

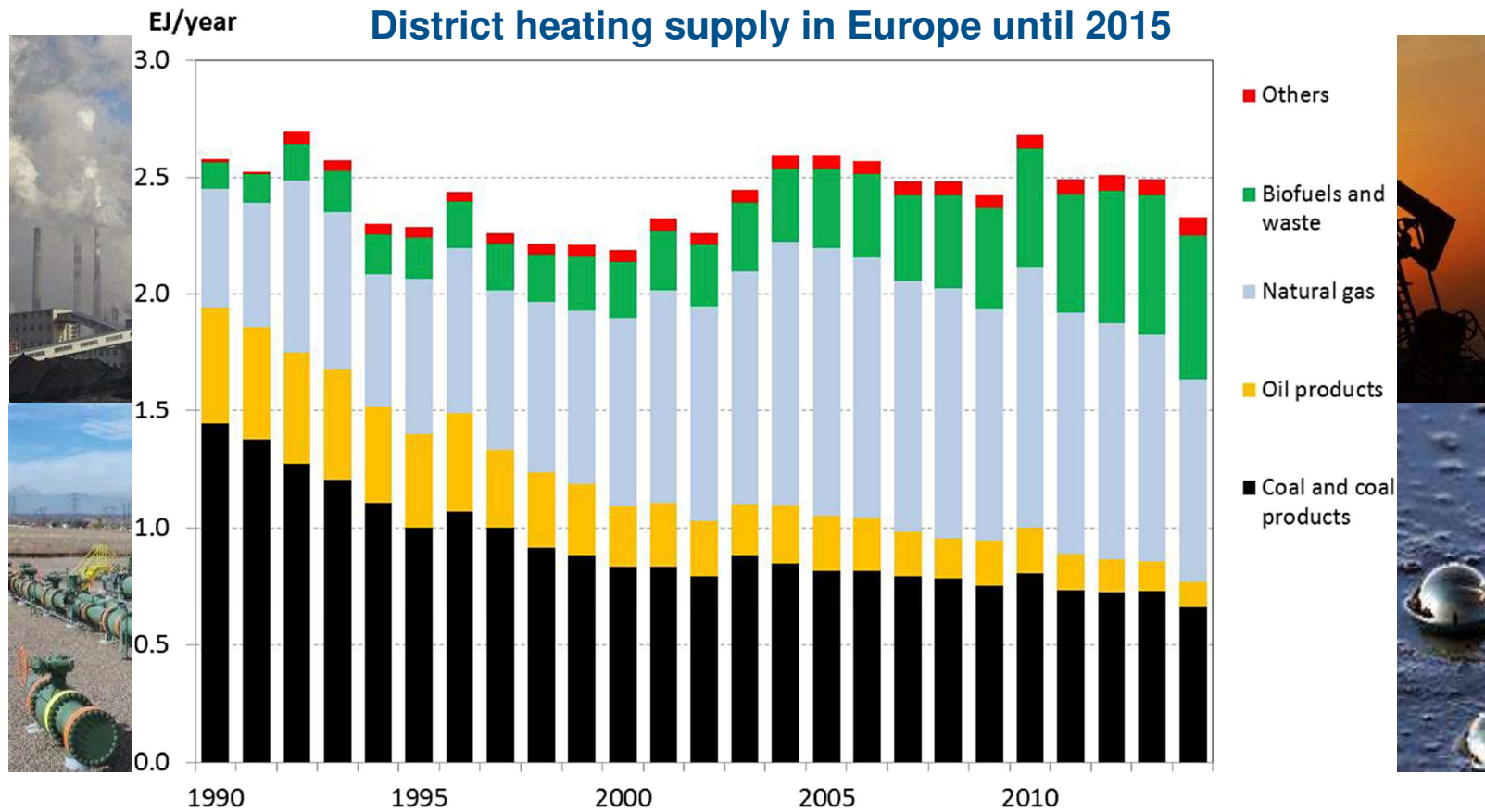


Potentials of Solar Heating in Europe

Christian Holter & Patrick Reiter @ ISEC Graz 2022

Tuesday, April 26, 2022

How is today's district heating supplied?



Werner (2017), <https://doi.org/10.1016/j.energy.2017.04.045>

What problems occur for utilities?

**SHORT
TERM**

High energy prices due to current crises (i.e., Ukraine war, COVID-19 pandemic)

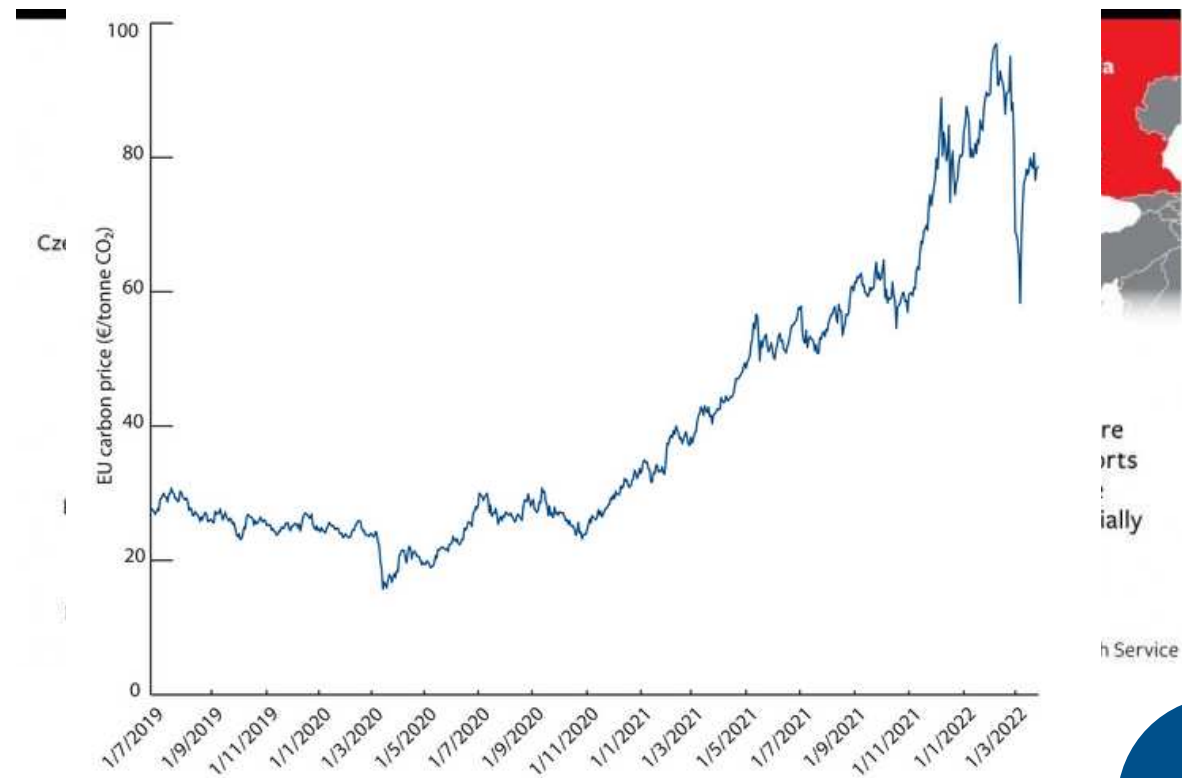
**MEDIUM
TERM**

Concern to maintain security of supply

**LONG
TERM**

Steadily increasing prices in CO₂ certificates

Development of EU ETS price (07/2019 – 03/2022)



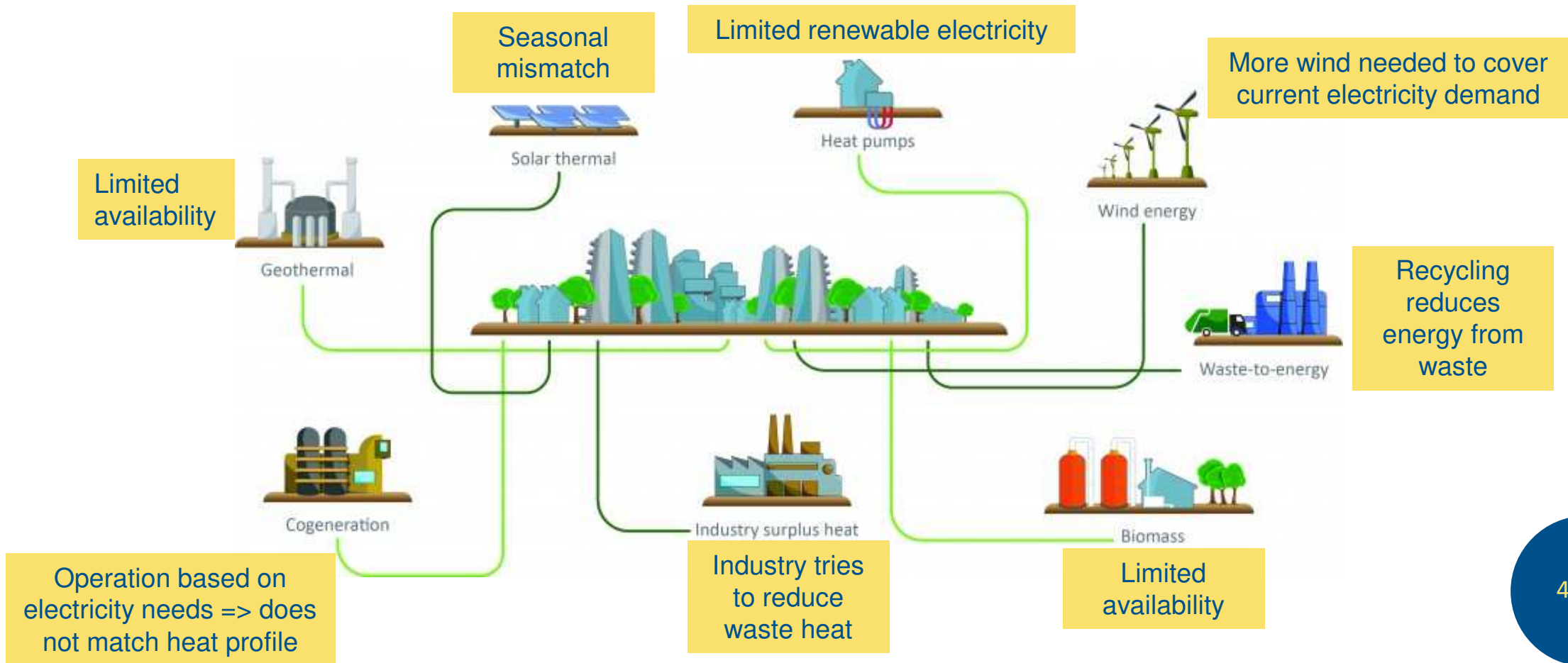
<https://www.cer.eu/publications/archive/policy-brief/2022/eu-emissions-trading-system-after-energy-price-spike#section-5>



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The future of district heating



What about biomass?

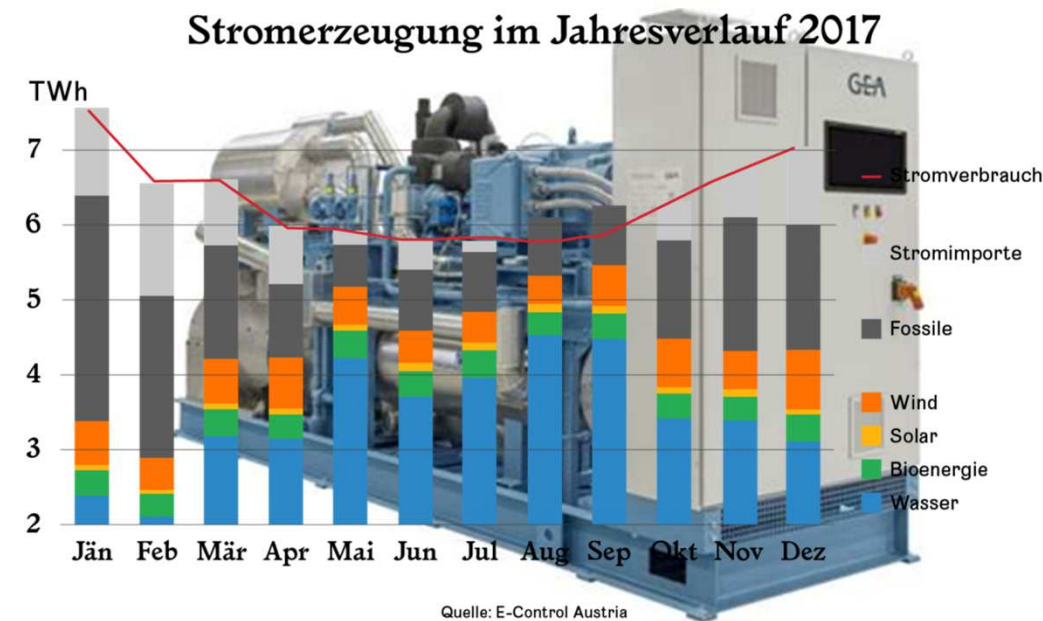
- Share is increasing, but in future relevant for medium / peak load supply
- Amount required is simply not available (especially locally or regionally)
- As example the biomass potential for Styria, AT*:
 - Physical annual potential for 549,000 m³ of harvested timber (incl. forest chips, bark & biomass from other sources)
 - Energetical annual potential 114,000 m³ or 200 GWh per year
 - Estimated price of 141 €/m³ (in 2025)



* Asada & Stern (2017) - *Holzbiomassepotenziale im Großraum Graz*, Karl Franzens Universität Graz

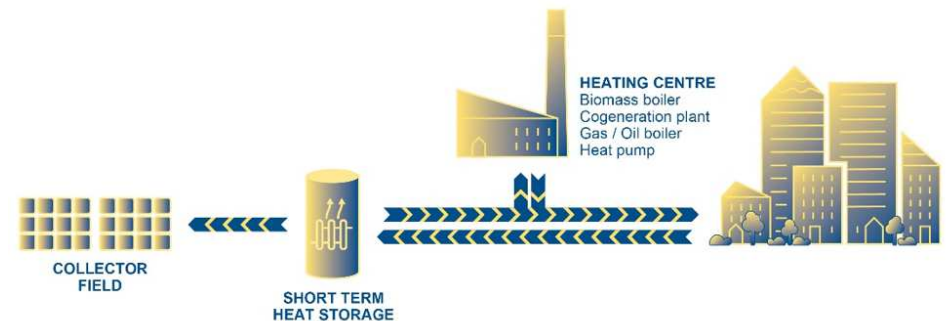
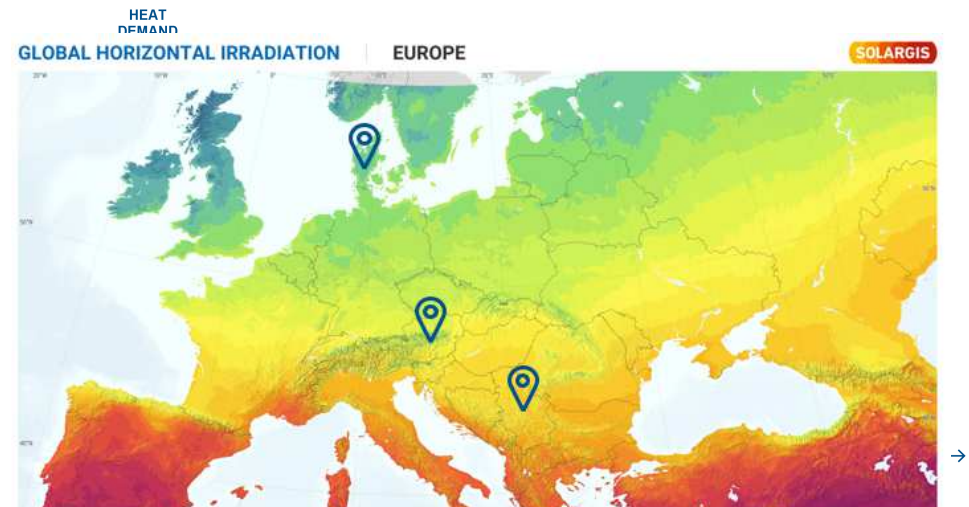
..and heat pumps?

- In Denmark framework conditions are good:
 - Mild winters and humid air
 - High yields of wind energy in winter
 - Low DH temperatures
- More difficult in other Central Europe countries:
 - Lack of green electricity (winter) and low-grade heat
- Example: Austria
 - Renewable electricity generation almost net-zero
 - In Winter still lots of import => grey or nuclear electricity



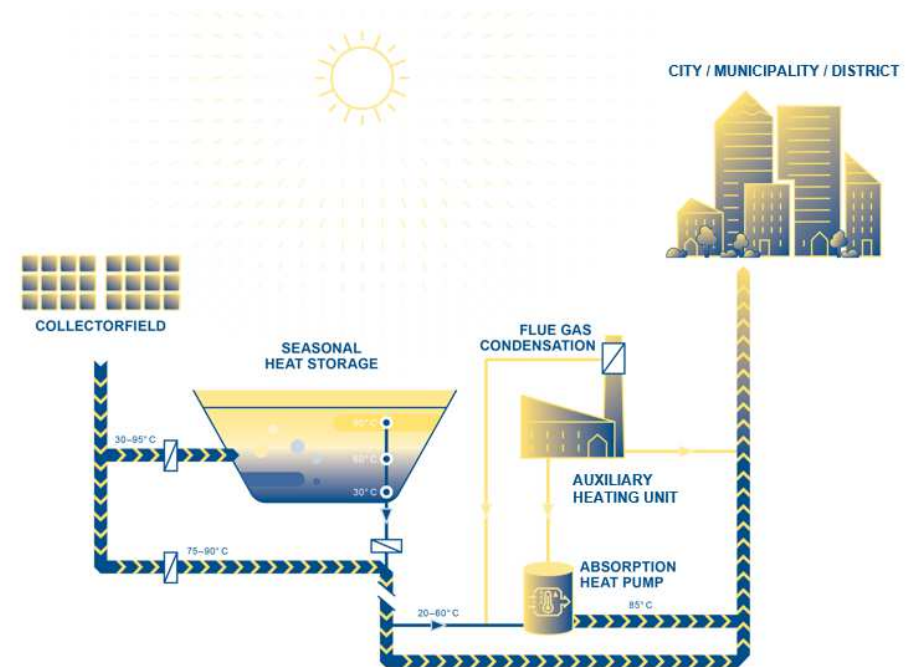
Solar district heating can be used anywhere

- Good solar irradiation all over Europe
 - Denmark (2018):
118 systems, 969 MW_{th},
1,384,000 m²
- Solar district heating typically for covering DHW demand in summer
- Seasonal heat storage to shift solar heat into shoulder and winter season



BigSolar for higher solar fraction

- BigSolar provides solar heat all year
- Solar coverage possible up to 60%
- Additional benefits:
 - Easy implementation in existing infrastructure
 - Multiple use of storage by other heat sources
 - Shaving of peak loads in winter
 - Replacing part load operation of boilers



Estimated market potential for solar thermal in DH

	Europe	Austria
Potential heat load	200 TWh	12 TWh
Corresponding collector area	350 Million m ²	22 Million m ²
Solar share in DH	30%	50%
Estimated investment necessary	€ 70 Billion	€ 4.4 Billion
CO2 savings	60 Million t/a	2.4 Million t/a
Value on EU ETS*	€ 4.7 Billion/a	€ 188 Million/a
*EU ETS price of € 78.33 (EEX Auction Price, 05.04.2022)		

To conclude

(1) Infinity availability without CO₂ emissions

Greater independence from fossil fuels & increase of security of supply.

(2) Efficiency

Area efficiency of solar thermal is 4-times higher the solar PV and 50-times higher than biomass.

Increase of energy efficiency by lowering DH temperatures (forward / return).

(3) Stable prices & long-term calculability

High CAPEX, but low OPEX resulting into calculable and stable heat generation costs over lifetime.

(4) Smart integration leads to additional benefits

Additional use of storage for other heat sources when storage is empty.

Smart operation allows shaving of peaks.

(5) Availability of land

Possible to use degraded land such as landfills but also water protection areas.

Using areas in metropolitan areas outside of the municipality / city center.

There is no soil sealing and offers a habitat for flora and fauna.



Contact us!

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