IRENA
INNOVATION WEEK
solutions for a renewable-powered future

IRENA
International Renewable Energy Agency

ELECTRIFICATION TRACK

# ELECTRIFICATION OF HEAT

## Session overview

Efficient electrification of heat is the "fastest route to greening the heating sector", said T**homas Nowak, Secretary-General of the European Heat Pump Association.** Power-to-heat solutions have reached a well-developed stage and are now seen to have the potential to supply low-cost, efficient and carbon-free heat for residential, commercial and industrial applications. Despite this progress, and the urgent need to reduce greenhouse gas emissions, fossil fuel sources still provide the majority of the heat supply for these sectors, while only a small fraction is provided from renewable energy sources. Pushing for an efficient electrification will not only provide clean, low-carbon heat but will also provide flexibility options for networks and help integrate higher shares of renewable energy in the electricity mix (also known as sector coupling of the power and heat vectors).

This session featured a panel discussion on the role that power-to-heat technologies can play in enabling the integration of high shares of renewable electricity in power systems. Experts highlighted real-world examples of the deployment of power-to-heat technologies and discussed what is needed to improve the technology and increase market penetration. The session was moderated by **Thomas Nowak (Secretary-General, European Heat Pump Association)** and comprised four presentations followed by a panel discussion.

## Presentation 1:
### Towards a renewable energy system – how to integrate power-to-heat

**Wolfram Sparber (Head, Institute for Renewable Energy at Eurac Research)** presented on the potentials of power-to-heat technologies for renewable energy integration and described a systematic regional approach, using South Tyrol, Italy, as an example. Key points included:

- In South Tyrol, the heating and buildings sectors need to be massively refurbished to meet the region's climate targets.
- In the power sector the speed of change and progress towards efficiency is proceeding at a rapid rate; however, in the buildings sector the region, as well as the European Union, have not yet found a way to unlock possibilities to massively refurbish.
- Heat pumps could provide an important contribution to reducing on-site emissions and enhancing the application of renewables as well as to provide demand side flexibility.

## Presentation 2:
### Vapor compression systems as flexibility enablers

**Torben Funder-Kristensen (Head of Public and Industry Affairs, Danfoss)** provided practical examples of how unused compressor capacities can be utilised for suppling heat demand. Key points included:

- Renewables with more volatile price structures can be made beneficial for all stakeholders in the energy system by adding storage and demand response and by utilising compressor capacities for heat pump processes. In this context, vapor compression systems could be used at different scales – for example, for supermarkets, data centres, and airport heating and cooling applications – to provide more flexibility.
- There is huge unused potential of vapor compression cooling systems, in which waste heat from the cooling process could be captured and fed into thermal energy grids.
- The current marginal investments needed to become "smart" are small.

## Presentation 3:
### Fostering sustainable heat in industry – key challenges and opportunities for solar process steam

**Martin Haagen (Business Development MENA, Industrial Solar GmbH)** provided insights into the key challenges for fostering sustainable heat in industry. Key points included:

- In some cases, solar steam generation reduces the on-site consumption of conventional fuel for heat purposes by over 40%.
- It is still very difficult to get the data on industrial heating needs (capacities, temperatures levels) necessary to assess market solutions.
- Technical solutions are available, but the policy, financing and market frameworks are lacking.
- Industrial demand is very specific, and high temperature requirements limit the application of heat pumps (who can provide only up to 160°C).

## Presentation 4:
## Heat storage solutions showcase

**Avi Brenmiller (Chairman and CEO, Brenmiller energy)** showcased examples of solar and storage solutions, especially when long-duration storage is needed. Key features included:

» Thermal storage can be utilised for district heating, using low-cost renewable power at off-peak times with the option of alternating to district cooling in the summertime.

» 1 EUR cent/kilowatt-hour at large scale for thermal storage; unlimited cycles over 30 years, at up to 95% efficiency.

## Panel discussion

In addition to the presenters mentioned above, the panel included:

» Guy Verkemans, Strategy Manager Sustainable Energy, VITO

» Monica Axell, Head of Energy and Circular Economy, Research Institutes of Sweden (RISE)

» Deger Saygin, Director, SHURA Energy Transition Centre

» Wei Lingxiao, Vice Director, Ministry of Science and technology of the State Grid Beijing Electric Power Company

## Highlights from the discussion:

» **Dual benefits.** Efficient electrification of heat has the potential to deliver two key benefits: 1) decarbonisation through renewable sources and 2) reduction in overall consumption due to better technical efficiency of electro-heating technology (e.g., heat pumps).

» **System perspective is needed.** If you fulfil a demand for cooling, you have heat for free. Using it is the best energy efficiency improvement possible.

» **Unique characteristics and requirements:**

- Up to now, the aggregation of small/intermediate loads has not seen similar opportunities to those that exist for major industrial loads. This could be overcome by more transparent information as well as better incentives and price signals.
- Time is a key challenge. In the heating sector "quick" changes happen in a time frame of 20 years.
- Industrial heating end-uses can be highly specific, with unique sectoral requirements, but they share many of the same barriers, which tend to be related to costs, trust in "new" technologies and flexibility (i.e., need for on-demand/constant supply). As such, the development of more sectoral approaches – for example, voluntary compacts among key businesses – could be beneficial in addressing specific and unique conditions.

» **Innovation solutions are proliferating, but deployment conditions less so.**

- In terms of technical solutions, all areas now have proven examples of innovations being deployed – e.g., advanced renewable heat options in improved heat pumps; electro-catalytic industrial processes; aggregation of commercial waste heat capture, etc. – but the framework conditions to deploy these solutions are not yet there.
- There is a lack of smart systems in place across the world, and nascent power-to-X innovations have not fully tested their business cases.

» **Policy solutions are well known, but they lack endorsement/implementation.** The panel's wish list from policy makers to accelerate the transition includes:

- Technology-neutral policies to provide a price signal on carbon (such as a strong carbon tax) or auctions, to avoid closing opportunities for solutions that could be unexpected or hybrid in nature.
- More ambitious targets.
- Research, development and demonstration (RD&D) and pilot programmes to cross the finance "valley of death" and reduce development costs.
- Recognition of the fact that we have the technologies needed to decarbonise available and in consequence, deployment research should be a focus of government financed programs.
- Support studies to find solutions at the value-chain level rather than at an individual technology level.
- Private sector push to provide data on heating use and costs that are currently unavailable.