



IGTC 2021

An Integrated Energy System to Decarbonise Islands – Gas Turbine Roles and Requirements

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Challenges of energy systems on islands:

- Often fossil fuel based energy system (imported)
- Remote location and costly grid connection to main grid
- Seasonal energy consumption to be matched with generation and storage

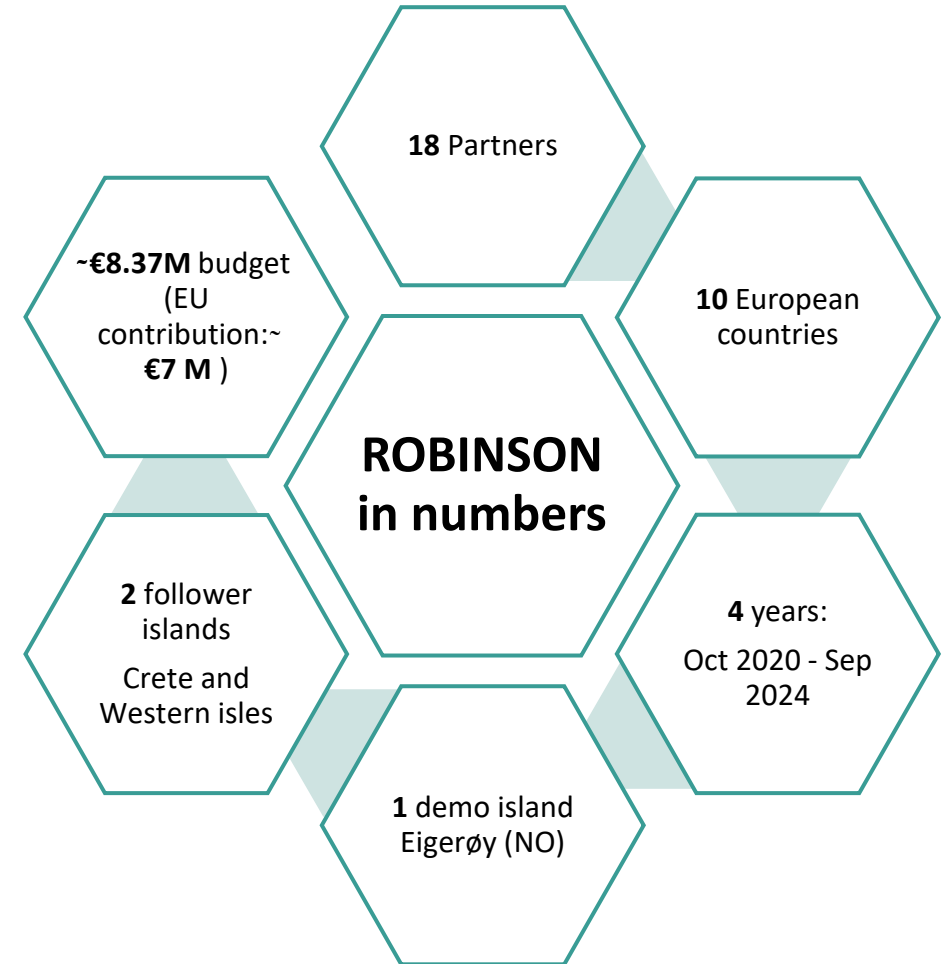


Concepts for islands inspire other regions



ROBINSON (Smart integration Of local energy sources and innovative storage for flexible, secure and cost-efficient energy Supply ON industrialized islands) is:

- An EU H2020 funded project
- Develops and demonstrates an intelligent, robust and flexible energy system integrating technologies across different energy vectors (electricity, heat and gas).
- Utilisation of locally available renewable energy sources
- Development and demonstration of new and existing technologies tightly interconnected



Current energy system at the demonstrator island “Eigerøy”

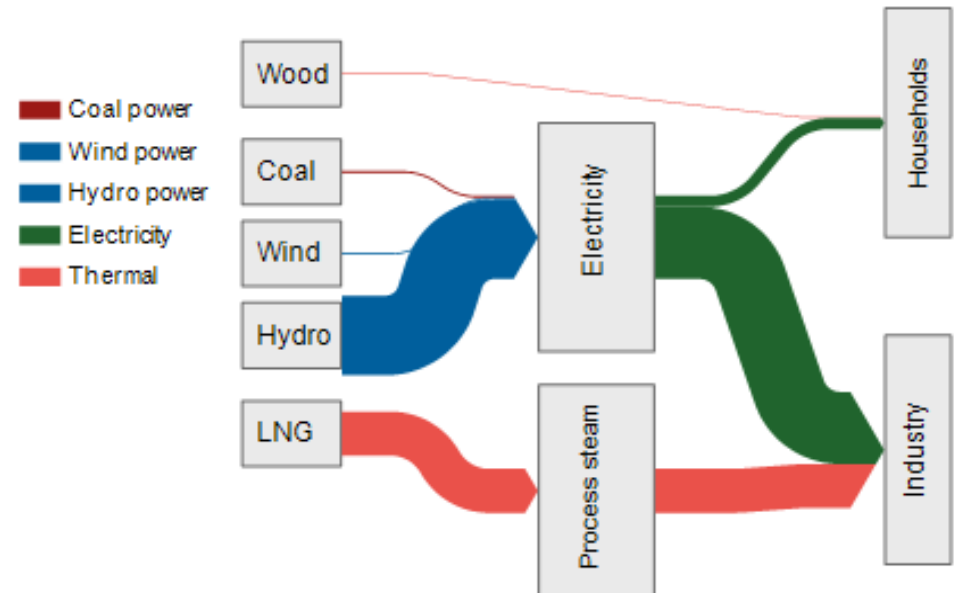


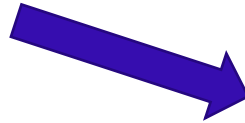
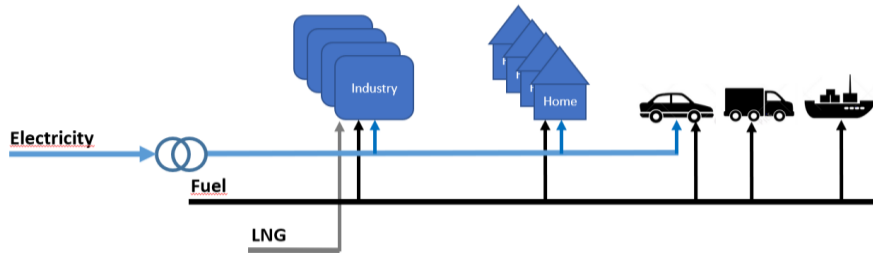
Basic facts	
Size	20 km ²
Population	~2500 (about 800 households)
Climate	Relatively high temperatures in winter and low in summer; relatively high wind speed
Industrial profile	A new fish industry has been constructed in January 2019, increasing the island’s need for electricity and steam. Moreover, new industries are to be established in the next years; they will increase the island’s energy demand and require an upgrade of the existing energy system.

Eigerøy’s current energy profile

Electricity: ~100% is imported from the mainland (average load 7,9MWh/hour, peak demand 18,5MWh/hour)

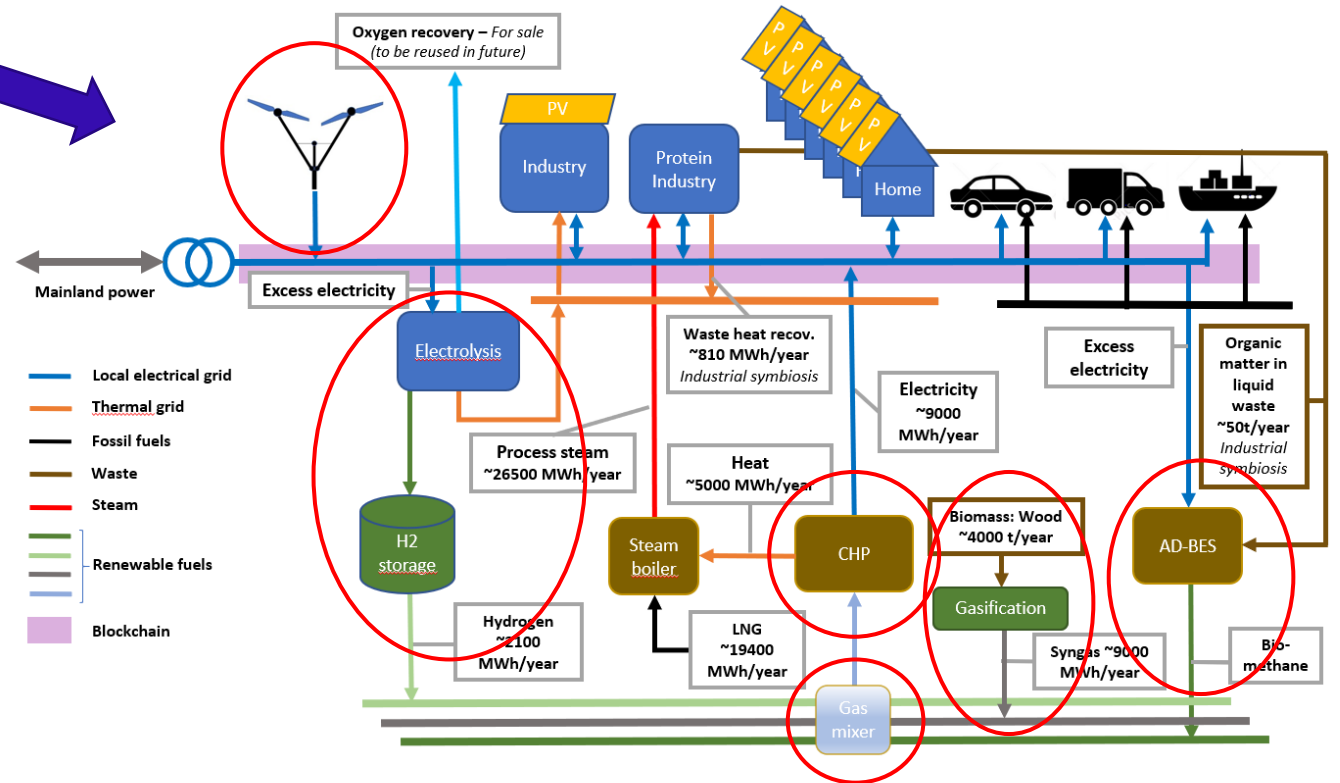
Thermal: 6950 MWh liquid fuel; >> 26500 MWh/year LNG





The demonstrator will not cover the energy demand of the whole island

It will be installed at the premises of the ROBINSON partner Prima Protein (PRIMA), which is the island's main consumer of fossil fuel (in 2019 consumption equivalent to 30GWh: ~80% of fossil fuel consumption in Eigerøy).





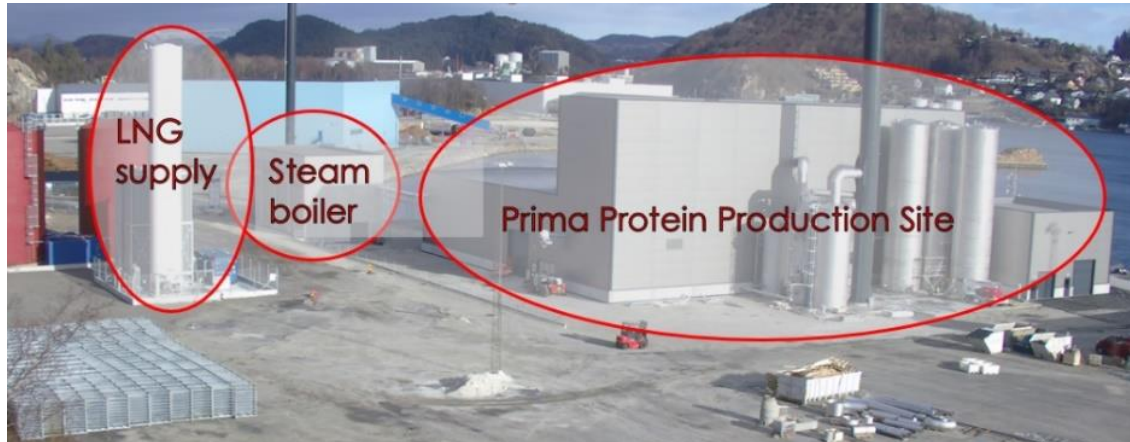
Demonstrator site at Eigerøy



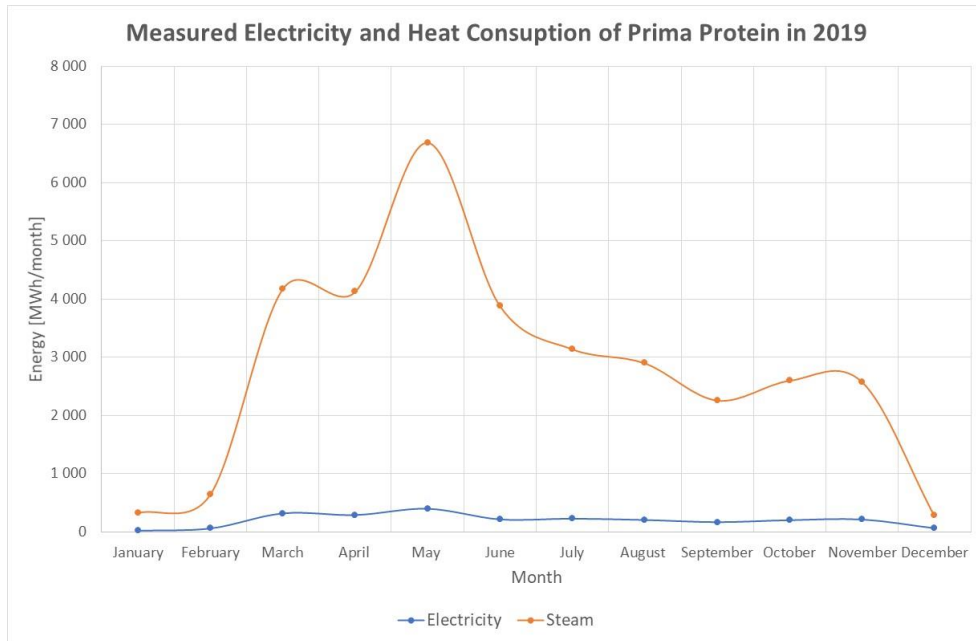
Mainly located at and around the industrial site of Prima Protein in the harbour area of Eigerøy.

The demonstrator is going to cover about 18% of the local energy demand for reasons of:

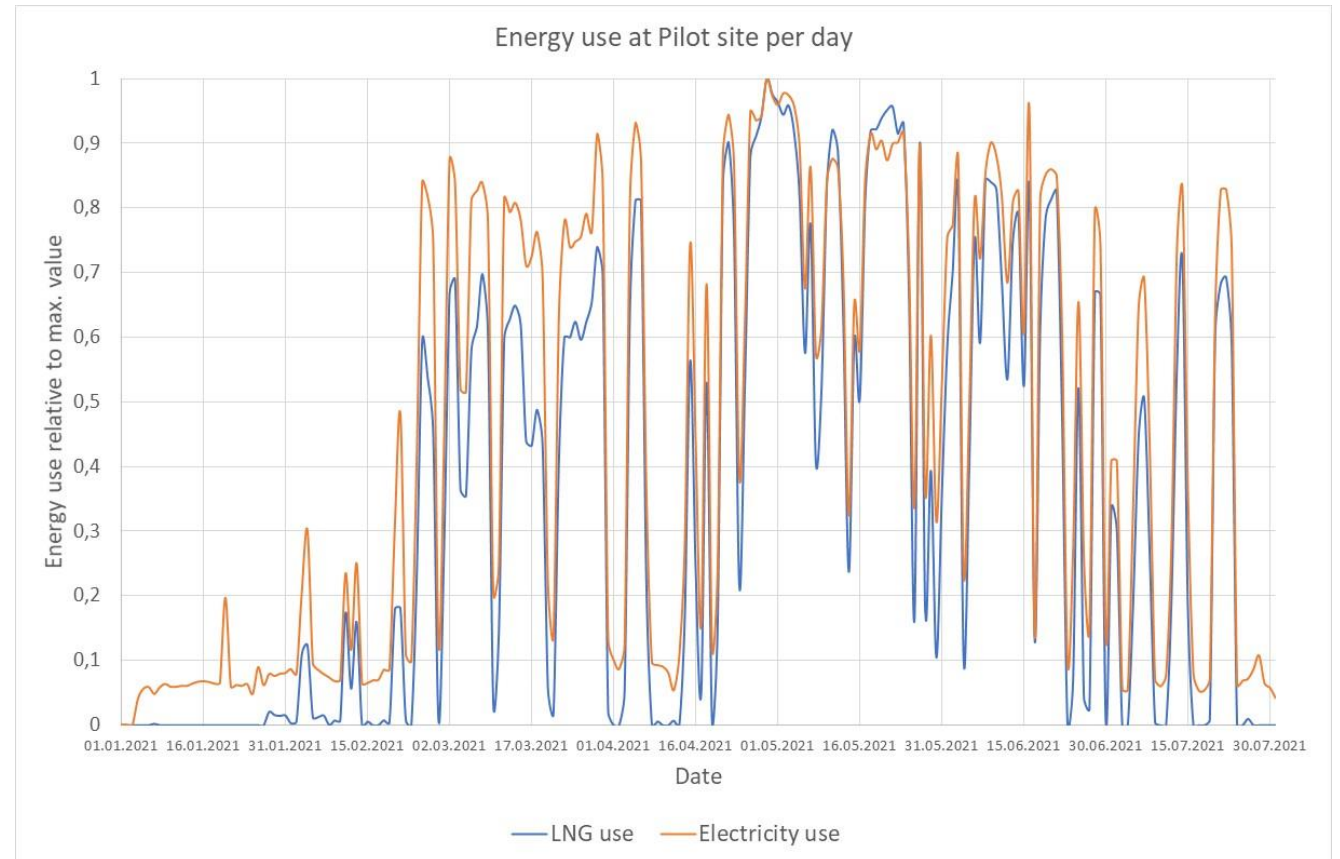
- Budget / funding by EU
- To not endanger the production



Energy demand has a strong seasonal profile
(Values used for the proposal)

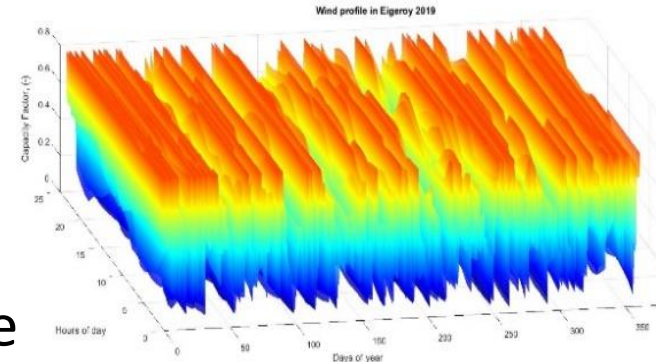


Energy profile variation per day; representing the first 7 months of 2021



Electricity via:

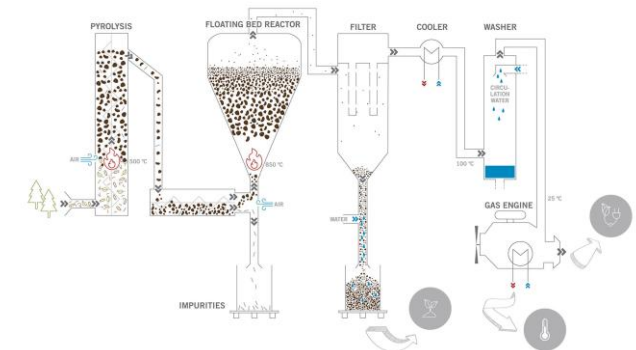
- Existing grid connection to main land
- Existing small scale solar PV
- Novel twin rotor 100 kW el wind turbine



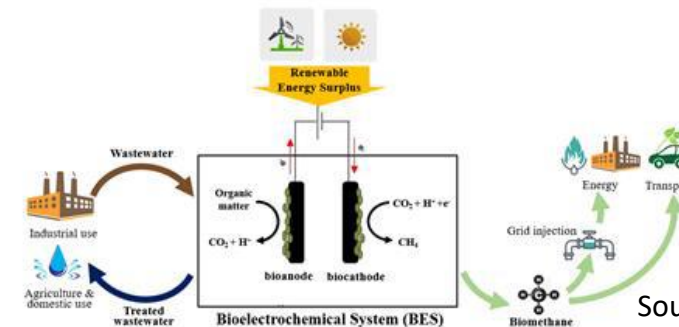
Source: RES-T 2020

Various new sustainable fuels:

- Hydrogen for power generation and transport
- Syngas based on gasification of waste wood
- Biomethane from anaerobic digestion assisted by bioelectrochemical systems (AD-BES)



Source: SynCraft 2021



Source: LEITAT 2021

The CHP is an Aurelia® A400

- 400 kW_{el} plus 500 kW_{therm}
- Wide range of fuel/fuel mixtures
 - Syngas / Biomethane and mixed with Hydrogen
 - LNG as backup

The CHP will:

- Provide electricity to the process at Prima
- Provide heat to support the steam generation at Prima

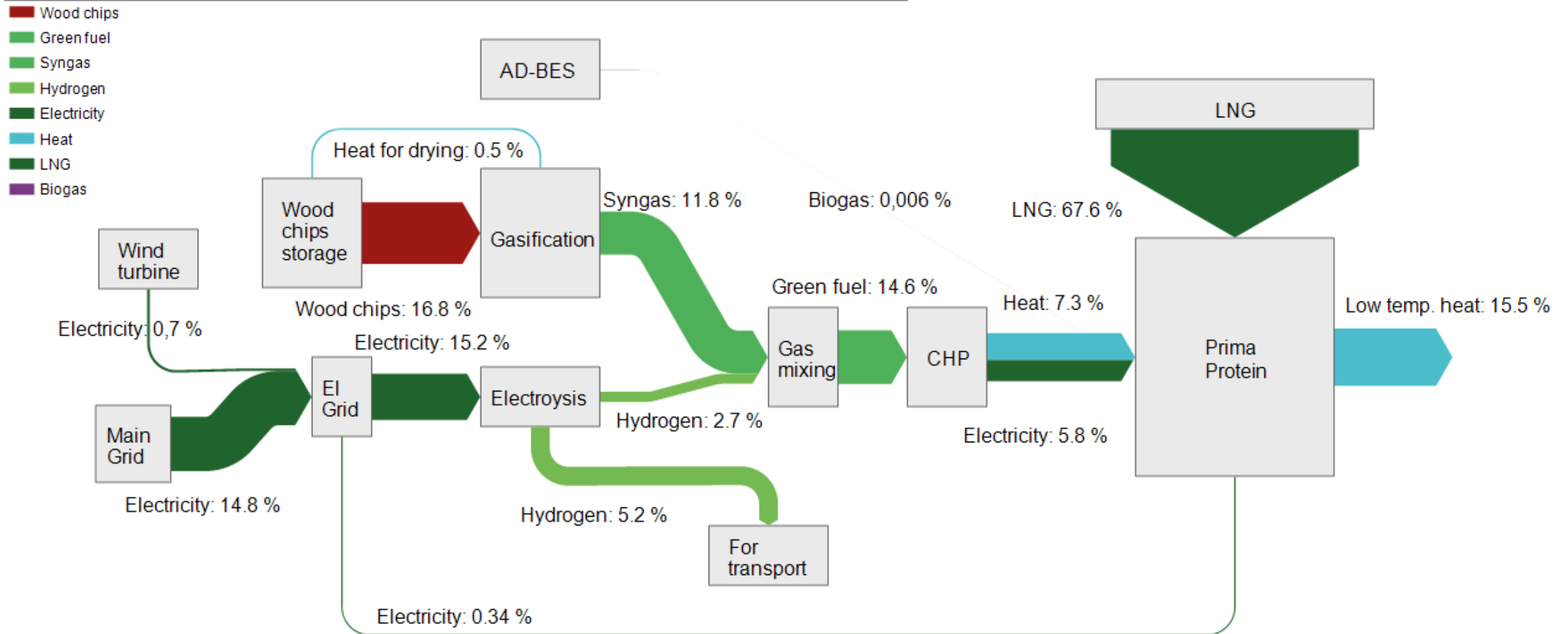
Novelty of the installation / integration at the demonstrator site:

- New developed fuel flexible combustor
- Layout and design in close connection with the fuel supply system to balance demand profile and different dynamics of fuel generation systems.



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Energy Flows for the demo site at Prima Protein



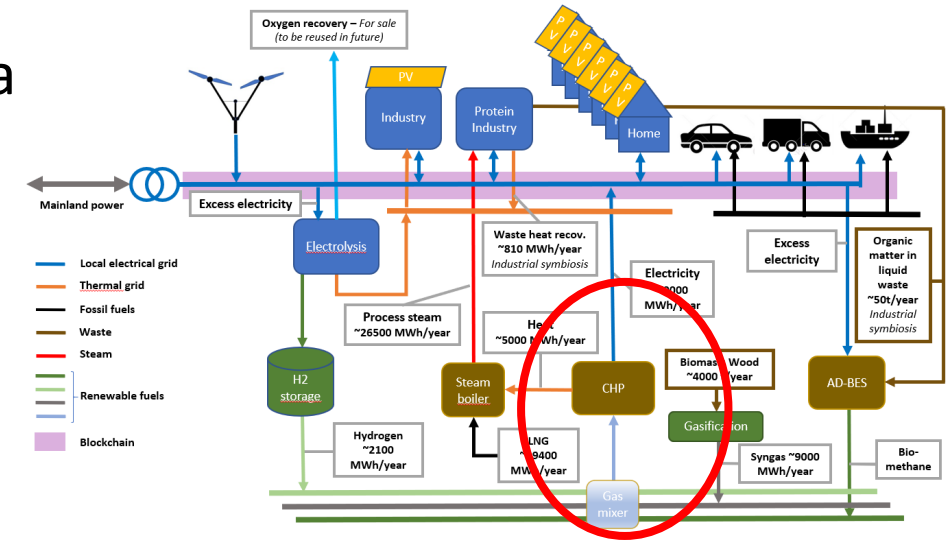
The CHP can have a vital role in energy systems of isla

Balancing various energy sources requires extended fuel flexibility

Balancing energy demand and RES requires an integrated approach to optimize the system in terms of layout and operation.

Different rules and regulations impact site / location specific solutions

Current uncertainties (cost development, adaptation of rules and regulations) make business decisions & system design challenging.





Thank you for your attention