the big PUZZLE

Strategic energy planning

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Experience from "The Capital Region of Denmark"

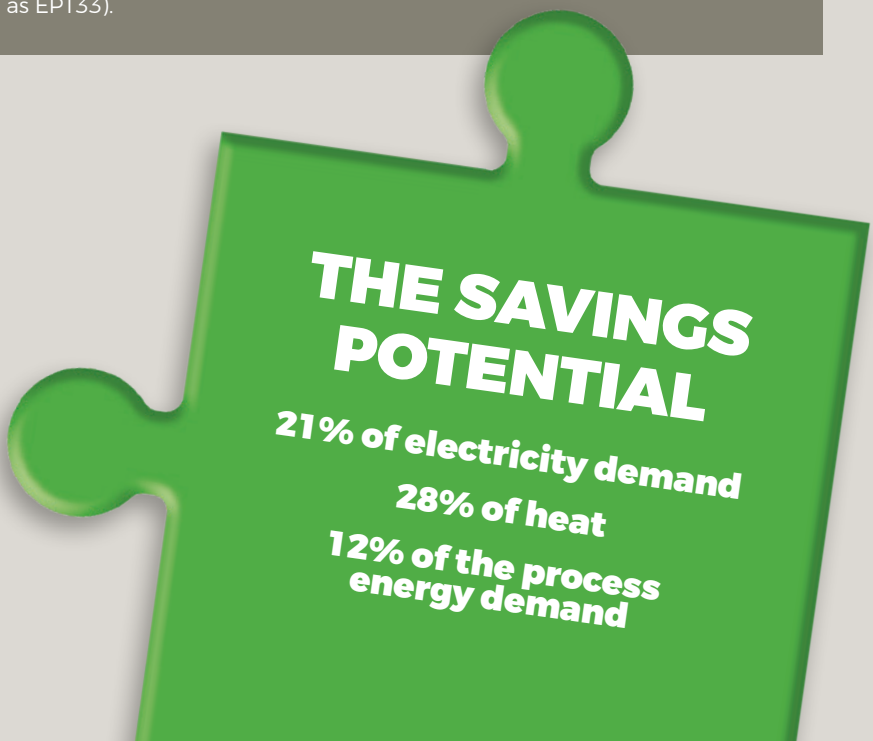
Looking into the future

Lars Gullev, CEO at VEKS, explains: "We are looking into a future energy system with far more wind power and less combined heat and power (CHP) production from CHP plants. A system that must be fossil-free, but in the long term also reduces the current level of sustainable biomass in the electric and cogeneration sectors. In the future, biomass - including biogas - will be used increasingly in the transport sector. The strategic energy planning, initiated in the Capital Region of Denmark, will contribute to realizing the fossil-free energy system of the future."

Analyses indicate electricity becoming the dominant source of energy interacting with district heating – and more electricity will be produced by wind turbines and solar cells. To accommodate more of this fluctuating energy, a flexible and integrated sectoral linked energy system is essential. Here, the EPT33 municipalities have the strengths to create the energy system of the future. The hard part is finding the right areas for energy production.

Cross Border Energy (EPT33)

The parties behind the ambitious project for improving a sustainable energy conversion. are the Capital Region, all 29 municipalities in the Capital Region, four from the Region Zealand, and 11 District Heating companies (waste, district heating, natural gas) in the Greater Copenhagen area. The project is named Cross Border Energy (hereafter referred to as EPT33).



In addition, 27% of electricity consumption can be made technically flexible and adapted to wind and solar.

For sustainable energy, a technical potential of 37 TW h/year is estimated. The largest potential being heat production, including solar heat, geothermal energy, and surplus heat in combination with heat pumps.

The goal for the EPT33 is:

Fossil-free electricity and heat supply in 2035

Fossil-free transport sector in 2050

Where are we going?

The first phase of EPT33 describes the ambitious route for the energy systems to reach the goal. In the period until 2050, considerable effort is required for energy savings. Despite increasing living space and more transportation in 2050, the final energy consumption will be reduced by almost 30% compared to 2015 (reduction from 38 to 27 TWh/year). But an increase in electricity, district heating, and biomass is expected.

In the period until 2035, the use of biomass will increase significantly. This is mainly due to conversion to biomass at the CHP plants, while the use of biomass for energy production after this time will be reduced. This will happen as heat pumps, solar heat and geothermal energy integrate district heating production. A significant expansion with solar cells and wind turbines is assumed, which - in combination with other prerequisites - means the EPT33 municipalities will shift from net importing to net exporting electricity.

As a result of the ambitious conversion, total CO2 emissions are expected to fall by 75% from 2015 to 2035.

The Danish energy supply has changed significantly over the past 30 years.

Equally radical changes are needed over the next 30 years until 2050 for meeting the national political goal of a climate-neutral society emitting fewer greenhouse gases than absorbing.

In the short run, the Danish government's goal is to reduce Danish CO2 emissions by 70% in 2030 compared to the 1990 level.

IN 2015, ENERGY CONSUMPTION IN EPT33 MUNICIPALITIES WAS 38 TWh:

- 40% heating
- 20% electricity
- 40% transport

Total greenhouse gas emissions 10.2 million tonnes CO2 eq.

The Capital Region differs from the rest of Denmark in several ways:

- 35% of Denmark's population lives in the EPT33 area
- A large area is urban and only a small part is agriculture
- The population density is 6-9 times higher than in the average Danish region
- A further increase in population is expected until 2040, as many people want to live close to Copenhagen
- More people live in apartment buildings
- More people use public transportation for shorter distances
- Most buildings in the urban areas are connected to district heating system

How do we get there?
The joint strategic energy plan for the EPT33 municipalities recommends a Roadmap 2025 presenting 34 actions being implemented by 2025. The vision of fossil-free energy systems in 2035 and a fossil-free transport system in 2050 requires considerable effort from many parts. All elements must be brought into play.

The 34 initiatives in the Roadmap 2025 are organized in six focus areas covering the total energy system in the EPT33 municipalities. The focus areas are:

1. DISTRICT HEATING AND COGENERATION
The conversion from fossil fuel to sustainable biomass is already well underway. With the planned projects, the conversion from natural gas and coal to biomass in the larger district heating systems is almost completed - no further action is needed here. The main challenges until 2025 are a reduction of greenhouse gas emissions from the remaining production units. The expansion of geothermal, solar, heat pumps and district heating boilers must be accelerated to prepare for a multi-strand supply and - in the longer term - a reduction of burning biomass.

2. HEAT
The heat supply must be fossil-free by 2035. A fundamental question is whether buildings should be supplied collectively or individually in the future. The possibilities are to expand district heating, based on renewable energy sources in new areas, convert to individual heat pumps - some places in combination with biogas, or to establish local heating solutions for clusters of houses. The main challenge is to clarify what is best for each area.

3. THE POWER SYSTEM
The electricity system plays a key role in energy conversion, as more wind power and solar cells enter the electricity system of the future. Electricity will account for a larger share of the total energy consumption - and an increase in electricity consumption of 70% is expected in 2050 compared to 2015. The challenge will be expanding wind and solar to efficiency, flexibility, capacity, and balance, in an energy system with unstable sources.

4. THE NATURAL GAS SYSTEM
Natural gas is well suited to serve critical functions in the energy system. The main challenge is a conversion from cheap and abundant natural gas for expensive and limited biogas. There are limited amounts of biogas, so you should prioritize and use it strategically - for example in heavy transport and as peak load fuel in the electric and district heating system.

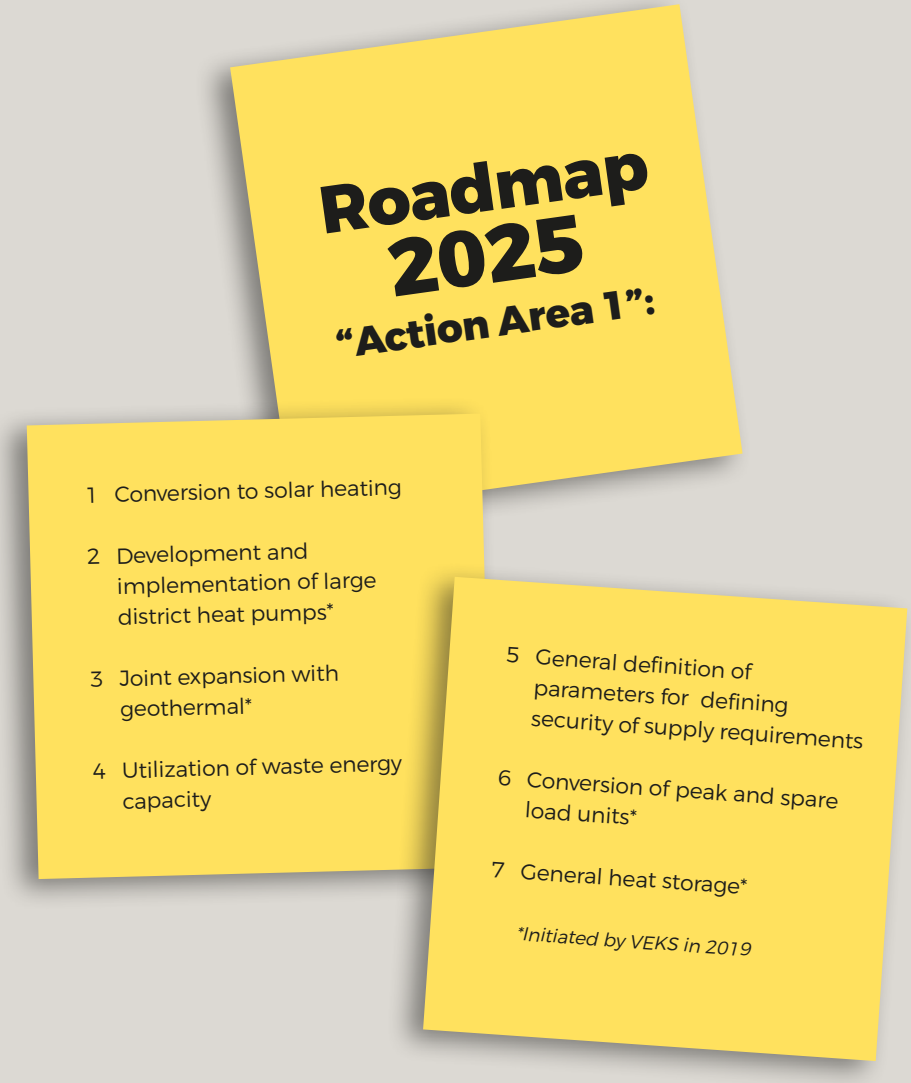
5. TRANSPORT
In the EPT33 area, there are short distances and a large proportion of public transport, bicycle, and walking. Still, there is a large, and rising, energy consumption from gasoline and diesel cars. The main challenge - for public transport - is meeting private citizens and companies' demands concerning flexibility. Therefore, a focus is:
- Municipal and regionally funded car fleets
- Better infrastructure for green fuels, especially electric cars

6. ENERGY CONSUMPTION
The energy consumption of buildings plays a key role in the energy system. As previously mentioned, they account for 40% of the total energy consumption in Denmark. Therefore, Roadmap 2025 has six specific measures reducing energy consumption in the building stock.

Prioritization and continuous adjustment
The transition to a fossil-free energy system is a complicated, long-term process. It requires new knowledge, new solutions, and a coordinated effort to make it a reality. There is a need for sustained efforts over the next several years, and therefore the initiatives in Roadmap 2025 are not exhaustive, but merely a collection of essential conversion elements that can help realize the energy vision.

Who does what?
The recommendations in Roadmap 2025 involve all players - region, municipalities, and utilities. Everyone must thus contribute to the transformation of vision into action - for example, by incorporating the recommendations into local climate and energy plans, or by the implementation of development projects. Actions are decided based on local conditions and priorities. However, the local effort cannot be seen isolated, but in the regional, national and global context. The recommendation is the actors continuously assess the need for cooperation supporting the transition.

Perspectives: Energy conversion, sustainability and green growth
At a global level, there is a growing demand for green solutions. And as a green pioneer country, Denmark can benefit from this. The analysis of Green Growth in Greater Copenhagen indicates an annual turnover of DKK 95 billion (€ 12 billion) and 42,000 new green jobs in Greater Copenhagen in 2035. However, this requires the actors in the EPT33 collaboration to maintain working hard for energy conversion.



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