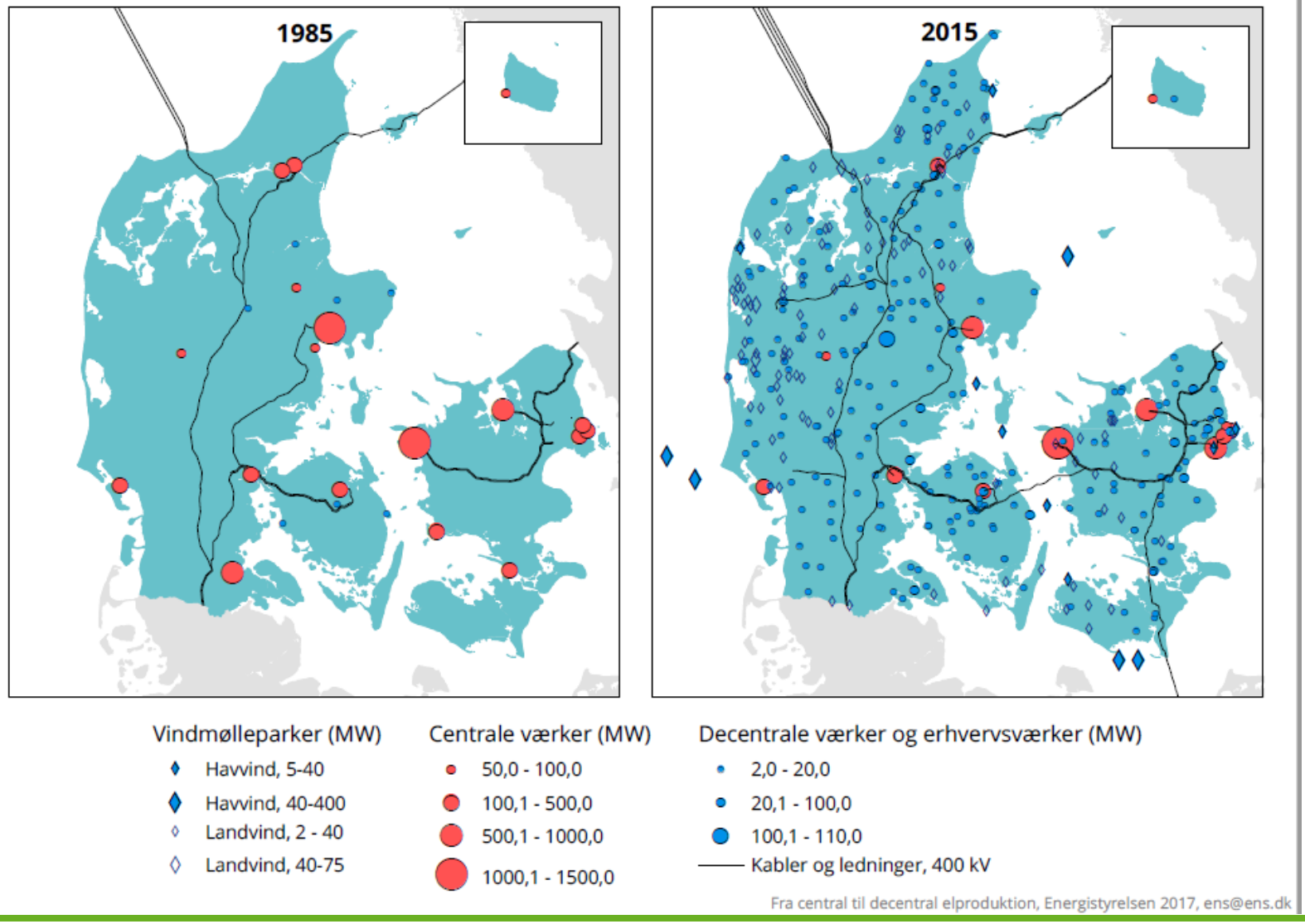
PlanEnergi

Role of District Energy in Decentralization of Energy Supply in Denmark

Power Supply System, Denmark



National Energy Planning

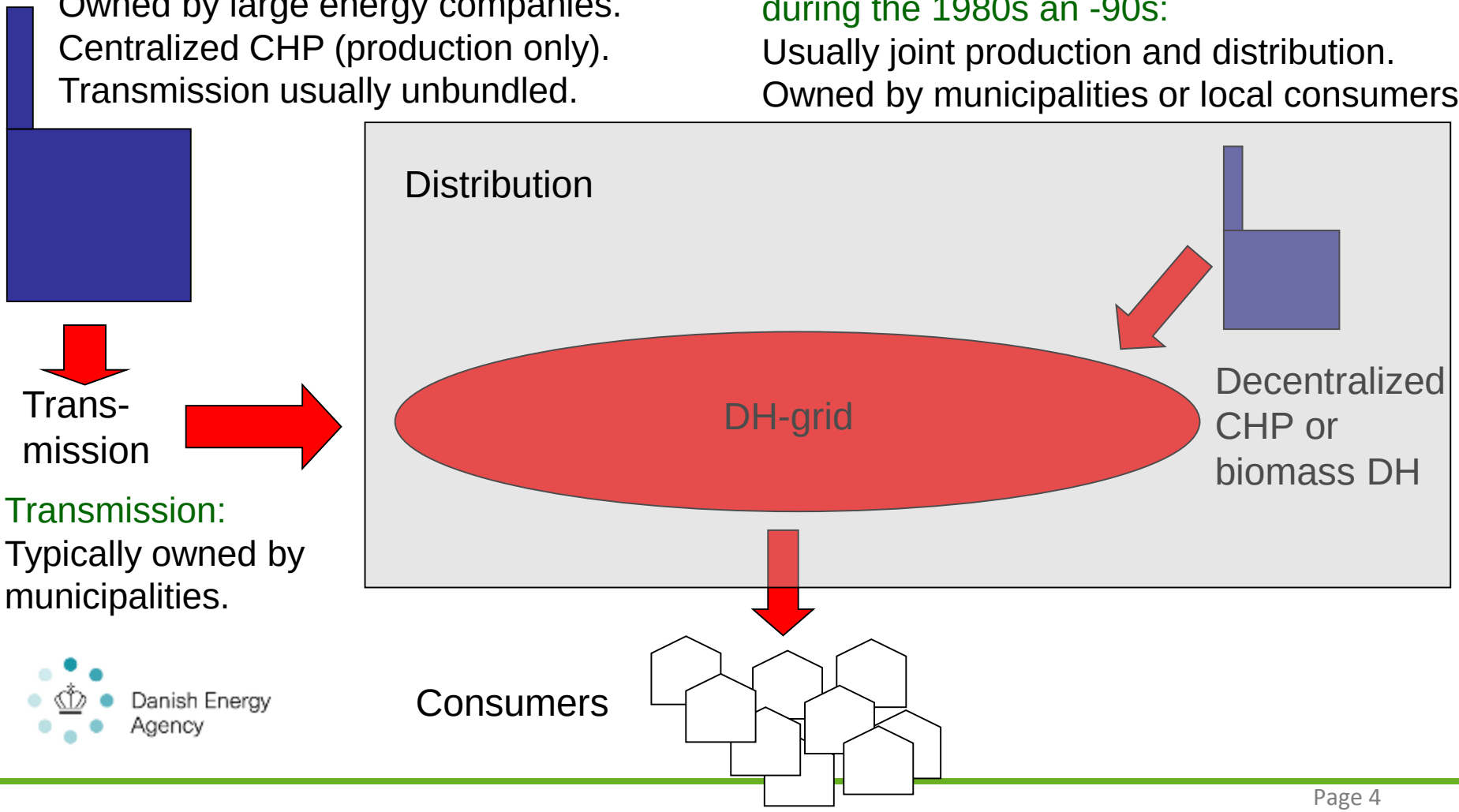
Green Fuels + CHP as technology

- Heat planning promoted green solutions by administrative decrees in 1990-1998:
  - New and existing district heating supplies should be Combined Heat and Power plants, if recommended by feasibility study. Very energy efficient technology
  - From oil and coal → natural gas and biomass
- CHP contributed ¾ of new power capacity from 1990-97.
- Municipality as Heat planning authority in the 1990's and today. Strong national guidelines for local decisions.
- Conversion to electrical based energy system 2010-2030

Organisation/local ownership

Large cities (originally power plants):
Owned by large energy companies.
Centralized CHP (production only).
Transmission usually unbundled.

Smaller centres (originally DH plants/CHP) during the 1980s an -90s:
Usually joint production and distribution.
Owned by municipalities or local consumers



Transmission:
Typically owned by municipalities.

Danish Energy Agency

Energy Planning – local/regionally

- A: Zero line – Data Collection, where are we?
  - Energy consumption – power, heat, fuels, transport
  - Energy ressources – fuels, renewable energy, excess heat
- B: Setting targets – where do we want to go
  - Environmental – CO_2, NOx, particles
  - Economical – import, local supplies
- C: Planning – How do we do?
- D: Corrective activities
  - Follow-up – standardized data collection

Local Energy Planning

District energy in long-term planning of urban development

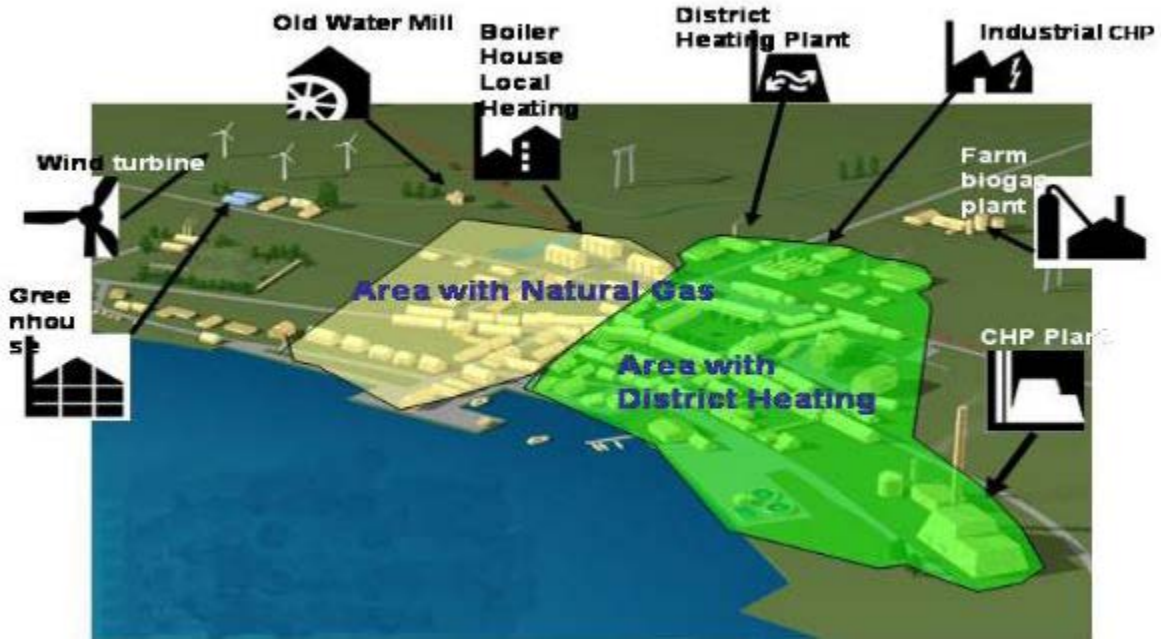
- Planning of DHC as for other infrastructures
  - (Power, water, sewage, gas)
- Planning of urban development
  - Location of residential and commercial areas
  - Location of energy production plants
  - Facilities with excess heat
- Design and requirements for new buildings adapted to DHC
  - Low-energy not zero-energy
  - Prepared for low-temperature

Heat Supply Zones

Danish Energy Agency

PlanEnergi

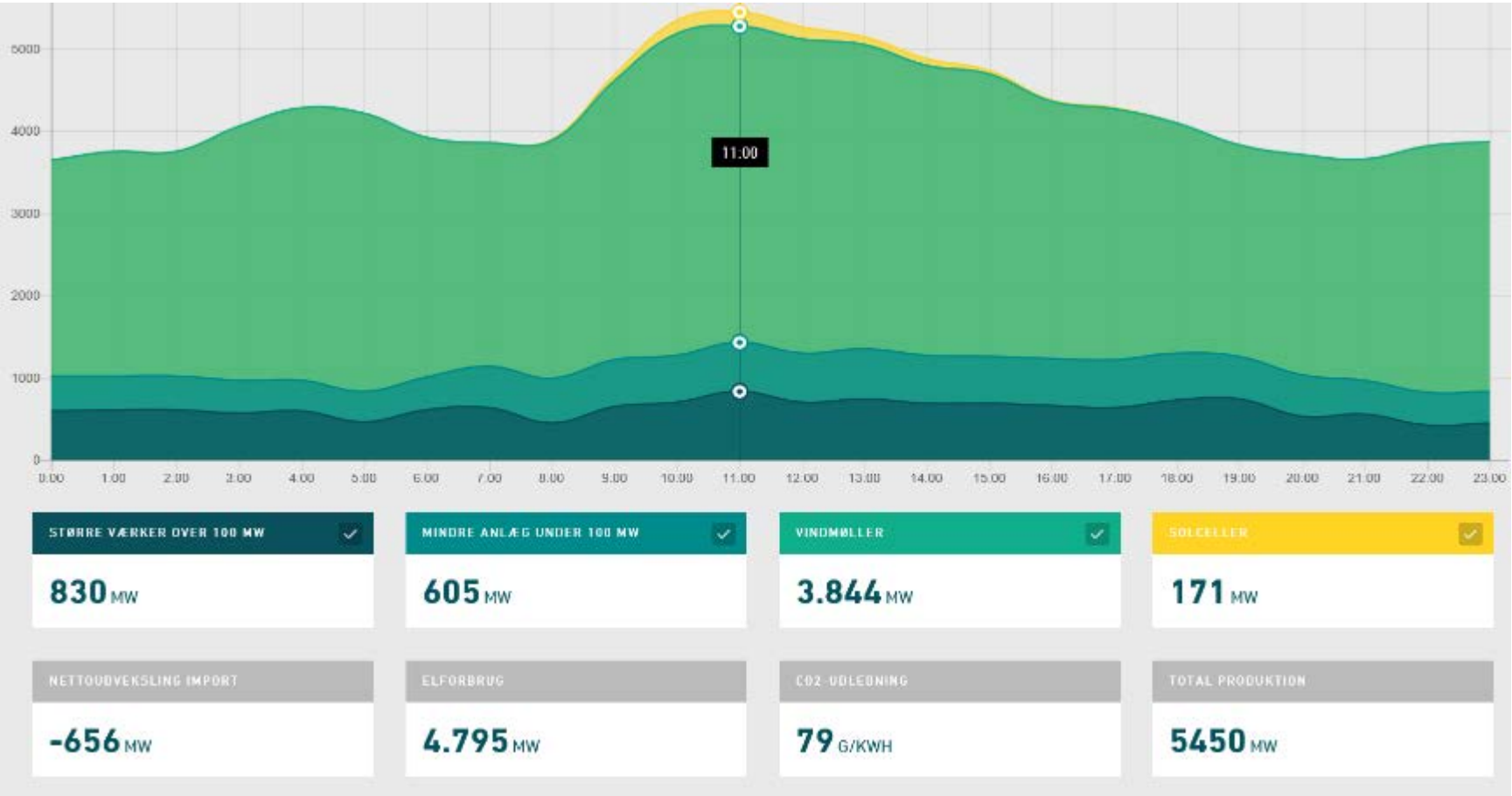
- First Heat Supply Act introduced supply zones all over Denmark. Secures economy of scale and optimal use of capacity. Preliminary zones in 80's, finally established in 90's.



World Bank citation: Supply zones can make DH compete with individual heating to the benefit of lower consumer prices

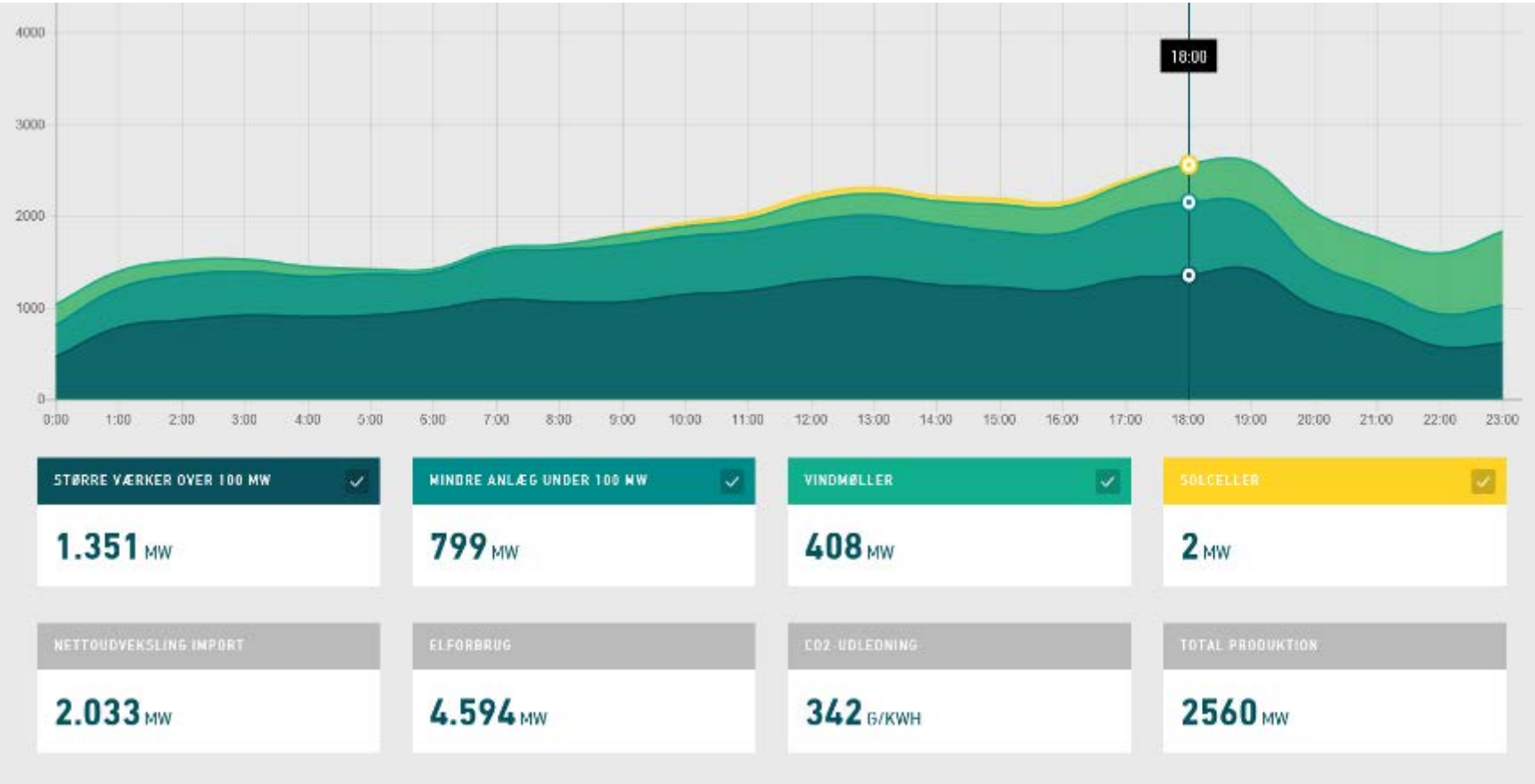
Power supply system 2019

October 11th – high wind-production



Power supply system 2019

October 16th. low wind-production



Integrated local energy plant, example

- **Braedstrup Total Energy**
  - **Heat production (– Power production**
  - **Heat Storage – function as power balancing unit**
  - **Power consumption**

Production facilities

- Solar collector area of approx. 18,600 m^2
- Borehole heat storage (BTES) of approx. 19,000 m^3 heated soil ($\sim$ 8,000 m^3 of water equivalent)
- Tank storages (2,000 m^3 + 5,500 m^3 $\sim$ 400 MWh)
- Electric HeatPump (6 MW_{th})
- Electric Heat Only Boiler (10 MW)
- Natural gas CHP (2x 3,7 $MW_{electr.}$ 2 x 4 MW_{th})
- Natural gas Boilers (13,5 MW_{th})

Energy Planning tools and examples

- DHAT
- https://ens.dk/en/our-responsibilities/global-cooperation/district-heating-assessment-tool-dhat

- Hotmaps
- https://www.hotmaps-project.eu/

- Planning and designing Energy Production Plants
- https://www.emd.dk/software/, EnergyPro, WindPro

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Thank you for your attention

PlanEnergi – Company Presentation

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History

- Idea: Creating an independent consulting firm to supply competent advice concerning all forms of renewable energy and energy efficiency solutions.
- Established in 1983.
- Purpose:
  "To promote the use of resource-saving and environment protective systems. The objective will be furthered through commercial and information activity within renewable energy, rational exploitation of energy and energy planning as well as information activities".
- Independent consultancy.
- Non-profit fund (a self governing business institution).
- 40 employees.

Business area

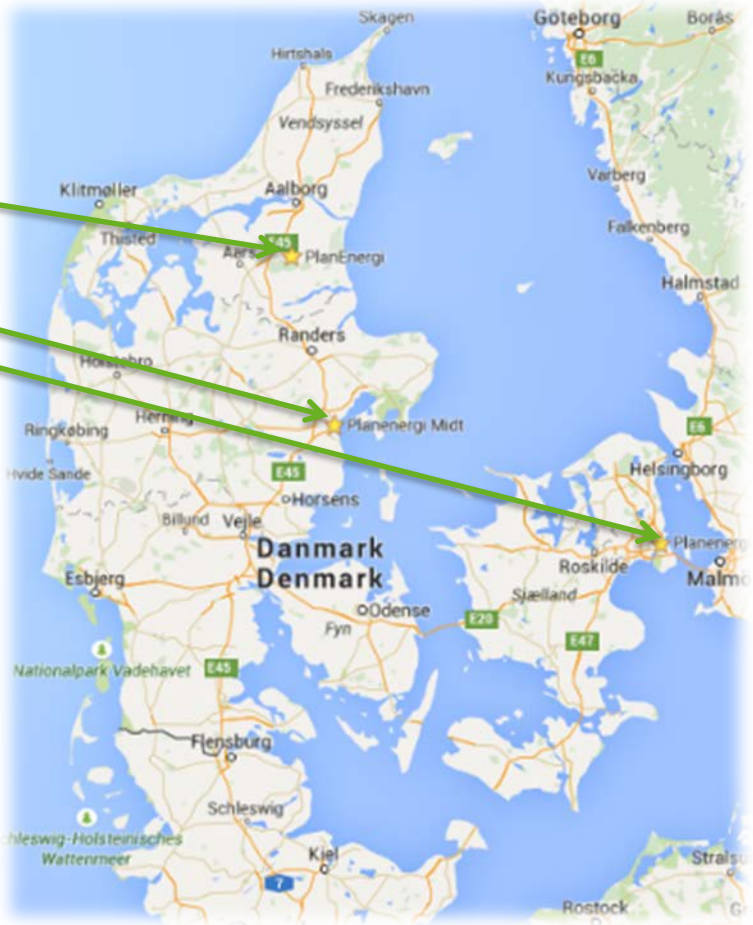
- PlanEnergi specialises in the development and creation of customised environmental solutions within renewable energy, rational energy use and energy planning.

- Main work areas:
  - Energy planning – Heating, cooling, transportation, industrial
  - District heating based on renewable energy

    solar thermal, seasonal storage, heat pumps, biogas, biomass, industrial waste heat etc.
  - Combined Heat and Power, heat only production and district heating networks
  - Combined heat and cooling, district cooling
  - Biogas – planning, design, project planning and general consultancy
  - Wind – planning, mapping, installation pattern and EIA with visualisations
  - Technology development
    - Power to heat/heat to power, H_2, Methanization, Energy Storage technology

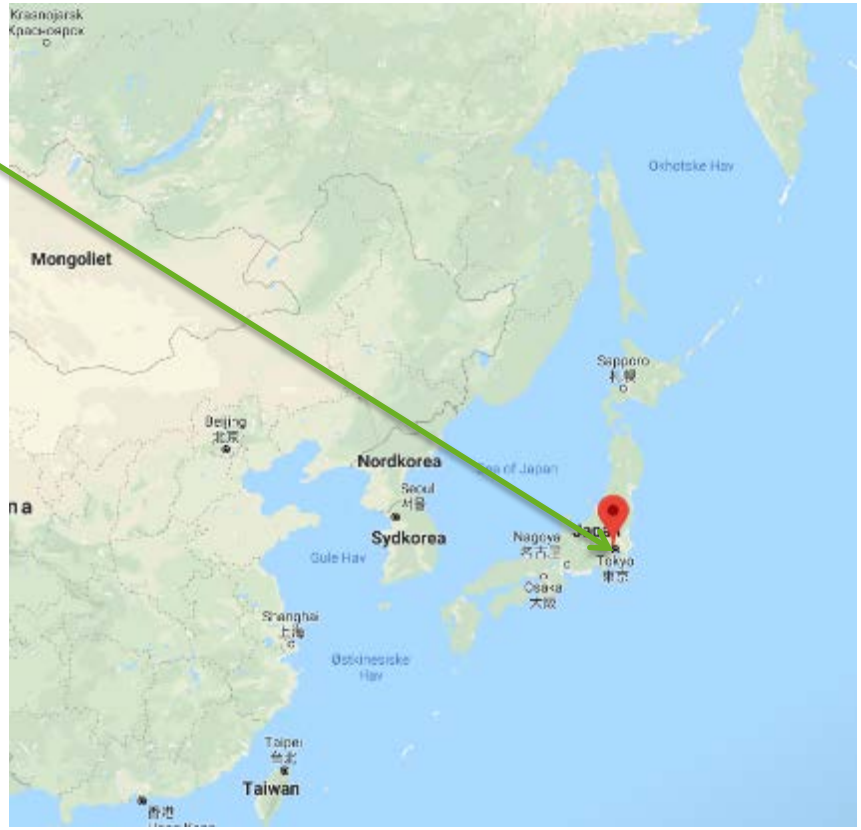
Locations

- Offices in
  - Skoerping
  - Aarhus
  - Copenhagen
- Location of tasks…



Locations

- Subsidies
  - PCE - PlanCommunityEnergy
    - Samsoe Energy Academy (DK)
    - ISEP (JP)
    - PlanEnergi (DK)
- Location of tasks…
  - Japan
  - Asia



References – International activities

4DH

celsius smart cities

CHESTER

CooHeating.eu

ECES Annex 28 DESIRE

FLEXYNETS

Heat Roadmap Europe

SHC

IFC
IFC International Finance Corporation Verdensbanken

JRC Joint Research Centre

SDH solar district heating SDHp2m

smarter city

SmartReFlex

References

Energy planning locally…

…and in large scale e.g.

- Heat Roadmap Europe:
  - DH not only relevant for northern Europe.
  - Mix: DH + HP + heat savings.
  - We should implement heat savings until the price of sustainable supply is less than the marginal price of additional savings
  - www.heatroadmap.eu

Samsoe Island
Strategic Energy Planning

References, selected items

Solar District Heating – SDH and seasonal Storage

Long Term Storage and Solar District Heating
Marstal DH, Dronninglund DH (front page picture), H.Taastrup,
Tibet, Austria, France

District Heating Heat Pumps (selections)

- **Broager**: 4 MW_{th}, heat source: ground water, combined with solar heating and gasfired CHP
- **Roedkaersbro**: 1,6 MW_{th}, heat source: waste water from diary. Combined with CHP (Natural and biogas)
- **Stoevring CHP Plant**: YouTube direct video: 8,7 MW_{th} , heat source: ambient air.
- 2 Mycom Electric driven compressors

Biomass

- **Oester Hornum:** 3,1 MW Heat Only Boiler for straw,
- **Gelsted:** 4 MW, Heat only boiler for wood chips
- **Vegger Biogas Plant:** 5.000.000 m^3 biogas/ year. – CHP and heating for DH and Diary

Dronninglund SDH

- 35.000 m^2 solar panel
- 60.000 m^3 seasonal storage (water pond 5-90 °C)