VTT Technical Research Centre of Finland

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Published: 01/03/2020

Document Version
Publisher's final version

International Renewable Energy Storage Conference
IRES
IRES 2020 Poster Exhibition
14TH INTERNATIONAL RENEWABLE ENERGY STORAGE CONFERENCE

Flexibility Options for an Island Energy System

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What is the challenge?

- High shares of variable renewable energy integrated
- Reliability and security of supply must be ensured
- Supplementary roles of different solutions required

Potential of biomass CHP?

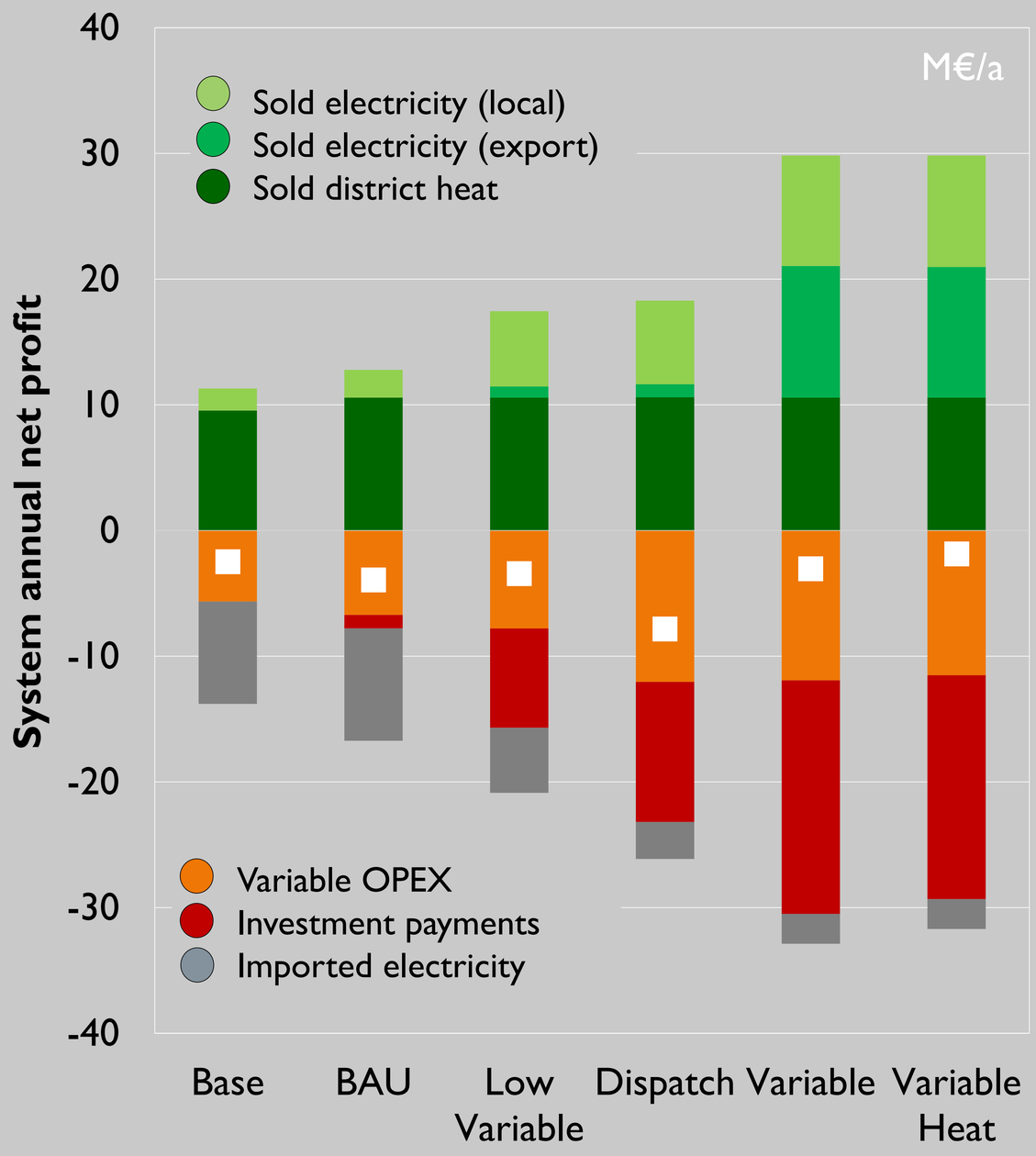
Combined heating and power using biomass fuels enables…

- Dispatchability with low OPEX
- High total efficiency
- Production flexibility with thermal energy storage

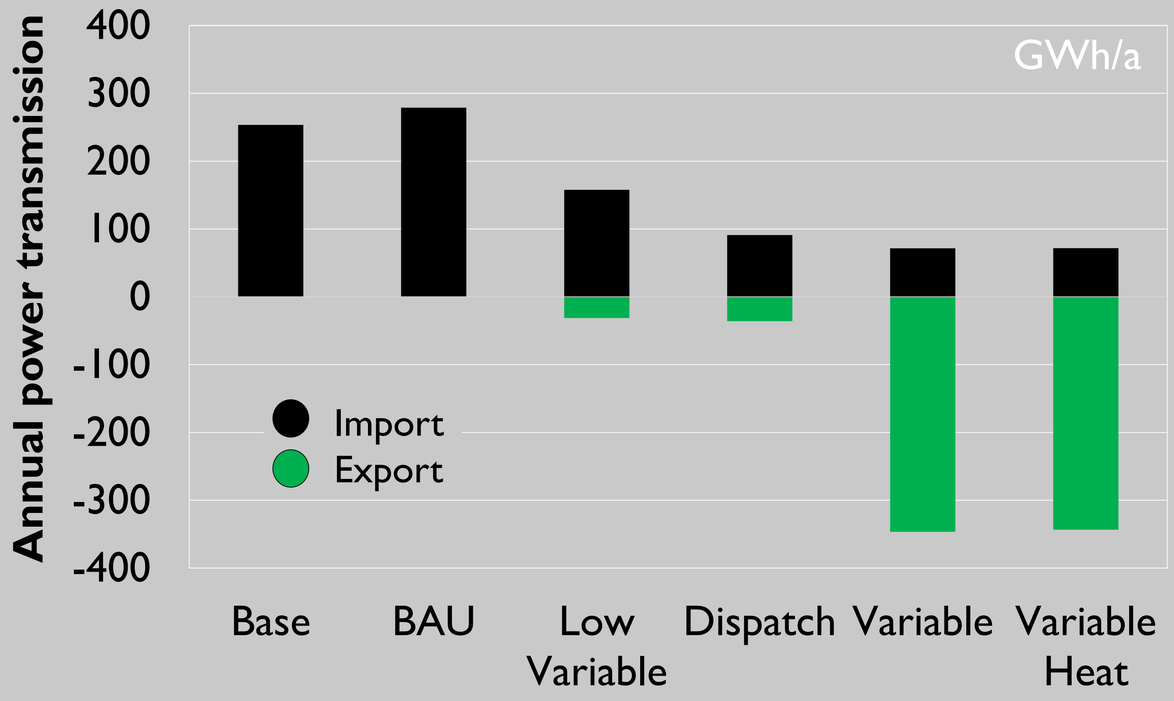
Focus on Åland Islands

Located between Finland and Sweden, to which power transmission possible

- Large wind projects in progress
- Limited potential for certain PtX solutions such as synthetic transport fuels and biogas upgrading with hydrogen

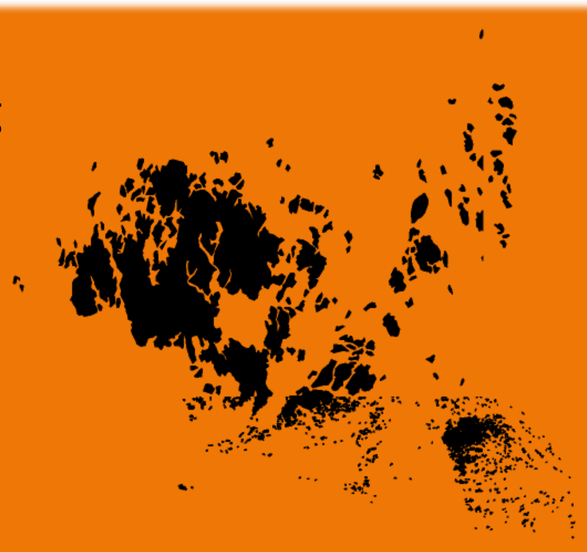


Scenario & capacity	Wind	CHP	PtHeat	Year
Base	21			2017
BAU	21			2025
Dispatch	85	15		2025
Low Variable	85			2025
Variable	185			2025
Variable Heat	185		15	2025



We studied the system using dispatch and investment optimization

- Mixed-integer linear programming
- Hourly simulation of a year
- Detailed unit models
- System total operating costs minimized



Optimality depends on the emphasis: costs, self-sufficiency, emission reductions or biomass consumption

- Power-to-heat promising
- Full self-sufficiency not realistic
- Potential for circular economy

VTT – beyond the obvious

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CEMBioFlex
Final report available