



This document is downloaded from the  
VTT's Research Information Portal  
<https://cris.vtt.fi>

VTT Technical Research Centre of Finland

## Flexibility Options for an Island Energy System

Thomasson, Tomi; Kiviranta, Kirsikka; Tapani, Antton; Tähtinen, Matti

Published: 01/03/2020

*Document Version*  
Publisher's final version

[Link to publication](#)

*Please cite the original version:*

Thomasson, T., Kiviranta, K., Tapani, A., & Tähtinen, M. (2020). *Flexibility Options for an Island Energy System*. Poster session presented at IRES2020, Düsseldorf, Germany.



VTT  
<http://www.vtt.fi>  
P.O. box 1000FI-02044 VTT  
Finland

By using VTT's Research Information Portal you are bound by the following Terms & Conditions.

I have read and I understand the following statement:

This document is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of this document is not permitted, except duplication for research use or educational purposes in electronic or print form. You must obtain permission for any other use. Electronic or print copies may not be offered for sale.

# Flexibility Options for an Island Energy System

Tomi Thomasson<sup>a\*</sup>, Kirsikka Kiviranta<sup>a</sup>, Antton Tapani<sup>b</sup>, Matti Tähtinen<sup>a</sup>

<sup>a</sup>VTT Technical Research Centre of Finland Ltd

<sup>b</sup>Reteres Ltd

### 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?

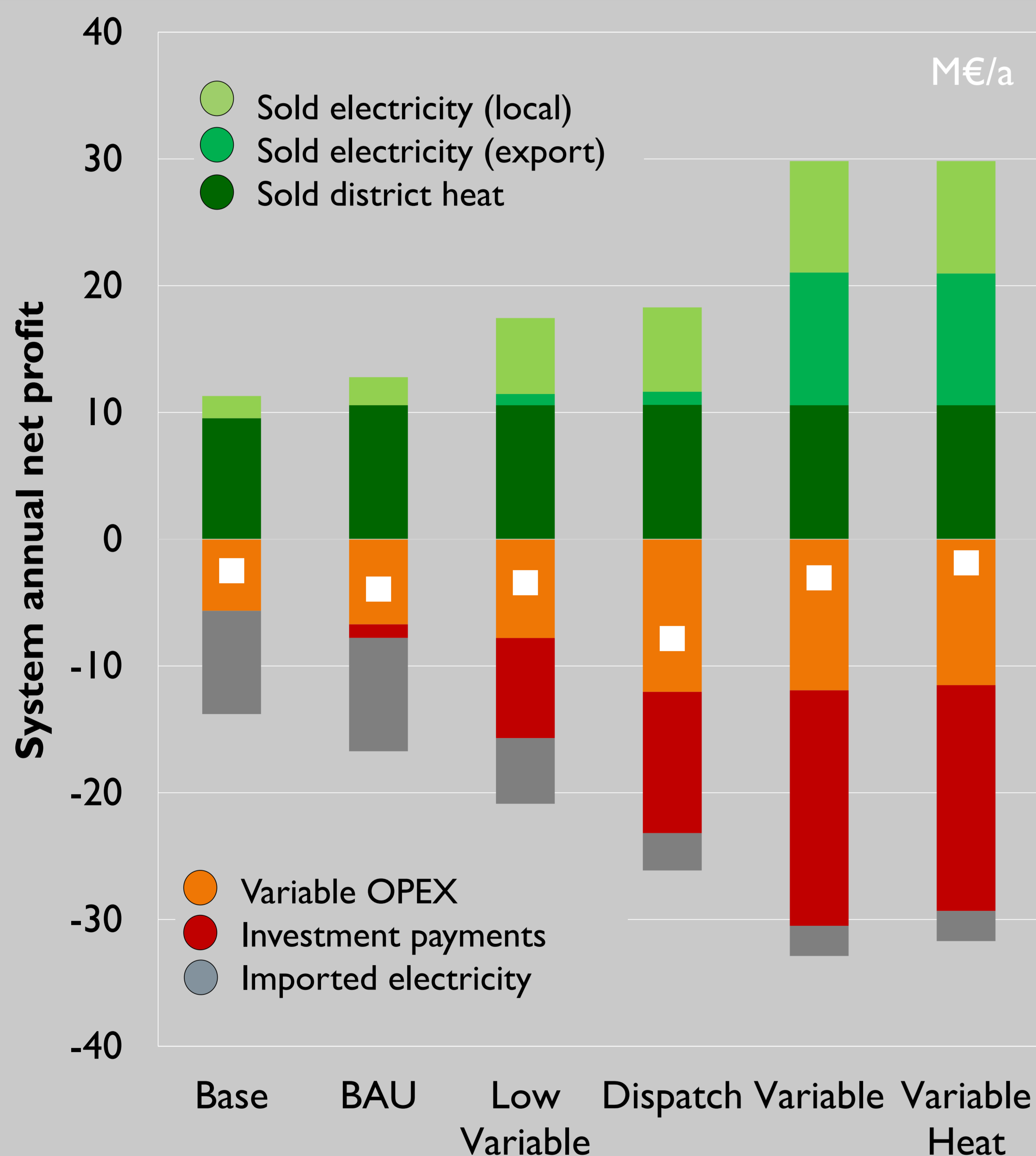
Combined heating and power using biomass fuels enables...

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

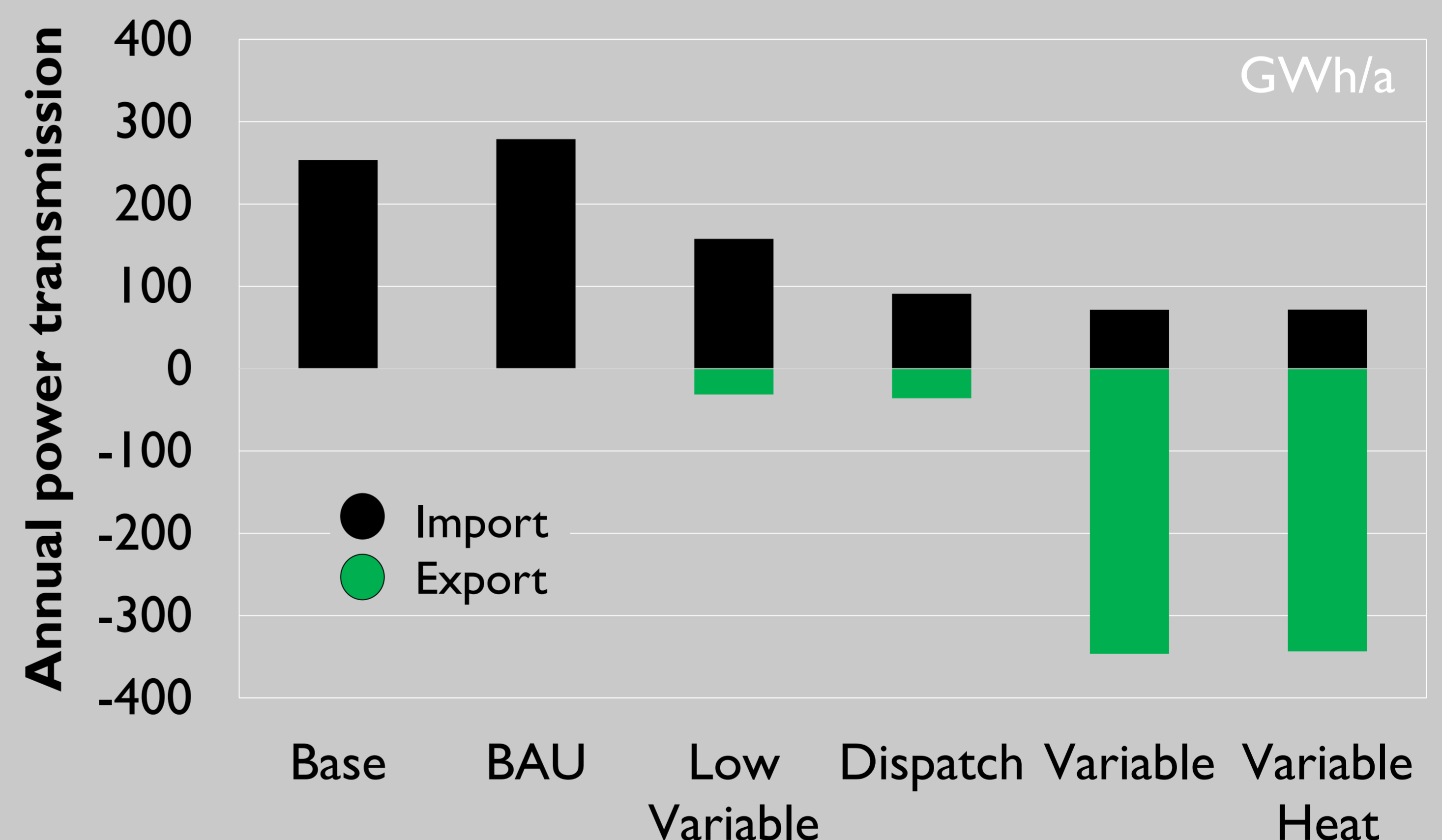
### Focus on Åland Islands

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

