Visions for Application of Energy Flexible Buildings in Denmark

or

Searching for Market Drivers for Flexibility in Energy Consumption in Buildings

Søren Dyck-Madsen
The Danish Ecological Council

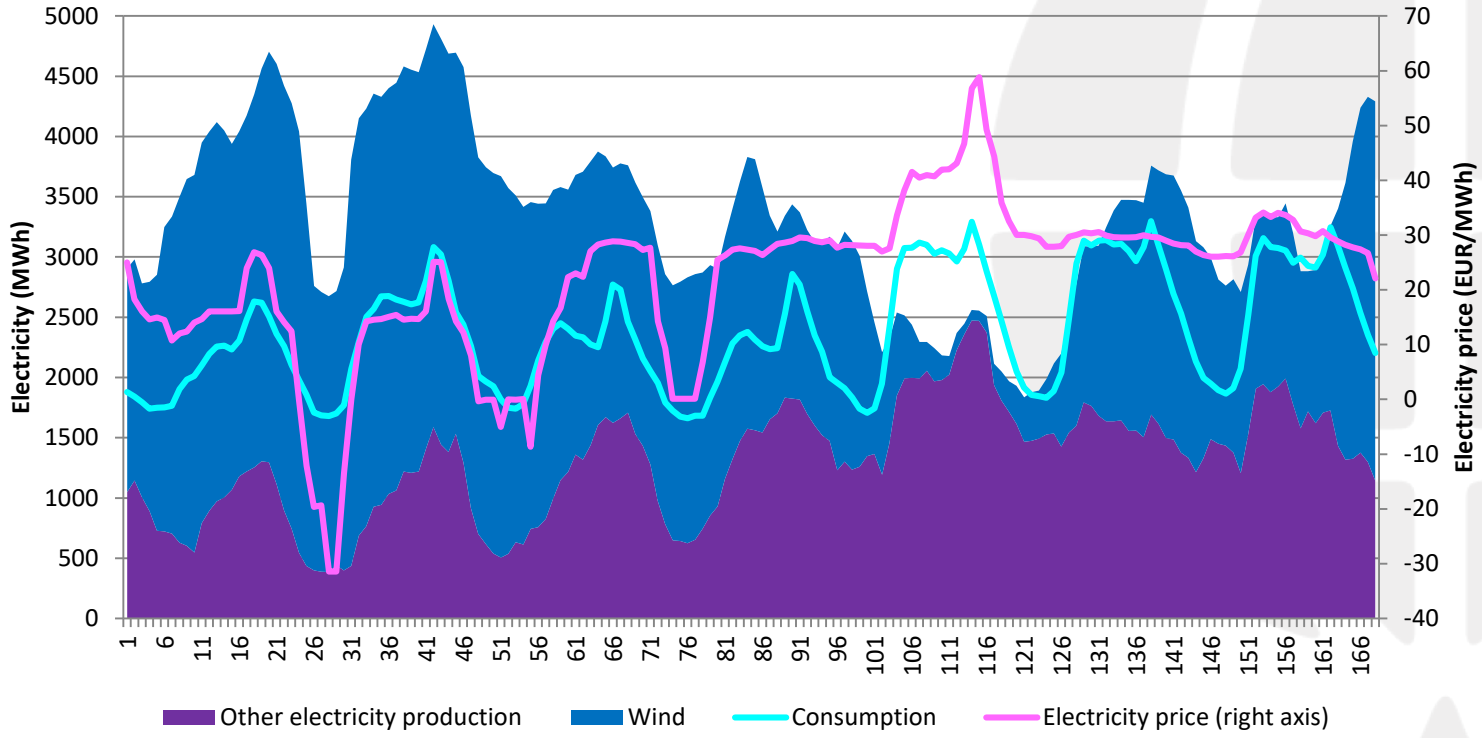
DET ØKOLOGISKE RÅD

Challenges and Buildings

- Flexible Energy Buildings is a means to help solve the challenges in a much more electrified and fluctuating energy system
- In order to investigate the market incentives for flexible energy consumption in buildings, you have to investigate and understand the characteristics of the challenges in a national understanding
- I'll start with possible business cases for flexibility in electricity consumption in buildings – and then add a few slides about district heating

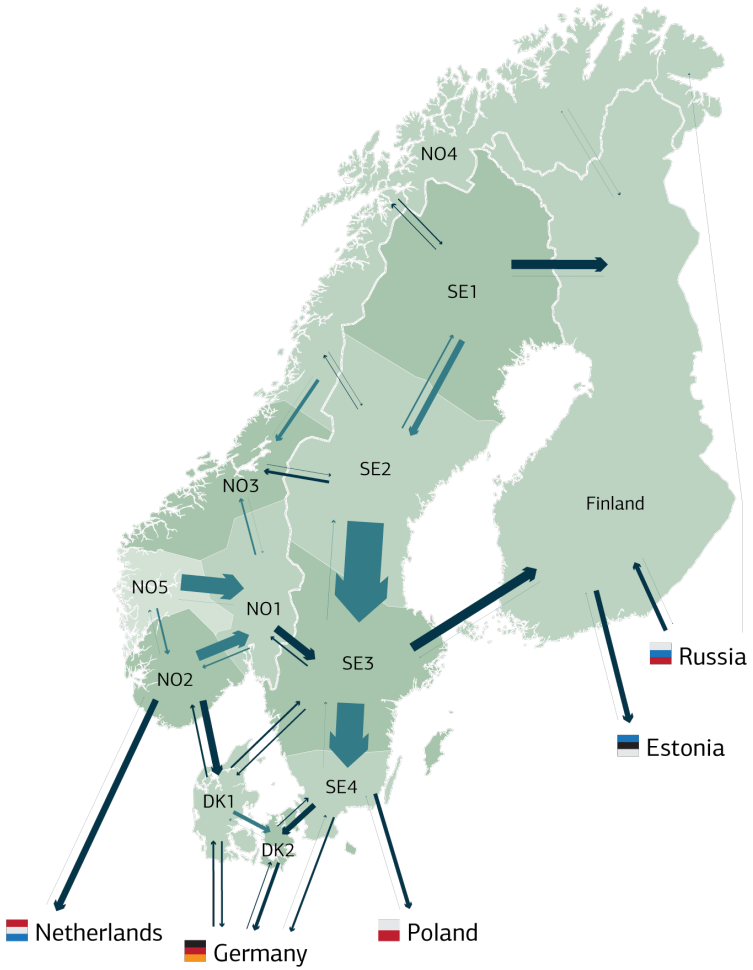
Fluctuating Electricity Production

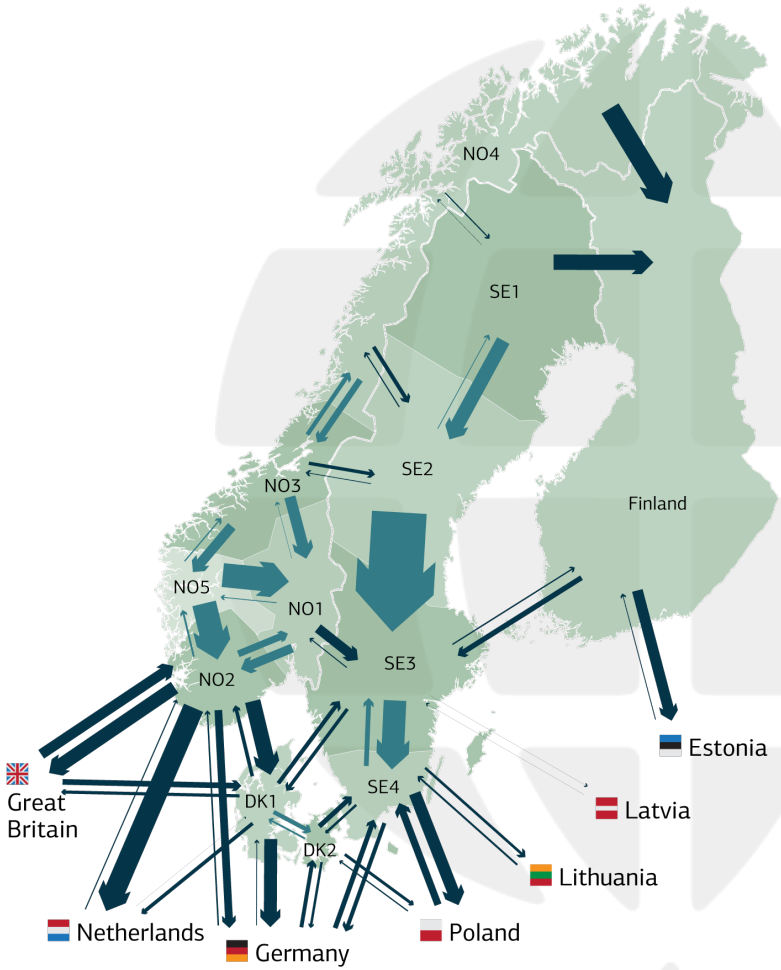
- Electricity - Production, Demand and Price, for Denmark West. First week in 2015



Source: Nordpool spot

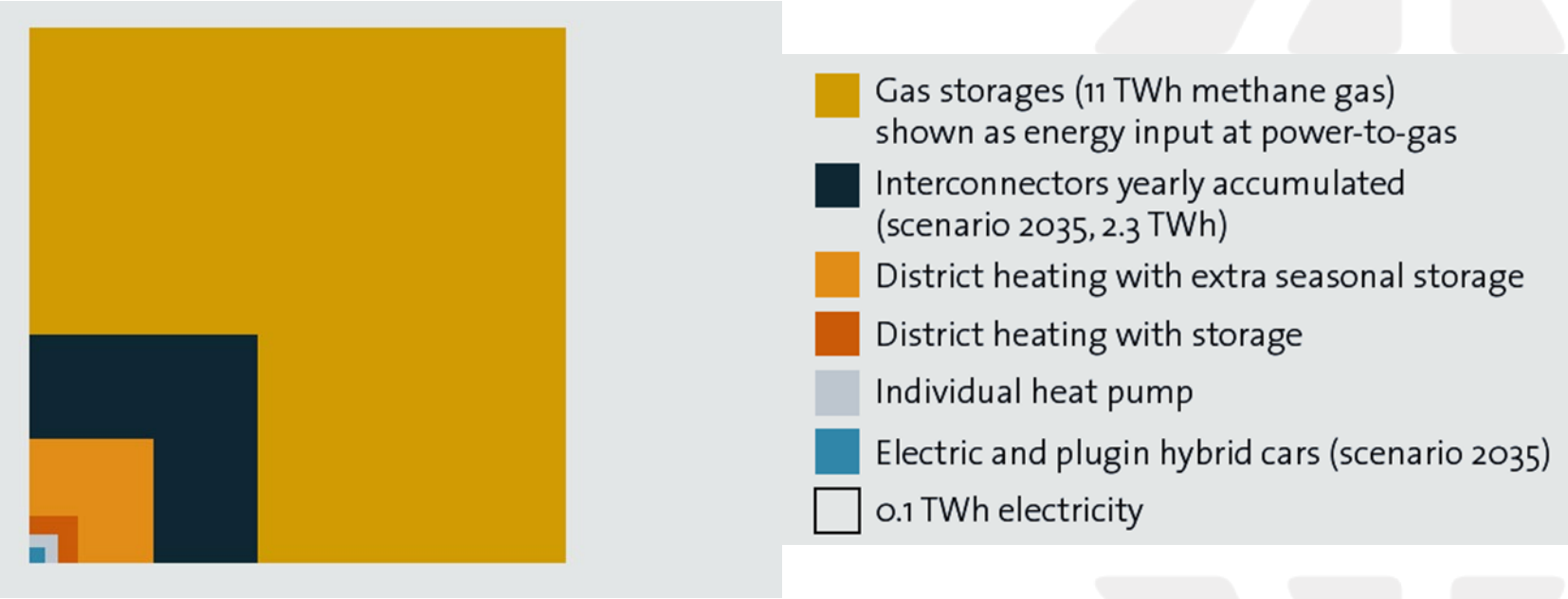
Much more Electricity in the System





Source: DTU Management Engineering

Storage Potentials in the Energy System

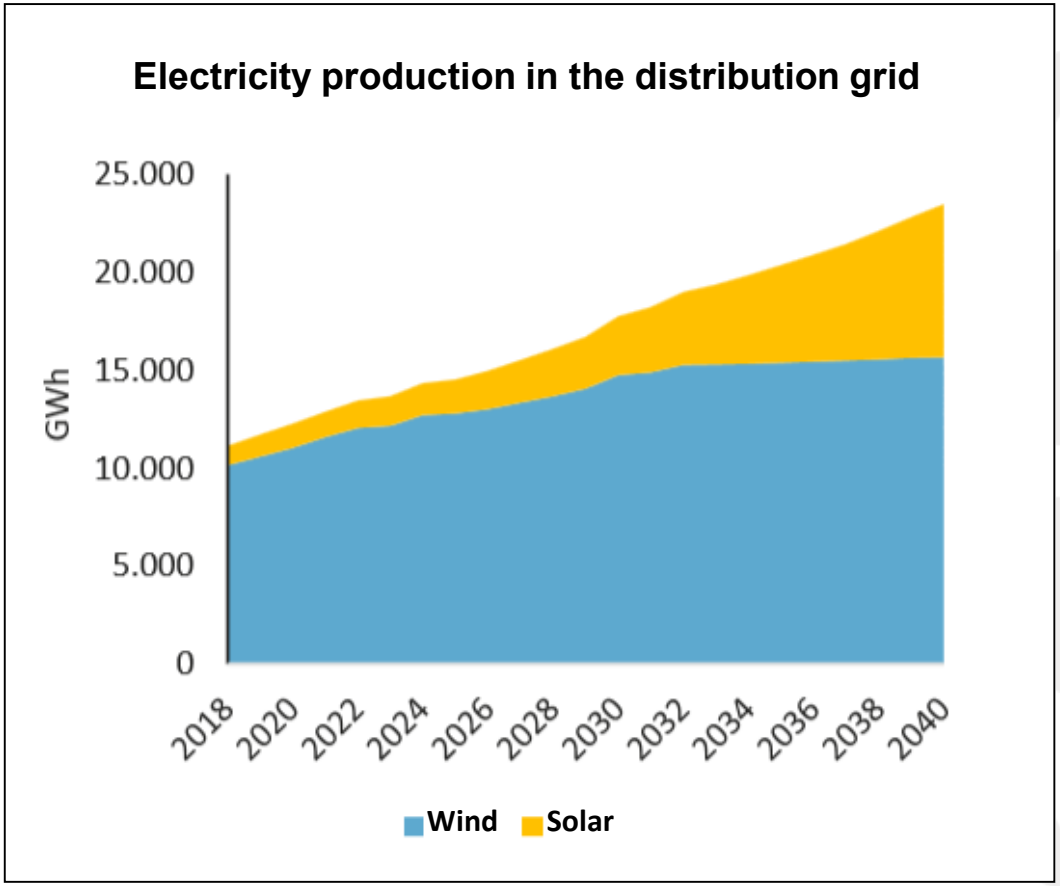


Source: Energy Concept 2030 (Energinet.dk)

Business cases for Flexibility in Buildings

- No real market for flexibility in buildings to help balance the future overall Danish electricity system to be expected
- Energy efficient buildings and oversize individual heat pumps can be disconnected in hours with very high electricity prices
- The situation is very different for the electricity grids and their future challenges than for the overall energy/electricity system
- The household costs for electricity and for transport of electricity is at average at the same level
- Here we can expect a future role and a market for flexibility in buildings helping solving (local) problems in the distribution grid

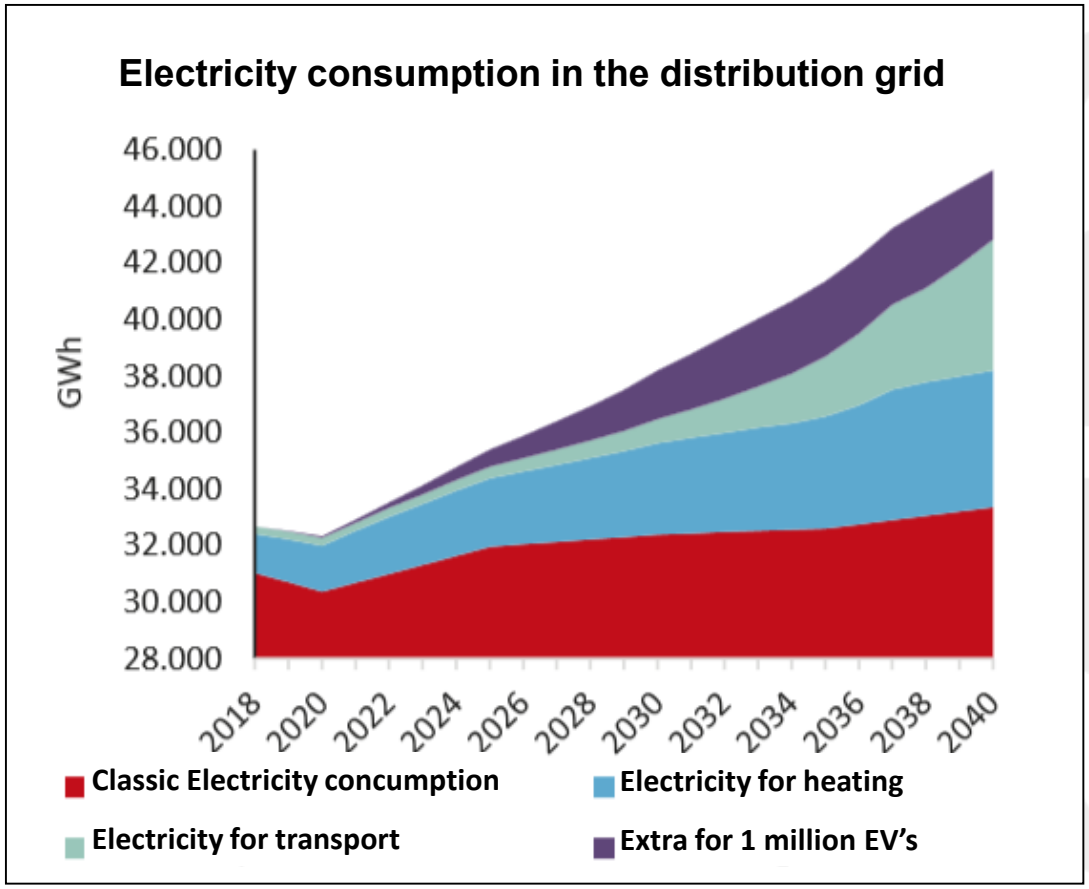
The Future is Electrification



Source: Danish Energy Agency 2018 and calculations done by Danish Energy 2018

Source: Electricity Grids for the Future, Danish Energy 2018

The Future is Electrification



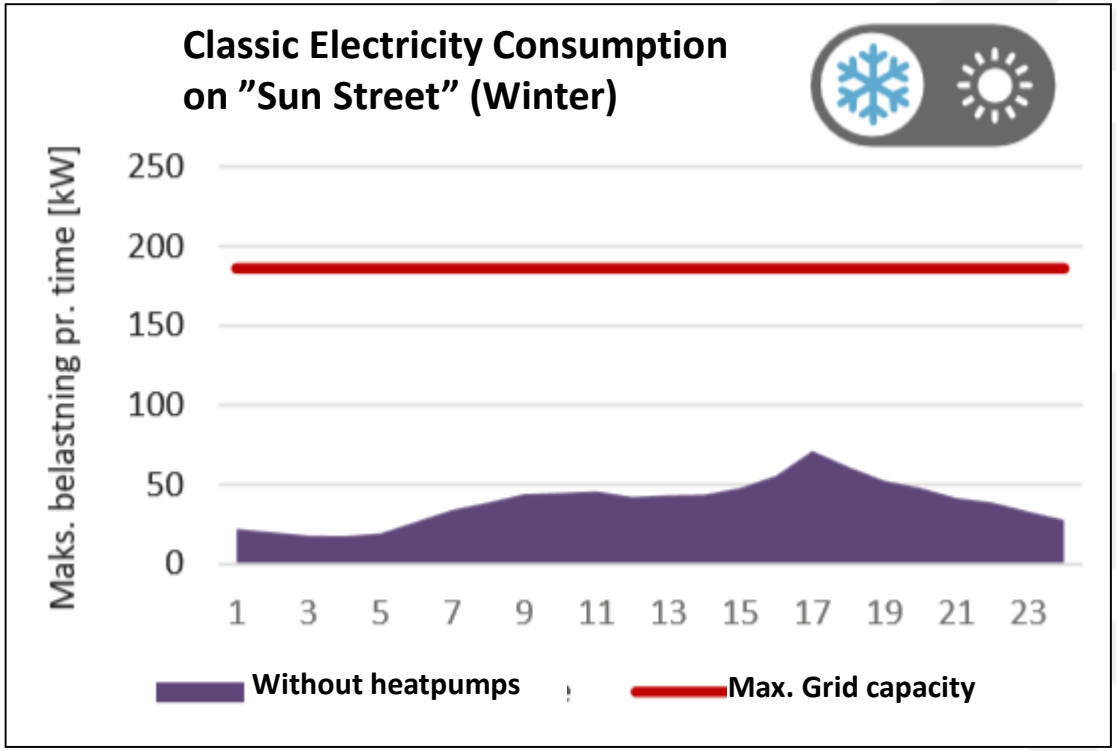
Source: Danish Energy Agency 2018, the Government 2018 and calculations done by Danish Energy 2018

Source: Electricity Grids for the Future, Danish Energy 2018

”Sun Street”

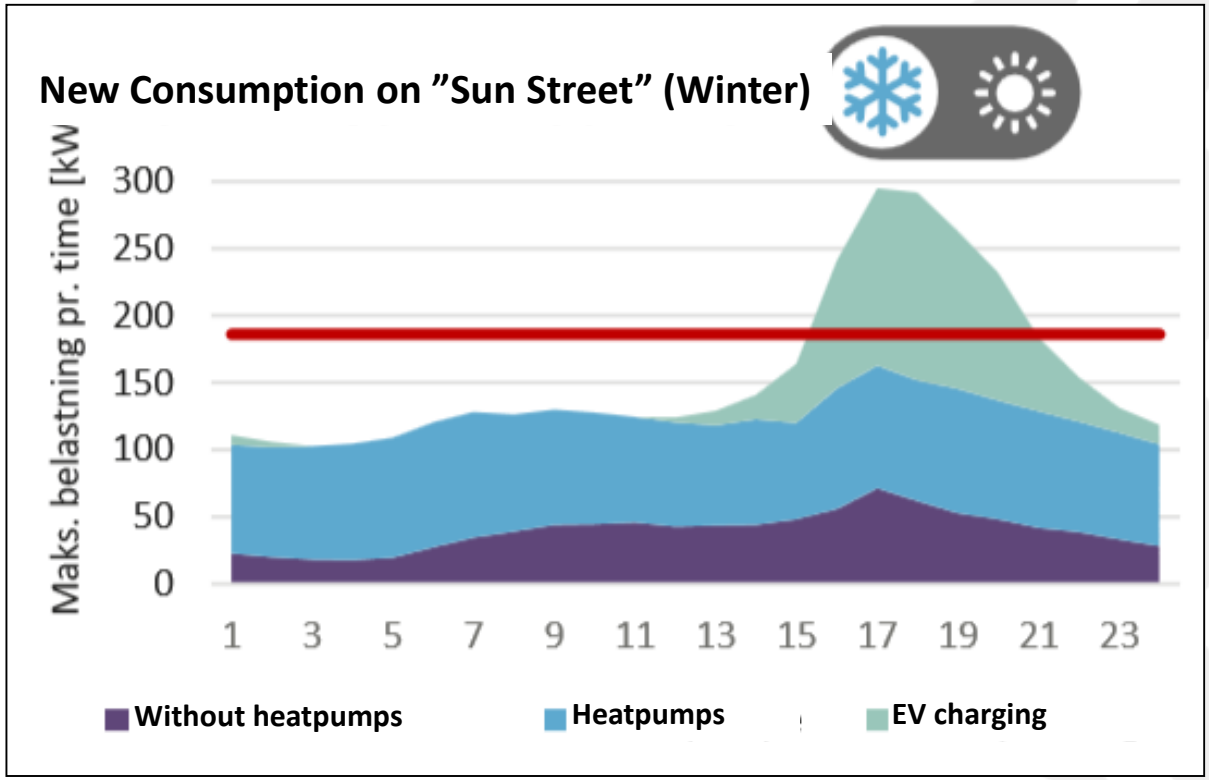
- The Classical Danish situation where 48 households share the same local grid
- There are 1.1 million households with weak grids dimensioned between 1960 and 2000 – and 0.1 million with stronger grids

No Problems today



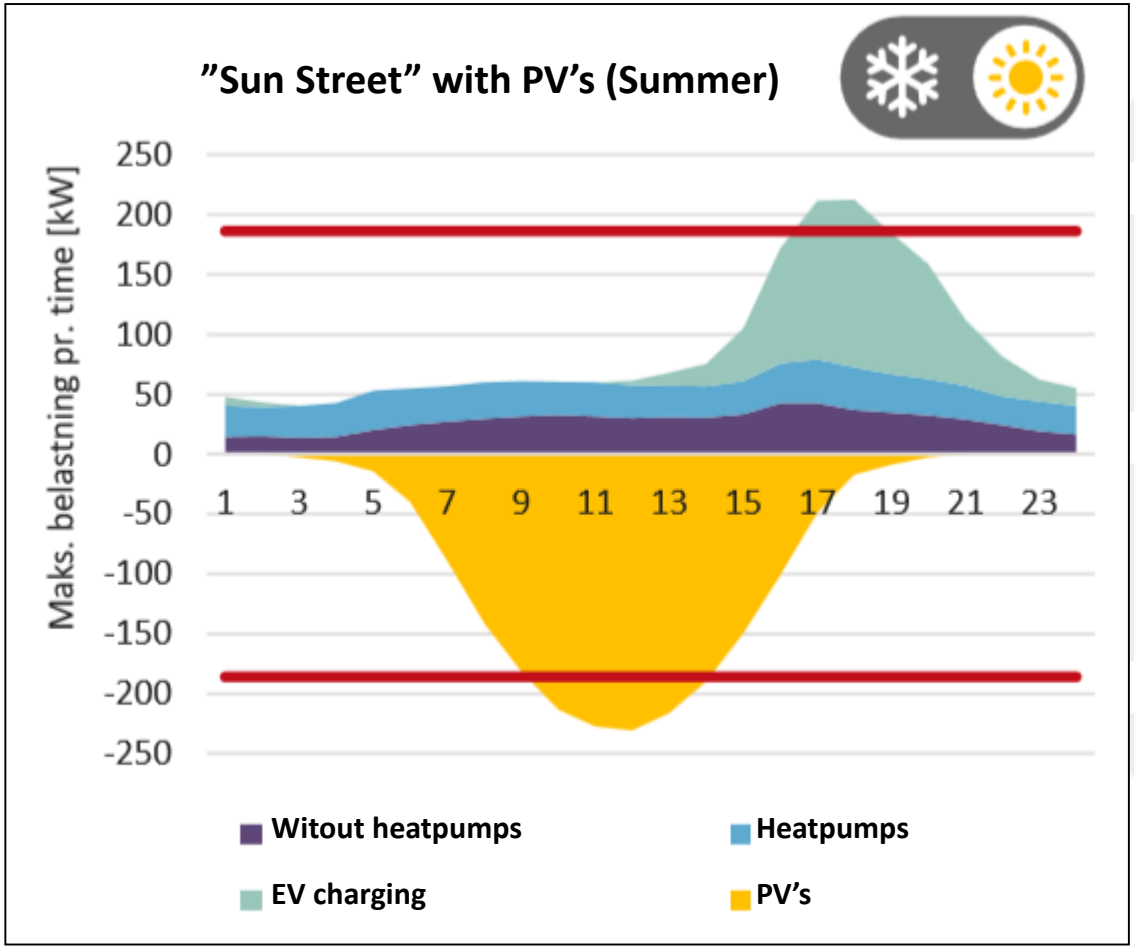
Source: Electricity Grids for the Future, Danish Energy 2018

Heat Pumps and Ev's Introduce Problems



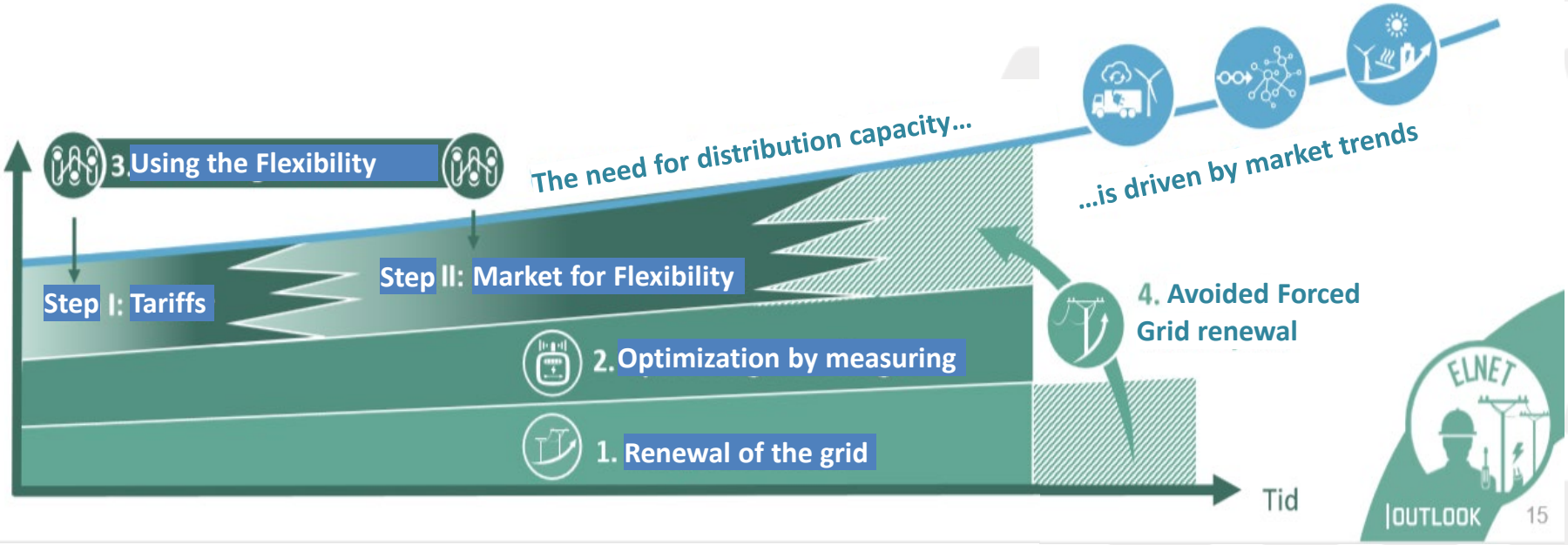
Source: Electricity Grids for the Future, Danish Energy 2018

Prosumers may also create Problems



Source: Electricity Grids for the Future, Danish Energy 2018

Where Flexibility is Needed to Minimize Costs



Source: Electricity Grids for the Future, Danish Energy 2018

Business cases for Flexibility in Buildings

- Flexibility in buildings can in the future play an important role solving dynamic local balancing problems in the (local) grid
- Especially the use of EV's, heat pumps and PV's will be important flexible element
- Tariffs is expected to be adjusted to help reduce overload
- Two kinds of flexibility functions for buildings to be expected:
- 1: To avoid paying future high tariffs and high electricity prices
- 2: To enter a future market for local just-in-time flexibility

New tariffs in electricity distribution grids?

1. Basic annual payment for the power effect used or reserved from the grid at the most critical times
2. Payment by kWh used - differentiated according to the actual “congestion” in the grid
3. Payment by kWh produced to the grid – differentiated according to the effect for the balance in the grid and the congestion of the grid
4. Premiums and/or markets for upholding the capacity/frequency mainly in the outer ends of the grid

- Annual meter charge

District Heating Flexibility Markets?

- More than 60 % of Danish buildings are heated collectively by district heating systems
- Physics are very different between electricity grids and district heating systems – Electricity grids needs action in seconds if melt down to be avoided – district heating grids don't
- Large heat pumps powered by electricity (and possibly green gas) in the future in the district heating systems can provide potentials for both flexibility and cheap storage benefits
- Will the positive incentives for the collective district heating to be flexible trigger incentives for flexibility in individual buildings?

District Heating Flexibility Markets?

- Cost drivers in district heating is the amount of hot water needed at a specific critical time (morning peak) at a specific temperature
- If you can manage to heat your building needing less effect, needing lower temperature, cool the return water efficiently and avoid peak hours by having a flexible building, you actually help the collective district heating systems to be more effective
- Do pricing and tariffs in district heating systems create incentives for providing these positive flexibilities in buildings?

District Heating Flexibility Markets?

- Most district heating system charge a rather high fixed flat rate per m^2 of heated area in the building = No incentive to be neither energy effective nor to be flexible
- Some district heating systems offers a lower connection charge and a lower fixed payment per m^2 for new energy efficient buildings = Incentive to construct energy effective buildings – none to be flexible
- Many district heating systems charges extra for bad cooling of the district heating water – and rewards for good cooling = Incentive to have good heating system – none to be flexible

District Heating Flexibility Markets?

- No district heating systems charges different prices reflecting the actual costs for producing the heat (summer or winter) – one is considering = No incentive for flexibility
- No district heating systems charges you for requiring higher temperatures of the district heating water in winter times = No incentives for flexibility reducing the need for high temperature
- Some district heating system has a lower charge per MWh if you take the heat from the return pipe, with temperatures of 40 – 50 degrees Centigrade = Incentive for being energy efficient and reducing the temperature need

District Heating Flexibility Markets?

- No district heating systems charges extra for using district heating water in the morning peak hour = No incentives for flexibility
- The answer to the question is NO – district heating pricing do not in general reward individual buildings for being flexible
- District heating payments and tariffs might need to be changed in line with the electricity tariffs

DET ØKOLOGISKE RÅD

Fremtidens miljø skabes i dag

BLEGDAMSVEJ 4B · 2200 KØBENHAVN N · 33 15 09 77 · WWW.ECOCOUNCIL.DK · INFO@ECOCOUNCIL.DK