Rådet for
Energieffektiv
Omstilling

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Appendix 1 to *Recommendations for Energy Efficiency Principles in the Green Transition*

A. Implementation of climate plans at the local level

B. District heating in densely populated areas and the opportunities this yields for sector coupling

C. Intelligent data-led energy management

D. Nudging of private homeowners

E. Energy renovation of older apartment blocks

F. Cost-neutral renovation of municipal buildings

G. Climate adaptation yields climate gains

H. Wastewater as a valuable resource

I. Energy optimisation of building operations based on detailed data collection

J. Green Reporting delivers competitive advantages

Aalborg University, the Danish Trade Union Federation of Construction Workers, CONCITO, the Danish Association of Architectural Firms, Green Power Denmark, the Danish Chamber of Commerce, the Danish District Heating Association, the Confederation of Danish Industry, De Frie Energiselskaber – Association of Independent Energy Companies, Drivkraft Danmark – Industry Association for Fuel and Charging, the Danish Property Federation, Energy Forum Denmark, the Danish Trade Union Confederation, the Danish Consumer Council THINK, the Danish Association of Consulting Engineers, Local Government Denmark, the Danish Agriculture and Food Council, Roskilde University, Green Transition Denmark, SMEdenmark, SYNERGI, the Danish Mechanical and Electrical Contractors Association, SustainableEnergy and VELTEK.

DK2020

Paris-compatible climate planning in 95 Danish municipalities

DK2020 in brief

DK2020 invites Danish municipalities to develop climate action plans which are in line with the Paris Agreement. The initiative makes use of an internationally recognised planning tool developed by the C40 cities network. The climate plans are ultimately approved by C40. The project launched in 2019 with 20 pilot municipalities which all now have politically adopted and approved plans. Since then, 75 municipalities have joined the subsequent project DK2020 – Climate Plans for all of Denmark.

Together with C40 Cities and CONCITO – Denmark's Green Think Tank, the philanthropic association Realdania was behind the DK2020 pilot project. Since then, the partnership has expanded to include Local Government Denmark (KL) and the five Danish regions.

Energy efficiency in the climate planning of the DK2020 municipalities

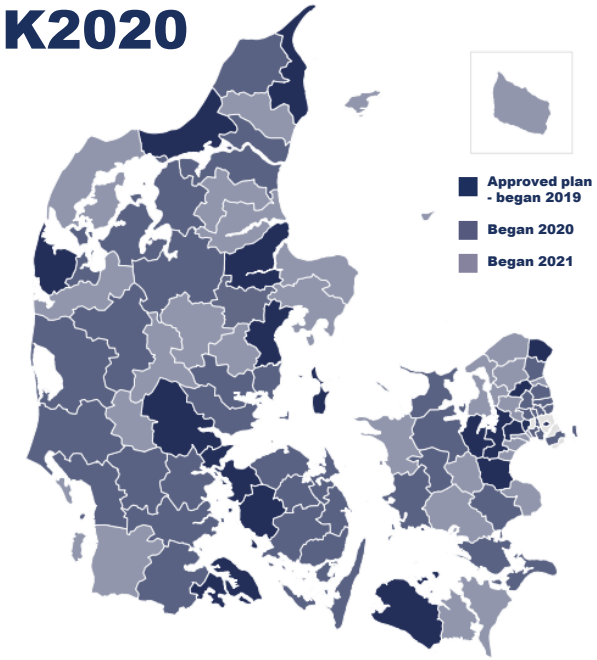
A DK2020 climate plan must address all significant greenhouse gas emissions within the geography of the municipality. It must include an action plan comprised of concrete measures for the reduction of emissions which are in line with the 1.5℃ ambition of the Paris Agreement, and they must also include a strategic plan for adaptation in relation to foreseeable climate changes.

The improvement of energy efficiency is one of several tools that form part of the municipalities' climate efforts. The majority of the pilot municipalities in DK2020 work with energy efficiency improvements both for the municipality as an enterprise and as a geographical entity – which is to say, the municipality plays a facilitating role in supporting energy efficiency improvements among citizens and businesses.

The 20 completed plans include a range of planned measures which shall contribute towards greater energy efficiency. The box to the right lists some examples of measures to boost energy efficiency which feature in the climate plans and address emissions within the geography of the municipalities. This is achieved through green requirements in owner strategies, via partnerships with utility companies and through energy mapping and consultancy for citizens and businesses.

In regards to their own operations and buildings, the pilot municipalities play a more direct role in relation to energy efficiency improvements. Examples of energy-efficiency measures include the energy renovation of municipal buildings in addition to data-led energy management and governance.

95 Municipalities in DK2020



Examples of measures to boost energy efficiency in the completed DK2020 climate plans:

Strategic energy planning, the drawing up of heat plans, the phasing out of oil and gas-based heating, individual heat pumps, the establishment of electric "kettles", collective heat pumps, geothermal energy, letting of district heating connection plants, expansion of energy-efficient district cooling, support to companies in the conversion of process energy, densification and expansion of the district heating network, low-temperature district heating, the utilisation of local surplus heat, the use of remote data for the more efficient running of the district heating network, climate awards for energy-efficient SMEs, the replacement of outdoor street lighting with LED lights (which offer the option for dimmed lighting at certain hours), mapping of energy consumption in businesses, energy networks for caretakers in high-rise buildings, energy consultancy and advisory services for homeowners and businesses.

Realdania · KL · midt · Region Hovedstaden · Region Sjælland · Region Nordjylland · Region Syddanmark · CONCITO · C40 Cities

DANISH DISTRICT HEATING ASSOCIATION

A short history of district heating in Denmark

It all began with energy-efficient waste and cogeneration

Ever since the days of the first waste heat plant in 1903 and the first combined heat and power plant in 1920, which uses surplus heat from electricity production for district heating, this energy-efficient use of waste incineration and fuels such as coal, natural gas and biomass has been the cornerstone of district heating production in Denmark.
Between 1990 and 2020, 60 to 80% of district heating production in Denmark was undertaken in connection with thermal electricity production.

Today 66% have district heating

Today 1.8 million Danish households – equivalent to 66% of the total – get their heat from district heating.

In 2020, renewable energy sources accounted for 72% of all district heating production.

The district heating sector currently employs 11,000 people and exports DKK 6.4 billion.

Today many residential areas are in the process of transitioning from natural gas to district heating.

The future of district heating in Denmark: *Sector coupling and surplus heat*

Today there is a transition underway within both electricity and district heating production in Denmark, away from incineration facilities and with an ambition to reach 100% carbon neutrality by 2030.

Within district heating, investments are being made primarily in large electrically-driven heat pump systems which extract energy from the air, seawater or sources of waste heat. These heat pumps can be used in conjunction with more fluctuating forms of renewable energy production as the energy can be stored in the water in the heating element and in energy stores. Investments are also being made in large solar heating systems and the establishment of geothermal energy.

At the same time, more and more surplus heat is being used from sources such as industry, data centres and wastewater treatment plants. In the future, the production of PtX (electrofuels) is also expected to be able to produce large quantities of surplus heat that can be used in the district heating networks.

A key factor for energy efficiency at the system level is that all of these sources of surplus heat are established in places where surplus heat can be utilised for district heating.

Energy planning is the foundation

One crucial factor for the spread of district heating has been energy planning whereby Danish municipalities since 1976 have had the competence to approve district heating projects on the basis of socio-economic calculations, among other things. District heating companies then have the option to receive attractive financing as the municipality can guarantee the loans, however at the same time profit from district heating is regulated by legislation in order to protect consumers. Until 2019, municipalities could also impose an obligation on consumers to connect to the collective district heating and natural gas networks in Denmark to ensure the heating basis and thus the economics of large investments. Today this is secured in new district heating areas through the use of binding advance commitments from consumers.

Intelligent data-led energy management: Building data supports the green transition in Aarhus

Data is an important tool in securing the efficient use of our resources

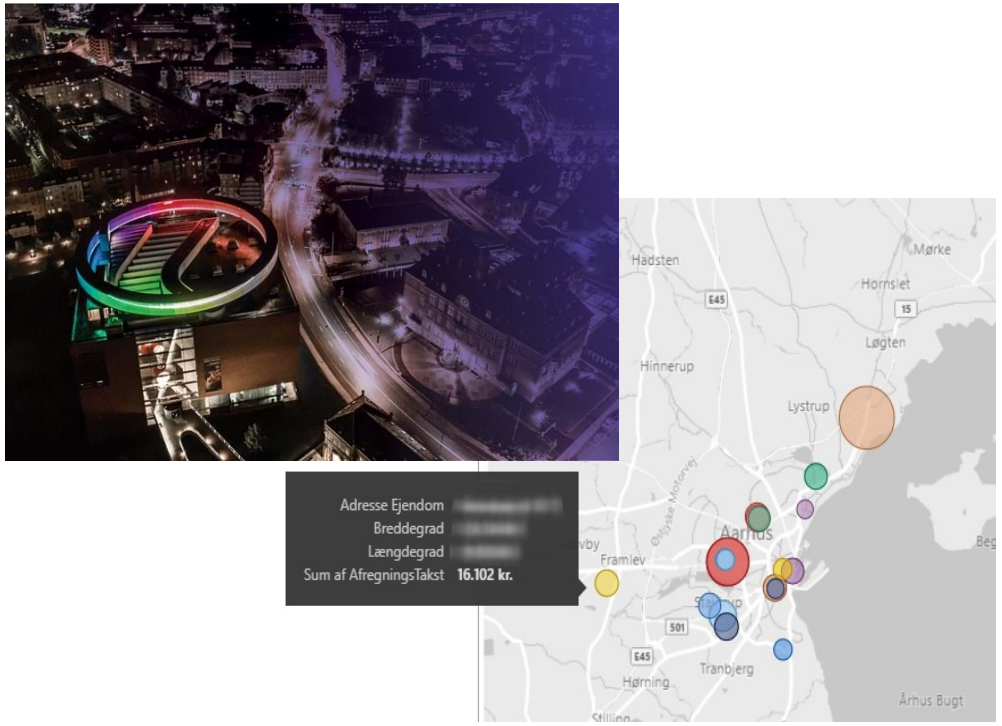
Considerable savings can be made in the operation of buildings by working in a systematic and targeted way to collect data and generate an overview of different consumption data.

Aarhus Municipality has been working with the Intelligent Data-Led Energy Management project since 2018. The project has achieved over five percent in energy savings per annum by taking a systematic approach to consumption data. The cost is approximately four million per annum while the savings each year are over 7.3 million.

Savings have primarily been made in three areas: through the benchmarking of building performance, the reduction of water consumption and the improvement of cooling in district heating systems.

Having an overview of the data is absolutely essential in order to identify the building and the area which can offer the best savings. The energy data are presented in simply and easy-to-read analyses which can in principle by understood by anyone with even a minimal understanding of the figures and technology. For example, data can be viewed on an interactive map which presents a visual overview. This provides both cases for energy optimisation but also the opportunity to monitor consumption on a day-to-day basis and thus quickly identify faults and shortcomings.

These simple and comprehensible analyses contribute towards a culture change whereby employees themselves can take an interest and engage in the monitoring of their energy consumption. This culture change resulted in a saving of 12 percent on water consumption in Aarhus Municipality buildings.



The picture shows one of the visual maps which charts the cooling penalty for different municipal buildings. The size of the circle reflects the size of the settlement rate.

Sonderborg, Denmark:

Energy renovation of private homes

ProjectZero
SØNDERBORG

ProjectZero, Sønderborg

Together with local tradespeople, monetary institutions, estate agents, energy advisors and district heating companies

Sønderborg's 18,600 owner-occupied homes were leaving a considerable carbon footprint as many were built prior to the oil crisis and thus were very energy inefficient. A large number had natural gas and oil heating.

The ZERObolig project has demonstrated how coordinated one-stop-shop measures which focus on both the market and demand can act as a catalyst for waves of renovation on a local level. Read more at www.ZERObolig.dk.

The results included

- 1,600 energy guidance processes carried out whereby more than 60% of the homeowners invested an average of DKK 150,000 each in energy renovation
- Increased employment and skills development in the construction sector

More concretely, ProjectZero launched the following measures:

- Training of just under 100 local trades people as energy advisors and the introduction of the trades people list which announces the names and addresses of these individuals
- Energy guidance given to 1,600 private homeowners with tight follow-up on the result and communication of good examples
- Greater collaboration with monetary institutions in the area and introduction of attractive ZERObolig lån loan products, among other things
- Establishment of special hotspot working groups with bolstered stakeholder collaboration, joint communication and training projects
- Monthly monitoring of impact generation

The new local partnerships are now focused on anchoring climate/customer journey and related competencies within both vocational and continuing education and training so that the sector is equipped for the next wave of renovation projects focused on sustainable construction.

The project and its experiences have inspired GrønBolig and other municipally coordinated projects in DK and abroad.

E

Langkærparken, Tilst:
Renovation of housing blocks from the 60s to greatly improve their energy efficiency

Developer: AL2bolig
Contractor: Enemærke og Petersen
Architect: NOVA5 Architects
Engineer: Esbensen

The renovation of the Langkærparken housing complex has demonstrated that it is possible to take a concrete housing block with poor insulation and bring it up to a modern level in terms of energy (and indoor climate) using efficient methods including prefabricated (and pre-insulated) facade elements and efficient monitoring processes. The renovated blocks meet the requirements for low energy class 2015. A pilot block was completed and delivered in 2012 before the remaining 34 blocks were then completed in line with a tight timeline between the years 2013 and 2016.

Photo: Enemærke og Pedersen

What does it take? A large number of buildings which need to be renovated or modernised. For energy efficiency and prefabrication/assembly techniques to be considered from the outset of the renovation project. Good cooperation between the developer, the project supervisor and the contractor throughout the entire project. And a clear signal from the developer that they have a high level of ambition for the energy efficiency of the renovated buildings.

Links:
Enemærke & Petersen | Langkærparken viser vejen! | Enemærke & Petersen (eogp.dk)
Langkærparken Klimablok (baeredygtigebygninger.dk

Cost-neutral renovation of 54 properties in Guldborgsund Municipality

The challenges facing Guldborgsund Municipality

Like most other municipalities, Guldborgsund Municipality was facing three challenges in relation to its municipal buildings:

- A large maintenance backlog – i.e. obsolete technology, unsealed windows, inadequate insulation, etc.
- Poor indoor climate – i.e. insufficient or zero ventilation, poor lighting, draughts from windows, etc.
- A desire to reduce energy consumption and thus CO2 emissions from municipal buildings

Why use the ESCO model?

Using the ESCO model for energy performance improvement and the renovation of municipal buildings is good management because the municipality moves money from being passively used on energy to an active improvement of municipal buildings. This means that the ESCO project is cost neutral and therefore does not cost money to the taxpayer.
Moreover, this public-private collaboration model also makes sense because the municipality gains knowledge and resources over a period and because the overall project is developed as part of a co-creation process between the municipality and the ESCO company.

Scope and results of the ESCO project

The project – which was carried out in collaboration with Siemens – covered 217,000 m2 which is equivalent to approx. 60% of the municipality's total building stock. The project encompassed the renovation of schools, sports halls, swimming facilities, nursery schools, administration buildings and libraries. The energy-saving measures deployed included the renovation or replacement of ventilation, heating and lighting. A number of water-saving measures were also implemented. All of the windows in the town hall were replaced due to leaks and mould.
Solar panels were established on sports halls, schools and nursery schools. The ESCO project reduced energy consumption by a total of 20% and annual CO2 emissions by almost 1,000 tonnes.

Guldborgsund Municipality also had a desire to involve children, employees and citizens in the ESCO project. In collaboration with learning experts, a complete online learning and education platform was developed.
More than 60% of the total project was completed in close collaboration between Siemens and local companies.

Project economy

The total scope of the ESCO project was DKK 68 million and it had a simple payback period of twelve years. The project was financed using loans from KommuneKredit. The loan repayments were covered by the savings made on the municipality's overall energy bill.

Reference

https://bit.ly/3nZCu87

SIEMENS

Låsby: Climate adaptation yields climate gains

Photo: Skanderborg Municipality

Grouping: Energy savings

Case: Låsby, Skanderborg Forsyning

Context

A recreational area has been created in Låsby where rainwater is a gathering point for citizens and a place to exercise.

The project demonstrates that it is very much possible to combine climate adaptation with improved quality of life.

The solution uses rainwater from the sewers thereby transforming the water from something which puts a strain on the environment and involves intense energy consumption to something of benefit to both citizens and the environment.

Opportunity

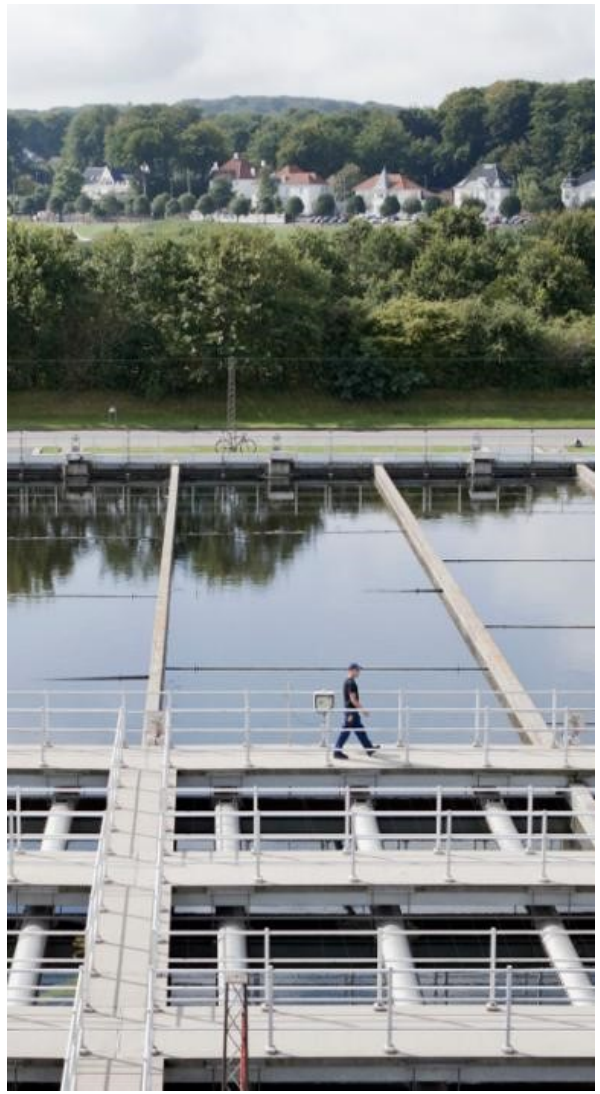
The energy used to treat a cubic metre of rainwater which runs into the sewers is on average 0.22 kWh.

In Denmark, about 2.5 times as much water passes through treatment plants than what is actually consumed. Thus there exists great potential to remove rainwater from the sewers using what is known as local-rainwater-harvesting solutions.

Impact

Increased focus on removing rainwater from the sewers can considerably reduce energy consumption in the water sector and contribute to meeting the ambition for the water and wastewater sector to be both energy and climate neutral.

Marselisborg Treatment Plant: Wastewater as a Valuable Resource



Grouping: Energy efficiency **Case**: Marselisborg Wastewater Treatment Plant

Context

It ordinarily takes a great deal of energy to purify wastewater so that pollution is removed before the water is released into the environment. In fact, globally the water sector is one of the most energy-intensive sectors and it is estimated to account for four percent of total electricity consumption per year.

In Denmark, the water sector accounts for only 1.8% of Danish electricity consumption and if all plants place focus on energy efficiency, the figure is expected to fall considerably over the coming years.

Opportunity

Energy consumption in the water sector can be reduced by using wastewater as a valuable resource and by implementing energy-efficient solutions.

The Marselisborg Treatment Plant is leading the way. They produce electricity and heat from wastewater – so much, in fact, that they currently produce 50% more electricity than they use.

The surplus electricity is supplied to consumers as green energy. They also produce surplus heat for the district heating network equivalent to the annual consumption of 500 households.

Impact

The entire Danish water sector has the potential to become energy neutral using existing technology.

Wastewater companies could produce enough energy to cover energy consumption for the entire water sector.

Renovation of the Nordisk Fjer building in Copenhagen

Continuous energy optimisation of operation based on detailed data collection

Developer: Pension Danmark
Turnkey contractor: NCC
Partners in the ELFORSK project on data collection: LB Forsikring, PensionDanmark, NCC, DTU and VELTEK

For office buildings, schools and other buildings which have a fixed pattern of consumption, sensors and an expanded level of detail in data collection can allow for a highly effective management process and continuous energy optimisation.

Energy optimisation was achieved through an IoT set-up which collects data on consumption, indoor climate and user behaviour and then presents them in user-friendly dashboards. Simply put, this made it possible for operational staff in the building to identify and stop or curtail the inexpedient consumption of electricity, water and heat and thus easily reduce CO2emissions and bring down costs at the same time.

Some significant examples of energy savings made via the concept include:

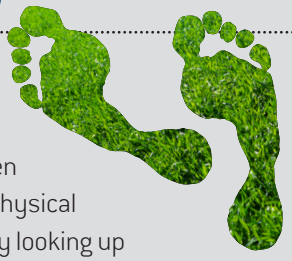
- Optimisation of the operating time of ventilation systems to match actual usage of the building
- Rapid troubleshooting of erroneous operating time and programming of ventilation systems (savings of 200,000 pa)
- Inexpedient use of refrigeration equipment (savings of 100,000 pa)
- The replacement of defective components which erroneously call for longer operation (savings of 80,000 pa)
- Optimisation of temperature setpoints in order to make better use of free heat and better indoor climate
- The opportunity to gather a wide range of benchmarks and to evaluate energy consumption against other buildings

Most of the above gains were not detected by the CTS system in use in the building and presumably could have continued without being discovered for an extended period of time.

What does it take? At its core, the solution is based on the use of IoT devices and cloud data capture, meaning that it can be installed on all existing and new buildings. It takes an interest from the developer – and a minor investment in the relevant instrumentation of the building. For an office building of 15,000 m2 , the instrumentation would cost DKK 300,000. In return, it enables energy savings of approximately DKK 400,000 per annum.

Photos: Jonathan Grevsen

Green reporting generates competitive advantages



The requirements for companies to measure and document the effect of their initiatives relating to the green transition and sustainability are on the rise. From 1 January 2023, the EU will be tightening its requirements on the non-financial reporting of the largest companies. It is expected that these requirements will later spread to other actors in the value chain such as SMEs and smaller enterprises which act as suppliers or subcontractors.

SIF Gruppen A/S is a major electrical installation company based in Zealand with approximately 420 employees. The company finds that their customers and partners are increasingly demanding documentation about the efforts and measures taken by the company in relation to the green transition and sustainability. For this reason, since October 2021 SIF Gruppen A/S has been participating in a project initiated by the trade and employers' organisation TEKNIQ Arbejdsgiverne whereby the company systematically describes, measures and documents their carbon emissions and their work in relation to the environment, social responsibility and good corporate governance. The data collected are entered into a digital platform which automatically generates an individual ESG report for the company and provides a detailed CO2 calculation.

Through the project, the company has invested time and resources into collecting and recording sustainability data and describing their initiatives in relation to the environment, social responsibility and good corporate governance.

Obtaining consumption data from energy and utility companies (electricity, gas, district heating and water consumption) and oil companies (fuel consumption) is currently the most time and resource-intensive process related to green reporting, especially in those cases where the company has departments in different locations and where data are collected from different meters.

At present, this process is undertaken manually either through the use of physical consumption billing documents or by looking up information about consumption at the company on the website of the energy or utility company. There is a considerable need for these consumption data to be made available so that companies can pull up their own data online directly from the utility or oil companies concerned.

According to Lars Mejlby, CEO of SIF Gruppen, their new green documentation has already generated value for SIF Gruppen A/S. As examples they cite tendering processes and the use of documentation in procurement processes, and in negotiating cooperation agreements with customers including one case where the ESG report proved decisive for a long-term cooperation agreement with a large Danish biotech company.