelligent city management technology.

By switching to LED street lighting, municipalities can cut energy use by around 50% and a further 25% by making bulbs smarter. Lighting can also be used to improve general safety.

In addition to the project enabling a 75% cut to energy consumption from street lighting, DOLL works with intelligent waste management for visualizing resource consumption.

Big data facilitates domestic energy savings

→ Through big data, guidance and smart energy management systems, energy savings can be achieved automatically without any restoration of buildings or behavioral changes.

In Middelfart Municipality, the project Smart Energy in the Home (Smart Energi i Hjemmet) has shown that an **average energy saving of 7% in single family houses can be achieved.** The project initially included 200 single-family houses in Middelfart Municipality, from which heat consumption data were collected. Thanks to the project's exploratory approach, the households made energy savings. The success of the project was down to guidance and introduction of smart energy management systems.

The data collected includes temperature, living space, meteorology and behavioral data. The project installed **a system in homes to automatically lower the temperature at night and when no one is home.** Besides Middelfart Municipality and the many homeowners, additional project participants include the Danish Building Research Institute, the company PassivSystems and Bolius, a knowledge center for homeowners.

↓1.26

MWH CAN BE SAVED ANNUALLY PER HOME

UN SUSTAINABLE DEVELOPMENT GOALS

The project found that, by connecting homes to the development of smart technology and data collection, buildings can be used for energy storage in future smart grid cities.

With a saving of 7% off the heating bill, the project has shown that with relatively few changes, energy for heating can be saved and the associated emissions can be cut significantly.

The project is a good example of the Triple Helix model, whereby a Danish university cooperates with a company and a public institution in order to foster social and economic development.

With smart heating installed, the system automatically lowers the heating at night and when the occupant is not at home.

Personal advisors boost energy renovations

8,000

KWH SAVED ANNUALLY PER HOME THROUGH SUPPORTED ENERGY RENOVATIONS

→ With energy checks, clear information and personal follow-ups, Helsingør Municipality is encouraging citizens to energy-renovate their homes.

In order to promote the energy renovation, especially of older houses and buildings, the citizens of Helsingør Municipality have been offered an energy check and thermographic scan of their property. The energy check should inform and motivate citizens to energy-renovate their homes and possibly even replace their oil-fired boiler with a less polluting heat source. The objectives of the energy renovation project are that 100 energy checks will be carried out, that 50 homes will be energy renovated within one-two years, and that **energy consumption will be reduced by 8,000 kWh annually per dwelling.**

To maximize the impact of these efforts, the municipality's energy advisors follow up on the energy check. The municipality also addresses citizens through "scrap-your-oil-fired boiler"- meetings, and has made an online energy calculator available. The municipality expects that the initiative will **reduce emissions of CO_2-equivalent greenhouse gases by 780 tonnes per year.**

UN SUSTAINABLE DEVELOPMENT GOALS

The energy check emphasises a healthy indoor climate. Better housing ventilation and fresh air in the house improves the indoor climate, benefiting residents and especially allergy sufferers.

According to the energy renovation project's objective, 100 oil-fired boilers should be replaced by heat pumps, saving 320 tonnes of CO_2 per year from the switch.

The expected average energy saving of 8,000 kWh per dwelling is estimated to provide a CO_2 saving of approximately two tonnes of CO_2 annually.

One of Helsingør Municipality's energy advisors visiting a private home to make energy checks and give advice.

Learning and technology accelerate the green transition

→ Smart technology and learning are brought together in Høje-Taastrup to create a more sustainable municipality, both now and in the future.

5

MUNICIPALITIES ARE INVOLVED IN THE SMART CITIES INITIATIVE

UN SUSTAINABLE DEVELOPMENT GOALS

The project's integrated learning process helps to ensure that students acquire the knowledge and skills they need to support sustainable development in the future.

The project develops a tool that ensures more efficient energy consumption, which can optimize the use of sustainable energy forms.

Cities, research institutions and companies collaborate to develop tools which ensure the smart integration of energy systems, utilization of data, behavioral insights and learning.

At two schools in Høje-Taastrup Municipality, a cloud-based system is being developed to make buildings more energy-efficient, optimize the indoor climate and educate building users in sustainable practices. The tool's interface, skoleklima.dk (SchoolClimate), is designed to be accessible to users of the school and municipality. At the same time, learning tools and processes are integrated into the system to increase pupils' awareness on climate issues, along with making the building more energy efficient.

The development of the system is part of the Smart Cities Accelerator initiative and set to be extended to other public buildings. In the initiative, Høje-Taastrup cooperates with four municipalities, three energy suppliers, four interdisciplinary groups at universities and the innovation network Climate-KIC. The initiative aims to spread the use of smart systems to promote renewable energy. The systems can monitor buildings and control their ventilation and heating systems based on weather forecasts, energy prices, type of energy, the state of building stock, how many people are in the building, and indoor climate data. The project has been developed in collaboration between the school's teachers, anthropologists from the University of Copenhagen and computer and civil engineers from the Technical University of Denmark.

Students learn about sustainable development when taught about sustainable behavior; meanwhile, public buildings become more energy-efficient.

Cooling down a factory to warm up the city

13,000

TONNES OF CO_2 REDUCED EACH YEAR AS A RESULT OF THE PROJECT

→ Bjerringbro's local heating plant has entered into a collaboration with the company Grundfos to supply district heating using the factory's surplus heat.

The project The Energy Central (Energicentralen) has enabled Bjerringbro's heating plant to utilize surplus heat from Grundfos' production plants for district heating. **Groundwater is used to cool down the factory machines and store the surplus heat until it is ready to be distributed through the district heating system** using a series of heat pumps.

The former cooling system consumed large amounts of energy and generated heat. Now, 15% of Bjerringbro's district heating comes from the Energy Central project, **equivalent to 13,500 MWh of heat, and an additional 10,500 MWh for cooling per year.** The Energy Central is also designed so that visitors can easily learn about the plant through large windows and information screens displayed. All of these initiatives led to the collaborative project winning the Heat Pump City of the Year award in 2014. The project has been so successful that a project called Energy Central 2 is already in the pipeline.

The heating plant utilizes the surplus heat from the production at Grundfos' factory.

UN SUSTAINABLE DEVELOPMENT GOALS

The project contributes to sustainable economic growth by reducing fossil fuels in district heating, while the company Grundfos reduces its consumption and cost of energy and cooling.

The establishment of the Energy Central projects means that it is no longer necessary to construct traditional refrigeration systems, responsible for excess heat and emissions.

Grundfos and Bjerringbro heating plant have established a partnership connecting the company and local city to create an innovative and sustainable project for the benefit of all.

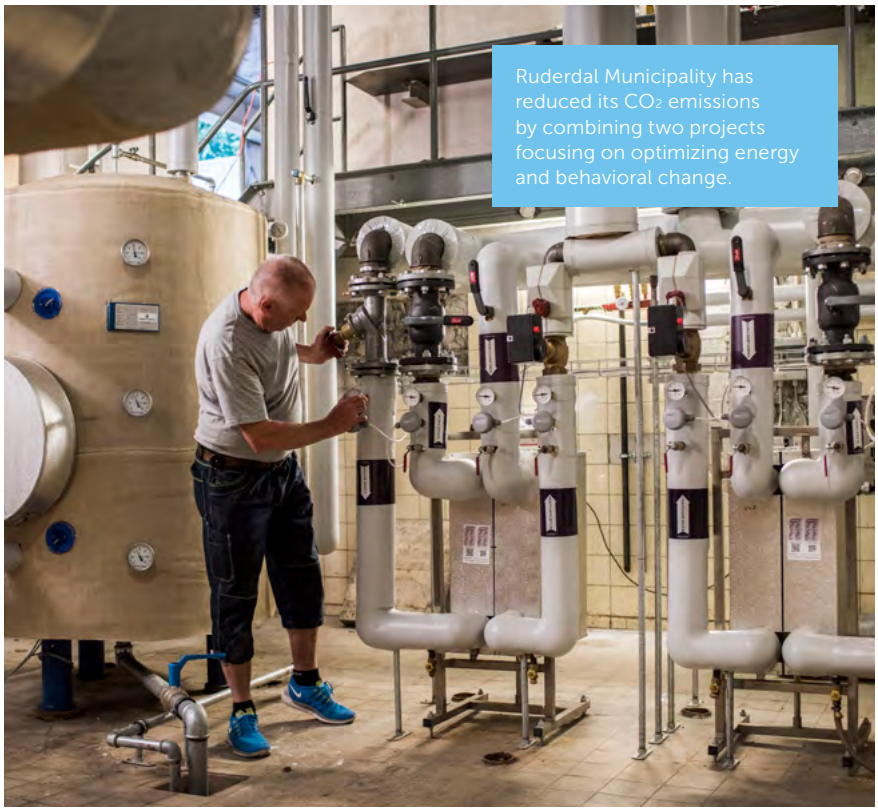
RUDERSDAL MUNICIPALITY

Optimization and good behavior reach energy goals

→ Rudersdal Municipality has reached its goal of reducing CO_2 by focusing on changing the students' behavior and optimizing energy.

By combining energy-saving technologies with behavioral change, **CO_2 emissions have been cut by 20% over a five-year period from 2009 to 2013 in the municipality's school buildings.** The behavioral aspect of the project consisted partly of upskilling the technical service managers and partly of influencing school students. To maximize the impact on the users cross-sectoral cooperation was established between the people in charge of energy at the property management department and the school sector.

The schools have focused on educating students about how their actions affect the climate. The pupils themselves have taken an active role, developing ideas and concepts to create a better understanding of energy-efficient behavior. In this way, the students have become "energy consultants", capable of improving energy behavior in homes by providing good advice. The municipality has now expanded the project to target the young, elderly and disabled. In addition, the municipality has chosen to continue the project and set a target of achieving a further 15% CO_2 reduction by 2021. The project started as an ESCO project, **a financing model whereby energy renovations are paid off by future energy savings**, guaranteed by the supplier.



Ruderdal Municipality has reduced its CO_2 emissions by combining two projects focusing on optimizing energy and behavioral change.

© Morten Nilsson

↓20%

CO_2 REDUCTION ACHIEVED BY THE MUNICIPALITY'S SCHOOLS

UN SUSTAINABLE DEVELOPMENT GOALS

These efforts streamline the use of resources and create an instantly more sustainable city, via technical upgrades and long-term behavioral changes.

By educating and influencing students' behavior, the municipality helps promote sustainable consumption habits.

The project has been carried out in collaboration between the contracting company NCC and the municipality. The good results are based on the involvement of citizens and users.

Smart renovations for energy efficiency

500

HOUSES AND 413 SOCIAL HOUSING UNITS HAVE BEEN ENERGY RENOVATED

UN SUSTAINABLE DEVELOPMENT GOALS

With their professional operations and many housing units, the Ringgården project demonstrates how social housing associations are suited to contributing to renewable energy and efficiency measures.

The READY project ensures modern and resource-efficient housing for disadvantaged citizens in the social housing association Ringgården, located in Aarhus Municipality.

READY also targets consumption habits of residents. Ringgården's residents contribute to the project through sustainable management and efficient utilization of natural resources.

→ Part of a large international project, Aarhus Municipality is improving indoor climate through building renovations and smart technology for energy efficiency.

Aarhus Municipality, Sweden's Växjö, Lithuania's Kaunas, and a number of other collaborators are working together on an ambitious project that **maps linkages between energy renovation, health and indoor climate.** The project, READY, is a demonstration project showing how smart data and new technologies can help to optimize existing solutions as well as develop new ones. Smart grids, low temperature district heating, heat pumps, solar panels and many more have all been tested.

The main objective is to uncover possibilities for reducing pressure on the energy grid at peak times. The project is investigating how existing housing can be renovated for energy efficiency in a cost effective way, to meet future climate challenges and requirements for indoor climate and health. In Aarhus alone, 413 apartments across the Ringgården Housing Association - built in the 1980s - **have been renovated using batteries, heat recovery and solar panels,** which generate both power and heat from the sun. The measures are expected to reduce energy consumption by over 50% with the remaining energy coming from renewable sources. READY also investigates whether users have changed their energy behavior following renovations.

READY has a wide range of public and private partners who help test smart grid technology and low-temperature district heating.

VEJLE MUNICIPALITY

Testing and scaling new technology to create a smart city

3,552

MWH POWER SAVING TO DATE WHEN INSTALLING 19,000 LED STREETLIGHTS

→ Vejle Municipality tests and scales new technologies that can create cleaner, smarter and more climate-friendly urban spaces.

As part of Rockefeller's urban network, 100 Resilient Cities, Vejle Municipality uses new technology and data to become more aware of how to create greener and smarter urban areas and address challenges like pollution. Under the Smart City headline, Vejle tests digital solutions in low-cost pilot projects before scaling up the best. For example, the relationship between traffic, air quality and CO_2 levels was tested in 2016 using low-cost sensors in collaboration with the Technical University of Denmark, the Norwegian University of Science and Technology and Climate-KIC. The pilot project demonstrated the potential for more data-driven decision-making when tackling pollution and greenhouse gas emissions.

Another of Vejle Municipality's Smart City projects registers Wi-Fi signals in the city center to provide an overview people's movements. The goal is to use the data to create better opportunities for citizens and tourists to use green transport options, such as buses, bikes and walking, thus designing a more climate-friendly city. Lastly, the municipality has installed LED lighting across many of its 25,000 road lighting fittings. This has so far resulted in a power saving of 3,552 MWh - the equivalent of the annual electricity consumption of 800 houses[1].

LED street lights not only result in lower power bills, but make people feel safer due to the brightness of the light.

UN SUSTAINABLE DEVELOPMENT GOALS

Globally, we need to be more energy efficient, and Vejle Municipality shows how this can be achieved with its LED street lights, using 70% less power than traditional street lighting.

Technology and innovation are the cornerstones of smart city projects, which use digital solutions to address environmental and climate challenges such as pollution and congestion.

The membership of 100 Resilient Cities and the Smart City strategy demonstrate Vejle Municipality's focus on partnerships. This is further demonstrated by the Air Quality Measurement Project.

1. www.bolius.dk/saa-meget-el-vand-og-varme-bruger-en-gennemsnitsfamilie-279/

CLIMATE ACTION PLANS

MUNICIPAL COLLABORATION

Northern Jutland supports green transition and jobs
P. 101

HOLSTEBRO

Flood protection facility safeguards inland city
P. 100

VEJLE

New opportunities from creating a resilient city
P. 96

SØNDERBORG

Envisioning a carbon-neutral city by 2029
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AARHUS

Strategic climate action reduces emissions
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MIDDELFART

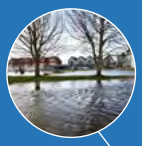
From municipality to climate laboratory
P. 93

→ Climate Action Plans present the value in cooperation across and between municipalities, citizens and businesses. Many of the collaboration projects focus on knowledge sharing and education, while demonstrating the value of combining rainwater management with other actions, such as water purification or establishing recreational areas.

LYNGBY-TAARBÆK

From fortification to climate defense

P. 94



ODSHERRED

Strategy combines climate adaptation with municipal goals

P. 99

COPENHAGEN

Revitalizing apartment buildings

P. 98

MUNICIPAL COLLABORATION

100% renewable energy across the capital region

P. 95

Strategic climate action reduces emissions

↓50%

REDUCTION IN CO_2 EMISSIONS SINCE 2008

→ With an ambitious plan to become carbon neutral by 2030, Aarhus is focusing on broad public engagement and future energy infrastructure.

Since 2008, when the Aarhus Municipality committed to carbon neutrality by 2030, the municipality has managed to halve its CO_2 emissions as part of their green transition. This was done by reorganizing its heat and energy generation as well as energy renewal of existing buildings. The **Climate Plan 2016-2020 contains 50 climate initiatives, putting Aarhus on the path to carbon neutrality.** One of the milestones in the climate plan is to create a strategic planning framework for the future energy infrastructure. Another initiative is a tool which helps to ensure that city planners include energy and infrastructure aspects in urban planning in a timely manner. This kind of strategic energy planning can lead to innovative energy solutions that benefit both the municipality and businesses.

The climate plan not only takes into account the typical areas of climate mitigation such as transport, buildings and industry, but also focuses on areas where the municipality does not have direct influence: its citizens. Aarhus Municipality has therefore created the Climate Game (Klimaspillet), where citizens can choose actions that reduce CO_2 emissions and see the effect of their choices. **The game has proven effective in increasing understanding of climate action, and is now being used in 100 primary schools and high schools** in Aarhus Municipality.

The strategic planning framework for the future energy infrastructure is an important step for Aarhus to become CO_2 neutral by 2030.

UN SUSTAINABLE DEVELOPMENT GOALS

Aarhus Municipality wants to be an attractive city to live in. An often forgotten precondition is an energy system with affordable and secure supply, which the climate plan will help to provide.

Since 2008, Aarhus Municipality has halved its CO_2 emissions by reducing energy consumption in municipal buildings by 25%.

The Climate Plan 2016-2020 was created through cooperation between 250 different actors. Five seminars were held and roadmaps developed with over 60 solutions to the biggest climate challenges.

From municipality to climate laboratory

→ In Middelfart, the municipality has been transformed into a live showcase for climate and energy projects to inspire other regions and communities.

450K

M² OF CLIMATE PROTECTION IN KLIMABYEN'S FOUR PROJECT AREAS

UN SUSTAINABLE DEVELOPMENT GOALS

Instead of overloading the existing sewer system, The Climate City uses natural water management solutions to avoid flooding and pollution of the local aquatic environment.

Citizens have joined the architects to transform the streets into greener spaces. At the same time, speed limits for cars have been lowered, increasing safety for walkers and cyclists.

Middelfart Municipality has entered into partnerships with relevant companies, citizen groups, associations, organizations and researchers among others. This ensures the success of the climate projects.

Middelfart takes climate change seriously and plans to be prepared for future climate change and unpredictable weather. To this end, the Climate Laboratory (Klimalaboratoriet) has been developed which seeks to mitigate climate change as well as adapt to it. Middelfart connects learning, business growth and urban development through multi-stakeholder partnerships. In general, the municipality wishes to provide energy and climate solutions for smaller cities on a 1:1 scale. **These include training craftsmen in energy conversion, rain gardens, intelligent heat management, and energy efficiency projects.**

The Climate City (KlimaByen) is one of Middelfart's most important climate adaptation projects. It has established new rainwater treatment plants which allow rainwater to be transported through the city, rather than having to expand the drainage system. **The Climate City covers four areas representing different types of urban space commonly found in Denmark, making it a relevant and inspirational project for other municipalities.** Additionally, the high level of citizen engagement has resulted in the creation of attractive outdoor spaces with opportunities for activities, recreation, community and learning.

Trees and flower beds have been planted all along Karensvej to collect everyday rainwater, slowing rainwater runoff and diverting water away from the roads.

From fortification to climate defense

↓50K

M³ OVERFLOW WASTE WATER WILL BE CONTAINED BY THE PROJECT

→ The reopening of the moat at Lyngby's historic fort protects against flooding, while retaining cultural heritage and creating a new recreational area.

As part of its climate protection scheme, Lyngby-Taarbæk Municipality plans to reopen the moat at Lyngby's historic fortress in cooperation with the utility company, Lyngby-Taarbæk Forsyning. **The reopened canal is designed to handle wastewater, while blending into the urban environment** and surrounding landscape. The canal creates a green recreational corridor through the municipality's commercial center, Kongens Lyngby. In addition to this climate-safe area, the reopened fortress will convey a piece of Danish history about Copenhagen Fortress (Københavns Befæstning), which was in use from 1888 to 1920.

The wastewater plant will disconnect wastewater from an urban area of 80 hectares, or roughly 50,000 m³. This reduces the risk of overflow to the stream, Mølleå, by 70%. **This unique combination of water purification, urban space and cultural heritage regeneration has never been seen before in a Danish context**, and the plans have been developed in close cooperation with citizens and the area's allotment society.

The moat will form an integral part of the urban space and offer a recreation area for the city's citizens.

UN SUSTAINABLE DEVELOPMENT GOALS

By remedying water overflows from drain basins, the reopening of the fortress' moat in the municipality will reduce the risk of diseases caused by water and soil pollution.

The project preserves local cultural heritage by restoring the fortress moat and ensuring a future-proof use for the monument as a tool in climate adaptation.

By decoupling an area of 80 hectares, the project strengthens resistance against climate-related risks such as heavy rain.

MUNICIPAL COLLABORATION*

100% renewable energy across the capital region

→ Denmark's capital and surrounding municipalities have entered into a partnership with local utilities to create a fossil fuel-free energy supply.

In the project Energy Across (Energi på Tværs), 33 municipalities, the Capital Region of Denmark, and nine utility companies have entered into a partnership with the purpose of coordinating and collaborating on the energy transition in the capital region through strategic planning. **Their vision is for the entire region's electricity and heat supply to be fossil-free by 2035**, and the transport sector to be fossil-free by 2050. The partnership has been established in recognition of the fact that achieving these ambitious goals requires a holistic, coordinated approach.

The joint framework accelerates and strengthens the green transition, as increased cooperation will reduce the number of sub-optimal investments and inefficient solutions. To ensure that both municipalities and utility companies get a competency boost, **knowledge sharing has been key to the project.** If the targets are reached by 2050, the region will have achieved an annual reduction equivalent to 9.2 million tonnes of CO_2.

33

MUNICIPALITIES PARTICIPATE IN THE STRATEGIC PARTNERSHIP

UN SUSTAINABLE DEVELOPMENT GOALS

The project will provide 100% renewable electricity and heating by 2035. Additionally, the project focuses on efficiency in order to reduce the region's energy consumption.

The project strengthens resource efficiency, reduces negative environmental impact locally, and ensures more sustainable urban development, transportation and waste management.

The project's broad and horizontal cooperation between the region, municipalities and utility companies promotes knowledge sharing and makes the actors' efforts more efficient and standardized.

The project and the broad collaboration involved will lead to a massive reduction of CO_2 emissions in the capital region.

* Allerød, Ballerup, Bornholm, Brøndby, Christiansø, Copenhagen, Dragør, Egedal, Fredensborg, Frederiksberg, Frederikssund, Furesø, Gentofte, Gladsaxe, Glostrup, Greve, Gribskov, Halsnæs, Helsingør, Herlev, Hillerød, Hvidovre, Høje-Taastrup, Hørsholm, Ishøj, Køge, Lyngby-Taarbæk, Roskilde, Rudersdal, Rødovre, Solrød, Tårnby and Vallensbæk municipalities.

VEJLE MUNICIPALITY

New opportunities from creating a resilient city

→ With its new climate strategy, Vejle Municipality is turning the increasing risk of flooding into an opportunity to improve citizens' well-being.

3,450

L/S OF WATER CAN BE REDIRECTED BY THE NEW PUMP STATION

Vejle Municipality is using innovative solutions to address climate change-related flooding risks. In total, the municipality has launched 100 city-wide initiatives to make Vejle resistant to future climate challenges. Due to its location, the local district Østbyen is particularly challenged by rain and cloudbursts and is experiencing floods with increasing frequency. The municipality has created a coherent climate strategy which, in addition to climate protection, **also will create recreational value and enhance community spirit**.

The natural waterways from the city's hills are connected to new recreational paths for pedestrians and cyclists. By controlling and using the water constructively, Vejle **creates a safe and attractive environment with urban spaces and green areas,** while ensuring that houses are better protected against floods. In addition, a new pumping station ensures that the vulnerable areas can pump out large volumes of rainwater.

With the new resilience strategy, Vejle is estimated to be able to handle a 1-in-a 100-year flood.

UN SUSTAINABLE DEVELOPMENT GOALS

The city's climate adaptation initiatives give capacity to handle massive rainfall while simultaneously creating recreational green areas for citizens.

Vejle's climate adaptation strategy reduces the risk of flooding, particularly in areas where wastewater damages infrastructure and property.

Vejle Municipality partners up with companies, citizen communities, associations and organizations to ensure that current and future climate projects are successfully realized.

Envisioning a carbon-neutral city by 2029

→Unique public-private partnership, ProjectZero, demonstrates how great climate leadership can transform how cities, communities and companies operate.

ProjectZero was established in 2007 **with the ambition of making the entire Sønderborg region carbon neutral by 2029.** Since 2007, a number of collaborative and transitional programs have been launched under the public-private partnership, such as ZEROcompany. ZEROcompany provides advice and climate strategy guidance to member companies including the major local companies Linak and Danfoss. These major players have implemented energy efficiency strategies, established extensive solar power systems and reduced CO_2 emissions by 45%. Another program, ZERObuilt (ZERObyg) has educated hundreds of energy advisors and raised awareness about ZEROhome (ZERObolig). 1,600 households have been visited by ZERObolig, many of which have gone on to undertake energy renovations of their own.

The municipality is determined to reach its goal of carbon neutrality through education, sustainable urban development, new housing concepts and green business. By the end of 2016, **both CO_2 emissions and energy consumption had been cut by 35% and 17.5% respectively compared to 2007.** Among many initiatives, this was achieved by retrofitting more than 3,000 homes and switching to district heating of 95% green fuel in three cities. The municipality has replaced 44 diesel buses with new biogas buses and energy renovated 124 municipal buildings, 42 of which now boast solar panels. These measures have almost halved CO_2 emissions across the municipal administration.

Huge transformations happen through a series of targeted initiatives that engage citizens as well as other local and national stakeholders.

↓35%

REDUCED CO_2 EMISSIONS ACROSS THE ENTIRE REGION

UN SUSTAINABLE DEVELOPMENT GOALS

Learning materials on the environment and sustainability has been added to the curriculum of 16,000 students. A collaborative vocational learning platform has also been set up in collaboration with Haiyan County, China.

ProjectZero's overall goal is to create sustainable communities. The initiative works with community organizations to coordinate efforts which include topics such as local food production and job creation.

ProjectZero has fostered many partnerships, inspiring new local collaborations based on the ProjectZero's model, including architect Frank Gehry's large-scale urban-harbour development in Sønderborg.

Revitalizing apartment buildings

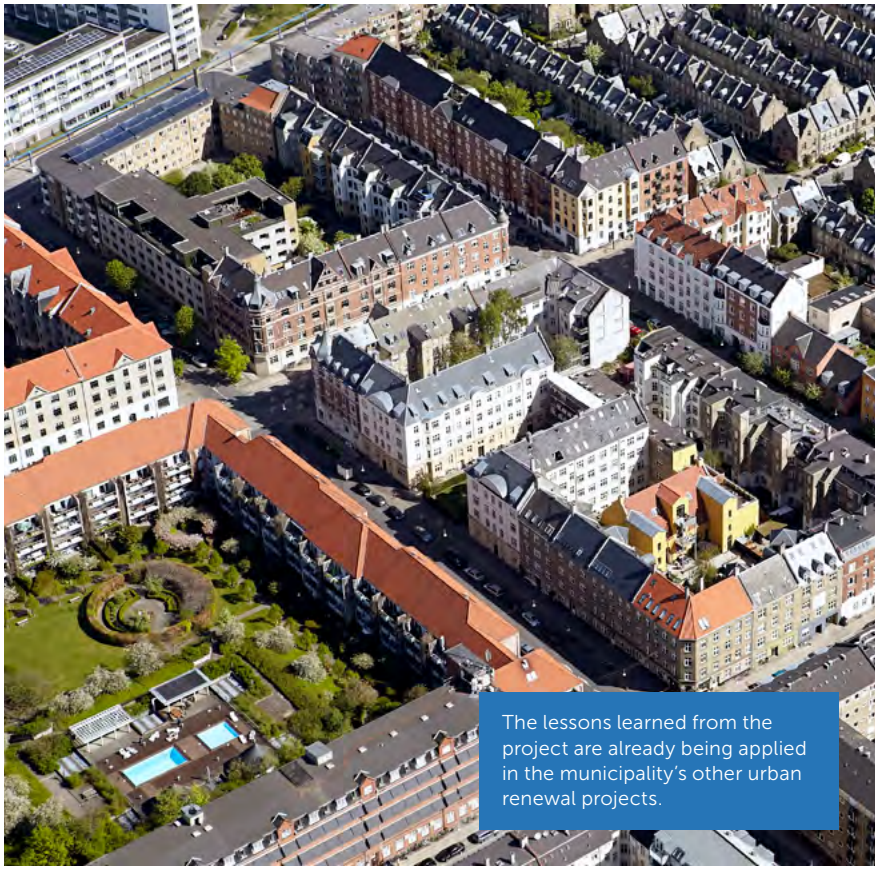
↓16.8K

TONNES OF CO_2 WILL BE SAVED THANKS TO THE RENOVATION PROJECT

→ The municipality, residents, advisers and suppliers have collaborated on a flagship project to inspire the municipality's forthcoming urban renewal.

As part of the Copenhagen Municipality Climate Strategy, the project based in the Østerbro district **demonstrates how an old building can be climate-proofed and simultaneously enhance the residents' quality of life.** The municipality has collaborated with local actors to develop and test climate adaptation solutions. Once the five-year project is completed in 2018, the buildings, facades, courtyards and sidewalks will be fully renovated.

Rainwater is the main focus of the project, as effective management will minimize damages caused by future downpours. A stream was placed in the center of the apartment block's courtyard, connecting the buildings to a water supply of collected rainwater. This **allows the rainwater supply to be channeled into houses for laundry and toilet flush purposes.** The innovative design feature reduces grid water consumption of the properties by 27%. In addition to handling rainwater on the property and consequently preventing flooding, the renovation will reduce heat-island effects, lower the buildings' CO_2 emissions by 16,800 tonnes and offer recreational value to residents.



The lessons learned from the project are already being applied in the municipality's other urban renewal projects.

UN SUSTAINABLE DEVELOPMENT GOALS

The courtyard facade features improved insulation and ventilation, as well as allowing in more daylight. It also facilitates outdoor socializing among residents.

This project in the Østerbro district has increased the recreational value of the area and strengthened locals' sense of community, both within and between the individual apartment buildings.

The project aligns with the city's climate targets by reducing the buildings' energy consumption by at least 25% and handling all rainwater on the property.

Strategy combines climate adaptation with municipal goals

→ Odsherred's climate change adaptation plan combines coastal protection and water management with local goals for urban development, tourism and trade.

67

MILLION EUR CAN POTENTIALLY BE SAVED FROM AVOIDED DAMAGES

With many low-lying areas, the City of Nykøbing Sjælland is vulnerable to storm surges and cloudbursts. Therefore, Odsherred Municipality has made a climate adaptation plan for Nykøbing Sjælland, where elements such as urban development, improved nature and water quality will be combined with efforts to climate-proof the area. Among others, Nykøbing Sjælland will be protected against a 1-in-50-year flood in 2050. **This safeguards around 55,000 m2 of ground floor area in private homes, 3,000 m² of basement area and 29 companies.** By preventing flood damages, 67 million EUR worth of damages could potentially be saved.

The stream, Grønnehave Bæk, is also part of the project included in the municipality's overall climate adaptation plan, which drains rainwater away from a 120 hectare rural area outside Nykøbing Sjælland and a residential neighborhood in the city. A new stream along the coast transports rainwater around the city, helping to prevent floods. Although the plan for Nykøbing Sjælland is still in an early phase, it clearly **demonstrates the importance of incorporating all municipal strategies when planning climate adaptation initiatives.** Additionally, the municipality recognizes that climate-proofing the city center benefits tourism and local companies as well.

Nykøbing Sjælland's low-lying urban areas along the coast are at high risk of flooding during cloudbursts and storm surges.

UN SUSTAINABLE DEVELOPMENT GOALS

The climate adaptation project will reduce pollution in Nykøbing Bay. This will improve the water quality of the Isefjord, which houses several Natura2000 sites (protected nature areas).

In addition to preventing damages caused by cloud-bursts and storm surges, local drainage systems will be installed in all new urban areas to avoid overloading existing city sewers.

The project is collaborative and involves many stakeholders, including Odsherred Municipality, Odsherred Forsyning, Orbicon / Lynghus Consult, anglers and local citizens.

HOLSTEBRO MUNICIPALITY

Flood protection facility safeguards inland city

→ A new climate adaptation facility has been designed to manage rainwater in Holstebro, the only inland area in Denmark at high risk of flooding.

Holstebro has been highlighted in the EU Floods Directive as the only inland city in Denmark to face significant flood challenges. These challenges will only be worsened by the changing climate. A major problem is that most of the area's water drains off in the Storå stream running through Holstebro. This results in constantly elevated water levels which increase the risk of flooding in the city's low-lying areas.

This risk will be mitigated with a new climate adaptation facility which will operate when the city is threatened by floods. Water will be withheld in the lake, Vandkraftsøen and a river valley outside the city. **A dam with locks is being constructed in the river valley, while a new dam-and-lock facility is being built in front of an existing dam by the lake, both of which help retain water for a few days.** A working group has been set up by the municipality to settle a compensation agreement with the owners of the land used for storing water. The facility is expected to be completed in a few years and will climate-proof 740 properties at an estimated value of 580 million EUR.

Holstebro suffers from regular floods in the winter months as a result of snowmelt, precipitation or prolonged periods of heavy rainfall.

5

MILLION M³ OF WATER CAN BE WITHHELD BY HOLSTEBRO'S NEW FACILITY

UN SUSTAINABLE DEVELOPMENT GOALS

Floodwater in urban areas poses health and hygiene problems, and can potentially contaminate both ground and surface water. The new facility will ensure that floodwater is contained in the river.

The project will protect 740 houses in Holstebro Municipality against extreme weather conditions, while simultaneously reducing potential negative economic consequences.

The local sewage treatment company and Herning Municipality are also part of Holstebro Municipality's project team. They cooperate with the agricultural organizations representing landowners in the project area.

MUNICIPAL COLLABORATION*

Northern Jutland supports green transition and jobs

→ Northern Jutland's eleven municipalities and Region have mapped the possibilities of becoming 100% self-sufficient with renewable energy by 2050.

1.3

BILLION EUR PER YEAR WILL GO TO RENEWABLES OVER FOSSIL FUELS

In cooperation with the North Denmark Region, the eleven municipalities have analyzed what it takes to become self-sufficient with renewable energy by the year 2050. The municipalities and the region are cooperating to avoid suboptimization and poor decision-making throughout this transition. Thus, **the foundations are laid for a strategic energy plan with common goals which, with the green transition, can create 50,000 full-time jobs**.

Sharing knowledge and experiences has been a major part of the project since the beginning. The work has been conducted through a number of established technical working groups focusing on wind turbines and district heating among other sources. **Each of the groups has prepared a guidebook targeting other municipal employees, which brings together knowledge, experience and advice** on the different topics covered. These guidebooks can also be accessed by employees from municipalities outside the North Denmark Region.

UN SUSTAINABLE DEVELOPMENT GOALS

The project has strengthened municipal cooperation toward energy sources and has come up with options to make Northern Jutland self-sufficient with renewable energy.

50,000 full-time jobs will be created as a result of the 12 billion EUR investment required for Northern Jutland to become self-sufficient and run on renewable energy.

The North Denmark Region faces the challenge of local out-migration. Job creation has therefore been an integral part of the green transition plan, supporting local development and energy optimization.

Wind energy will contribute to making the region self-sufficient through renewable energy by 2050.

* Brønderslev, Frederikshavn, Hjørring, Jammerbugt, Læsø, Mariagerfjord, Morsø, Rebild, Thisted, Vesthimmerland and Aalborg municipalities.

STORM SURGE PROTECTION

STRUER

Climate protection gives city and harbor a boost

P. 106

MUNICIPAL COLLABORATION

Partnership accelerates climate change adaptation

P. 110

LEMVIG

Keeping people safe and dry from rising sea levels

P. 104

FREDERICIA

Jutland's first climate-proof canal city

P. 107

→ A direct effect of climate change is rising water levels along the Danish coastline, and this category shows how municipalities can reduce the risk of floods in coastal areas. A common characteristic of these projects is the combination of climate protection with solutions that add value for the citizens, such as better road and sidewalk infrastructure for cyclists and pedestrians and regeneration of public spaces.

MUNICIPAL COLLABORATION

Jointly financed erosion protection

P. 109

HALSNÆS

New sluice protects the City of Frederiksværk

P. 111

LEMVIG MUNICIPALITY

Keeping people safe and dry from rising sea levels

→ As a place surrounded by water, Lemvig Municipality is showing the rest of the country what a climate-proofed seafront harbour could look like.

25

YEAR FLOOD EVENT CAN BE WITHSTOOD BY "LE MUR" IN THE HARBOR

Thyborøn in Lemvig Municipality is among the most vulnerable Danish cities when it comes to coastal flooding, as the city is surrounded by water. The municipality has therefore initiated a number of projects to future-proof the city against rising sea levels, stronger rainstorms, land subsidence and elevated groundwater levels. In order to **provide a comprehensive overview of the challenges, Lemvig Municipality is developing a dynamic climate adaptation model, using geophysical mapping as well as satellite surveillance of land subsidence and rising water levels.** The model is expected to be completed in 2022.

But while the model is being developed, in the meantime the municipality has built "Le Mur" ("The Wall") in 2012 to safeguard Lemvig harbor. The concrete wall runs along the harbor and creates inclusive urban spaces such as a marketplace, playgrounds and ball game areas. **The wall already proved its worth in 2013 when storms hit the country.** However, the municipality is also threatened by Thyborøn Canal and Western Limfjord. These areas are being climate-proofed by the municipality to a 1-in-50-year storm surge level, which is expected to be 60 cm higher than today's levels. The plan is to narrow Thyborøn Canal in order to lower the water level, thus protecting citizens living along the coast of the Limfjord.

In Lemvig, citizens contribute to climate projects; their ideas have so far led to a skate park, station for veteran trains, performance podium and a crab basin.

© SLA

UN SUSTAINABLE DEVELOPMENT GOALS

The project is developing a method to prevent pipeline rupture and fallbacks in underground water infrastructure. This is expected to be marketed globally to areas facing the same challenges.

The project builds resilience in coastal towns and empowers citizens to tackle future extreme weather events, thereby strengthning local efforts to preserve cultural and natural heritage.

The project examines the consequences for aquatic and coastal ecosystems together with all relevant NGOs and experts in order to minimize harmful impact.

© MADS KRABBE

STRUER MUNICIPALITY

Climate protection gives city and harbor a boost

→ Struer has created a multifunctional climate project that combines flood protection and a new urban recreational space to reconnect city and harbor.

20

YEAR FLOODING EVENT IS THE PROJECT DESIGNED TO WITHSTAND

UN SUSTAINABLE DEVELOPMENT GOALS

By reconnecting the city and the harbor of Struer, space is created for new shops and cafes, generating new commercial opportunities throughout the area.

Struer Municipality shows how climate-proofing can be combined with a social goal of creating better urban spaces for the benefit of the city's operation, businesses and citizens.

The project will prevent increasingly occurring storm surges from devastating the harbor area in Struer, while also draining surface water during extreme rain events.

Due to its location, Struer is vulnerable to floods from both the sea and cloudburst events. With the new flood protection installed, the municipality is not only able to control potential floodwater, but is also renewing the urban landscape. **The project consists of strategically placed curbs and moveable components to defend the land against floodwater.** The flood protection system is integrated into the harbor area to withstand rising sea levels from the Limfjord, creating a new social urban space at the waterfront. Existing arch bridges, placed on the central part of the harbor, retain the water and allow downward flows from cloudbursts while preventing tidal waters rising from below.

The installation addresses three challenges. First and foremost, it protects the city from storm surges and cloudburst events. In addition, it reconnects the city and the harbor in a new, open and inclusive urban space with room for small shops and cafes. Finally, **the new architecture reduces heavy traffic through the area and provides better space for pedestrians and cyclists.** Overall, the project illustrates that socially conscious urban planning and climate change adaptation can go hand-in-hand.

Struer's location at the Limfjord implies a natural storm surge risk, which is expected to increase in the coming years.

© Schønherr

Jutland's first climate-proof canal city

→ In Fredericia, climate-proofing is an extensive and innovative project that is addressing climate change challenges through integrating recreational value in project planning.

2.5M

ABOVE DAILY WATER LEVEL IS HOW MUCH THE AREA HAS BEEN RAISED

Fredericia Municipality is in the process of transforming the center's former industrial area into an **attractive new canal city which will protect the harbor and city center against the rising sea level and storm surges.** The canals will open the historic fortress town up to the water, creating a lively neighborhood with direct access to the sea. From the beginning of the project, the focus has been on finding multifunctional solutions for the canal city, and the project aims to create more recreational urban spaces, up to 2,800 new jobs and 1,000 new apartments.

The project will elevate the terrain and adapt the dikes so that the promenade running alongside the canal will sit 2.5 meters above the daily water level. **This will prevent flooding while also giving citizens access to high quality urban spaces amongst the waterways.** For example, benches and trees will adorn the promenade and citizens will be able to jump in the water easily.

UN SUSTAINABLE DEVELOPMENT GOALS

As well as focusing on climate change adaptation, the canal city project in Fredericia Municipality generates economic development and 2,800 new jobs among local businesses.

The new district creates a lively atmosphere and a sense of local identity. These factors will improve ownership of the previously very industrial area, and will make Fredericia more attractive to newcomers.

The project is working to create a CO_2 neutral district, where low-energy homes are a requirement and energy must come from alternative energy sources, such as surplus heat and solar cells[1].

The canal city addresses the rising sea levels with a holistic approach to climate change adaptation, which creates added value for citizens and newcomers.

1.Kanalbyen i Fredericia: Udviklingsplan, 2018

Jointly financed erosion protection

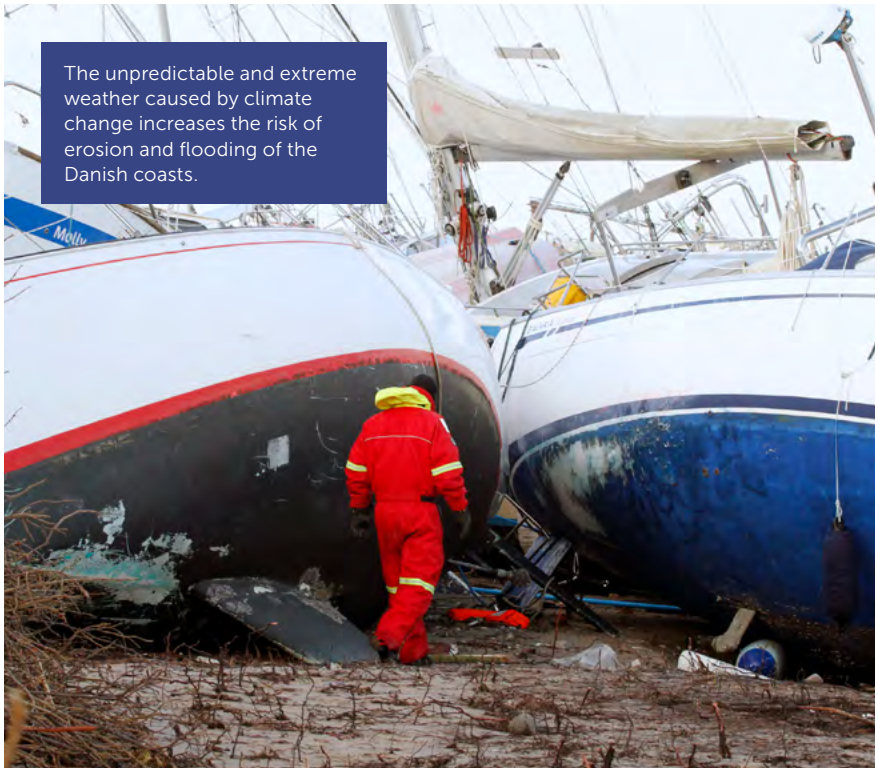
↑242

MILLION EUR OF EXPECTED INCREASED LAND VALUE ACROSS THREE MUNICIPALITIES

→ With landowners footing the bill, 60 km of North Zealand's coastline will be protected against erosion in the future.

North Zealand's coastline has been hit hard by storms in recent years. Storm Bodil in 2013 caused 11.5 million EUR worth of damage in the area alone. The conclusion is clear: North Zealand's coastline needs protection. Therefore, Gribskov, Halsnæs and Helsingør municipalities have joined forces on the comprehensive coastal protection project: The Future of the North Coast. The project will prevent erosion and secure the coast against extreme weather which is projected to become more frequent with climate change. **Feeding the beach with sand and gravel and creating protective rock structures will protect properties, natural sites and cultural assets on the 60 km coast line.** Although the project is still in the planning phase, it is expected to be completed by 2021.

Feeding the coast with sand is not new in itself, but the project's public-private funding model is noteworthy. The landowners who live closest to the coast and are in most need of protection are covering some of the 47 million EUR total bill. **This approach is both innovative in terms of climate change adaptation funding, and a fair model,** given that the total assessed land value may rise by as much as 242 million EUR as a result of the project[1].



The unpredictable and extreme weather caused by climate change increases the risk of erosion and flooding of the Danish coasts.

* Gribskov, Halsnæs and Helsingør municipalities

UN SUSTAINABLE DEVELOPMENT GOALS

The project enhances the resistance of coastal properties and infrastructure against extreme weather, while preserving beaches that are part of Danish cultural and natural heritage.

By securing the beach and coastal areas on Zealand's north coast against erosion, the project preserves natural habitats and ecosystems for both plant and animal life.

The project is based on cross-municipal cooperation and an innovative funding model, where both landowners and municipalities increase long-term environmental and economic value.

1. Ingeniøren.dk, article: Kystsikring gør nordkystens sommerhuse 1.870 millionermere værd, 2014.

MUNICIPAL COLLABORATION*

Partnership accelerates climate change adaptation

→ Coast to Coast Climate Challenge (C2C CC) is a knowledge platform and a series of projects for climate adaptation running across multiple Danish municipalities.

31

PARTNERS PLUS SUPPORTING ACTORS MAKE UP THE C2C CC NETWORK

The 31 partners of Coast to Coast Climate Challenge (C2C CC) have joined forces to create a climate-resilient region at the forefront of handling the consequences of climate change. Crossing municipal and regional borders, the project represents a unique example of collaboration, coordination and knowledge sharing about a communal climate change adaptation agenda.

The project, which has a total budget of approximately 12 million EUR, is part of the EU LIFE framework. The project is anchored in cross-sectoral subprojects and 17 local demonstrations projects, all dealing with climate change and other environmental challenges. Projects are by nature highly interdisciplinary and public-private cooperation is encouraged, so that successful projects have the opportunity to exhibit their solutions and inspire more partnerships. Through workshops and partnership meetings with the firms, the C2C CC works on making water a resource in the solutions that will be a part of creating sustainable regional development. One of the 17 local demonstration projects is the AquaGlobe project in Skanderborg, supporting research, communication and development of water-related sustainability projects.

C2C CC aims to create resilient cities in a climate robust region, based on long-term strategy and collaboration.

© Mads Krabbe

UN SUSTAINABLE DEVELOPMENT GOALS

Coast to Coast Climate Challenge focuses on identifying areas for innovation by facilitating development workshops on products, competencies and concepts for sustainable water management.

The project is addressing climate risks, integrating solutions to climate change challenges, building capacity and sharing knowledge across municipalities, regions and countries.

Cooperation is key for the C2C CC project, with partners from 18 different municipalities, 8 utility companies and 4 knowledge institutions all working together.

* Favrskov, Hedensted, Herning, Holstebro, Horsens, Lemvig, Morsø, Norddjurs, Randers, Samsø, Silkeborg, Skanderborg, Skive, Struer, Syddjurs, Thisted, Vesthimmerland and Viborg municipalities.

New sluice protects the City of Frederiksværk

→ In cooperation with a local utility company, Halsnæs Municipality has installed a new sluice to protect the City against rising water levels in Roskilde Fjord.

↑2

METER HIGH WATER LEVEL INCREASES WILL NO LONGER FLOOD THE CITY

Situated between a large fjord and a lake, the old industrial city of Frederiksværk offers great cultural and natural experiences. Unfortunately, close proximity to water also means that rising water levels represent a major challenge and risk for the city's operations, economy and cultural heritage. Therefore, in 2017 Halsnæs Municipality, together with a local utility company, constructed a high water sluice in Arresø Canal at the lake's outlet to Roskilde Fjord. When the water levels rise in Roskilde Fjord, the sluice now protects the city. Prior to the construction of the barrier, Frederiksværk city center, the city's high school, historic buildings and the city's campground were flooded by high water events of 1.2-1.4 meters. **The new sluice can protect the city should water levels rise up to two meters.**

In order to ensure effective water management, **the municipality has installed two pumps within the sluice system which extract water from Arresø Canal, preventing water from accumulating inside the sluice when it is closed.** The project has been undertaken by Halsnæs Municipality and a local utility company, who have also worked closely with the Nature Agency under the Danish Ministry of Environment and Food.

In 2017, the sluice was challenged by Storm Ingolf and passed with flying colors[1].

UN SUSTAINABLE DEVELOPMENT GOALS

With the new sluice, Halsnæs Municipality has taken an active step to protect the historic buildings of Frederiksværk for future generations.

The City of Frederiksværk is experiencing flooding caused by water level overflows with greater frequency. The sluice system makes the city more resilient and better adapted to climate change.

The sluice is a good example of how municipalities along the Danish coasts and fjords can manage and protect vulnerable areas in a manner that is both efficient and sustainable.

1. Halsnæs Municipality, press release: Nu indvies højvandssluse, 2017

CLIMATE ADAPTATION OF STREAMS AND LAKES

AARHUS

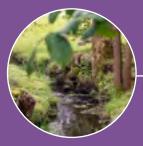
Rewilding for climate adaptation and biodiversity

P. 114

RANDERS

Meadow restored for natural water management

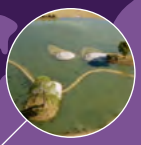
P. 122



ASSENS

Streams reopen for the benefit of citizens and drainage system

P. 123



ODENSE

Lake offers value for adaptation, conservation and recreation

P. 119

TØNDER

Wetland benefits citizens and the environment

P. 125

SVENDBORG

A natural protection against flood risks

P. 117

→ In this category, municipalities demonstrate how they are able to combine climate adaptation with nature conservation and urban development. The projects harness the benefits of natural environments, for instance by managing cloudbursts and floods by disconnecting rainwater from the sewage system, and by managing rainwater through landscaping and restoring wetlands, lakes and streams.

ALLERØD

Climate protection with a recreational focus

P. 116

MUNICIPAL COLLABORATION

Common challenges require common solutions

P. 120

ISHØJ

Newly landscaped lake and forest prevent floods

P. 124

GULDBORGSUND

Wetlands act as natural flood defence

P. 118

AARHUS MUNICIPALITY

Rewilding for climate adaptation and biodiversity

→ Aarhus Municipality creates synergy between nature and climate adaptation in the swamp Geding-Kasted Mose.

Northwest of Aarhus, the municipality has taken a holistic approach combining climate adaptation and biodiversity into a large natural area. Under the name Rewilding Geding Kasted Mose, the municipality seeks to promote more dynamic wildlife **by introducing pastures for natural cattle, wild horses and water buffalo, in order to make the area self-regulating.** The rewilding concept is about creating year-round pasture and giving animals and water more space in the landscape. The latter occurs by opening drainage and un-restraining streams and wetlands, which are also well-known climate adaptation methods that reduce flood risk in nearby urban areas. The methods include reduced drainage of organic soils which has the added benefit of increasing soil carbon levels.

Aarhus has added a further 36.5 hectares of former farmland to the natural area. **This shift from intensive farming to conservation generates a significant annual saving of greenhouse gas emissions.** Moreover, groundwater is protected in this additional area. The municipality's goal is to establish a 140-hectare cohesive conservation area which contributes to climate protection, increases biodiversity and creates better experiences in nature, improving quality of life for citizens.

Reintroducing pasture animals mirrors ancient ecosystems before mass human intervention, protecting the area's many rare species from disappearing.

© Casper Thybjerg, TTF ApS

↑3

MILLION M³ CLEAN DRINKING WATER ANNUALLY COMES FROM GROUNDWATER

UN SUSTAINABLE DEVELOPMENT GOALS

3 GOOD HEALTH AND WELL-BEING

The area has become a green public getaway with 5.9 kilometers of new trails encouraging visitors to reconnect with nature and exercise, thus improving mental health and well-being.

6 CLEAN WATER AND SANITATION

Vulnerable groundwater is protected by converting 36.5 hectares from farmland into a natural area. The groundwater provides approximately three million m³ drinking water for citizens every year.

15 LIFE ON LAND

Ecosystems are protected by reintroducing ecosystem-regulating species which help increase biodiversity and reduce the need for supplementary inputs year-round.

Climate protection with a recreational focus

↑69

BUILDINGS CLIMATE-PROOFED, INCLUDING SCHOOLS AND NURSERIES

→ A recreational area in Lynge is helping to increase biodiversity, optimize rainwater management and protect the land against flooding.

In recent years, the recreational area Lynge Fælled, which offers visitors an urban nature experience, has been challenged by flooding. Heavy rains have led to buildings being at risk of flooding and the possibility of overloaded sewers contaminating lakes and streams. **The municipality has responded by creating a new rainwater solution to climate-proof the city and improve conditions in the stream Lynge Å.** By remodelling the landscape with depressions and lakes, up to 2,000 m³ of rainwater can be stored in the reservoirs and released into the drainage system at a manageable rate.

The project has been developed in collaboration between Allerød Municipality, the University of Copenhagen, Novafos and Watercare. The project demonstrates how, rather than being stored in sewer pipes, surplus water can be integrated as a natural feature in urban and residential settings. Together, the project partners have developed innovative methods that not only contribute to climate-proofing the area, but **improve water quality and recreational spaces in Allerød.** In addition to nature-enhancing initiatives such as temporary lagoons, reservoirs and a permanent lake, the project focuses on water purification. Connected to the project, a double porous filter has thus been developed to ensure high water quality and thriving green areas.

The project's botanical and recreational priorities allow the citizens to enjoy a community rich with nature.

UN SUSTAINABLE DEVELOPMENT GOALS

With water purification efforts and a more stable flow of water, the municipality expects to achieve significantly higher water quality in the nearby streams and lakes.

The recreational project came about from the municipality's wish to flood-proof the area Lynge Fælled so that it will withstand a 1-in-25-year rainfall event.

The project seeks to improve biodiversity by bringing more than 40 new plant species to the area and creating good biotopes, especially for amphibians such as salamanders.

A natural protection against flood risks

→ Svendborg has created a unique climate adaptation project using the nearby forest to retain water, protecting the city from floods after cloudbursts.

↓725K

EUR ANNUAL SAVINGS THANKS TO SVENDBORG'S FLOOD DEFENCES

The best solution is not always the most expensive: Svendborg's cloudburst protection is living proof of this. During heavy rain, the municipality's water management solution retains water from heavy rain and cloudbursts in an area of a forest nearby where the water can slowly permeate the ground. This system helps to prevent the stream running through the city from overflowing its banks and causing a flood. **This solution is an alternative to the very expensive underground or lowered concrete structures used in cities elsewhere.** The climate mechanism can protect Svendborg city against a 1-in-75-year rain event, equivalent to approx. 100 mm rainfall over four hours.

The municipality has taken the opportunity to not only improve flood protection, but also to **create a new ecosystem in the forest where 23,000 m³ of rainwater can be stored.** The municipality estimates that this form of climate protection saves approximately 725,000 EUR annually, which is 1.5 times the installation value. With cloudbursts expected to become heavier and more frequent in a future affected by climate change, the municipality's project has already returned the investment.

Constructing the forest pool was 15 times cheaper than creating the concrete structures.

UN SUSTAINABLE DEVELOPMENT GOALS

The solution prevents the city from being flooded with rain and sewage, reducing the risk of contaminated drinking water and the spreading of diseases.

The project makes the city of Svendborg more resistant to massive rainfall while protecting the people who live and run their business near the river and harbor.

The pool has a built-in fishing passage enabling trouts to pass. This promotes a growing trout stock and thus general biodiversity, which is a special focus area in the municipality.

GULDBORGSUND MUNICIPALITY

Wetlands act as natural flood defence

↑190

HA OF LAKE, MEADOWS AND FORESTS HAVE BEEN NATURALLY RESTORED

→ With the restoration of the Bøtø Nor Reserve, Guldborgsund Municipality has strengthened the area's unique nature and protected large areas from flooding.

In 2015, Guldborgsund Municipality implemented a major expansion and nature conservation project in the local natural habitat, Bøtø Nor. **The project's comprehensive natural improvements and climate protection actions improve living conditions for the area's many plant and animal species** which, due to Bøtø Nor's southern location and dry climate, house species that are not seen anywhere else in Denmark.

During the recovery and conservation project, **Bøtø Nor was transformed into a permanent wetland area.** The work involved clogging ditches in the surrounding area, installing drainage and laying down three kilometers of plastic membrane in the ground to retain water. The adaptation actions have enabled the area to drain water away from popular nearby holiday destinations which have previously experienced severe flooding during heavy rains. By expanding the wetlands, the area will now be able to cope with a 1-in-100-year rain event.

UN SUSTAINABLE DEVELOPMENT GOALS

Guldborgsund has contributed to promoting more sustainable agriculture by letting cows and sheep graze in the area, which has a ban on the use of pesticides and fertilizers.

The Bøtø Nor Reserve can handle a 1-in-100-year rain event, ensuring that the surrounding dwellings are not destroyed by floods as the risk continues to increase with climate change.

By expanding the natural area from approximately 85 to 190 hectares, the municipality has contributed to improved biodiversity and highlighting the area's diverse fauna and flora.

Several of the area's private landowners have voluntarily converted their agricultural land into nature reserves.

Lake offers value for adaptation, conservation and recreation

→ The recently constructed lake, Glisholm Sø, collects rainwater in the growing southern part of Odense and offers a recreation area rich with plant and animal life.

34

LITERS PER SECOND IS GENTLY RELEASED FROM GLISHOLM SØ TO NEARBY STREAM, LINDVED Å

Historically, when rain poured over Odense Municipality, the nearby stream, Lindved Å, would be flooded by the huge volumes of water and reach residential areas south of the city. The municipality has put an end to this with the construction of Glisholm Lake, designed to collect and store rainwater. Today, Glisholm is Odense's largest lake with a wet volume of approx. 42,000 m³ and a surface area of 70,600 m². **In the event of heavy rain and cloudbursts, which are expected to become more frequent in the future, the lake can hold up to 87,000 m³.** In addition, the lake is equipped with a sand trap to remove any sand, gravel and oil residues that might accumulate in rainwater and runoff, keeping the lake clean and protecting ecosystems.

But Glisholm Lake is more than just a tool in Odense's struggle against future wild weather. In cooperation with the Danish Society for Nature Conservation, Odense Municipality has **established wetlands, paddocks and small islands with trees, rocks and poles - a thriving place for birds such as herons and cormorants.** Citizens can also enjoy the rich animal and plant life from landscaped paths and benches adorning the lake's surrounds. Odense refers to Glisholm Lake as a "three-in-one of climate adaptation, nature conservation and recreational value".

Glisholm Lake receives rainwater from an area of 677,000 m² soon to house new industrial developments and residential areas.

UN SUSTAINABLE DEVELOPMENT GOALS

With a growing residential and industrial area south of Odense, the need for handling urban rainwater rises. Glisholm Lake is able to keep up with this development and protect the new areas.

The lake and surrounding area of 127,000 m² contain wetlands, small islands, trees and rocks, and are home to a number of terrestrial animals, including shorebirds and salamanders.

Glisholm Lake was developed in collaboration with VandCenter Syd and the Danish Society for Nature Conservation, to create a technical solution that simultaneously promotes biodiversity.

MUNICIPAL COLLABORATION*

Common challenges require common solutions

→ The flooding of Usserød stream (Usserød Å) became the catalyst for a cross-municipal collaboration to adapt to climate change.

Together, three municipalities have found one common solution and vision for a common challenge. **Usserød Å, which stretches eight kilometers through Rudersdal, Hørsholm, and Fredensborg municipalities,** will be regarded as a valuable element of the urban natural environment in the future, as well as a tool for climate adaptation.

The project came about after heavy rainfall in the year 2010 caused the watercourse to break its banks and flood the surrounding areas. Through the partnership (a former EU-LIFE-supported project), **the municipalities have established a permanent organizational model with shared preparedness and a common knowledge database to reduce flood risks along the river.** Hydraulic measurement and control systems have been set up which can simulate the water's movement at different precipitation events, allowing the municipalities to model and prepare for potential future events. In addition, wet meadows and sluice systems have been established to regulate flooding in times of extreme rain, protecting more vulnerable areas downstream. A digital handbook has been developed, allowing other professionals to learn from the project.

Walking along Usserød Å, the current water level can be read at a number of measuring stations using QR codes.

* Rudersdal, Hørsholm and Fredensborg municipalities

8KM

THE LENGTH OF USSERØD Å, A STREAM PREVIOUSLY PRONE TO FLOODS

UN SUSTAINABLE DEVELOPMENT GOALS

13 CLIMATE ACTION

The municipalities have a joint technical toolbox for climate adaptation. Data collection enables a common alert and response system which citizens can also access.

14 LIFE BELOW WATER

The new management strategy for one of the sluices maintains a constant water level in Sjælsø, the stream's feeding lake. This approach protects ecosystems through regulating plankton levels, since more of the predatory fish survive[1].

17 PARTNERSHIPS FOR THE GOALS

The project has paved the way for ongoing cross-municipal cooperation between the three municipalities around Usserød Å, which can lead to cooperation in other areas as well.

1. Lokalavisen.dk, article: Usserød Å-projekt sikrer flere rovfisk og renere vand, 2015

RANDERS MUNICIPALITY

Meadow restored for natural water management

↑40K

M³ WATER CAN BE MANAGED BY THE WET MEADOW DURING CLOUDBURSTS

→ Randers Municipality has transformed a wet meadow into a natural water management facility to protect Vorup against water from above, below and from the sea.

In the district of Vorup in Randers Municipality, water poses a threat on many fronts. Rain can lead to flooding from cloudbursts, overflow from the Gudenåen stream, elevated groundwater levels, high tides and storm surges from the Randers fjord. Although the challenges are numerous, **Randers Municipality has taken action to turn the tide,** with an ambitious climate adaptation project on Storkeengen.

The wet meadow, Storkeengen, is located between the village of Vorup and the Gudenåen stream, and these natural conditions will be used to the municipality's advantage in their project. **By using new cloudburst waterways, water is led from surface areas in Vorup to the wet meadow.** Here, the water is purified in reservoirs designed as natural wet meadow areas before being released to the stream. In addition, a pump directs the water over a coastal dike which is used during high water levels. The wet meadow is just the first stage of Randers' vision to combine climate adaptation, quality natural assets and urban development. The residents of Vorup can look forward to keeping their feet dry as well as enjoying nature in the new park.

Randers Municipality commences construction work in 2018, and Vorup can call itself fully water protected by 2021/2022.

UN SUSTAINABLE DEVELOPMENT GOALS

The wet meadow would not normally be able to house a technical pumping facility, but with this solution rainwater from the 30-ha urban area can be purified before entering the stream.

The project sees extreme weather threats as an opportunity to use water as a resource in green city development, with a new recreational area that protects Randers' natural heritage.

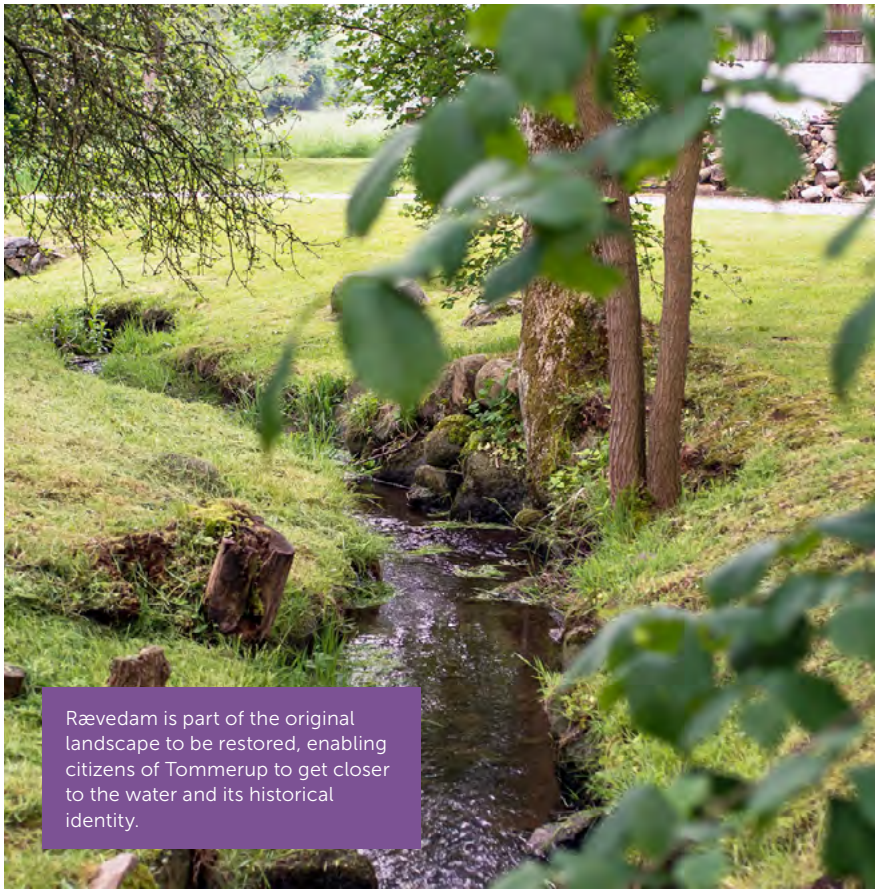
The project ensures that eight hectares of fens are protected, which would otherwise have been at risk from flooding, according to the municipality's calculations.

Streams reopen for the benefit of citizens and drainage system

→ In Tommerup, the community is adapting to climate change by returning their historical Rævedam stream back to the surface.

The town of Tommerup has long been faced with an overloaded drainage system due to the constrained stream, Rævedam, that was piped underground. Therefore, Assens Municipality and **the local utility company have decided to collaborate to return the stream to the surface,** not only to adapt to a changing climate but also to create a recreational haven for citizens.

By reopening the 1,300 meter long water course, the stream water and Tommerup's rainwater will be separated. The stream can then flow naturally through the town, while rainwater will be led through the old pipes to three new delay reservoirs in the shape of small lakes. Here, the water will be cleaned before being directed to the stream at a rate which the stream can handle. According to calculations, the implementation of the **climate project will result in reduced damage costs of 14 million EUR over the next 100 years. The new blue-green natural areas will also increase the area's carbon uptake in the soil.** Thus, the project will not only reduce the risk of floods, but also create a number of environmental and social co-benefits.



Rævedam is part of the original landscape to be restored, enabling citizens of Tommerup to get closer to the water and its historical identity.

14

MILLION EUR IS EXPECTED TO BE SAVED THROUGH ADAPTATION MEASURES

UN SUSTAINABLE DEVELOPMENT GOALS

The establishment of wetlands in the project area helps bind nitrogen from the atmosphere and surface water, thereby reducing nitrogen leaching to the stream with 33 kg N/ha.

Reopening the stream and establishing natural areas will increase biodiversity in Tommerup and will work as ecological corridors for flora and fauna throughout the town.

Strengthened cooperation between the municipality and utility company creates cheaper and better climate solutions that lay the foundation for future climate change adaptation projects.

ISHØJ MUNICIPALITY

Newly landscaped lake and forest prevent floods

→ With a newly landscaped lake and a forest the size of 35 soccer fields, cloudbursts and floods are no longer a worry in Ishøj Landsby.

When the railway company Banedanmark offered compensation to Ishøj for altering its forests and land areas to make way for a new railway line, the municipality took the opportunity to create a comprehensive plan for a new nature area. **The result is a 26-hectare newly planted forest, Landsbyskoven, and a 30,000 m² lake** located where Banedanmark dug up the soil. The municipality expects that the new plantation and water feature will help adapt Ishøj Landsby to a future with heavier rain and more unpredictable weather.

The newly constructed lake can hold 16,000 m³ of water and features a floodgate which helps regulate the water flow into the nearby brook, Baldersbæk. This addition has increased the capacity of Baldersbæk significantly, meaning that **the lake helps prevent flooding** both in Ishøj Landsby and in the future industrial and residential areas planned by the municipality. With over 100,000 trees, the new forest has a number of environmental co-benefits: it will sequester carbon dioxide, increase biodiversity and protect the groundwater. Finally, a five-kilometer recreational trail system demonstrates how climate adaptation projects can create attractive natural areas of benefit to the locals.

The forest was planted last year, and although the trees have not fully grown yet the trail system can already be used.

↓286

TONNES OF CO_2 CAN BE SEQUESTERED BY THE 26-HECTARE FOREST

UN SUSTAINABLE DEVELOPMENT GOALS

With a five kilometer long trail system, wooden bridges, lakeside benches and diverse trees, the new area provides optimal conditions for exercise enthusiasts and nature lovers alike.

The project has both expanded the public transport infrastructure and enabled climate adaptation and urban development of new industrial and residential areas in Ishøj.

The newly constructed lake is a collaboration between Ishøj Municipality, Ishøj Forsyning (utilities) and Banedanmark, with all parties achieving their goals: a win-win-win project.

Wetland benefits citizens and the environment

→ A constructed wetland in the Tønder Municipality will help solve rainwater problems, while enriching the area's recreational and biological life.

1,200

M³ OF WET MEADOW INTEGRATED IN A NATURE-PROTECTED AREA

In Tønder Municipality, the construction of a new wetland will address future rain and sewage challenges. The upcoming closure of the local wastewater treatment plant in 2024 means that the municipality, in cooperation with the utility company, Tønder Forsyning, will begin to utilize the ecosystem services of a wetland area to filter rainwater from the town and increase flood protection. The area will also serve as **a recreational area for citizens to enjoy.** The concept is based on imitating the natural purification processes that occur when water passes through streams, lakes and wetlands.

In Denmark, other types of basin solutions have been used to hold back and clean rainwater in urban areas. With trickle meadows or constructed wetlands, which are widely used in the United States, it is possible to create an area rich in biodiversity where people can also come to enjoy nature. In this way, **the wetland not only addresses the problem of larger amounts of rainwater in an economically efficient manner, but creates added value for citizens of the municipality.**

UN SUSTAINABLE DEVELOPMENT GOALS

The wetland helps to reduce the risk of infection from waterborne diseases, as the sewage system is designed to separate sewage and rainwater into each of their sewer pipes.

The project is located in a field area along the stream. In this area, a raised road doubles as the city's embankment, helping to reduce the risk of flooding.

The wetland both cleans and filters water slowly which then trickles down to the stream Brede Å and into the Wadden Sea, thus helping to protect the marine ecosystem.

When the water level is high in Brede Å, vegetation is only just visible in the wetland which filters rainwater before directing it into the stream.

TRANSPORTATION

MUNICIPAL COLLABORATION

Revolutionizing mobility in Northern Jutland

P. 130

AARHUS

Electric cars on your doorstep

P. 136

ÆRØ

Emission-free ferry to sail the South Funen Archipelago

P. 128

ODENSE

→ Many of the projects included in the Transportation category reflect the trend at a local government level to electrify both public and private transportation. Buses, bicycles, ferries, taxis and cars are electrified in an effort to reduce the CO_2 emissions caused by traditional internal combustion engines. Another example is integrating electric cars into the power grid and utilizing intelligent transport systems to reduce congestion on cycle paths.

FREDERIKSBERG

Vehicles delivering power back to the grid

P. 129

ROSKILDE

Roskilde leads the way with electric buses

P. 132

COPENHAGEN

New scheme gives cyclists the green light

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MUNICIPAL COLLABORATION

Electric bikes make two wheels better than four

P. 134

BORNHOLM

Electric cars store power for 'the Bornholmers'

P. 133

Emission-free ferry to sail the South Funen Archipelago

→ Europe's first 100% electric ferry, developed by Ærø Municipality, helps define the future of carbon-neutral waterborne transport.

↓2,000

TONNES OF CO_2 PER YEAR ARE TO BE SAVED BY THE E-FERRY

Ærø Municipality is in the process of developing **Ellen: a 100% electric power-driven, energy-efficient and emission-free ferry.** Ellen will not only replace the conventional ferry between Ærø and Funen, but will pave the way for CO_2-neutral, pollution-free and energy-efficient waterborne transport worldwide. The idea for the ferry came from local citizens; today, it is shaping the development of a whole new ferry prototype. The ferry has an newly developed battery system which has received type approval, and which allows it to sail seven times longer per charge than other electric ferries across the world.

On Ærø, six wind turbines produce 125% on average of the island's annual electricity consumption. This production leaves plenty of surplus energy on which Ellen will be able to run in the future. In periods of inadequate surplus energy, rather than sailing on a diesel powered emergency generator, Ellen will instead boast a 100% electric emergency generator, making it the first ferry of its kind in the world to achieve absolute carbon neutrality.

With its uniquely developed battery system with type approval, Ellen will be able to sail seven times longer on one charge than existing electric ferries.

UN SUSTAINABLE DEVELOPMENT GOALS

An emission-free ferry with no air pollution will lead to annual reductions of 41,400 kg NOx, improving health and well-being for passengers, crew and local residents.

The E-ferry is an innovation project on which a number of industrial partners have collaborated to design a 100% electric ferry, sailing longer than has ever been seen in E-ferry services.

On Ærø, residents depend on ferry transport to get to and from the island. Sustainable infrastructure, like Ellen, will ensure the connection to the mainland in the future.

Vehicles delivering power back to the grid

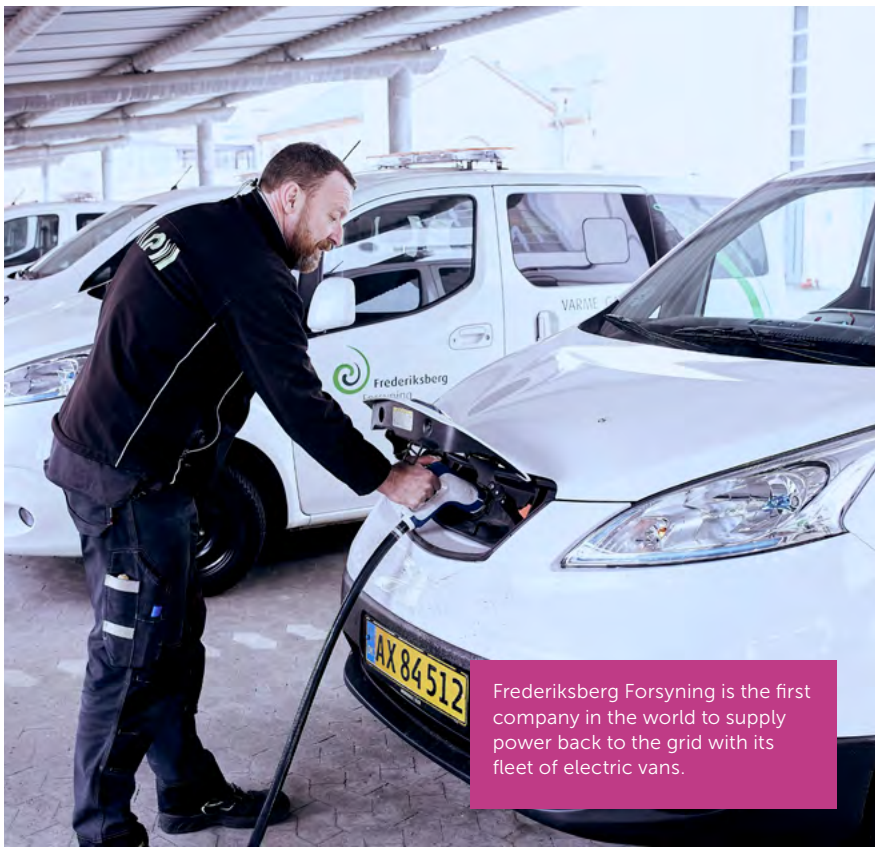
10

NISSAN E-NV200 VANS SEND POWER BACK TO THE NATIONAL GRID

→ The utility company, Frederiksberg Forsyning, is putting Denmark on the map as the first with a fleet of electric vans that sends power back to the grid.

Frederiksberg Municipality's utility company is the first in the world to use vehicle-to-grid (V2G) chargers for their electric vans as a part of a commercial project. V2G is a type of technology that helps stabilize the power grid during peak loads by using the vans' batteries as an energy source when not in use. Such two-way charging is useful in the early evening when local demand for electricity is at its highest. **By using the vans, which are parked up and plugged in at this time as a source of electricity, the demand on polluting fossil fuel power plants is reduced, thereby reducing carbon emissions.** The company can also generate revenue from electricity sold back to the grid by charging up at times when prices are low, and discharging when prices are high.

Energy storage is a major challenge in Denmark. **Electric vehicles could be an important component in the transition from fossil fuels to renewable energy.** The project, in collaboration with Nissan, Enel and Nuvve, will contribute to the municipality's goal of halving CO_2 emissions between 2005 and 2020. As the world's first project of its kind, it will be important to learn lessons about the efficiency of constantly charging and discharging batteries, in order to improve this technology in the future.



Frederiksberg Forsyning is the first company in the world to supply power back to the grid with its fleet of electric vans.

UN SUSTAINABLE DEVELOPMENT GOALS

The transition to electric vans reduces the use of fossil fuels and improves air quality thanks to reduced emissions of NOx, SO_2 and $PM_{2.5}$.

Improving the capacity of energy storage is a major enabling factor in the transition to renewable energy. This V2G project could play a role in accelerating this transition.

By showing the world both the environmental and economic benefits of a fleet of electric vehicles with V2G chargers, the municipality can inspire others to switch to climate-friendly vehicles.


73
NATBUS
Aalborg
NT
SCANIA
2412
NT
Bussen
kører på
biogas

MUNICIPAL COLLABORATION*

Revolutionizing mobility in Northern Jutland

→ A new inter-modal travel planning app improves mobility in rural areas by connecting the main travel network with taxis and carpooling schemes.

↑100K

CITIZENS USE NT TRANSPORT SERVICES ON A DAILY BASIS

In North Jutland, the region's transport service organisation (Nordjyllands Trafikselskab) is busy incorporating private cars into the public bus network. Nordjyllands Trafikselskab (NT) is owned by the Northern Jutland municipalities and the North Denmark Region. **NT has launched a new travel planning app which includes public transport, GoMore carpooling, 'Plustur' for remote areas, long distance buses and taxis.** Soon 'Flextur', which picks up travelers at their front door, will also be added. With the travel planner, 'MinRejseplan', launched in April 2018, it is possible for people in North Jutland to plan their journey across different modes of transport and transport service organizations.

Through cross-sectoral partnerships, the multi-modal travel planner allows for better use of the region's existing infrastructure and road capacity. Public transport becomes more efficient and reliable, even bringing citizens from door to door without extra charges. **At the same time, the new services allow citizens to choose more environmentally friendly transport means** without compromising on convenience. The project has thereby improved mobility in the northern part of Jutland and made its citizens less dependent on having their own car.

With the app 'MinRejseplan', travelers in the North Region of Denmark can easily access solutions tailored to their individual needs.

*Aalborg, Brønderslev, Frederikshavn, Hjørring, Jammerbugt, Læsø, Mariagerfjord, Morsø, Rebild, Thisted and Vesthimmerland municipalities

UN SUSTAINABLE DEVELOPMENT GOALS

By reimagining public transport, NT improves citizens' mobility in both the city and countryside, creating a functional, accessible alternative to privately owned cars.

Efficient public transport is key to a well-functioning society. By strengthening transport, citizens' well-being and quality of life is improved while getting them faster from A to B.

Through partnerships with other transport service organisations, NT not only increases the use of public transport, but also offers citizens an efficient way of travelling.

Roskilde leads the way with electric buses

↓1,400

TONNES OF CO_2 EMISSIONS ARE REDUCED ANNUALLY WITH THE BUSES

→ Roskilde will become the first municipality in Denmark to introduce electric buses on all intercity bus lines. The buses will hit the roads in the spring of 2019.

Roskilde Municipality has set itself at the forefront of green development by reorganizing its public transport. In cooperation with the public transport company, Movia, Roskilde Municipality will roll out electric buses on all nine municipal bus lines. **The electric buses, which will start running in April 2019, will transport approximately 2.8 million passengers each year.** The transport company Umove East has won the bid, at no extra expense to the municipality than the current diesel-run buses.

The municipality's new electric buses are produced by the Chinese company, Yutong. The chosen model, the **E12, is a 12 meter long low-floor city bus, awarded the environmental bus of the year in 2017.** The E12 can drive 280 kilometers on one full charge, which can last a full day. The buses will help eliminate the emission of NOx particles and reduce CO_2 emissions from municipal public transport. In addition, they make only half as much noise as the municipality's current diesel buses. Roskilde Municipality will become the first municipality to comply with the agreement established by Movia and Danish municipalities: that bus operations are fossil-free by 2030.

From April 2019 all intercity bus lines in Roskilde Municipality will be covered by award winning electrical buses.

UN SUSTAINABLE DEVELOPMENT GOALS

Electric buses do not emit local air pollution and therefore improve air quality. The reduced noise from the buses also helps to ensure higher quality of life for the area's inhabitants.

By purchasing 20 environmentally friendly electric buses, the municipality is supporting sustainable industry and innovation, two crucial drivers for economic growth and development.

By replacing diesel buses with electric buses, Roskilde Municipality reduces its CO_2 emissions, and takes action against climate change.

BORNHOLMS MUNICIPALITY

Electric cars store power for 'the Bornholmers'

→ Bornholm is discovering how electric vehicles will affect the electrical grid in a future without petrol cars.

19

NISSAN E-NV200 AND NISSAN LEAF CARS HAVE BEEN PURCHASED BY THE MUNICIPALITY

With a new energy project and the purchase of 19 electric cars, the municipality has taken **the first steps towards making the transport sector greener in Bornholm.** The project, Across Continents Electric Vehicle Services (ACES), was created in collaboration between the municipality, Bornholm Energy & Utility (BEOF), Nissan, Nuvve and the Technical University of Denmark, and will run until 2020. The project will investigate how the grid is affected both technically and economically when electric cars are integrated. BEOF will simulate what happens to the grid when there are over 10,000 electric cars on the island's network. To achieve this data, the project partners have developed a simulation model of the total energy system in Bornholm.

The 19 new electric cars are part of a vehicle-to-grid (V2G) solution. Each car has an 11 kW charger that can both charge the battery and discharge it, thereby sending power from the electric car's battery back to the grid. When the cars are not in use, **the energy supplier gains full access to the battery and can withdraw electricity back to the power plant when needed.** With the commitment to connect to the energy plant within a daily set timeframe, the municipality can use electricity almost free of charge.

With V2G charging, electric cars will send electricity back to Bornholm's network when the cars are not in use.

UN SUSTAINABLE DEVELOPMENT GOALS

By exchanging fossil fueled cars for electric cars, air quality is improved as emissions of NOx, SO_2 and $PM_{2.5}$ are significantly reduced.

It is difficult to store renewable energy. The use of V2G chargers along with the car's battery can help drive forward the shift from fossil fuels to renewable energy.

Switching to electric vehicles with V2G solutions give significant economic benefits. The project can therefore help inspire other municipalities to make the same climate-friendly choices.

MUNICIPAL COLLABORATION*

Electric bikes make two wheels better than four

↓154

TONNES CO_2 EMISSIONS REDUCED BY COMMUTERS

→ Denmark's biggest electric bike project has got car commuters choosing two wheels over four, leading to less CO_2, fewer sick days and more road space.

In 2014, eight municipalities and eight hospitals in the Capital Region of Denmark launched the project, Test an Electric Bicycle. The project gave people commuting over five kilometers to work or school **the option to replace their car with an electric bike for three months.** The electric bicycles were purchased and lent out by the municipalities and hospitals to employees and citizens, in exchange for a commitment to cycling at least three days a week.

A total of 1,681 people participated in the project. Together, they biked more than 884,000 kilometers. This corresponds to an average of 526 kilometers per commuter, reducing their carbon footprint by 91.5 kilos - just by replacing their car with an electric bicycle. The project has a number of positive effects on test participants' health and has resulted in lasting changes to transport habits. One year after the test period, **more than one third continue to cycle for a minimum of three days a week;** together, they bike almost 2,000,000 kilometers a year. With relatively close partnerships and simple methods, "Test an Electric Bicycle" is an example of how to achieve CO_2 savings, promote citizens' health and reduce the impacts and environmental problems of increased road congestion.

© Mikkel Østergaard

*Albertslund, Ballerup, Frederiksberg, Gladsaxe, Høje-Taastrup, Odense, Roskilde and Gentofte municipalities

UN SUSTAINABLE DEVELOPMENT GOALS

3 GOOD HEALTH AND WELL-BEING

By cycling 30 minutes on an electric bike each day, you achieve the necessary recommended exercise to avoid lifestyle diseases and reduce your number of sick days.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Test an Electric Bicycle has moved commuters off the roads. During the test period, the project reduced car commuting by 884,000 kilometers.

17 PARTNERSHIPS FOR THE GOALS

The campaign has created strong results for public partner synergy across municipalities and the region's hospitals through exchanging experience and knowledge.

Electric cars on your doorstep

→ Collaborating with public housing associations, Aarhus increases access to electric cars and creates a new transport service for citizens.

By 2030, the transport sector will be the largest source of CO_2 emissions in Aarhus. And with projections indicating that the demand for transportation is going to increase further, the municipality is putting new measures in place. In partnership with car service TADAA!, Aarhus Municipality has come up with **a plan for reducing the number of petrol cars on its streets by 1,000**. The goal is to be achieved by cooperating with public housing associations and private housing communities. These entities commit to making shareable electric vehicles with fixed parking spaces available to residents, making green transportation easy and accessible.

By raising awareness of both the benefits of electric cars and shared car ownership over private ownership, Aarhus Municipality will reduce total energy consumption from transport. In addition to ensuring that parking spaces are close to the homes, the municipality has removed parking fees for TADAA! members in the eastern part of Aarhus. **Over the course of the project, 24 shared electric vehicles were on the roads**, estimated to replace between 96 and 240 privately owned cars.

↑27%

INFORMS THAT THE SCHEME HAS PERSUADED THEM NOT TO BUY A CAR

UN SUSTAINABLE DEVELOPMENT GOALS

Road transport is the second largest polluter in Aarhus. Across Denmark, air pollution is estimated to cause about 3,750 premature deaths a year. Electric cars significantly reduce pollution.

Accessible, sustainable transport is essential to well-functioning cities. Here, emphasis is placed on increased mobility and accessibility, ensured through effective transport services.

Car sharing is estimated to replace between 4 and 10 privately owned cars. Mobility services make it easier not to own a car, reducing environmental impact.

Citizen engagement has been essential to the project, which has given citizens better mobility in daily life and high user satisfaction.

New scheme gives cyclists the green light

↓2,500

TONNES OF REDUCED CO_2 EMISSIONS WILL RESULT FROM THE PROJECT

→ Copenhagen's new traffic management platform is promoting green transport across the city, and making the municipality more climate-friendly.

Copenhagen is a world-famous cycling city. Every day thousands of Copenhageners use a bicycle; **on average, they bike over 1.3 million kilometers each week**[1]. Copenhagen Municipality has implemented a new traffic management platform, a so-called Intelligent Transport System, to further promote cycling and the use of public transport.

The traffic management platform can monitor the current traffic situation and intervene in events, both unforeseen and planned. In this way, the platform increases travel efficiency for cyclists and public transport users. By connecting the platform to municipal traffic signals, **it can cut 10% of cyclists' travel time and reduce bus passengers' travel time by up to 20%.** Cyclists are prioritized with targeted real-time information on electronic information boards along the roads. By strengthening both biking and public transport methods, Copenhagen hopes to make green transport even more attractive and cut CO_2 emissions from the transport sector.

© Troels Heien

The traffic management platform will contribute to CO_2 reduction and will be part of Copenhagen Municipality's goal to become CO_2 neutral by 2025.

UN SUSTAINABLE DEVELOPMENT GOALS

Swapping four wheels for two can have mental and physical health benefits, while contributing to a greater quality of life for others through reduced air and noise pollution.

The project supports green infrastructure innovation by prioritizing the primary method of transportation in Copenhagen and making the bicycle the more attractive option.

Bikes are second only to walking in terms of CO_2 emissions and resource consumption, so replacing car journeys with bicycles can help cut emissions from the transport sector.

1. Copenhagen Municipality, website: www.kk.dk/indhold/45-cykler-til-arbejde-og-uddannelse-i-københavn

SUSTAINABLE COMMUNITIES

AALBORG

Green Agents make it easy to be sustainable

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RANDERS

Turning waste into gold

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AARHUS

Aarhus' Green Embassy helps foster green communities

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MIDDELFART

From grey concrete to a green oasis

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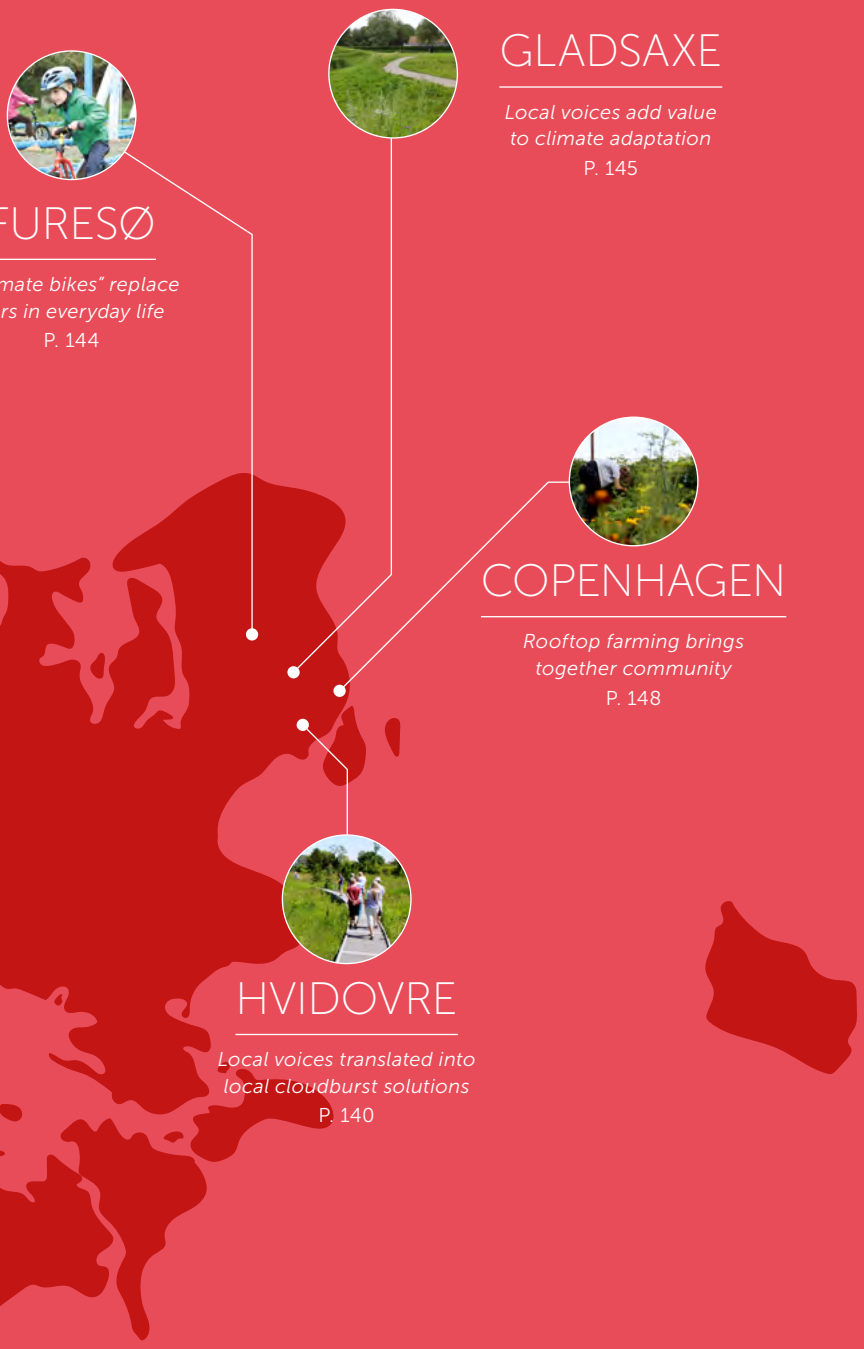
→ The projects within the Sustainable Communities category show how some municipalities successfully put their citizens first when developing sustainable solutions. Social meeting places are created within green project spaces such as roof farms, climate conservation areas and recycling stores where citizens can meet, help and inspire each other.



FURESØ

"Climate bikes" replace cars in everyday life

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GLADSAXE

Local voices add value to climate adaptation

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COPENHAGEN

Rooftop farming brings together community

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HVIDOVRE

Local voices translated into local cloudburst solutions

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HVIDOVRE MUNICIPALITY

Local voices translated into local cloudburst solutions

→ In cooperation with local citizens, Hvidovre Municipality is future-proofing the area of Strandøre against flooding and water damages.

↑32.5K

M^3 OF WATER CAN BE HANDLED BY THE CLOUDBURST SOLUTIONS

Homes in Strandøre, an area situated next to the coastal meadow in Hvidovre Municipality, are at risk of flooding during cloudburst events and sustained periods of rain. To solve this challenge, **the municipality has engaged citizens and other relevant stakeholders to identify a number of solutions.** Through a collaborative process of citizen engagement, the area's interested residents have had the opportunity to contribute their ideas to the project. This process not only positively contributed to flood protection, but also helped transform local voices into local solutions.

While one group conducted a tour to examine the areas at risk and understand the challenge in greater depth, a working group went further afield to take inspiration from similar projects in other municipalities. These activities generated a number of suggestions which were compiled into an ideas catalog and presented to local politicians and citizens of Strandøre. Not only did the ideas catalog garner acceptance politically, but the process also resulted in a **high level of citizen engagement and co-ownership, which has increased the well-being of residents and strengthened local communities** throughout the area. This community spirit has been amplified online, with citizens able to follow the entire process through for example social media. Additionally, the process has been documented along the way, making it easier for other municipalities to follow suit.

In Hvidovre Municipality, citizens have been exploring areas at risk of flooding as well as taking inspiration from other areas on field trips.

UN SUSTAINABLE DEVELOPMENT GOALS

The project and its results have given citizens more opportunities to be outside, with more green spaces, water playgrounds, and more diversity in the areas surrounding bike paths.

Through the project, collaborations between both civil society and the private sector have transformed local values into green solutions and strengthened local communities.

The project demonstrates how innovative citizen engagement can increase awareness of climate-related challenges and spur action to reduce the effects of climate change.

Turning waste into gold

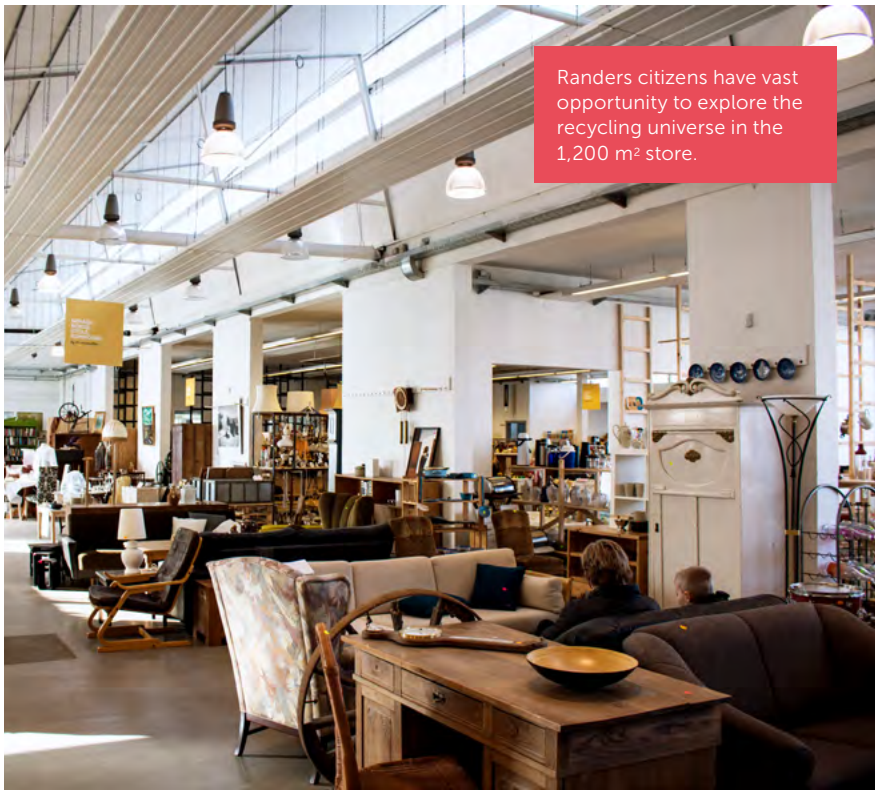
↑400

TONNES OF WASTE AND TEXTILES ARE EXPECTED TO BE RECYCLED EACH YEAR.

→ Finderiet creates jobs for people on the edge of the labor market, while making it easy for Randers' citizens to find and buy second hand treasures.

When recycling store Finderiet opened in Randers in May 2017, the event did not go unnoticed. **Locals flocked there, showing that people in Randers truly recognize and embrace the benefits of recycling and support projects with social benefits.** Finderiet aims to create flexible jobs in order to protect the environment and enable citizens to recycle effectively.

Finderiet is run by the socio-economic fund GOGGS. The fund has entered into a five-year agreement with the municipality, allowing Finderiet to collect furniture and other items from Randers' recycling depot with the purpose of restoring them and selling them in store. Finderiet collects textiles and building materials for recycling and, through events, provides citizens with inspiration and knowledge to transform discarded items into new treasures. **Behind the counter in Finderiet you will meet people employed through the Danish flexi-job scheme.** This scheme is offered to people with reduced working capacity or to early retirement pensioners as a way of supplementing their pension and staying connected to the labor market. Thus, in addition to turning waste into 'gold' and creating an alternative to extra consumption, Finderiet serves a social purpose. At its opening, the store had 36 employees.



Randers citizens have vast opportunity to explore the recycling universe in the 1,200 m² store.

UN SUSTAINABLE DEVELOPMENT GOALS

In collaboration with a number of partners, Finderiet offers vocational internships and courses to STU students (tailored education for young people with special needs).

By creating an inclusive workplace, Finderiet allows citizens at the edge of the labor market to join a community and contribute to Randers' economic growth.

Finderiet cooperates with stakeholders within Randers municipality, including the technical and environmental administration, job center and citizen service.

Aarhus' Green Embassy helps foster green communities

→ In Aarhus Municipality, the Green Embassy turns the traditional role of municipalities and citizens upside down, giving life to citizen-driven projects.

2

CITIZEN-DRIVEN PROJECTS HAVE BEEN DEVELOPED WITH THE EMBASSY'S HELP

UN SUSTAINABLE DEVELOPMENT GOALS

The two citizen-driven projects provide citizens with the opportunity to take part in and enjoy green activities. This is expected to provide both physical and mental health benefits.

The Embassy supports sustainable communities by giving citizens responsibility for their own projects.

With the help of the Embassy, partnerships are able to blossom between groups that would not necessarily collaborate otherwise, leading to the changes that citizens wish to see.

The Green Embassy is located in the heart of Aarhus and **functions as a melting pot for green ideas and co-creation.** Here, citizens can drop by and get inspiration about green activities, or share their knowledge about gardens, urban spaces and what nature has to offer. The fundamental principle of the Embassy, better known as the Seed (Frøet), is that the municipality leaves "business as usual" behind and allows citizens to create change and form new partnerships. Open-mindedness and curiosity are essential to the space.

With this philosophy as a starting point, the Embassy has nurtured the growth of two citizen-driven projects: a working group focused on making the street Hans Broges Gade more green and welcoming; and a garden community in Frederiksbjerg City Park where flower beds and fruit bushes have been planted. The projects have helped create a new sense of community and social cohesion, for example between two unlikely groups: the local daycare and an elderly group, as well as with citizens who enjoy the flowers and the park. All together these new projects and the communities **encourage greater awareness of the environment and climate, which is a necessity for promoting greener behavior and changing norms.**

The Green Embassy is a meeting place that aims to inspire citizens and the municipality to form new communities and co-create climate projects.

"Climate bikes" replace cars in everyday life

↓11

TONNES LESS CO_2 PER YEAR THANKS TO FURESØ'S "CLIMATE BIKES"

UN SUSTAINABLE DEVELOPMENT GOALS

The project and Furesø's local campaign, All Children in Daycare Bikes, have resulted in 33% of children and parents who previously drove now choosing to bike to school and work.

At the shop, Pedalartisten, adults with disabilities are given the opportunity not only to learn new skills but also to achieve better social integration through meaningful paid work.

The 100 Climate Ambassadors of Furesø have integrated climate action and awareness into the core activities of the municipality's work in order to reduce CO_2 emissions.

→ Furesø Municipality has successfully brought green mobility into the everyday lives of people of all ages - particularly adults with disabilities.

Furesø Municipality has taken action against climate change by appointing municipal office managers as Climate Ambassadors, who have developed the project Climate Bikes for Children and Adults. Together, they have created a number of concrete ways for **employees in the municipality, children and adults with disabilities to contribute to society and Furesø's climate efforts.** And in this effort, the bikes play a key role.

A total of 130 bikes have been distributed to the municipality's offices and institutions. Through various campaigns, Furesø has been encouraging its employees to drive less during working hours, and children and parents to bike to school and work. As part of the project children can train their biking skills on a transportable bicycle course that runs between daycare centres and schools in Furesø. An important part of the project is that the bike shop Pedalartisten, responsible for transporting the bike training course, inspecting and repairing bikes, offers jobs to people with disabilities. **The bikes are popular, used by locals to cycle 3,000 km per year**, and the project has been a great success: 6,000 children and their parents have participated in more than 400 cycling weeks.

In Furesø, children enjoy cycling on the mobile bike path, which is looked after and transported around the municipality by adults with disabilities.

Local voices add value to climate adaptation

→ A co-development project engages citizens in designing recreational elements for a local municipal climate adaptation project protecting exposed areas from a 100-year rain event.

↓36

TONNES OF CO_2 SAVED EACH YEAR VIA THE KING HANS GARDEN PROJECT

In 2014, Gladsaxe Municipality initiated a local climate adaptation project. Three years in, local citizens have been given the opportunity to directly influence the recreational elements of the project. Under the citizen-driven budget scheme 'Local Voices', local citizens have worked collaboratively and with local decision makers, to implement a series of recreational features. The result of the overall project is the green urban space, 'King Hans Garden' (Kong Hans Have), **fit to accommodate recreational activities by citizens of all ages, while protecting the area against a 100-year rain event.**

Today, the previously unused area of land has been **transformed into a small hilly park with trails, a lake, trees, and over 3,000 plants and flowers,** in part-climate adaptation, part-rejuvenation project. From the busy street next to the park, heavy rains are directed to King Hans Garden, which has a volume of 2,300 m³, allowing natural filtration processes to ease pressure on drainage systems and reduce the chance of flooding. The involvement of citizens has helped locals to embrace the climate adaptation project in its entirety, and has improved social cohesion throughout the local community.

Today, the garden, which was previously an unused lawn, has been transformed into a landscape rich in nature.

UN SUSTAINABLE DEVELOPMENT GOALS

The project has led to public schools and institutions on Kong Hans Street gaining access to the Garden as an outdoor classroom where students can explore nature.

The adjacent street, now greener and safer, is expected to increase the number of children and adults who choose to bike, providing a new perception of the local environment.

The King Hans Garden project has integrated nature into the city and the everyday lives of its citizens. This includes an increase of flora and fauna into the area.

From grey concrete to a green oasis

3,700

M³ RAINWATER IS DETAINED AND RELEASED INTO THE GROUND EACH YEAR

→ In Middelfart, a nursing home parking lot has been transformed into a thriving Climate Garden, to the benefit of both residents and the local sewer.

At the nursing home Ældrecenter Skovgade, residents rarely sit out on their terrace during good weather anymore. Instead, they meet in the Climate Garden, **a small paradise filled with plants, an orangery, pergolas, outdoor exercise machines and musical instruments**. Many of these initiatives have been carried out in line with the residents' wishes, who now invite neighbors, young people and daycare centers to visit the garden. In addition to being a social gathering site that improves residents' quality of life, the Climate Garden also serves as a climate adaptation project. Its total surface area is 11,000 m² and the natural drainage properties of the vegetation allow the rainwater to permeate the soil slowly, rather than run off quickly and strain the drainage system.

Rainwater is directed from the 4,000 m² roof space and 2,000 m² parking space to percolation ditches and rainbeds in the Climate Garden. Together, these can accommodate and retain rainwater from even the strongest cloudbursts. The Climate Garden is part of the municipality's larger project, the Climate Lab. As is the case with many of the other projects, the Climate Garden acts as a demonstration project that inspires landowners in the area to handle their rainwater locally.

The Climate Garden helps prevent the municipality's drainage systems from becoming overloaded. The rainbeds can hold between 30 and 40 cm of water.

UN SUSTAINABLE DEVELOPMENT GOALS

In the garden, residents can rehabilitate their ability to walk and improve their balance in calm green surroundings. The garden also helps maintain a natural daily rhythm that improves the elders' well-being.

The project is for everyone: in the garden's design, thought has been given to elements that invite the community in, such as exercise machines, musical instruments and green seating areas.

The Climate Garden is the result of a collaboration between municipality departments, residents, relatives, and volunteers to create a joint climate adaptation project.

Green Agents make it easy to be sustainable

↑212K

CITIZENS IN AALBORG CAN BENEFIT FROM THE GREEN AGENTS

→ With their motto, "It must be easy being green in Aalborg", Green Agents inspire citizens with tips on how to "greenify" their everyday life.

Aalborg Municipality has responded to its citizens' desire to contribute to the green transition, lending a helping hand to make ideas and plans a reality. **The 'Green Agents' are sustainability professionals with experience in making projects and plans come to life**, utilizing their network and expertise. They are available to everyone from individuals with a great idea, to companies wanting better energy efficiency and organizations who wish to adopt the mindset and practices of the sharing economy.

Across the municipality, the Green Agents have supported citizens' dreams and plans for creating sustainable communities. With the help of an Agent, the municipality's schools have received teaching materials to promote a greener lifestyle among students. Additionally, **an app has been developed with Aalborg University which enables citizens to visualize their energy consumption**, and a housing association has received guidance on how to establish a car-pooling system. Furthermore, the Green Agents are always on-hand to support residents' meetings, events and themed days, as well as being active on social media, sharing advice and garnering attention for the sustainability agenda.

Aalborg's Green Agents give sustainability advice, enabling citizens to fulfil their own green initiatives.

UN SUSTAINABLE DEVELOPMENT GOALS

The Green Agents' focus on inclusion, resource efficiency, mitigation and climate adaptation help create a more sustainable city and community.

Through co-creation processes focusing on sustainable solutions, Green Agents enable the citizens to develop their sustainable skill set and contribute to a green transition.

An array of partnerships have been established through the project, including public-private partnerships and civil society-based partnerships, all using previous experience and knowledge.

COPENHAGEN MUNICIPALITY

Rooftop farming brings together community

→ Denmark's first ever rooftop farm brings local food production to the city with support from the municipality and the local community.

13K

PEOPLE VISIT THE PIONEERING URBAN ROOFTOP FARM EVERY YEAR

Denmark's first ever rooftop farm, **ØsterGRO, supplies its 40 member families with ultra- local and sustainably produced eggs, honey, and vegetables.** By bringing the farm to the city, the project links the farmer directly with the consumer, inspired by the concept Community Supported Agriculture. The organic urban farm is run by the three employees, its members and volunteers. The rooftop farm has been established with support from the Copenhagen Municipality, but today the project is self-sustainable and financed through revenue educational activities and membership fees from the families involved amongst other revenue streams.

Also situated on the roof is the restaurant Gro Spiseri. As part of the experience, guests receive a tour of the farm. This is just one of the many ways in which the green urban space educates its 13,000 annual visitors about food waste and sustainable food production. At the same time, **the farm contributes to climate proofing the municipality.** Below the raised flower and vegetable beds, there is a 350 m² water reservoir where rainfall is collected for the irrigation of plants during the growing season.

The plants and soil retain rainfall, but the farm also has a water reservoir running beneath the beds with a capacity of 7 m³.

UN SUSTAINABLE DEVELOPMENT GOALS

At ØsterGRO all raw materials are used and recycled. This helps to educate visitors about sustainability, the climate and resource challenges, as well as the need to reduce food waste.

Seeing, working with and tasting unprocessed products directly from the ground can inspire citizens to switch to a healthier and more plant-based diet, as well as promoting local farming.

ØsterGRO has created a community where citizens of all ages can meet and experience urban farming. The farm is also used as a restaurant and provides space for other activities such as yoga.

CIRCULAR ECONOMY

AALBORG

Aalborg gets rid of throwaway culture

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AARHUS

Swap what you have for what you need

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VEJLE

In Vejle, waste gets sorted like never before

P. 161

BILLUND

Citizens team up to reduce waste in the community

P. 155

→ In the Circular Economy category, municipalities show how new circular technologies, solutions and business models can help ensure better use of resources and strengthen citizens' participation in circular thinking through sharing, exchange and reuse. Several projects in the category have the direct aim of establishing a sharing culture amongst citizens by enabling them to upcycle and swap items with each other.

MUNICIPAL COLLABORATION

Sustainable business models lead the way

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ALLERØD

Local businesses join forces to reduce CO_2 emissions

P. 154

FREDERIKSBERG

Neighbors share to reduce consumption and waste

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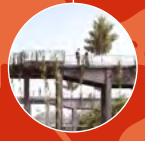


NÆSTVED

Business and climate initiative for entrepreneurship

P. 157

Aalborg gets rid of throwaway culture

→ Under the collaborative program Circular North Jutland, Aalborg has launched a number of innovative projects focusing on circular economy and use of resources.

↓57.5K

TONNES ANNUAL CO_2 REDUCTION FROM MUNICIPAL PROJECTS

UN SUSTAINABLE DEVELOPMENT GOALS

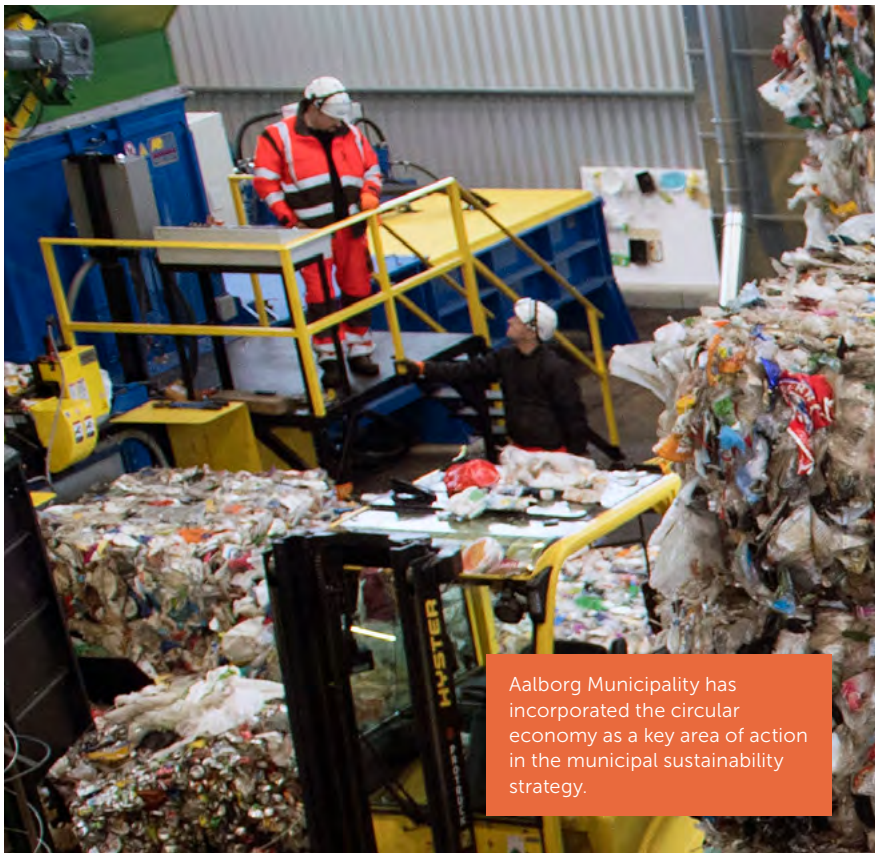
Waste remains in the circular loop, giving rise to new job opportunities. In North Jutland, the green goods and services sector - including the circular economy sector - creates 8,500 full-time jobs[1].

The program drives innovation and development among companies in North Jutland by offering resources and knowledge, and fostering new collaborations.

Cooperation between municipalities, Aalborg University and the private sector creates circular economy initiatives and projects, as well as sustainable business development.

With Circular North Jutland, Aalborg is aiming to be a circular municipality. Through the many initiatives involving both children and adults, as well as large and small businesses, the municipality has already reaped huge climate benefits. **As part of the green procurement policy, the municipality has set new standards for procurement in schools.** Instead of discarding old furniture, there are now standards in place for furnishing classrooms with a mix of new and refurbished furniture.

On the business side, Aalborg has been driving sustainable business development with a particular focus on plastic as a recyclable resource for companies. Among other activities, it reaches out to small and medium-sized enterprises by making energy and resource plans for 100 companies. These plans enable companies to reduce energy consumption and ensure better use of resources, raw materials and waste. **Municipal projects on resource and energy efficiency have reduced 57,500 tonnes of CO_2 emissions.** Further reductions were made possible by reduced waste transport and less waste from schools and companies.



Aalborg Municipality has incorporated the circular economy as a key area of action in the municipal sustainability strategy.

1. Region Nordjylland: Grønne varer og tjenester - regional og beskæftigelse, 2017.

ALLERØD MUNICIPALITY

Local businesses join forces to reduce CO_2 emissions

↓589

TONNES OF CO_2 REDUCTION BY JUST 11 COMPANIES

→ In Allerød, 50 companies have joined the Carbon 20 Network to share knowledge about sustainable opportunities and means to reduce CO_2 emissions.

Allerød Municipality has created a network of local businesses that aims to strengthen the private sector's efforts within sustainability, CO_2 reduction and circular economy. During the span from 2013 to 2016, **11 ambitious companies have reduced their CO_2 emissions by 588.9 tonnes.** This corresponds to an average saving of 32.4% for the 11 companies during the 3-year period.

In Allerød, local business is responsible for 40% of the CO_2 emissions in the municipality. This shows the importance and potential of collaboration between local business and the municipality. Also, this collaboration is crucial for the **municipality to achieve its ambition to reduce CO_2 emissions by 55% by 2025.** In addition to the 11 partner companies, the network consists of 39 other companies, which meet twice a year to network and share knowledge and experiences. Green branding, mobility and solar energy have been among the themes of these meetings.

The opportunities in the sustainable energy transition have helped local companies reduce their CO_2 emissions.

UN SUSTAINABLE DEVELOPMENT GOALS

Carbon 20 has strengthened its members' competitiveness by e.g. reducing energy costs or identifying new green markets, showing that what is good for the environment is also good for business.

In addition to energy savings, the sub-project Sustainable Bottom Line focuses on material savings, industrial symbiosis and the circular economy.

The 11 partner companies have on average lowered their CO_2 emissions by 32.4% from 2013 to 2016.

Citizens team up to reduce waste in the community

→ In Billund Municipality, recycling depots take on an extra dimension as they combine upcycling and community input to minimize waste.

↓150

KG OF WASTE IS EXPECTED TO BE SORTED PER CITIZEN PER YEAR

UN SUSTAINABLE DEVELOPMENT GOALS

11 SUSTAINABLE CITIES AND COMMUNITIES

The project creates a new service for citizens so they can make better use of their resources. It brings citizens closer together and boosts local engagement, both for users and volunteers.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

In this project, it is the citizens who run and manage local recycling facilities. This gives them hands-on experience in handling trash and encourages everyone to be more responsible.

17 PARTNERSHIPS FOR THE GOALS

Volunteers working in partnership with the municipality help deliver a more circular economy in Billund, showcasing the benefits of working together.

In Billund Municipality, smaller, local recycling depots are being set up with the user in mind, making it easier for citizens to get rid of their waste. The project is based on a co-ownership model rooted in local life. The ownership model requires **involvement and understanding of the citizens' everyday practices and needs around recycling waste.** This has resulted in tailored recycling facilities that boost recycling rates, as the citizens involved in the project gain more knowledge and experience while building a greater sense of responsibility.

Citizens have been involved right from the start - from ideation to design - as well as in the actual operation of recycling sites. The sites are run by a team of volunteers who have received training in how to recycle correctly. Based on local needs, **trade and repair facilities has been set up to enable upcycling and waste minimization with the help of citizens.** The project has managed to design a user-centric recycling depot model which could be an inspiration for other municipalities.

Trade and repair facilities has been set up for citizens to both recycle and upcycle their old items, giving them a new lease of life.

MUNICIPAL COLLABORATION*

Sustainable business models lead the way

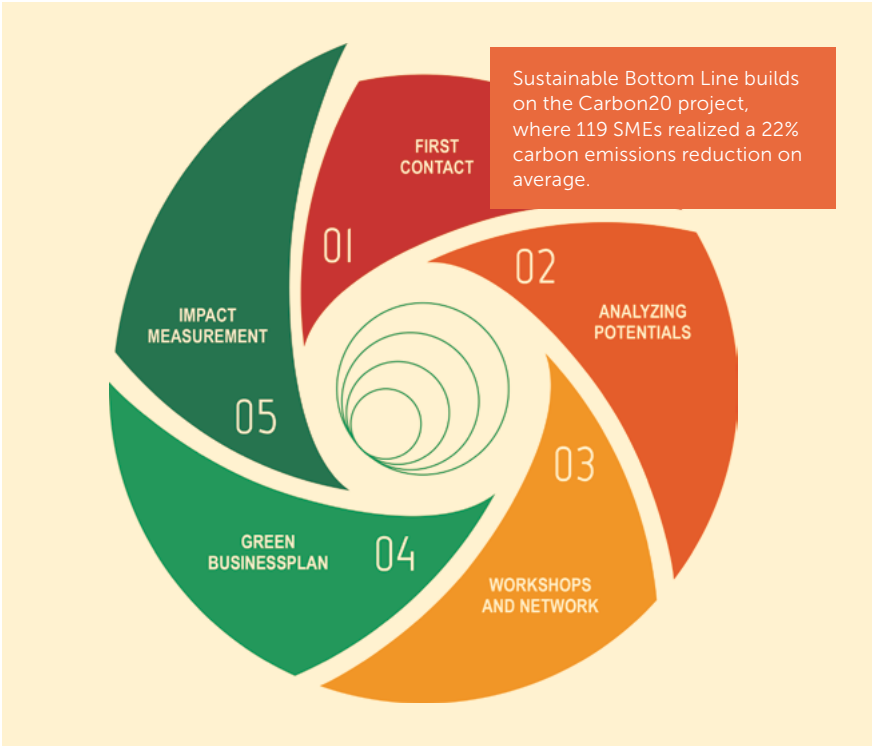
13,297

MWH POTENTIAL ANNUAL ENERGY SAVINGS

→ The Sustainable Bottom Line project helps local businesses to boost the green transition and improve their competitiveness.

The Sustainable Bottom Line project (Bæredygtig Bundlinje) gives small and medium-sized enterprises in the Capital Region the chance to develop a green business model which enhances energy and resource efficiency, competitiveness and boosts the bottom line. Throughout the project, **companies are offered a structured process with potential analysis, consultancy and process support, culminating in a green business model.** This gives smaller companies, who do not have the capacity to develop green business models on their own, the opportunity to work systematically with sustainable business development.

Sustainable Bottom Line is a collaboration between the municipality and each company, creating value for both parties. While the companies experience the direct benefits of the project, their reduced CO_2 emissions and resource consumption also provide a positive effect on the municipalities climate and waste targets and green business development. In the first half of 2018, 88 companies were part of the project, and the goal is to develop a total of **100 green business models by 2019.** This is equivalent to a reduction of companies' material consumption by approximately 2,500 tonnes and a cut in CO_2 emissions by approx. 5,000 tonnes.



Sustainable Bottom Line builds on the Carbon20 project, where 119 SMEs realized a 22% carbon emissions reduction on average.

* Allerød, Copenhagen, Fredensborg and Frederikssund municipalities

UN SUSTAINABLE DEVELOPMENT GOALS

Sustainable Bottom Line contributes to energy efficiency in companies and supports the transition to renewable energy through energy assessments and guidance on better utilization of raw materials.

The project helps to map possibilities for recycling materials, such as upcycling, so that resources can be reintegrated into the economic cycle.

Core to the project is the vested cooperation between companies and the municipalities, as well as their joint work to underline resource efficiency in business strategies.

Business and climate initiative for entrepreneurship

→ An old paper mill has been transformed into a recycling and innovation center as part of the municipality's sustainable business strategy.

1,300

PEOPLE HAVE VISITED THE RESSOURCE CITY HUB IN NÆSTVED

Ressource City is the name of Næstved Municipality's ambitious climate initiative. By **creating a green business cluster, Ressource City helps to solve issues such as lack of resources, negative environmental impact and climate challenges.** The EU-supported project is a collaboration between the municipality, organizations, businesses, schools, universities and entrepreneurs. Small and medium-sized enterprises can join Ressource City to receive aid for developing green products, services and business models. Among others, the initiative will also take part in designing intelligent waste recycling containers to be installed underground in central Næstved.

Ressource City resides in Maglemølle, an old retrofitted paper mill renovated to house the project. In addition, an advisory service has been established to support companies and entrepreneurs. The service has led to a partnership between Reiling Glas Recycling and Ardagh Glass Holmegaard with **one partner annually sorting 100,000 tonnes of collected glass, and the other reusing the sorted glass for new bottles.** This partnership is an example of local collaboration integrating recycling, job creation and CO_2 reductions, creating a virtuous cycle for all involved.

UN SUSTAINABLE DEVELOPMENT GOALS

Ressource City is part of the municipality's future-oriented business strategy which also addresses issues facing peripheral towns and municipalities, such as citizens relocating to bigger cities.

As the average Danish household produces 1,272 kg of waste per year (2015), this project stands out by focusing on improving resource and waste recycling, waste prevention and reducing energy consumption across the municipality.

With its focus on partnerships and knowledge sharing, Ressource City is busy producing a recipe that can be followed by other municipalities in the country and globally.

1,300 guests, including a Chinese delegation, have visited Ressource City to learn about circular economy, construction and waste in a Danish context.

© Maglemølle

FREDERIKSBERG MUNICIPALITY

Neighbors share to reduce consumption and waste

↓52K

KG OF CO_2 IS POTENTIALLY REDUCED ON AN ANNUAL BASIS AS A RESULT OF THE TEN SWAP CABINETS

→ Housing associations are using innovative waste solutions to improve community connection in neighborhoods and lower consumption.

Frederiksberg Municipality is testing a new scheme to challenge single-use culture through an innovative partnership with a circular economy organization called Naboskab. **Ten swap cabins have been set up in housing associations across the municipality for citizens to add and take books, services, clothes, machines and more, instead of throwing things out.** The project's value lies not only in the solution to reduce consumption and waste, but in the fact that municipalities can use the project to strengthen communities and promote cooperation. In addition to reducing consumption and CO_2 emissions, the vision for the project is that it will increase social value for residents in the housing associations.

In tandem with setting up the new swap cabins, the municipality has initiated an **Environmental Ambassador scheme, where volunteers from the associations disseminate knowledge locally about recycling and environmental efforts.** Environmental Ambassadors are crucial to the project's longevity and create lasting change, as local and social anchoring provide the best conditions for sustained behavioral changes to consumption and recycling.

The swap cabins give the individual fewer things to store, access to more objects and improve community spirit between neighbors.

UN SUSTAINABLE DEVELOPMENT GOALS

As well as the environmental impact of the scheme, social cohesion is also increased in the housing associations; this is a major motivational factor for the Environmental Ambassadors.

The swap cabins contribute to reducing waste and can replace buying new items. According to Naboskab's calculations, each cabin reduces CO_2 emissions by 5,208 kg per year.

The project is an example of how interactions between the private, public and civilian sectors can develop and embed innovative and efficient solutions for the waste area.

Swap what you have for what you need

↓550

TONNES OF CO_2 IS SAVED ANNUALLY THROUGH REUSE[1]

→ Aarhus' recycling center, Reuse, is encouraging citizens in reusing through social media platforms and workshops.

In the heart of Aarhus you'll find the recycling center Reuse. Under the slogan "Give what you have and take what you need," the center enables citizens to bring in and pick up furniture, as well as items and materials that would otherwise be discarded. Reuse is not only a recycling center in the conventional sense, but also a platform for engaging the community. It communicates with and reaches out to citizens through social media, **organizes activities such as upcycling workshops, and offers "goodie boxes" packed with essential items for youngsters moving out of their parents' home.**

The recycling center's communication strategy has proven successful, with an average of 350 visitors every day. **500 tonnes of furniture, items and materials that fall out of the normal recycling loop (e.g. flea markets and thrift shops) are recirculated through Reuse.** In 2018, the recycling center will relocate to the southern part of Aarhus (Aarhus Sydhavn), taking over an old slaughterhouse and transforming it to its new use.

Reuse engages citizens with a wide range of workshops where participants learn how to upcycle, recycle, and repair items.

UN SUSTAINABLE DEVELOPMENT GOALS

Reuse is an example of how recirculating materials can turn waste into a resource and extend the lifespan of household items, thereby making the city more sustainable.

Reuse promotes the circular economy by collaborating with organizations, citizens, artists and companies who can make good use of recycled and waste products.

Reuse recirculates 500 tonnes of "waste" materials that fall outside the conventional recycling loop, leading to savings of 550 tonnes of CO_2 every year.

1. According to Reuse's own calculations.

In Vejle, waste gets sorted like never before

→ In just two years, a new waste strategy has brought Vejle Municipality to the forefront of household waste recycling.

↓11.5K

TONNES OF CO_2 REDUCED ANNUALLY THROUGH RECYCLING

With the introduction of a new waste scheme, the municipality has made light work of sorting household waste. These changes are taking place not only in households but in the public domain, where sorting garbage cans have been installed. Additionally, the municipality has introduced garbage trucks that run on biogas. The new waste collection system has shown significant results. Today, citizens of the municipality sort approximately 81% of the 125 kg food waste that each Dane is said to produce annually. Since the introduction of the waste scheme, **the amount of organic waste collected has increased by 180%,** paper and cardboard by 19%, and plastic by 25%.

Vejle has received great interest in the project from other municipalities, businesses and interest organizations. In particular, **citizens' support of the project has attracted interest and curiosity.** One key reason for this support is the municipality's close dialogue and cooperation with citizens and companies, as well as homeowners and the homeowners' association. Additionally, the municipality has conducted major campaigns and disseminated information through events, public meetings, brochures, local press, social media and a temporary call center.

The municipality has held several events at the recycling depot, as well as workshops for housing associations and homeowners' associations.

UN SUSTAINABLE DEVELOPMENT GOALS

3 GOOD HEALTH AND WELL-BEING

The garbage trucks, which are running on biogas, save 700 tonnes of diesel a year. They also improve air quality by reducing toxic particle emissions, benefiting everyone's health.

4 QUALITY EDUCATION

The municipality has entered into a collaboration with Ecolarium, a knowledge center and experimentarium which, through exhibitions and events, informs children and young people about the importance of waste sorting.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

In 2015, Vejle Municipality's household waste recycling rate was 41%. Today, it is 61%, already exceeding the national target of 50% recycling in 2022.

1. The Danish Environmental Protection Agency, Report: Forundersøgelse af madspild i Danmark, 2010.

→ Arriving at the 100 projects

Creating the Klima100 publication has been a long, multi-phase process. The following demonstrates how the 100 projects were selected, as transparency of the application and evaluation process is of the utmost importance to us.

Chasing climate projects

Throughout December 2017 and January 2018, Realdania and Sustainia ran a national campaign to encourage all Danish municipalities to submit applications for Klima100. The campaign included direct contact to all Danish municipalities by phone or email, press releases, desk research, outreach activities, and social media posts[1]. As a result of these efforts, we received 162 applications from 82 municipalities.

Who was eligible?

To ensure that all of the submitted projects[2] were innovative, replicable for other municipalities, and had inspirational value, all applications had to meet the following eligibility requirements:

- The project must have been initiated after the 1st of January 2013.
- If the project was initiated before 1st of January 2013, the project still has to be active.
- The project must either be completely financed or partly financed if still under development.
- The project must have been developed and/or implemented by or in cooperation with a municipality.

1. It cannot be ruled out that the format of the campaign has meant that certain areas, sectors and types of projects appear more frequently than others.

2. The term 'project' is used in Klima100 to describe pilot projects, larger plans, initiatives and more.

THE PROJECTS HAVE BEEN DIVIDED INTO 12 CATEGORIES*

- RESPONSIBLE PROCUREMENT AND CONSTRUCTION
- GREEN BEHAVIOR AND EDUCATION
- RENEWABLE ENERGY
- GREEN LAND USE AND RECREATION
- CLIMATE-PROOF CITIES
- ENERGY EFFICIENCY AND TECHNOLOGY
- CLIMATE ACTION PLANS
- STORM SURGE PROTECTION
- CLIMATE ADAPTATION OF STREAMS AND LAKES
- TRANSPORTATION
- SUSTAINABLE COMMUNITIES
- CIRCULAR ECONOMY

*We originally worked with 17 sectors in the submission phase, before developing the final 12 sectors to best suit the range of applications that we received.

How did we score the projects?
Scoring and ranking such a wide range of innovative projects was no easy task. To ensure that the process was as stringent and transparent as possible, we used a detailed, multi-step scoring system, developed in cooperation between Sustainia and C40 Cities. This has been used in the selection for the Cities100 publication three years in a row and subsequently further developed to fit Klima100.

→ **STEP 1:** Sustainia assessed all the applications on the basis of the following seven criteria:

1

CLIMATE ACTION

→ The expected or documented reduction in greenhouse gas emissions and/or the expected or documented contribution to climate-proofing. Preference was given to results or goals that are measured and assessed quantitatively, and to documented results over goals.

2

CO-BENEFITS

→ Improvements of non-climate related matters, assessed according to the UN Sustainable Development Goals. Preferences was given to results or goals that are measured and assessed quantitatively, and to documented results over goals.

3

INNOVATION

→ Addressing challenges caused by climate change in an innovative manner. This includes the project's innovative elements, and whether the project is innovative on a national or international level.

4

COLLABORATION

→ Demonstration of strong cooperation between the involved project partners. This includes partnerships across administrations and municipality borders, or between municipalities and firms or organisations.

5

CITIZEN ENGAGEMENT

→ Involvement of citizens in the development and implementation of projects. Here the focus was laid on whether citizens have influenced the development and implementation of the project. Preference was given to quantitative documentation of the involvement.

6

SCALABILITY

→ The extent to which the project is designed, so it potentially can be scaled and duplicated elsewhere. We focused on whether it was planned to scale the project either within the municipality, or at a regional or national level.

7

KNOWLEDGE SHARING

→ To what extent the experiences from the project are shared or are planned to be shared, across administrations, municipality boards or national boards.

The initial project scoring was performed according to the seven criteria laid out above, with the combined score from all criteria giving the total score.

→ **STEP 2:** After Sustaina had given the submitted projects an initial score based on the evaluation criteria, the Klima100 Advisory Board (p. 168) assessed the projects based on the above mentioned evaluation criteria as well as their professional experience and knowledge.

→ **STEP 3:** To qualify the final selection further, Sustainia consulted with the thinktank CONCITO on a systematic basis throughout the project.

→ **STEP 4:** On the basis of the process described above, Sustainia made the final selection of the 100 projects, where the geographical and sectoral diversity of projects were also considered.

CO_2 equivalents
In Klima100 "CO_2" denotes the amount of CO_2 that has the same potential global warming effect as a given mixture and amount of greenhouse gases.

Explore Sustainia

→ Sustainability is our passion

Sustainia is an advisory group and digital agency focused on achieving the UN Global Goals by 2030. We work with municipalities, cities and companies alike to help them develop successful sustainability strategies, build mindset transforming digital tools, and amplify their sustainability brand and communications efforts.

As one of the world's leading communicators of sustainable solutions, we have clients and collaborators from all corners of the world. From international organizations, such UN Global Compact, C40, and the Asian Development Bank, to Danish municipalities and companies of all sizes. We now have over 25 employees with combined and extensive experience in sustainability, climate change, project management, analysis, communication, user experience and graphic design - not forgetting a passion for building a sustainable world!

→ **We can help you within a number of areas:**

Inspiring change

NEW KNOWLEDGE AND NEW IDEAS

We create bold strategies for inspiring change within organizations, helping you to transform your sustainability performance. With experience in sourcing, analyzing and vetting more than 5,000 sustainable solutions and innovative climate projects from all over the world, we have mapped and analyzed global market trends, and scrutinized how leading cities, firms, and countries around the world work strategically with sustainability and the Global Goals. We provide amongst other things:

- → Inspirational presentations
- → Workshops and ideation labs
- → Curated catalogs of ideas
- → Best practice presentations
- → Introductions to the Global Goals

Strategy

VISIONS AND PLANS

How do you want your organization to look when we reach 2030 and what moves will you take to get there? We help organizations create and improve their sustainability visions and strategies throughout all stages of the process. There is enormous business potential for embedding the Global Goals within your organization and partners. We help convert your ambitions into reality, and demonstrate how the Global Goals can support your business activities. We provide amongst other things:

- → Solution labs
- → Strategies for integrating the Global Goals
- → Creating unifying narratives
- → Strategic advisory
- → Illustrative future scenarios
- → Sustainability reports

Impact

MINDSET AND BEHAVIOR CHANGE

How do you change behavior - both internally within your organization and externally. We deliver transformative communication campaigns, and build digital products and services, for both Danish and international audiences, to create real and enduring change. We deliver amongst other things:

- → Behavioral changing communication campaigns
- → Branding material, including videos
- → Digital tools that create impact
- → Customized "guides" for your municipality or company
- → Events that make a difference
- → Membership of the Global Opportunity Explorer

SUSTAINIA

Contact **sustainia@sustainia.me** to hear more.

Explore Realdania

→ Quality of life through the built environment

Realdania is a philanthropic association and change agent that works to improve quality of life through the built environment. Among other things, this involves promoting sustainable cities to ensure attractive urban environments that contribute to well-being and quality of life.

Global climate change. Marginalized neighborhoods. Loneliness among seniors. Challenges facing rural areas. Unhealthy indoor climate. Realdania believes that the built environment can be a driving force to create solutions for some of society's most pressing issues.

For example, a climate adaptation project can create added value by providing a better urban environment, new spaces for meeting and activities, and even boost tourism. A retrofit project can help strengthen local communities. And the transformation of a marginalized residential area can help create new jobs and tie together the entire neighborhood.

Six philanthropic aims

Realdania works with six philanthropic goals that mirror global, national and local challenges where the built environment is of importance. One of the aims is to promote sustainable cities. Cities are at the frontline of climate change, with rising sea levels and increasingly intense cloudbursts, but they also play an important role as a catalyst for social development and are crucial to the transition towards a more sustainable society. Strategic city development can work as a tool to prepare cities for changes to come: economically, socially, environmentally, and culturally. This demands a holistic approach, good planning and long-term solutions.

Bringing people together for joint solutions

Cooperation is a central part of Realdania's philanthropic approach. Among others, Realdania supports C40 - a global network of mayors from 91 cities that work together to reduce greenhouse gas emissions and increase cities' climate resilience. The ambition is that the knowledge developed and disseminated internationally by C40 should benefit Danish cities and support cooperation and knowledge sharing among Danish cities. Similarly, Realdania's engagement with Sustainia is driven by the ambition to exchange knowledge and experience regarding sustainability in the built environment in an international context.

The Realdania association

Realdania is a philanthropic association with approximately 150,000 members. The mission is to improve quality of life through the built environment, meaning the physical environment for our daily lives. Realdania's work is for the benefit of both current and future generations and wishes to promote sustainable innovation and new knowledge. Since 2000, Realdania has financed more than 3,350 projects to the tune of more than 2.4 billion EUR. Membership of the association is open to all property owners.

Photo credits: 1. Claus Bjørn Larsen. 2. Leif Tuxen.
3/4. Søren Svendsen. 5. Bjarke Ørsted. 6/7. Ingemann/Degnbol

Klima100 Advisory Board

The Klima100 Advisory Board consists of 22 experts from 16 companies, universities and organizations.

The advisors have no direct financial ties to Sustainia, and all advisors were asked to disclose any biases or preferences.

Allan Skovgaard
Director, Emerging Water Technologies, Grundfos Holding A/S

Anders Vestergaard Jensen
Project manager, Climate-KIC Nordic

Simon Hansen
Director of Regions,
C40 Cities Climate Leadership Group

Birgit Paludan
Civil Engineer, Hydraulics

Ditte Lysgaard Vind
Managing Partner, The Circular Way by Lendager Group

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Mette Qvist
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Associate Professor, Technical University of Denmark

Ole Mark
Research Chief, DHI

Peter Harpsøe Engel
CSR-Director, Dansk Retursystem A/S

Rikke Dreyer
Chief Consultant Public Procurement, Ecolabelling Denmark

Gertrud Jørgensen
Professor, Landscape Architecture and Planning, University of Copenhagen

Annette Toft
Director, Danish Agricultural and Food Council, Bruxelles

The members of the Klima100 Advisory Board have contributed their knowledge in vetting solutions within sectors of expertise. However, the selection of solutions to be featured in the Klima100 is the sole responsibility of Sustainia. Moreover, the opinions expressed by the Advisory Board members do not necessarily represent the official opinion of the Advisory Boards members' organizations.

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Realdania and Sustainia's Klima100 is a celebration of some of the best climate solutions in Denmark's municipalities. **Never before has such a comprehensive, green and contemporary picture of Danish municipalities been drawn.** Klima100 is a testimony to the fact that the municipalities have the ambition, creativity, and drive to fight climate change locally and adapt both rural and urban areas to a changeable and unpredictable climate.

The 100 projects help municipalities adapt to and mitigate against climate change, ranging from energy efficiency measures and nature conservation to flood protection and ambitious climate plans that show the way to a fossil free future. **Klima100 guides from the wind-blown coasts through the creeks and streams to solar parks and recycling centers, through the narrow streets and wide boulevards to the patios and backyards.**

Klima100 proves that the green transition can happen on all levels, and that the municipalities have a crucial role to play in creating Denmark's green future.

100 climate solutions from Danish municipalities