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# The Importance of Temporal and Spatial Resolution When Determining Marginal Heat Suppliers in LCA Studies

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**Purpose:** Heating is a major cause of GHG emissions in Europe and globally. The EU has identified **district heating (DH)** as a key technology for the **green transition**. DH allows for using excess industrial heat and large-scale renewable technologies and enables smart energy systems to balance RE power production.

Therefore, DH is subject to radical changes in the coming years. The expansion of DH grids and conversion from fossil power plants to heat pumps and excess heat sources mean that the **life cycle impacts of heat consumption** will also change. In Denmark, 66% of households are heated by DH, meaning that the country is a global leader in DH implementation.

As DH is a planned system designed with overcapacity, changes in the production marginal do not happen as consequences of consumption but are instead based on policies and planning decisions. DH grids are local systems, and the impacts of moving consumption just a short distance can therefore vary greatly.

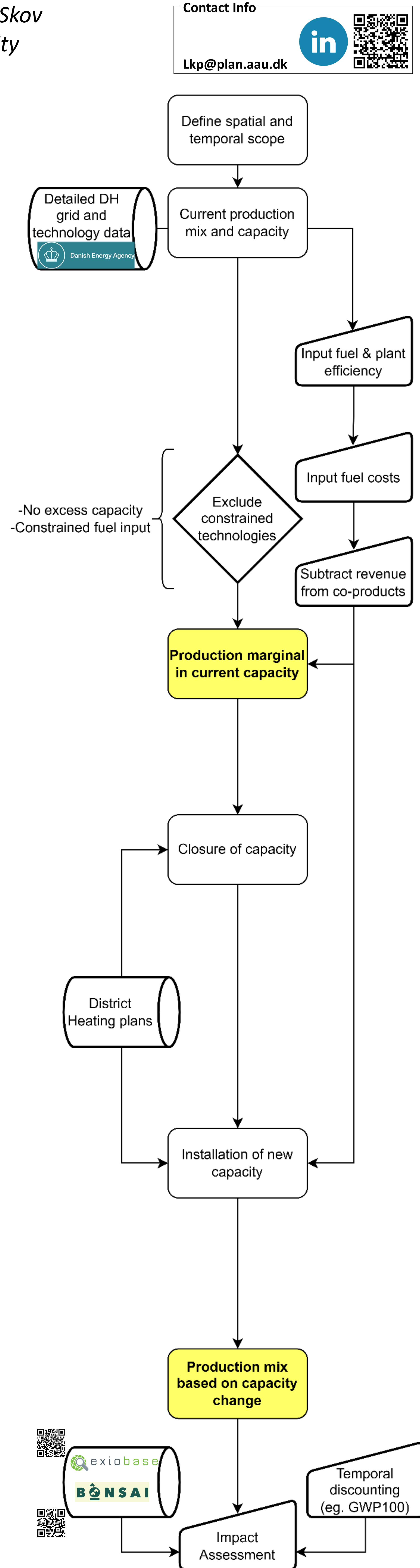
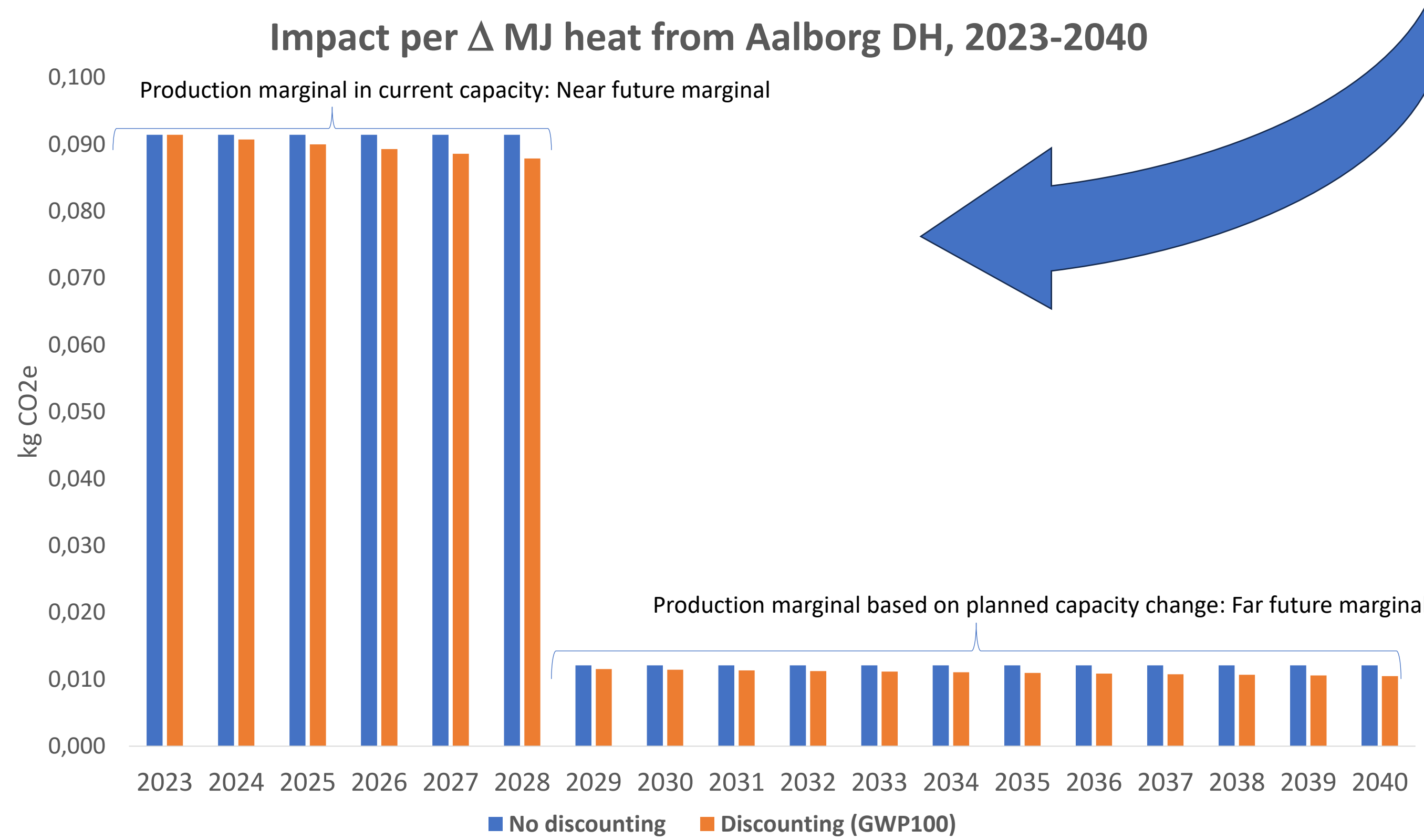
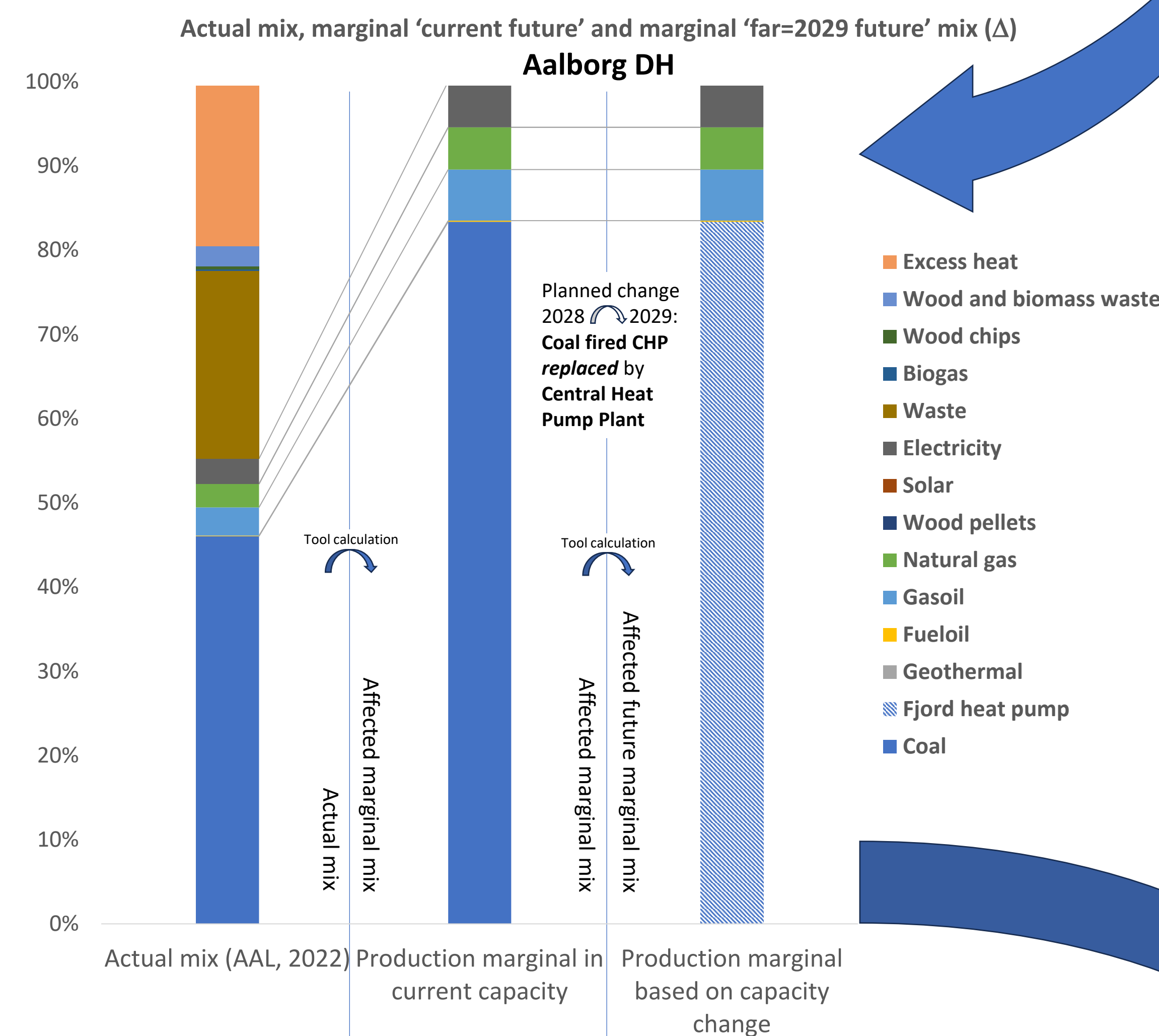
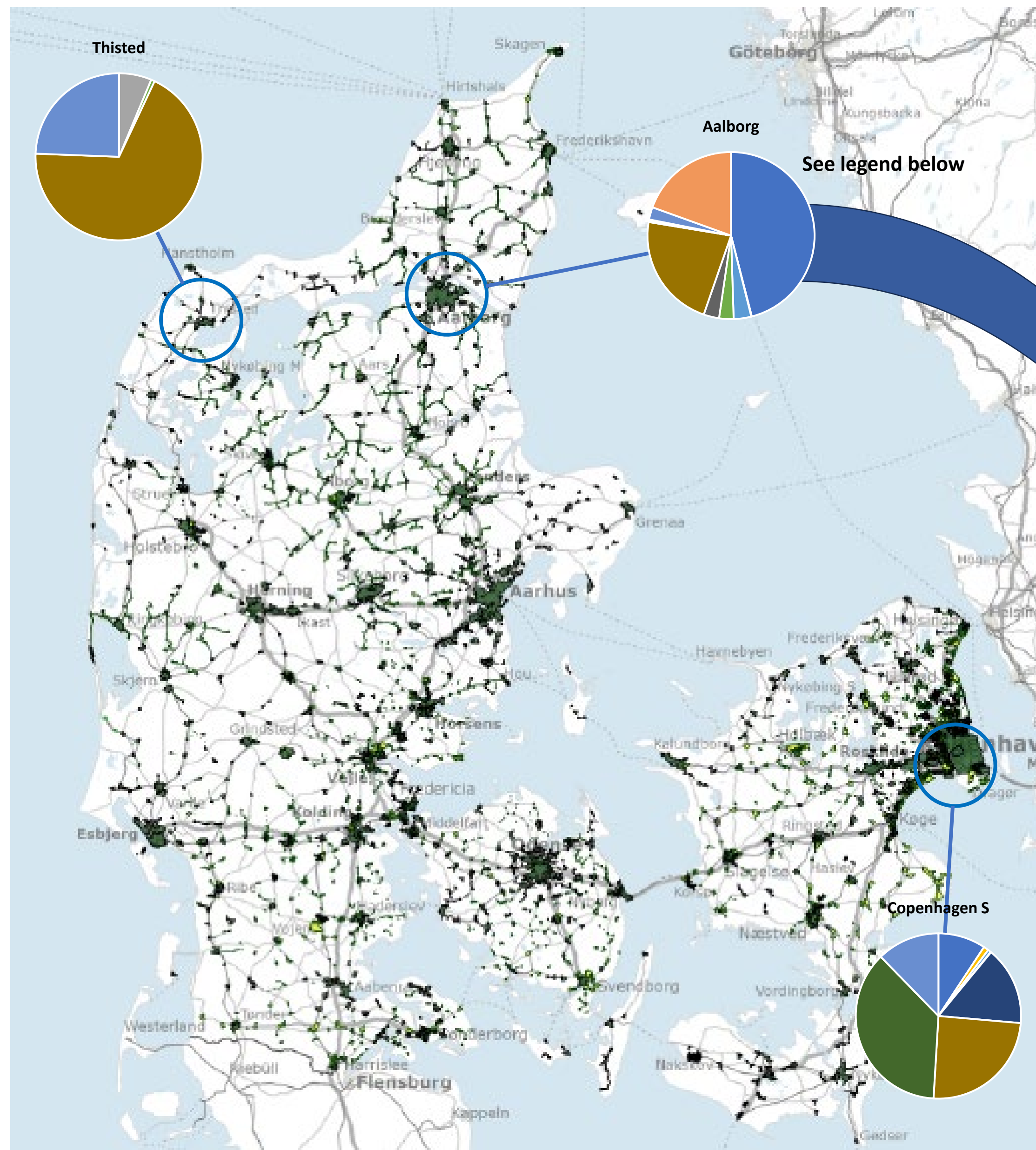
We have developed a tool, that **dynamically models** the marginal heat supply for different spatial and temporal resolutions to provide decision support across different future scenarios e.g., planning of PtX plants and evaluation of impacts from decisions influencing heating consumption.

**Methodology:** Using the **Consequential LCA** approach and the energy system modelling software **EnergyPLAN**, our tool can determine marginal heat suppliers based on historical data, whilst accounting for constrained heating technologies, fuel costs, supply capacity, and policy-driven scenarios for the development of the DH grids. The production mix is based on merit order, assuming that the cheapest fuels will be used first (excluding constrained suppliers).

Finally, the impact is calculated using the hybrid IO-database **Exiobase** or, alternatively, the open-source **Bonsai** database.

**Modelling assumptions:**

- Stable heat demand across years\*
- Over-capacity in DH systems (duty to supply) => Marginal technology is defined differently than usual
- A change in demand is distributed according to the normal demand distribution across a year, and thus the mix of technologies that will react is assumed to mask historical response.



\* Heating-need does not follow the general growth in DK-society, partly because the expansion of buildings needing heating is limited, partly because the building mass in general is becoming more and more well-insulated (due to regulation, policies, increasing heating prices, etc).