Innovative waste heat recovery experiment in Sweden

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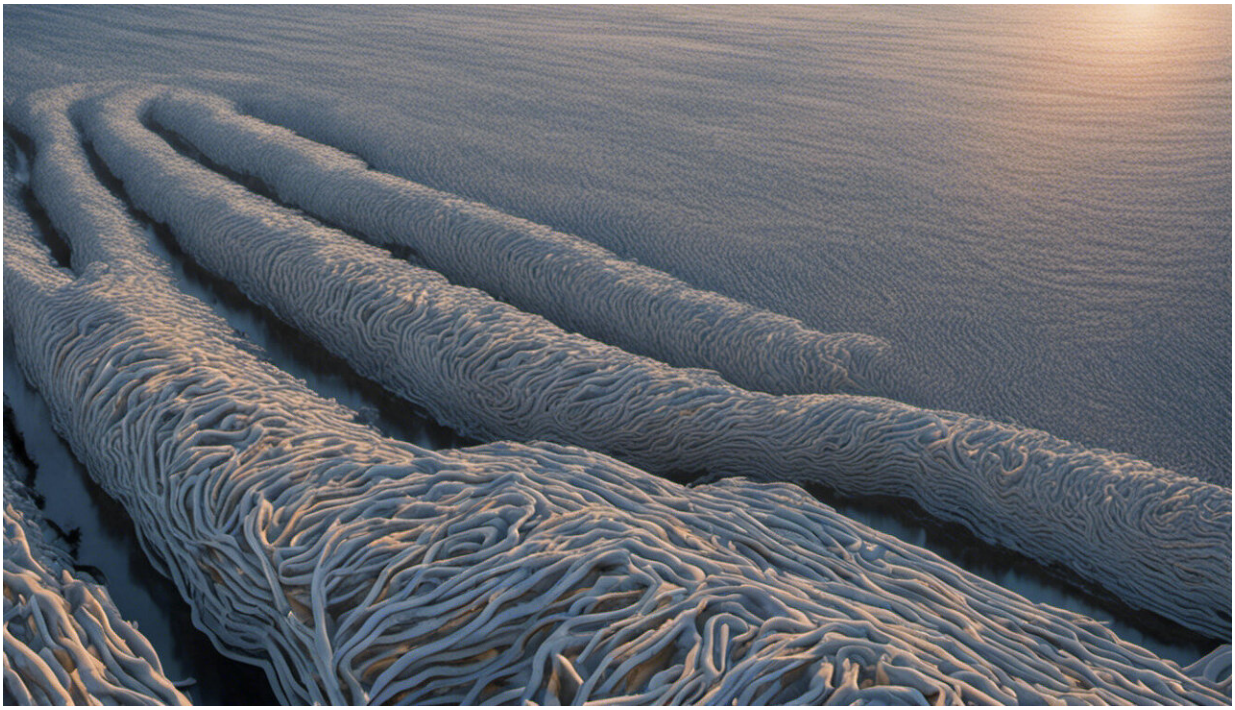

Credit: AI-generated image (disclaimer)

RISE Research Institutes of Sweden has set up a small fuel cell-powered data center in Luleå, a coastal city in northern Sweden, for the recovery of waste heat. The fuel cells generate electricity used to power the Edge data center and supply the excess heat to the local district heating and cooling grid.

RISE is a partner in the EU-funded WEDISTRICT project aimed at demonstrating that district heating and cooling systems can be built on a combination of renewable energy sources and waste heat recovery solutions. In the EU, 50% of consumed energy goes towards the heating and cooling of buildings, and roughly 70% of this energy is currently generated from fossil fuels.

How the system is set up

At the Luleå site, the data center and fuel cells have been set up in two containers stacked one on top of the other. The top container holds the fuel cells that run on locally produced biogas. The bottom container houses a liquid-cooled unit and the data center, which is backed by an uninterruptible power supply.

The system uses solid oxide fuel cells (SOFCs) that produce electricity from biogas. The SOFCs operate at high temperatures—around 600 degrees Celsius—making them particularly efficient for combined heat and power systems since the waste heat can be put to good use for heating and cooling.

However, the high operating temperature also has a disadvantage in that it takes a long time for the SOFC system to start up and reach its operating temperature. "We are using the only commercially available SOFC in Europe … and these are around 60 percent electrically efficient, but because they operate at 650 degrees Celsius they cannot be power cycled and their ramp in power production is poor, but they do provide a good grade of heat," explains Prof. Jon Summers of RISE in a news item posted on the Data Center Dynamics website. "So we have the data center in a container and stacked on top is the fuel cell container."

As reported in the news item, there is a smaller heat-reuse cycle within the two containers. The heat generated from the Submer liquid

immersion cooling tank inside the data center container is used to preheat the air intake for the fuel cells. "The return water loop from the CDU in the Submer setup will be around 50 degrees Celsius," states Prof. Summers. CDU refers to the cooling distribution unit. "Now the fuel cells consume air to function, but this air is best at 35 degrees Celsius, so the outside air (-25 degrees Celsius to 25 degrees Celsius) will be heated up by the heat from the Submer system."

The fuel cells will provide the local district heating grid with better-quality, high-temperature hot water at 95 degrees Celsius. "We believe, based on 2020 and 2021 weather data, that we can match the supply side of the district heating to work for around 8,000 hours of the year," remarks Prof. Summers.

The WEDISTRICT (Smart and local reneWable Energy DISTRICT heating and cooling solutions for sustainable living) project has another three demo sites besides Luleå. Located in Alcalá de Henares (Spain), Bierutów (Poland) and Bucharest (Romania), the sites showcase different solutions for 100% fossil-free district heating and cooling systems.

More information: WEDISTRICT project website: www.wedistrict.eu/

Provided by CORDIS

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