From waste to grid: re-using resources to achieve energy independence on islands

Waste valorization through Anaerobic Digestion Assisted by Bio-Electrochemical System (AD+BES) technology

EU GREEN WEEK 2021 PARTNER EVENT

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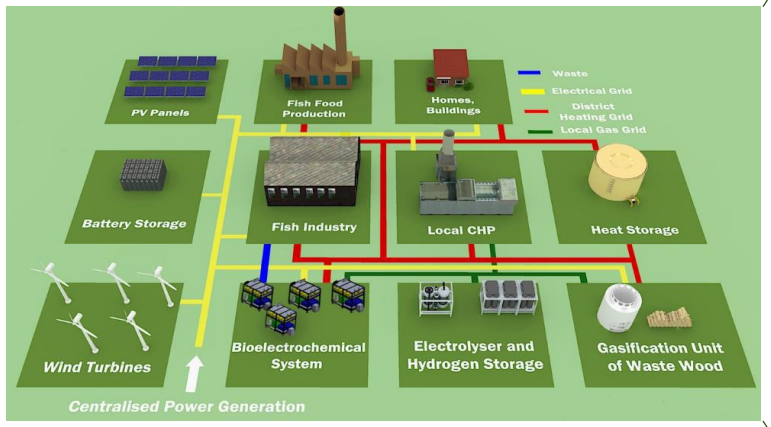
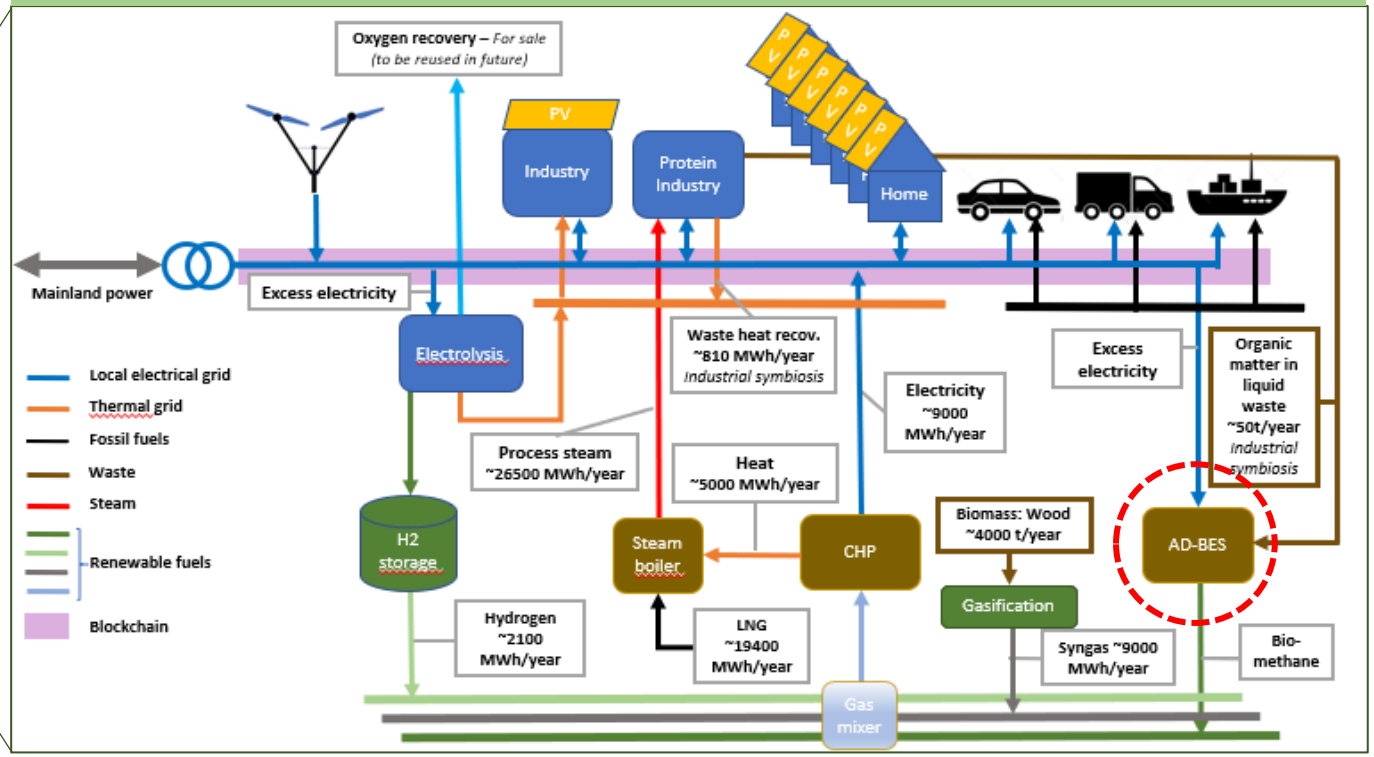
Keywords

- Energy management system (EMS)
- Different energy vectors
- Islands decarbonization
- Industrial symbiosis
- Waste valorisation



The ROBINSON concept applied on Eigerøy Island (Norway)



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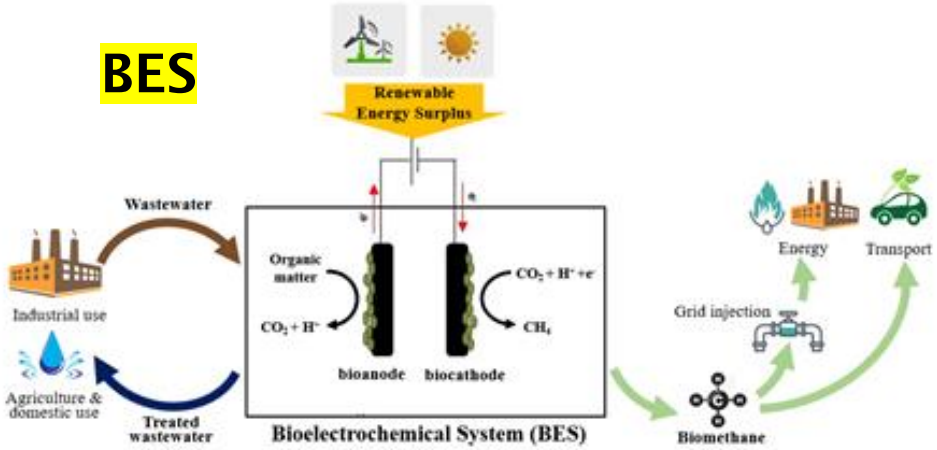
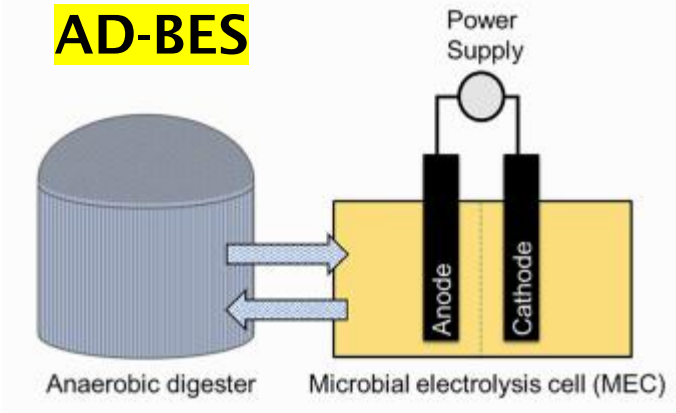
BES



AD-BES



Huang et al., 2020

- Bioelectrochemical system
- Electro-active bacteria
- Wastewater treatment
- Storage of renewable energy surplus
- Potential improvement of fermentation processes

- Improving anaerobic digestion process
- Reduction of CO_2 emissions related to waste treatment
- Production of biomethane as energy vector
- Technology integration into ROBINSON EMS

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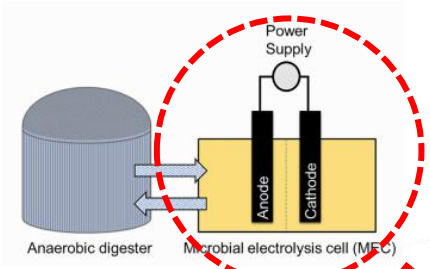
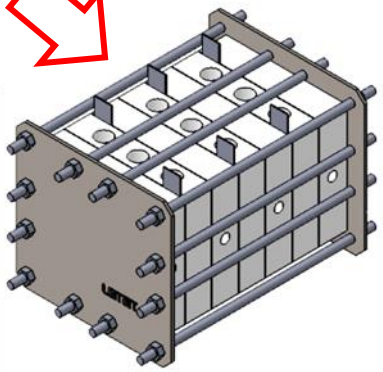
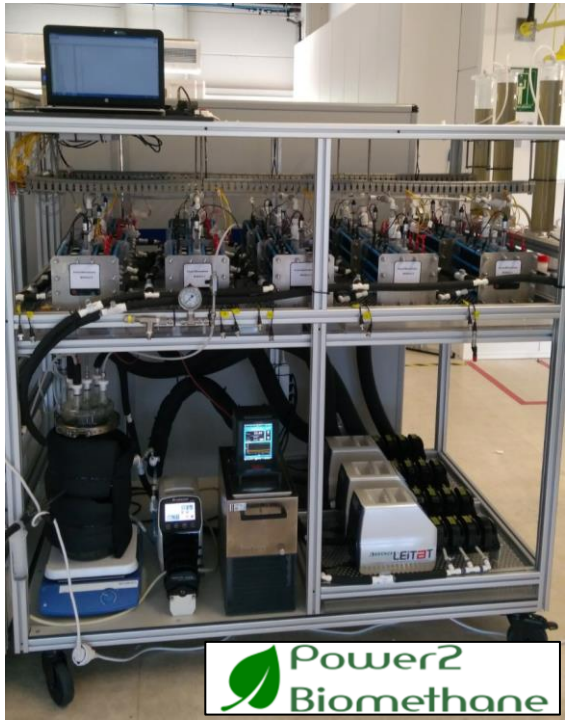
Huang Q et al. A critical review of microbial electrolysis cells coupled with anaerobic digester for enhanced biomethane recovery from high-strength feedstocks. Critical Reviews in Environmental Science and Technology 2020:1–40.

- Conversion of liquid waste from fish industry into biomethane by AD-BES
- Energy conversion efficiency around 70%
- Biogas production of 0,9 $m^3\ m^{-3}_{reactor}\ d^{-1}$, with CH_4 content > 95% (def. biomethane)







Ceballos et al., 2020

- Side-stream BES
- Modular system
- 3D-printed metallic electrodes (SS, Ti, alloys)

<u>Laboratory objectives</u>:

- Electrodes' materials and geometry optimization
- Best electrical connection for the BES stack
- Waste treatment capacity
- Microbial community characterization

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Ceballos-Escalera A et al. Bioelectrochemical systems for energy storage: A scaled-up power-to-gas approach. Applied Energy 2020;260:114138.

The AD-BES is expected to be up-scaled up to 1 m^3 scale, achieving the following:

- Treatment of fish industry wastewater (PRIMA Protein AS, Eigerøy)
- Electrical current demand up to 20 A m^{-2} electrode
- Power density up to 1 kW m^{-3} reactor
- Confirming biomethane productivity of 0,9 m^3 $m^{-3}_{reactor}$ d^{-1} with a purity > 95%

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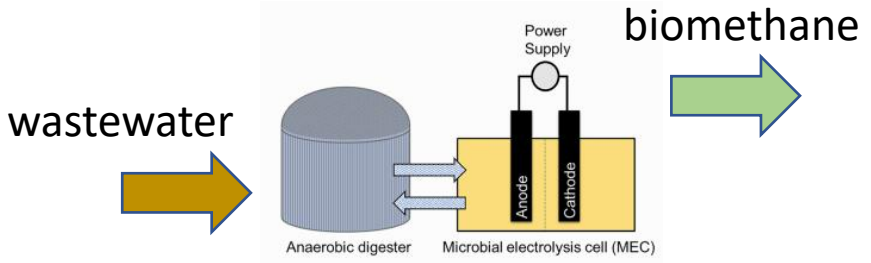
TRL 4 — Laboratory development — Technology up-scaling — *TRL 7*

2021 | 2022 | 2023 | 2024



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