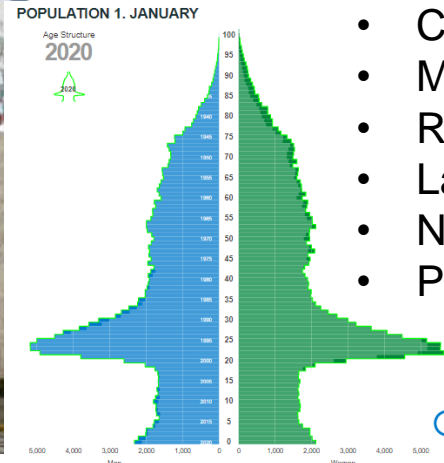


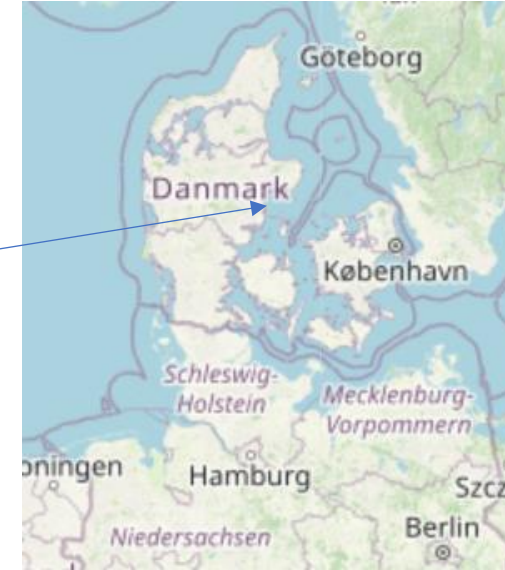
Postcards from Aarhus 2021

mostly about heat- and energy planning



- Denmark

- 5,8 Mio. inhabitants
- Capital = Copenhagen (1 Mio.)
- Social Democratic Party = PM
- Member of EU (50% like it)



- Aarhus

- 350.000 inhabitants
- Second largest city in Denmark
- From Vikings to students
- University of Aarhus
- Regional University Hospital with 10.000 employed
- Harbor and a very small airport 40 km outside the city
- City growth = 3.000 inhabitants every year
- Mayor from the Social Democratic Party - election in 10 days
- Railway Station and new light rail
- Large net of busses, 30% already on electricity
- No. 8 in the national football league, no. 1 in basket
- Population pyramid with many students



Short presentation

Søren Peter Sørensen



- Grew up in Nordslesvig – border district, absolute Danish
- But *nach der Wende in 89* often in Berlin and Hamburg, also Bremen, Heidelberg, Freiburg, Alsace
- Latest visit to Berlin 2 weeks ago – today huge respect for how the Germans deal with their history.
- Cand. Scient. in geography, 67 years
- **Heat Planner** at the regional level from 1981 – 1988
- Chief for the technical department in a small municipality (12.000 inhabitants) 1988-2003
- Chief for the technical department in the city of Silkeborg (90.000 inhabitants) 2003-2018
- No longer chief, but..
- **Energy planner** from 2019 in the municipality of Aarhus (325.000 inhabitants), a kind of come back.
- Living on a small farm outside the city with cattle in the summer (8,3 hectares-4 is forest)
- Converting from and old oil burner to heat pump (geothermal heat), existing heat boiler based on wood and the heat accumulation tank remains, total costs about 17.000 euro, probably 3.600 euro from the government. New oil- or gas-burners is **not** allowed in Denmark.
- Electric capacity must be upgraded to the heat pump and 2 electric cars (2-300%)

email: mojnsps@icloud.com



The Danish Climate Act

[Climate Act \(kefm.dk\)](https://kefm.dk)

Link to an unofficial translation.

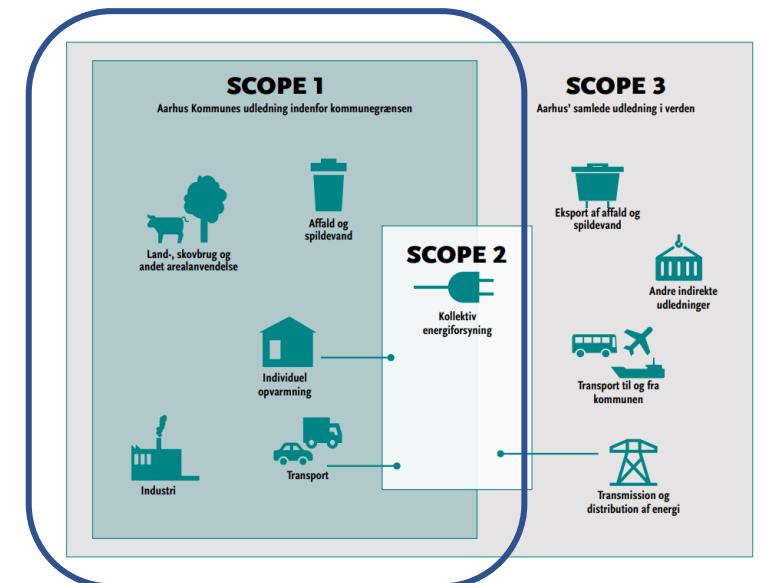
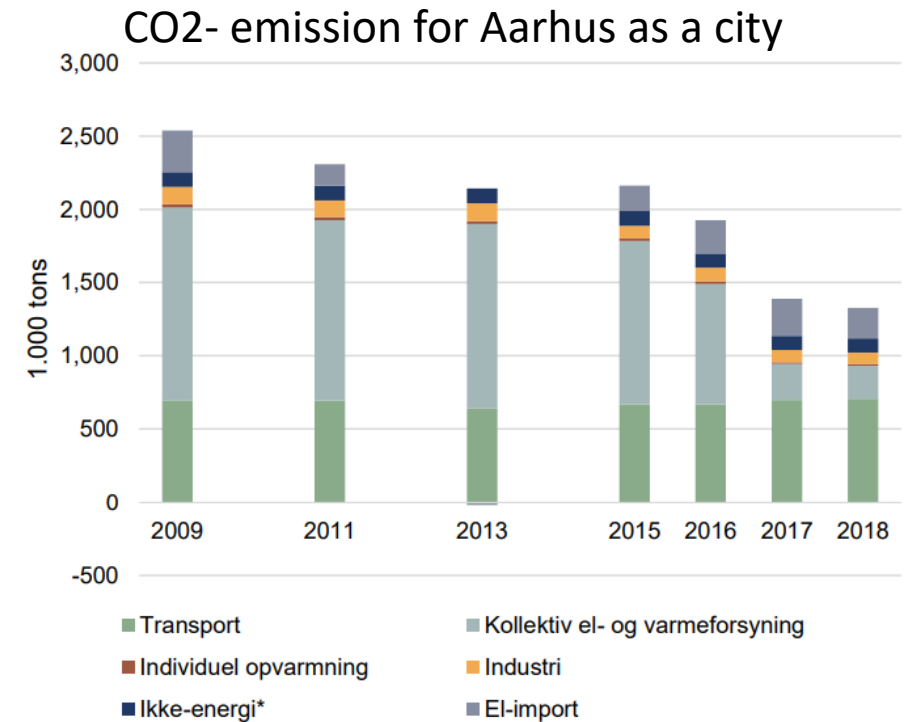
- *The purpose of this Act is for Denmark to **reduce greenhouse gas emissions in 2030 by 70%** compared to the level of emissions in 1990, and for Denmark to achieve a **climate-neutral society by 2050 at the latest**, taking into account the Paris Agreement target of limiting the global temperature rise to 1.5 degrees Celsius.*

- Danish Ministry of Climate, Energy and Utilities since 2007 [Home | en.efkm.dk \(kefm.dk\)](https://en.efkm.dk)
- The Danish Climate Act is a direct result of the national election in June 2019
- Broad political agreement confirmed in Dec. 2019
- 13 different climate partnerships gave in spring 2020 *Recommendations to the Danish Government*
- Climate Act passed in the Danish parliament (Folketinget) in June 2020.
- Autumn 2020 the Government formed the Danish Council on Climate Change (DCCC) Link to The Danish Council of Climate Change [Klimarådet \(klimaraadet.dk\)](https://klimaraadet.dk)
- 2021 political settlements on different topics – the negotiations about the agricultural sector reached a result 3 weeks ago.
- March 2021 the DCCC criticized the *hockey stick* – *an image of the main approach from the Government: let's wait with most efforts to 2029, maybe it would be easier*



Climate goals and topics in Aarhus

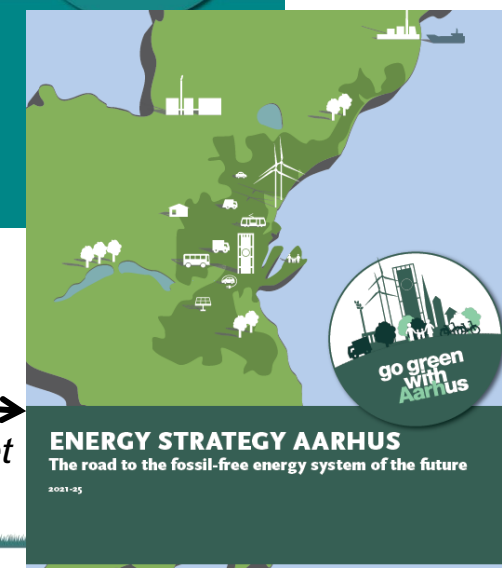
- Aarhus CO₂ neutral in 2030
(more ambitious than the national Climate Act: 70% i 2030)
 - The geography / the city
 - The municipality as a "company"/organization
- So far, we only consider Scope 1 & 2
- "CO_{2e}-gab" i 2030 = 600.000 tons CO_{2e} /year.
- Transportation is the challenge in Aarhus
 - Electric cars, busses, trucks?
 - Charging stations.
 - Many city planners don't like cars in the city at all
 - Compensation from outside like sea-based windmills?
 - Life cycle analyzes in building permits from 2023
 - Carbon Capture and storage?



4 new official Climate Plans in Aarhus

Our City Council is very, very ambitious.
These 4 plans were confirmed in May 2021
The City Council have granted 13-14 Mio. euro in 2020
and 14-15 Mio. euro in 2021 to climate projects and activities.

- Climate Strategi 2020 - 2030
- Climate Action Plan 2021 – 2024
- Catalog with 65 projects 2121 - 2024
- Energy Strategy



*3 plans are not translated to English or German – yet
The Energy Strategy is just translated to COP26*

Reflections about energy and CO₂ in local planning process – a necessary approach



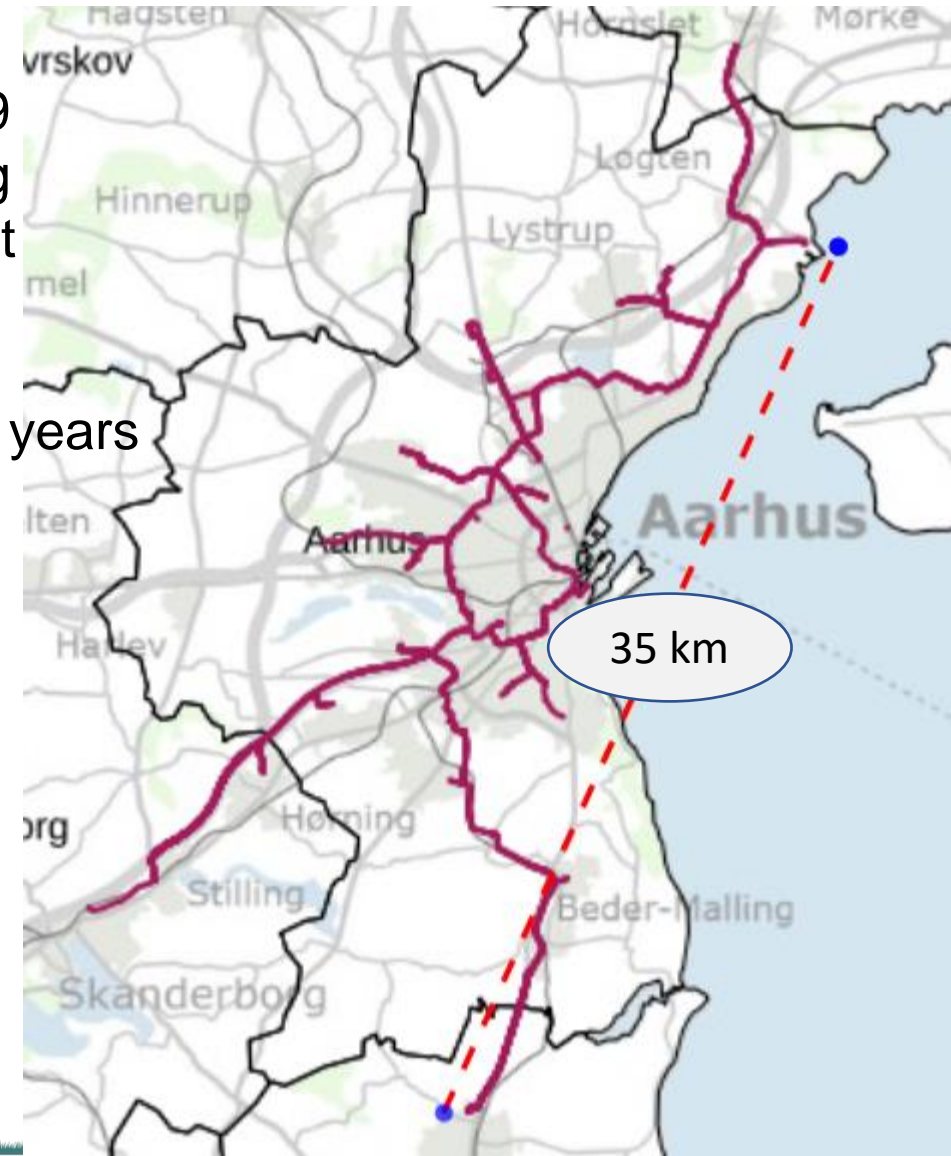
*Methods and calculations are not new, but nobody make these reflections in Denmark today.
The planners are a lot more interested in **aesthetics**.*

- Energy
 - Determine the **energy frame** for the building
 - Calculate the total gross-energy needs for
 - District heating and/or
 - Heating Pumps
 - Determine the main energy supply
 - Calculate the total gross-energy needs for electricity including households and electric cars 100%
 - Consider reserving space to energy plants like bigger heating plants, or electric pipes and transformation plants, solar cells and maybe also local batteries
 - Calculate the total the energy consumption in the new district and calculate CO₂ emission from energy
 - Maybe also calculate emission of CO₂ from the building process (Life Assessment Analysis LCA)?
- Other topics
 - Photovoltaic potential on the rooftops
 - Charging structure for electric cars
 - Reserving parking spots (only?) for electric cars?

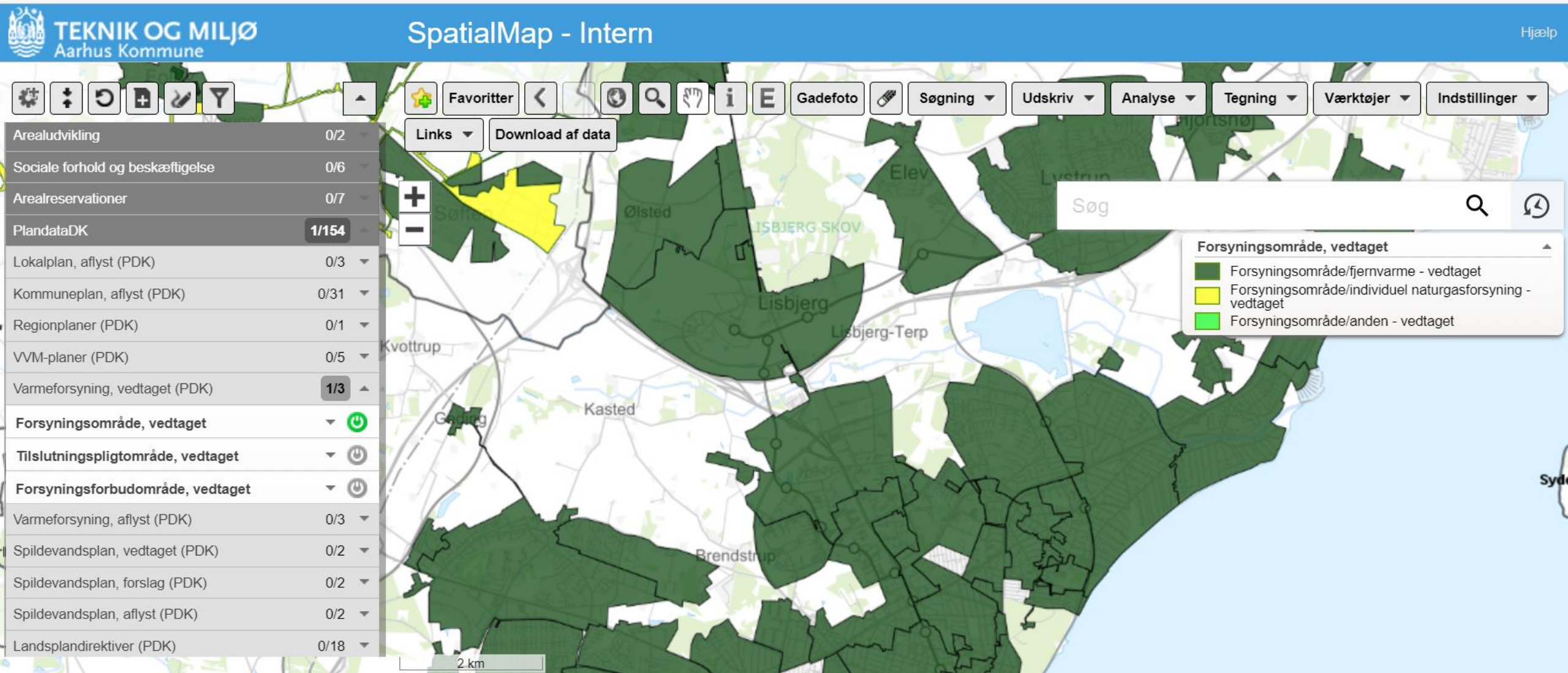


Energy Plan

- 90% are connected to district heating in Aarhus
- Mainly based on biomass (tree from overseas, local waste)
- *Connection obligation* is no longer a legal possibility since 2019
- Heat pumps are becoming strong competitors to district heating
- Heat pumps are more energy-effective, but noisy and they don't contribute with any kind of outdoor aesthetics
- Aarhus is preparing a new Energy plan showing
 - where district heating is an option for the next 2,3,5 and 10 years
 - where heat pumps are the only solution
- Assessment of the need for electricity to
 - Consumption in all the households
 - Heat pumps
 - Charging all electric cars in 2030
- The photovoltaic potential
- The energy potential from windmills
- The energy potential from surplus heat



Our energy plan - preview



Municipal energy plan for Aarhus

- 15 – 20 new layers in our electronic map system - look at [SpatialMap 4.2.1 \(aarhuskommune.dk\)](https://www.aarhuskommune.dk/SpatialMap/4.2.1)
 - Existing energy supply for every building (Housing and Building Register, look at [BBR](#))
 - Approved, but not realized energy projects (district heating)
 - Districts with existing connection obligations
 - Dividing the whole municipality in energy districts with homogeneous energy supply.
 - Proposing heat supply for new urban planning areas 2022-2023
 - Proposing heat supply for new urban planning areas 2024-2026
 - Proposing heat supply for new urban planning areas 2027-2032
 - Proposing heat supply for new urban planning areas later than 2031
 - Proposing new and necessary plants and grids for the future electric system
- A short report with economic and technical assumptions, data sources, links and key figures
 - Heating needs in 3 (?) different types of houses (villas/row houses/apartment blocks)
 - Need for electricity to the household in different housing types
 - Need for electricity for heating pumps
 - Need for electricity for cars
- Other topics
 - Photovoltaic potential from existing rooftops, mostly large store/business/production buildings
 - Surplus heat potential from large shopping centers, IKEA, companies



Photovoltaics on the grounds

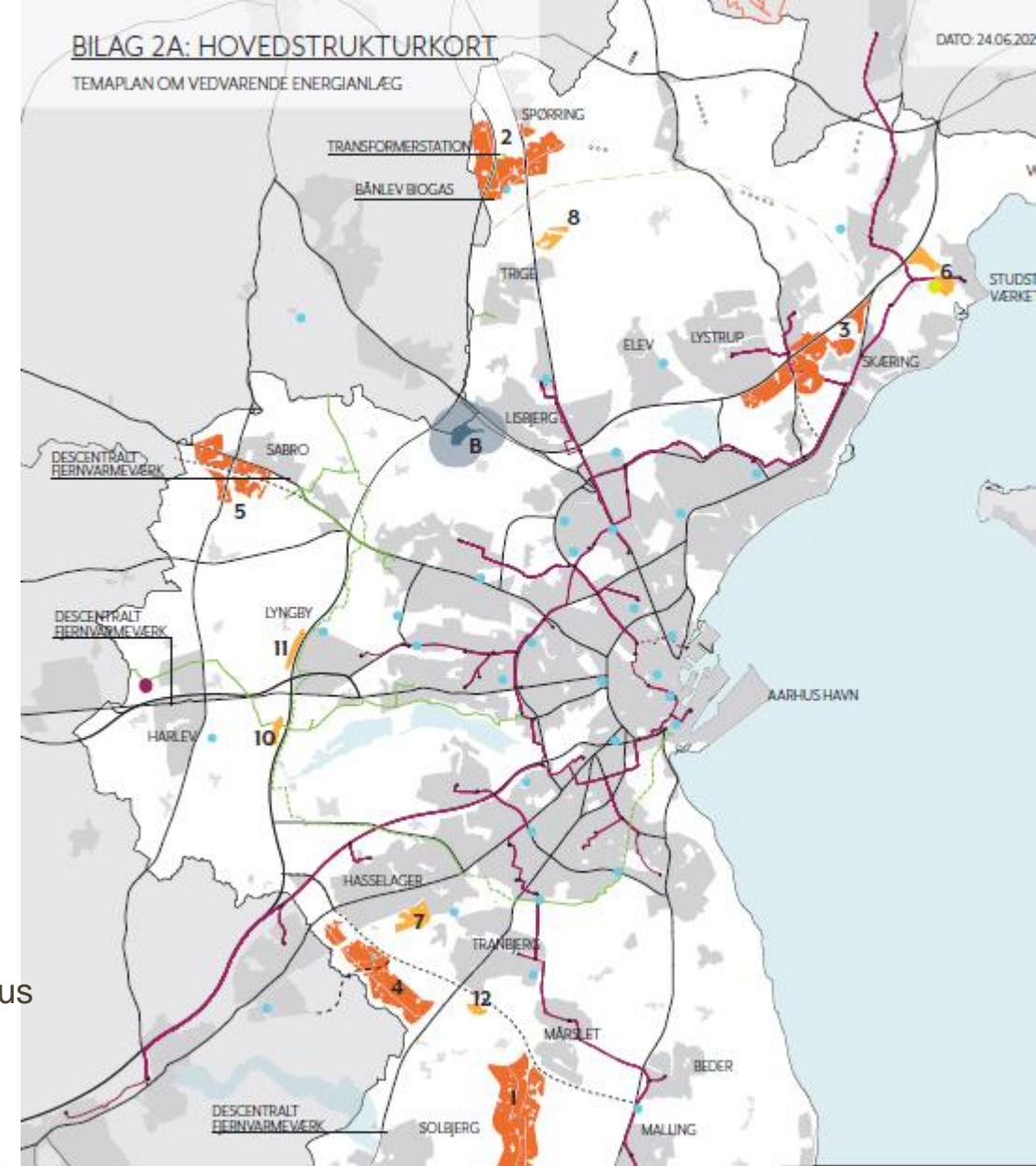
1 acre = 4047 m² = 0.40 hectares

1 hectares = 2,5 acres

- Today 600 hectares with PV in Denmark
- Applications for 24,000 hectares more in DK
- Creates national and local discussions and demands for a national strategi.
- Local plan for renewable energy in the municipality of Aarhus
 - 8 large windmills (3-5 MW each)
 - 1150 hectares with photovoltaic (1 hectare = 1 MW)
- No longer need for economic support to PV



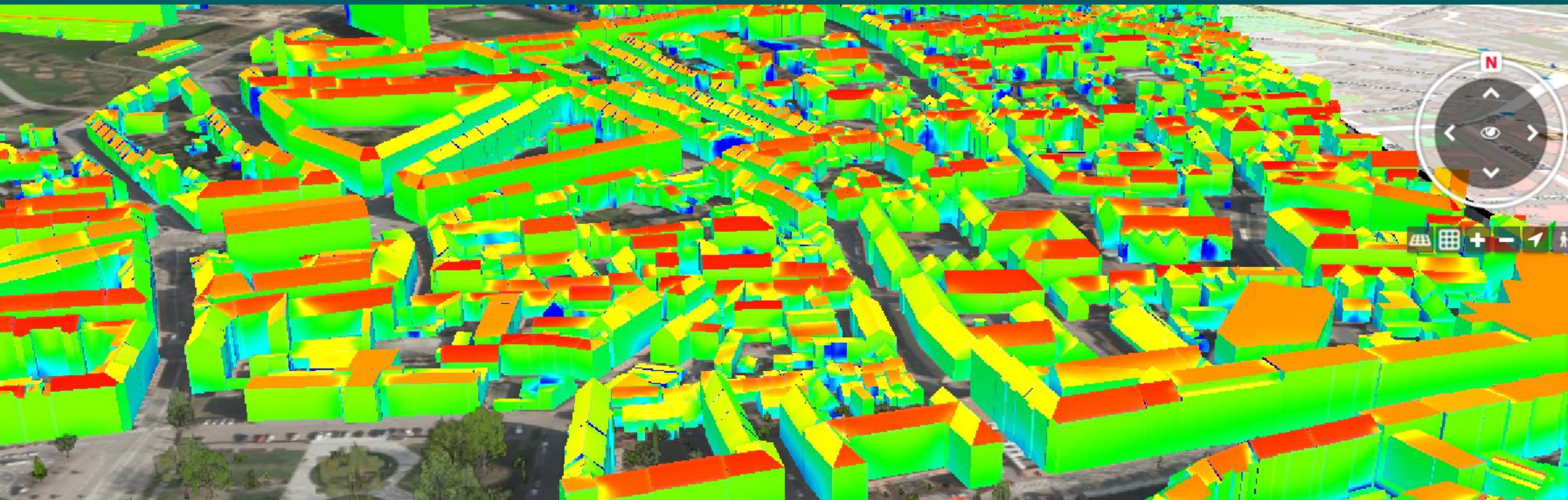
Plant of 100 acres 50 km north of Aarhus owned by Goggle, who also have another plant nearby in the same size.



Photovoltaics on rooftops – an IT-program like Goggle's Sunroof in USA

Aarhus is cooperating with a governmental department to develop a new digital tool:
Calculate total and local electricity production from existing and planned rooftops.

Look or click at the product from google [Project Sunroof](#)



Thanks for your attention and participation

- Denmark and Aarhus are small, means just a little in the global perspective
- We like the idea of being in the front, that others can learn from us.
but many papers and laws are NOT translated
- Currently we concentrate on *putting our own house in order*.
- Forgetting that most products and materials are coming from abroad (scope 3).
- In my view Denmark soon will have to adopt and find a majority for a public tax on CO₂ like the official *Danish Council on Climate Change* also have suggested
(building materials, energy, products, flights, meat...)
- Remove the ***hockey stick***
- Community elections 16. November 2021
- The months and years ahead will be filled with dialog, coffee, cake and cooperation

EXTRA: The main laws and regulations at the municipality level in DK

- Danish Planning Act
 - National Planning
 - Coastal and retail Planning
 - Metropolitan Planning
 - Regional visions
 - Municipality plans
 - Local Planning
 - Rural Area Administration
 - Climate adaptation: prevent flooding
- Building Act and Building Regulations
 - Energy Classes/frames, low energy houses
 - New sustainability Class voluntary 2021-2023 including Life Cycle Assessments
 - LCA mandatory from 2023 with a target for maximally (?) $8.5 \text{ kg CO}_2 / \text{m}^2 / \text{year}$
- Heat Supply Act
 - Collective heat supply facilities
 - Possibility for a comprehensive heat supply plan for the community
 - Approval of projects
 - Requirements for positive community finances
- Comments:
 - No legal demands for public heat planning
 - No legal demands for public electricity planning
 - No legal demands for public planning on climate mitigation
 - No legal grounds for connection obligation since 2018 to collective heat supply
 - No possibility to demand photovoltaic on rooftops

