

MAKING-CITY Webinar 2_PED TECHNOLOGIES SELECTION

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Oulu

Texts and photos:

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Kaukovainio pilot area



AGENDA

- ▶ General description of the PED area
- ▶ **Conceptual Design of PED Technologies**
- ▶ Replication Potential of PED Technologies

Conceptual Design of PED Technologies. The steps.

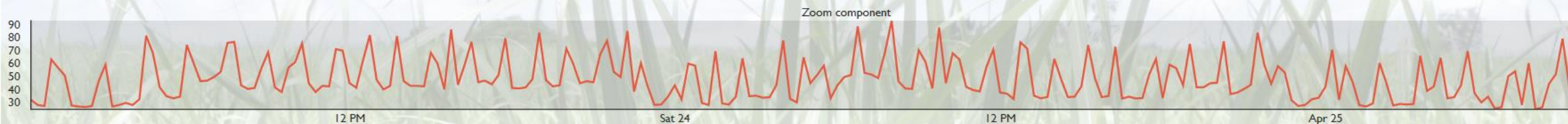
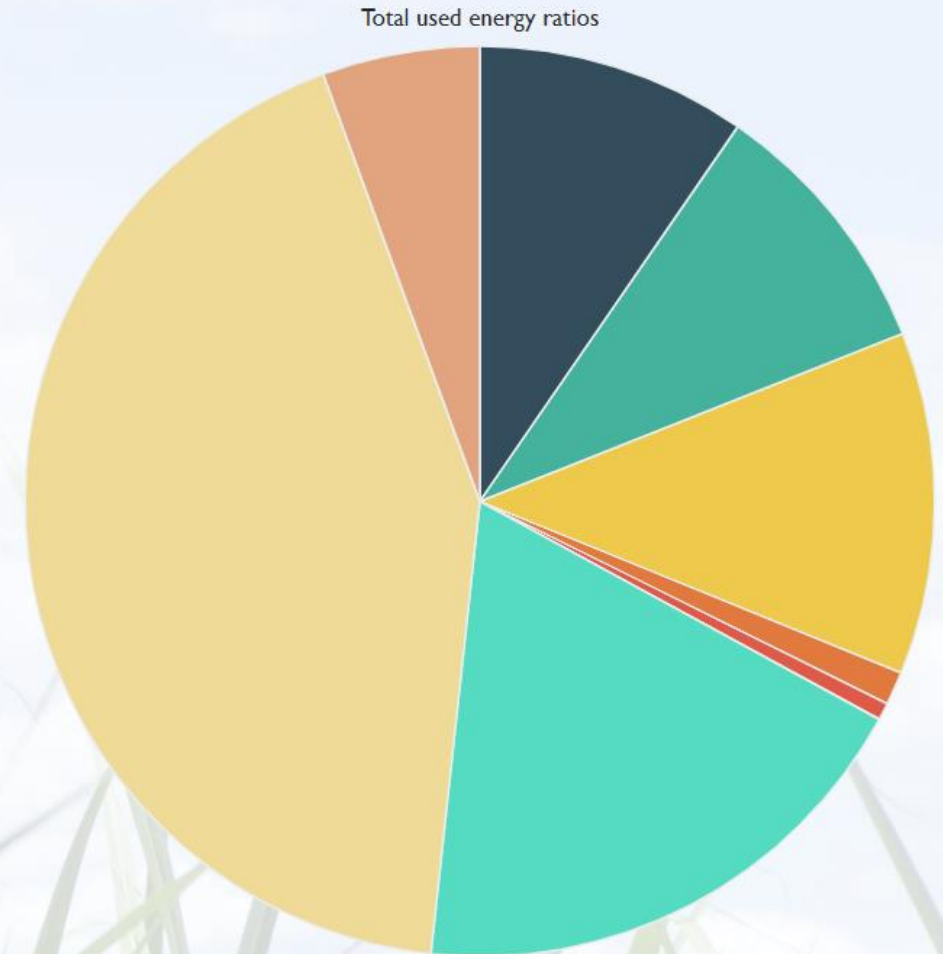
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- Hourly consumption profiles with different insulation levels and heat recovery solutions
- Hourly production profiles of those with low marginal cost and variable production:
solar, wind, excess and ambient heat, run-of-river hydro

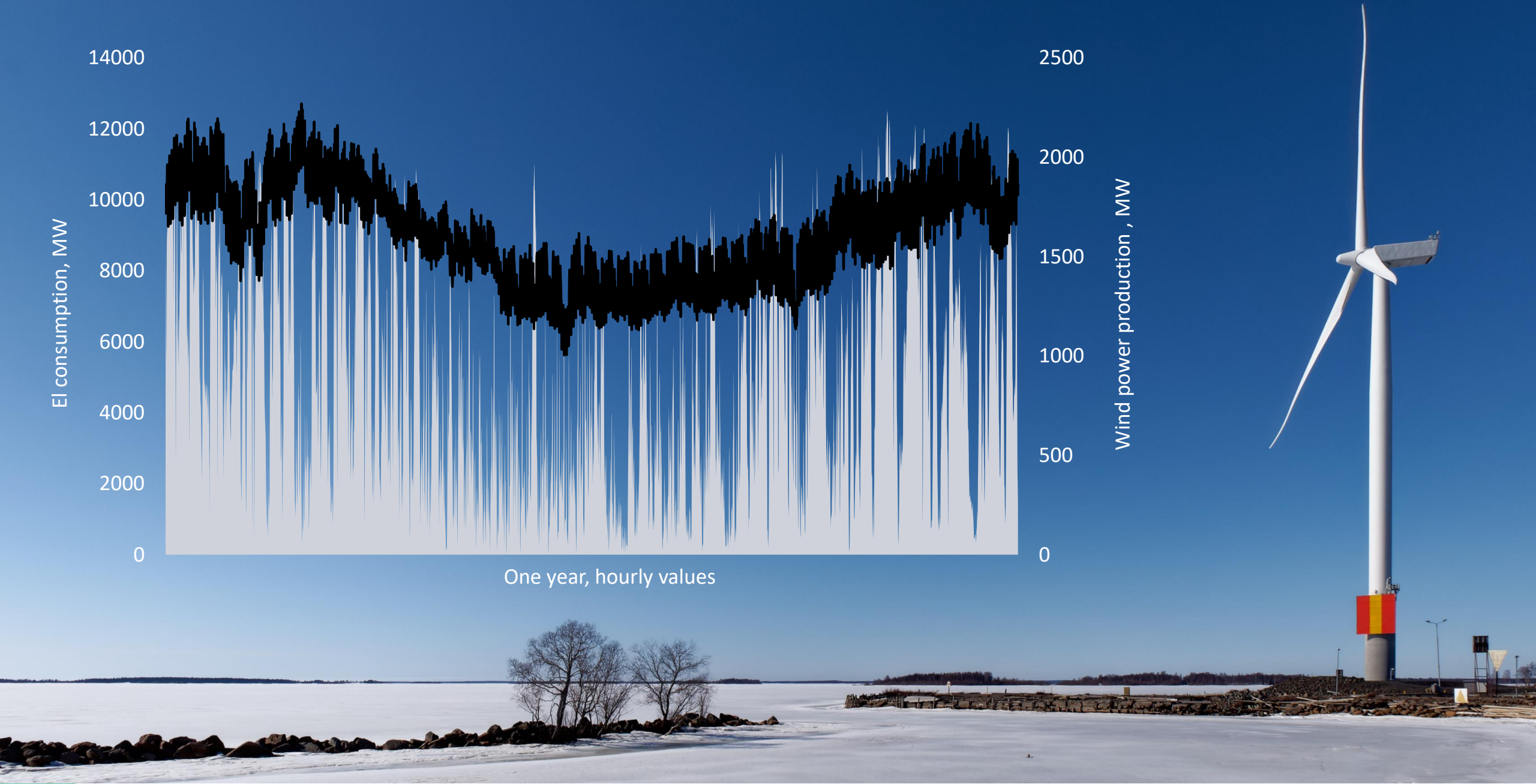
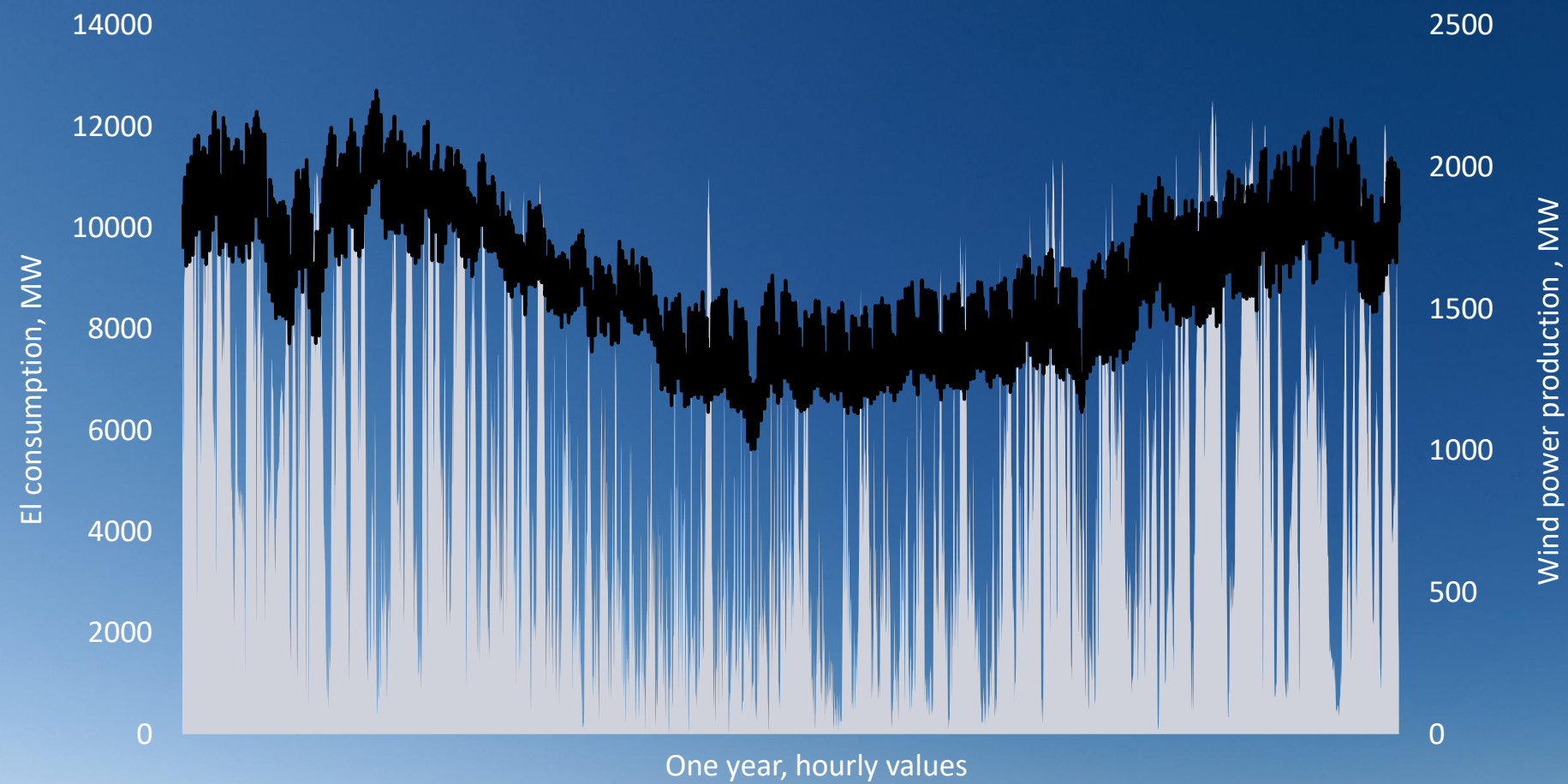
Electricity consumption in the store: <https://makingcity.vtt.fi/S-market/electricity>

ELECTRICITY CONSUMPTION

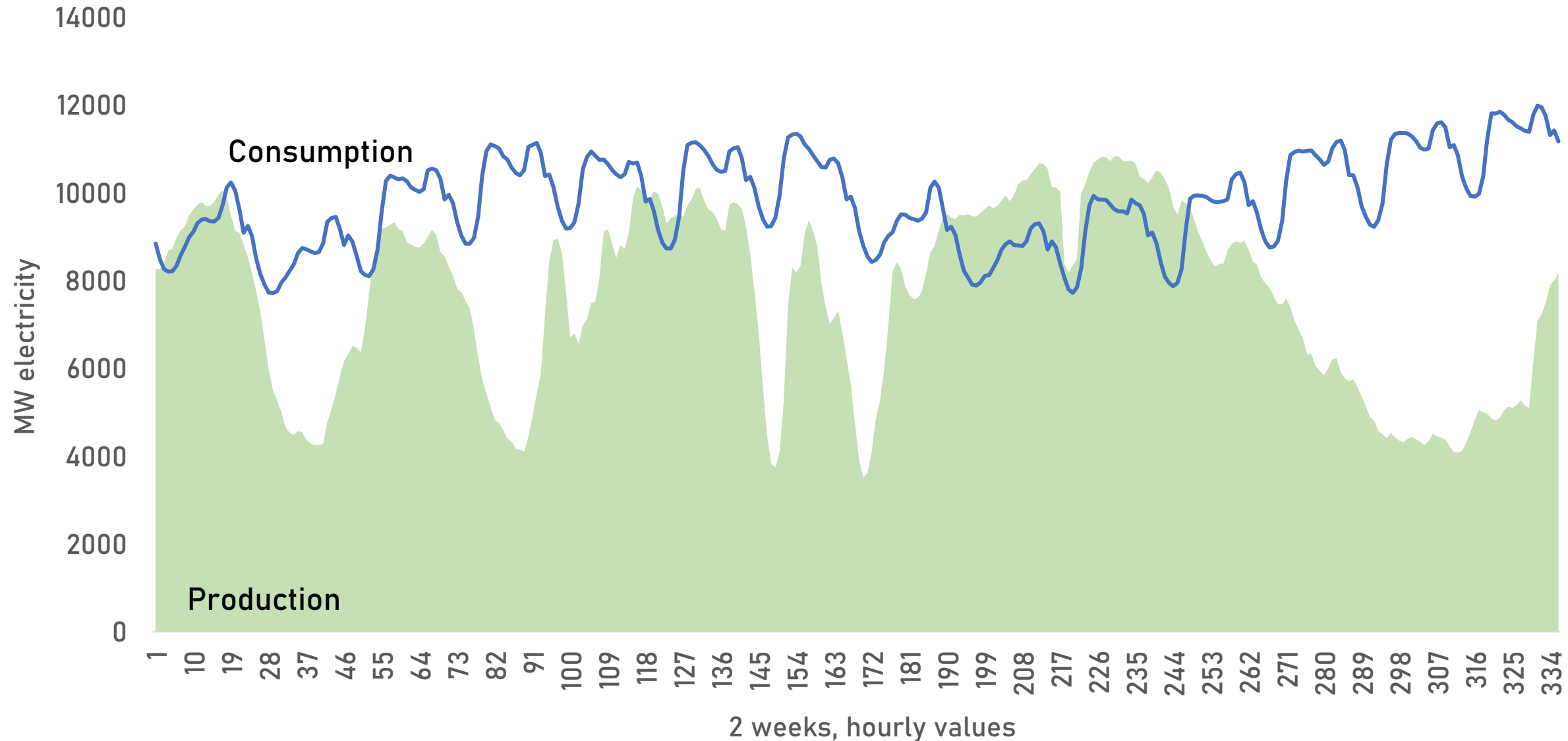
- HVAC
- Lightning
- Common spaces
- Oven
- Dishwasher
- Car heater
- Refrigerators
- Cooler machines
- Others



Electricity consumption in Finland and wind power production in 2020



Hourly consumption and production profiles.
Low marginal cost (=clean) electricity production vs. all consumption in the future?
Two weeks in February in Finland in 20xx.



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- Investment and operating costs and social impacts of different unit solutions.

Conceptual Design of PED Technologies. Unit solutions.

1. Consumption reduction

Moderate sq.m.

Placement of the area vs. services and affordances

Insulation

Ventilation heat recovery (air-to-air, HP)

Heat exchanger pipes under the building

Windows

Low-temp (floor) heating

2. Clean production

Wind

Solar

Biomass -> CHP with scrubber

Hydro

(Nuclear)

HP heat sources : exhaust air, cooling, outside air, water, ground, DH return water (=scrubber, CHP).

3. Networking, system functions

Electricity, DH and gas networks

Storages

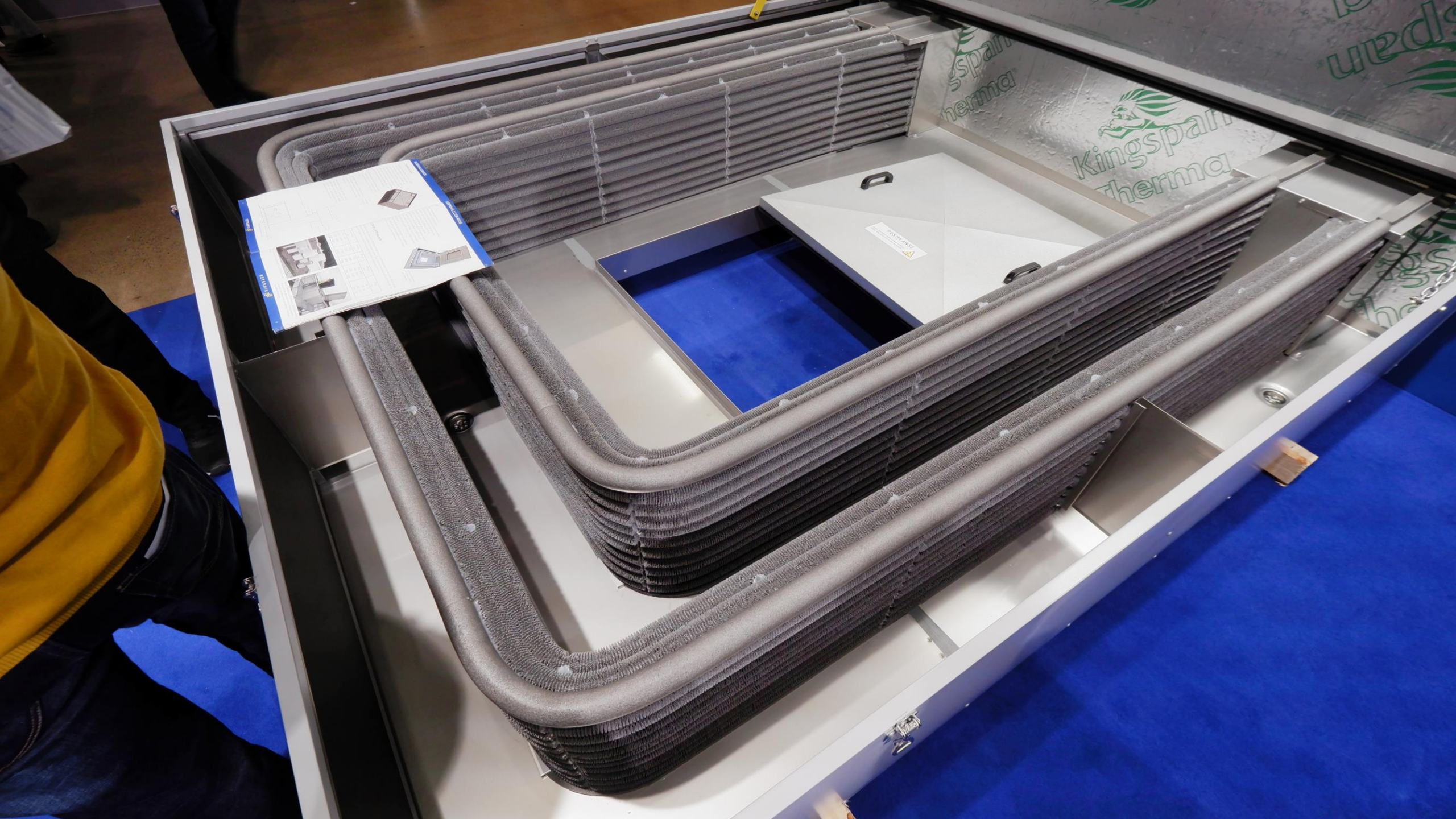
DSM











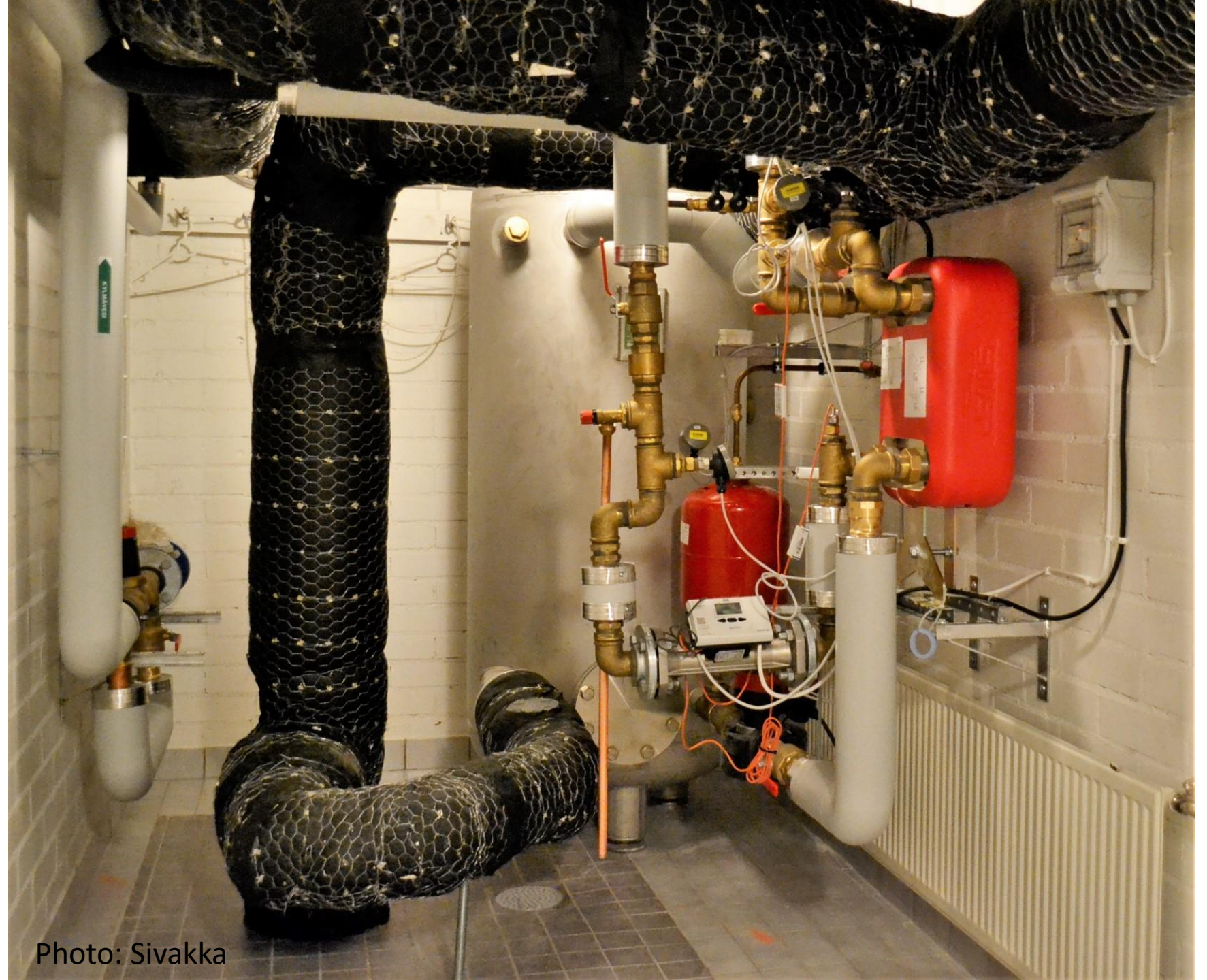


Photo: Sivakka











SINÄ TUULESTA TEMPAAT ENERGIAA

Asiakasomistajana olet yksi Pohjois-Suomen suurimmista tuulivoiman tuottajista.

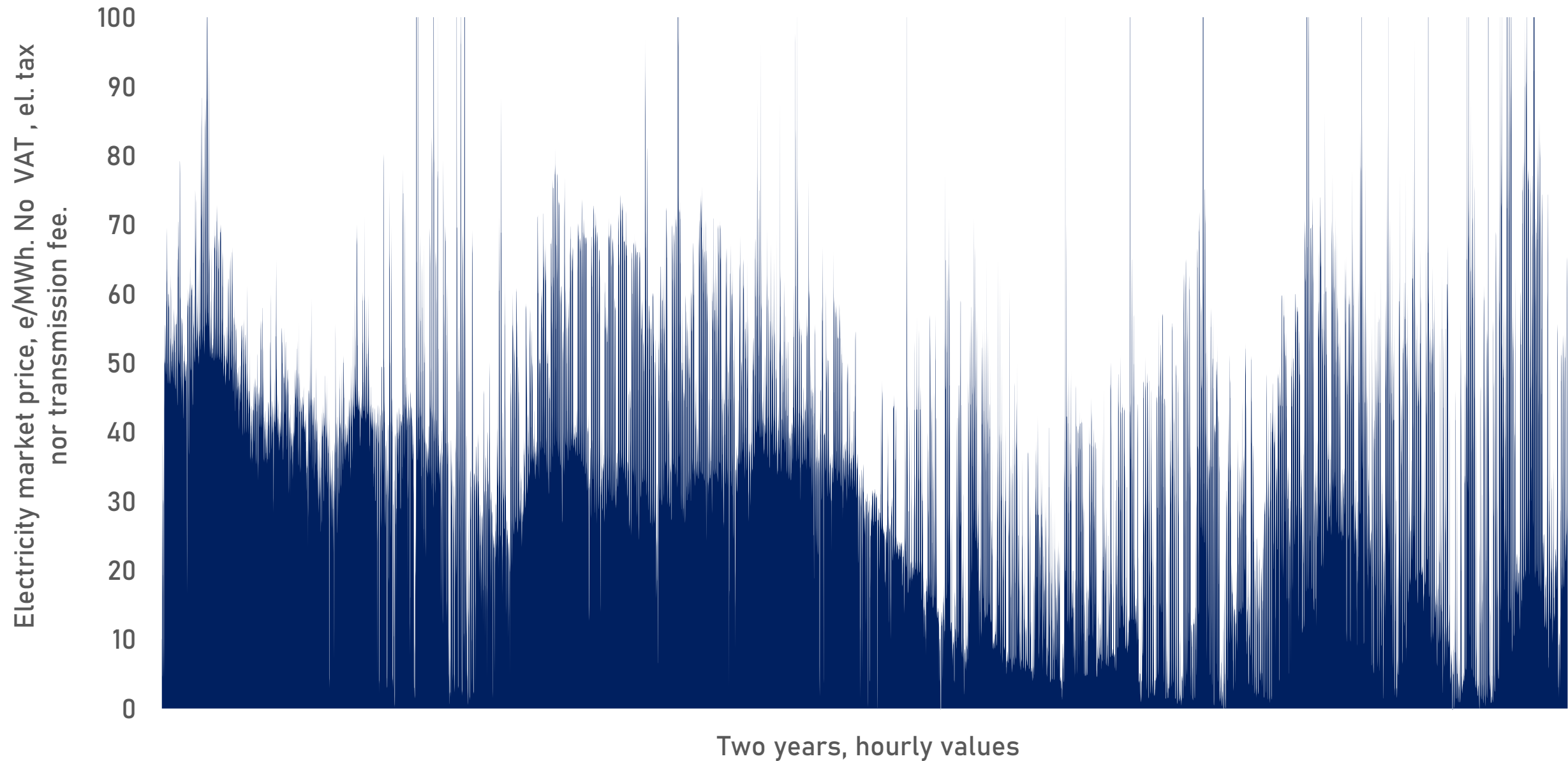
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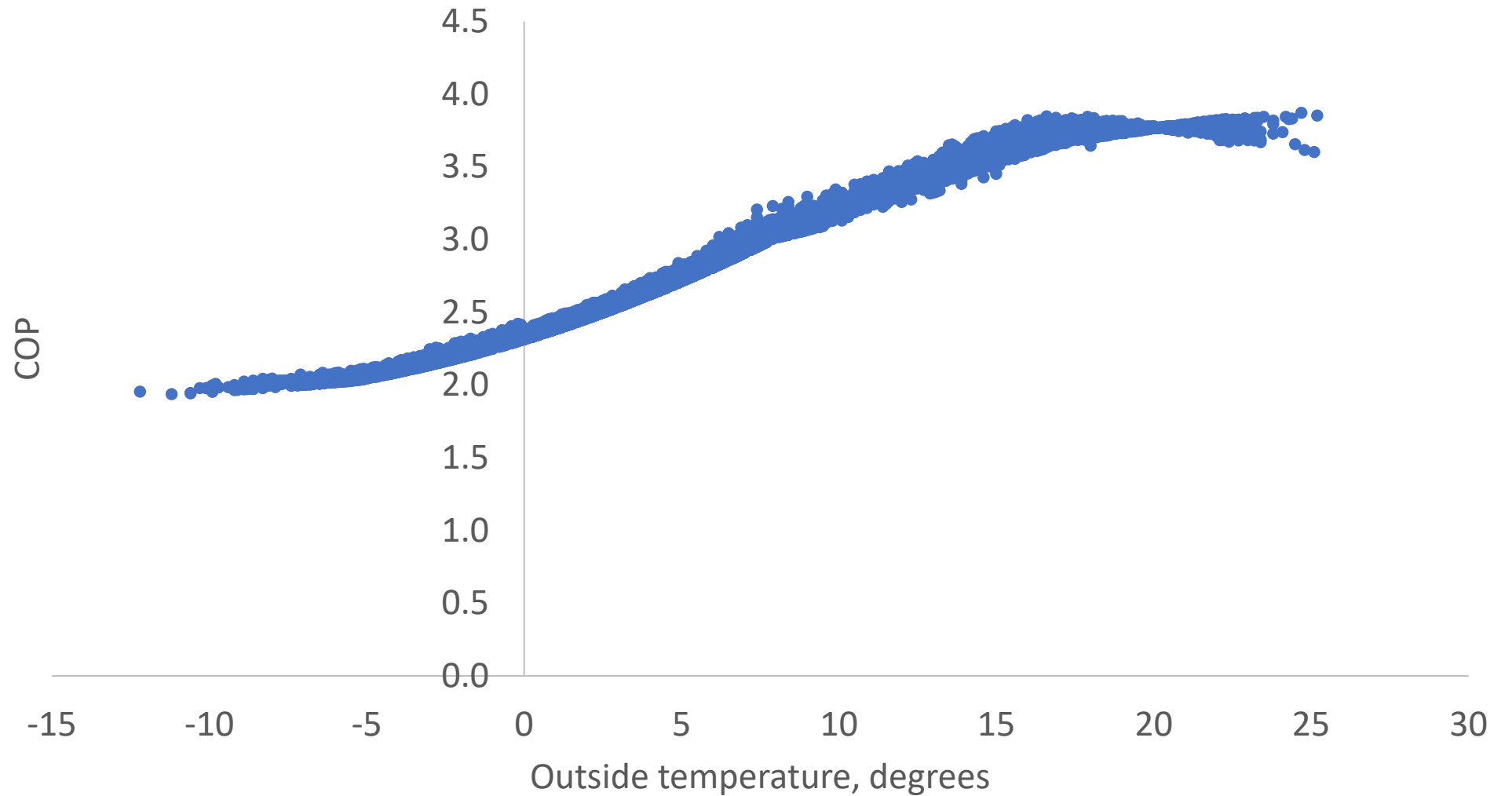
Unit technologies, basic properties. Some examples.

	CAPEX, e/kW	OPEX, e/MWh	Lifetime	Full load hours/a	Social cost/benefit
Wind	1300 (el)	7	25	3500	++-
Solar	1500 (el)	3	25	850	++
Bio-CHP	900 (el+heat)	30	40	e.g. 0-6000	+ -
Exhaust air HP	2000 (heat)	5 + (spot el. + 30 + 30) / COP	15	e.g. 0-6000	+
New windows	8000 (heat)	- Heat price	30	2000	+

Nordpool electricity market price in FI 2019-2020



Heat pump system coefficient of performance vs. outside temperature.
Several heat sources. Output temp 75...85 °C.



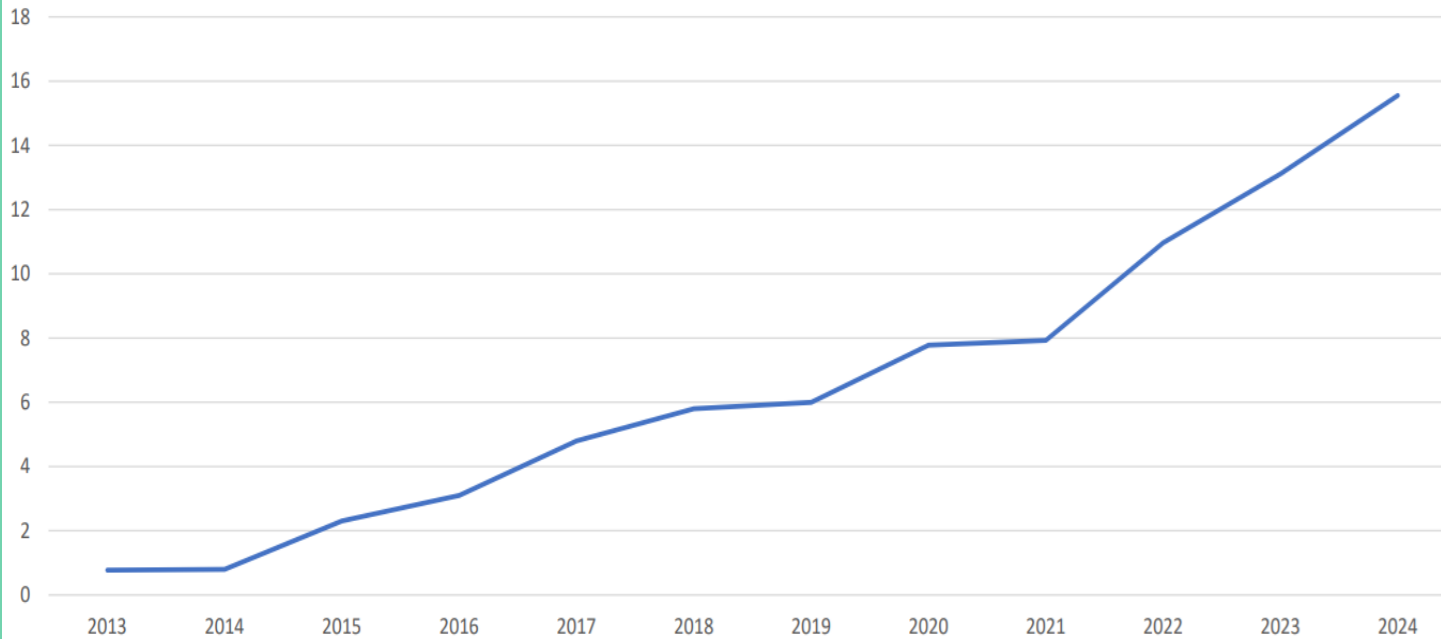
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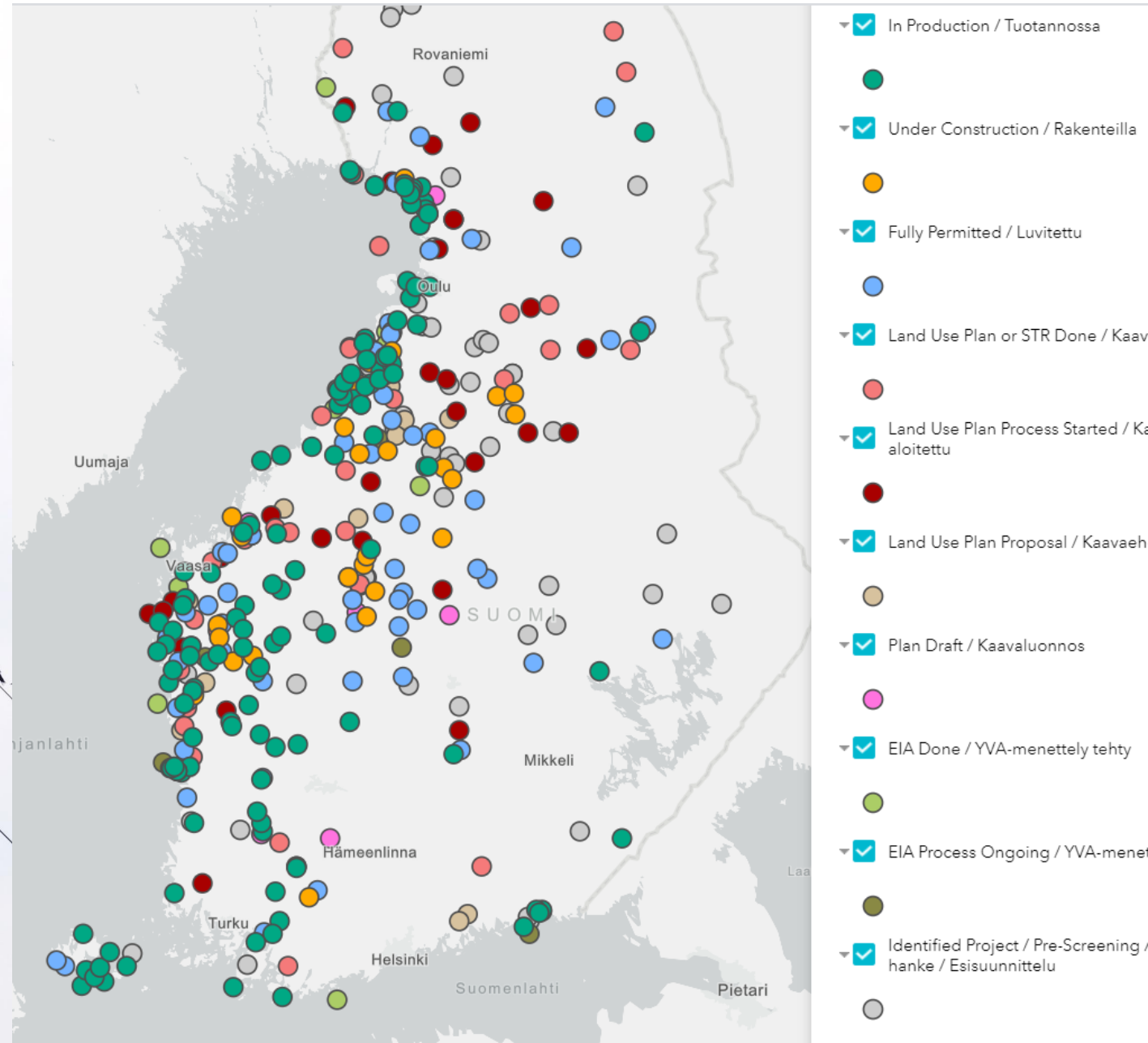
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- Investment and operating costs for different unit solutions
- Existing and upcoming energy production and transmission facilities (and future consumption)

Prognosis, Wind power production 2021 – 2024

Wind power production (TWh), for 2020-2024 annual production estimated according to the investment decisions made before 13th of January 2021



The current and planned wind power plants in Finland



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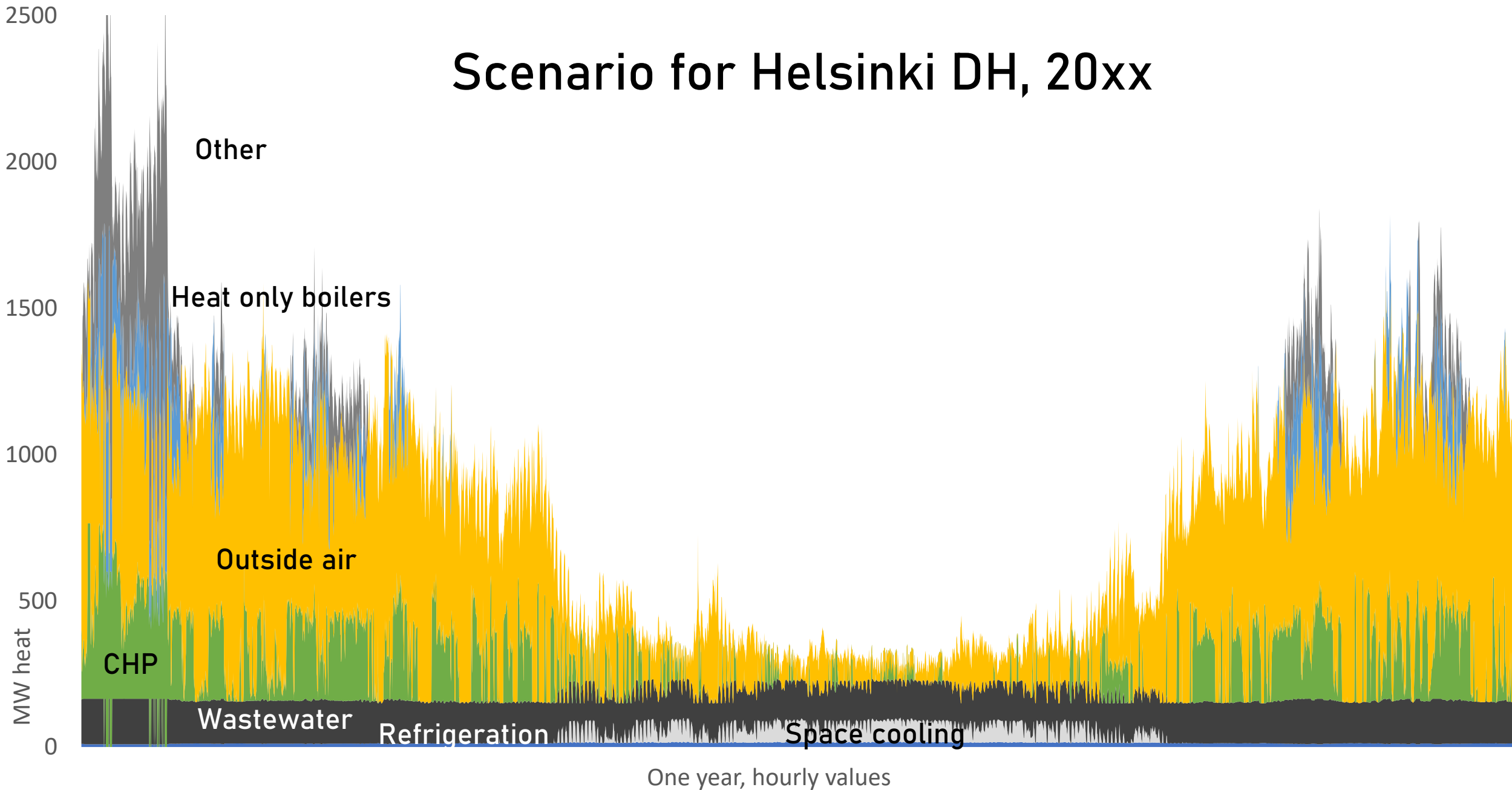
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2. Creating feasible portfolios, so that the heat and el needs are covered all the time



Drawing: Sanni Salo / Muodo

Scenario for Helsinki DH, 20xx



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2. Creating feasible portfolios, so that the heat and el needs are covered all the time

3. Techno-economical comparison of portfolios (with numbers)

The aim: minimize purchased energy during high general consumption

4. Societal comparison (without numbers)

- what is happening without interventions:
- social mood and trends
- interest rates for different investors and issues

-> Doing something (useful) that is close enough to be realized, but not happening in every case

Technology portfolios. A comparison of scenarios.

Portfolio shares	Avg heat cost, e/MWh	Amount of purchased energy, when load is >2/3 of the peak	Suits to the main mood or trend?	Impact on returns of investors for diff. tech
X% of el wind Y% of el solar Z% of el CHP + others A% of heat CHP B% of heat HP C% of heat HOB	40			
X + 15% of el wind Y + 5% of el solar Z - 15% of el CHP (others unchanged) A - 15% of heat CHP B +10 % of heat HP C + 5% of heat HOB Heat consumption reduction by D%	.		General opinion + Diff. politicians +- Authorities + Opinion leaders + Science +-	Wind ++ Solar + HP + CHP - Biomass +- En. companies +-

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Replication Potential of PED Technologies: lessons learnt

There should be a different solution portfolio in different context:

Natural gas / DH

Wind / solar-driven

Individual / “Individual” / centralized choices

In practice external energy (network) is needed, at least in Nordic countries.

Many targets, also in contradiction with each other. “Social mood” or trends are more important than usually admitted.

Who is the actor, who is the audience. Who can choose the own role?

Main barriers (for doing some long-term investment, monetary or other)

- need for quick pay-back times
- feeling unsecure about social status

Thank you!



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