

ASSESSMENT OF THE FUTURE WASTE HEAT POTENTIAL FROM ELECTROLYSERS AND ITS UTILIZATION IN DISTRICT HEATING

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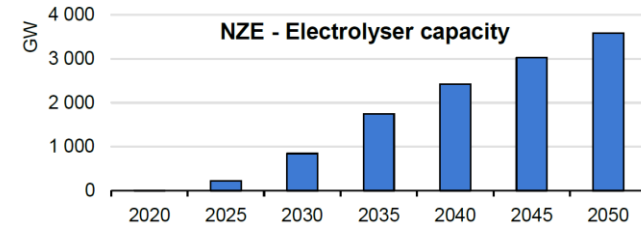
Ralf-Roman Schmidt

Work is part of project MEMPHIS 2.0 – “Advanced algorithm for spatial identification, evaluation of temporal availability and economic assessment of waste heat sources and their local representation”, financed by IEA DHC within Annex XIII

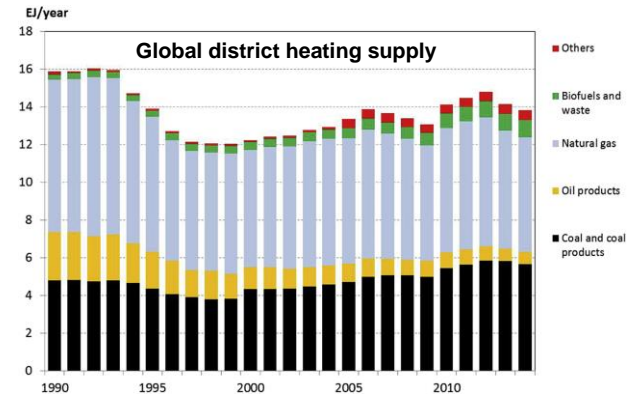


BACKGROUND & SCOPE

- Renewable H₂ is expected to become a corner stone of a decarbonised energy system
- Existing ambitious goals in Europe
 - **EU H₂ strategy:** 40 GW of electrolysis by 2030
 - **RePowerEU:** 10 Mt domestic production by 2030
- District heating supply mainly based on fossil sources
 - **Waste heat integration as an option for increased efficiency and decarbonization**



International Energy Agency. (2021). *Global Hydrogen Review 2021*. OECD. <https://doi.org/10.1787/39351842-en>



S. Werner, International review of district heating and cooling, Energy, Volume 137, 2011, <https://doi.org/10.1016/j.energy.2017.04.045>

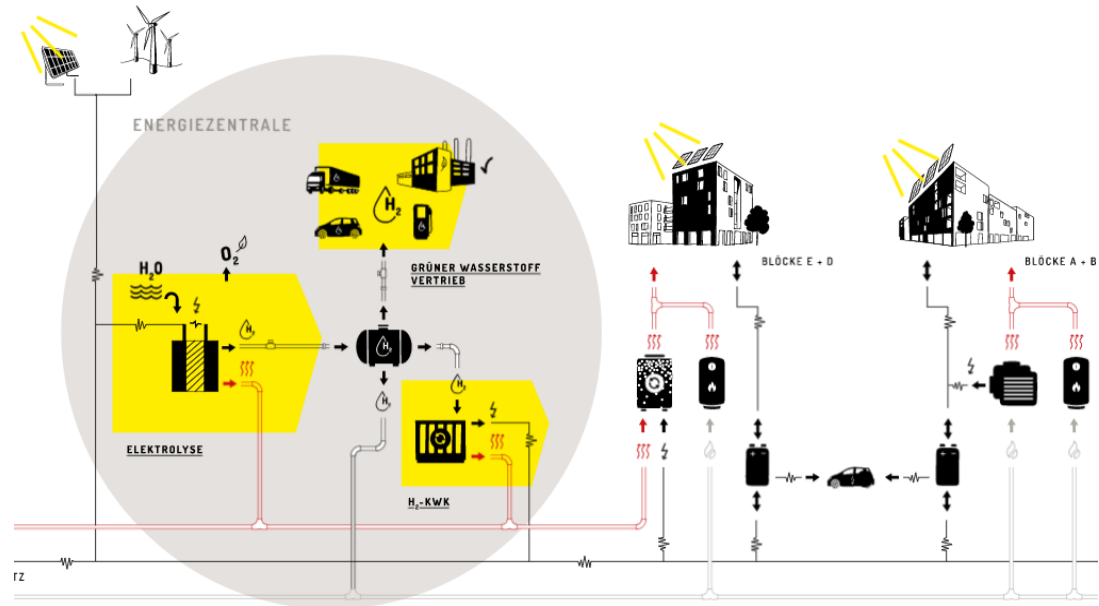
What potential can electrolyser waste heat provide for the district heating sector?

EXAMPLE OF EXISTING PROJECTS

ELECTROLYSER WASTE HEAT UTILIZATION

Green Hydrogen Esslingen

- Newly developed quarter (120,000 m²) with climate-neutral energy concept
- Integration of **1 MW alkaline electrolyser** in local energy system
- Waste heat utilization in local heat grid increases **system efficiency to 90%**



Agentur Blumberg GmbH, 'Energy supply in the neighborhood', <https://neue-weststadt.de/en/energiekonzept/#>
(accessed Oct. 07, 2022)

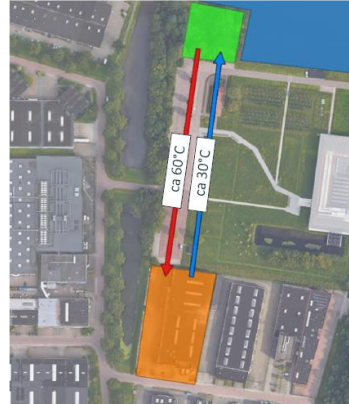
EXAMPLE OF EXISTING PROJECTS

ELECTROLYSER WASTE HEAT UTILIZATION

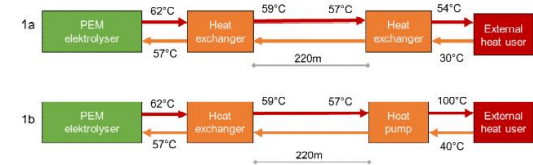
H-flex project

- Installation of **2.5 MW PEM** electrolyser to supply hydrogen refuelling station
- Waste heat utilization within adjacent laundry
- Delivery of 1.7 GWh per year increases overall **system efficiency to 91%**

Pipeline
200 m



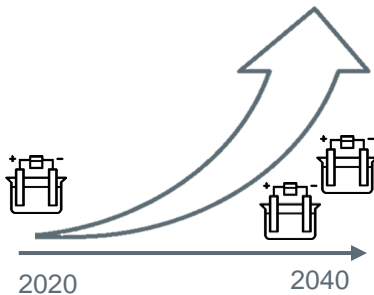
Delivery to local consumer
a) Directly (ca 60°C)
b) With heat pump (ca 100 °C)



METHOD

EVALUATION OF WASTE HEAT POTENTIAL

Electrolysis capacity



Data from

- **TYNDP 2022** (ENTSO-E / ENTSOG)
- **Net-Zero Emissions Scenario** (IEA)

Technology data

	Waste heat share	Waste heat temperature	Technology share	
			2030	2040
AEL	20%	70°C	80%	52%
PEM-EL	25%	70°C	18%	40%
SOEL	-	-	2%	8%

Alkaline electrolysis (AEL)

- Most mature technology

Polymer electrolyte membrane (PEM-EL)

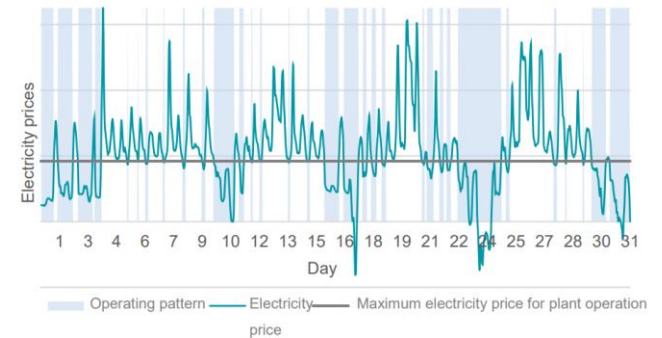
- Increasing market shares

Solid oxide electrolysis (SOEL)

- No useable waste heat

Full load hours (FLH)

Operating pattern for electrolysis plants over one month



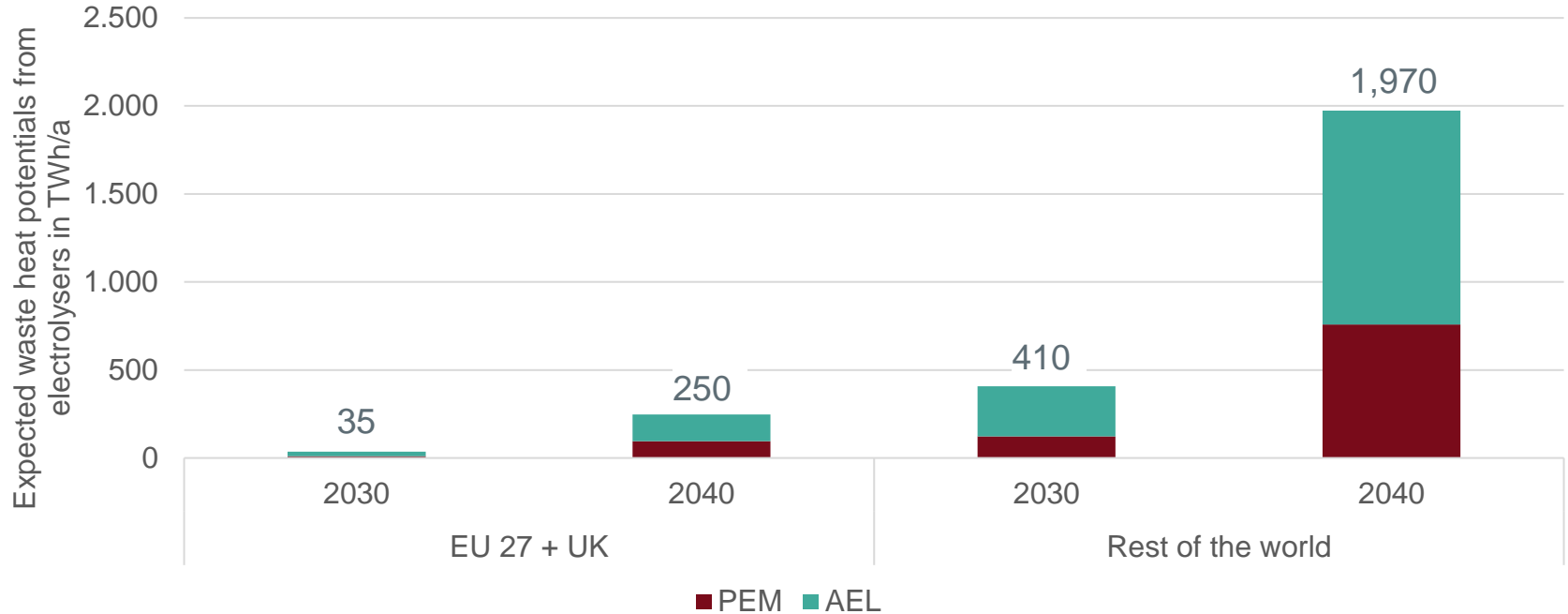
FLH depending on integration concept

- **Grid connected electrolyser**
- **Dedicated RES (no grid connection)**

Assumed FLH value: 3,500 h

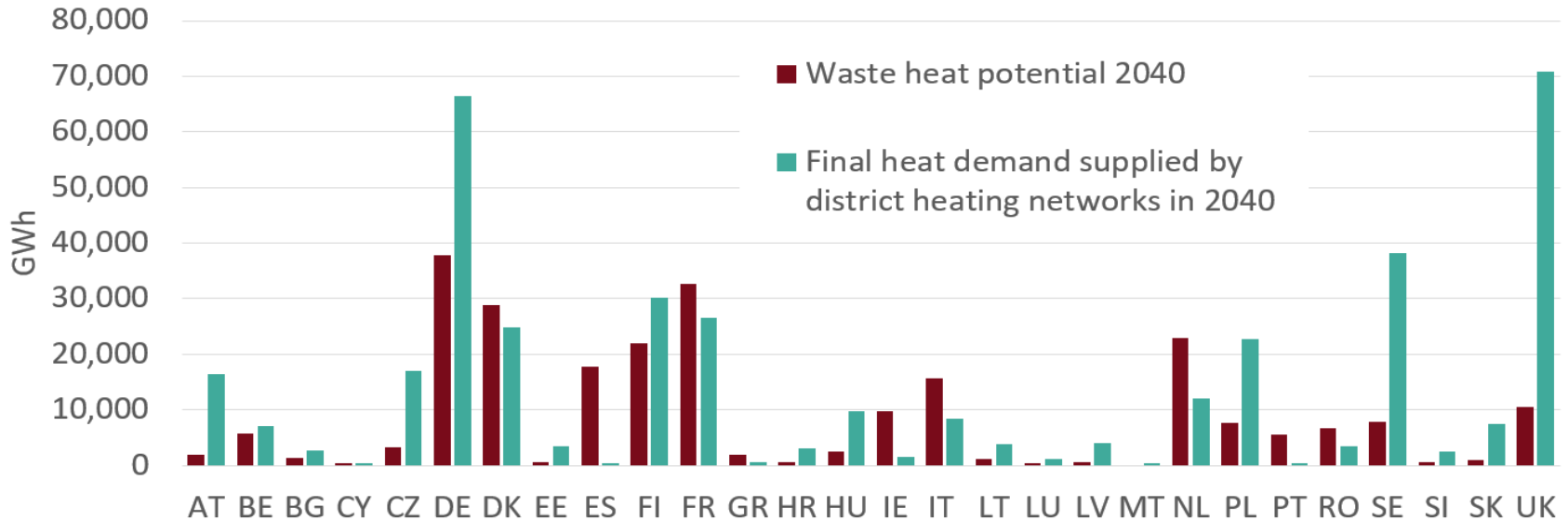
RESULTS

POTENTIALS EUROPE AND GLOBAL



RESULTS

COMPARISON TO DISTRICT HEATING DEMAND



Waste heat potential: 64% of projected district heating supply in 2040

CONCLUSIONS



Waste heat utilization from electrolyzers increases the overall system efficiency



Existing barriers must to be addressed for successful implementation (temporal / locational / temperature-related mismatch)



Waste heat from electrolyzers can be a key source for the decarbonization of district heating networks

THANKS FOR YOUR ATTENTION!

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