CETP Pitching & Matchmaking Event for Integrated Industrial Energy Systems

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Co-funded by the European Union

Pitch for the Zhengmao Li

Name of the project idea (and acronym if you already have one)

Data-Driven Sustainable Energy Systems with Seasonal Ammonia Storage, Market trading and Industrial Demand Flexibility

N/A

Consortium partners

- Coordinating organisation: <To be decided, looking for coordinators.>
- Main contact person: <To be decided>
- List of consortium partners:

- Energy companies and system operators (e.g., Fortum, Helen, Fingrid): for data access and pilot sites.
- Clean tech and equipment providers (e.g., ABB, Siemens, Danfoss): for control and integration technologies.
- Large industrial consumers (e.g., UPM, SSAB, Yara): offering flexible loads for testing.
- Hydrogen and renewable fuel companies (e.g., Gasgrid, Neste, P2X Solutions): for multi-energy integration.
- Digital and AI firms (e.g., TietoEVRY, Vaisala): for optimization and smart system operation.

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Data-Driven Sustainable Energy Systems with Seasonal Ammonia Storage, Market trading and Industrial Demand Flexibility

Challenge

- Green hydrogen and ammonia are fast developing that can support the decarbonization of Europe's energy system.
- Some European countries faces negative electricity price issues in summer with wasted energy. Seasonal ammonia storage can store surplus electricity in summer and use it in winter.
- Market trading can help with alleviating the negative prices issues by selling extra electricity to customers.
- Industrial sectors enable huge demand-side flexibility. Its process electrification and flexible scheduling can help to mitigate negative prices issue.
- A system level coordinated energy management approach should be effectively designed to reduce the system operation cost and gas emissions.
- Existing model-based methods can't handle the complexity of new energy systems. Pure AI method needs too much data which is hard to obtain especially when green hydrogen and ammonia are new.

Current H_2 and ammioia model

- ✓ Rough power to hydrogen to ammonia model
- ✓ Rough fuel cell model for ammonia consumption

Current Industrial Consumption

- ✓ Process electrification modelling is not enough
- ✓ The potential of demand side flexibility is not fully developed

Current System level analysis

- ✓ No comprehensive system level coordination
- ✓ Seasonal storage and market trading is not sufficiently studied.

Current solution method

- ✓ Model based methods: Rely too much on accurate model
- ✓ Pure AI methods: Rely too much on full data

Data-Driven Sustainable Energy Systems with Seasonal Ammonia Storage, Market trading and Industrial Demand Flexibility

Solutions proposed

Solutions:

S1: Practical Modeling of Green Hydrogen and Ammonia Supply Chian and Market Machinism

S2: Process Electrification and Demand-Side Flexibility modelling for Pulp Industry

S3: System-Level Operation of Energy System with Ammonia Storge, Market Operation and Demand-Side Flexibility

S4: Physics-Informed AI for Real-Time Operations under Uncertainty Sources

S5: Software Development & Stakeholder Connections

S6: Industrial technical demonstration to business usage case (TR6)

What we have:

We have mature energy system models and AI methods. Besides, the market mechanism and industrial load are also well-modelled.

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Pitch for the <project acronym> project 4/5

Our next step activities for proposal submission to CETP JC2025

Describe the fundamental key activities where you would need collaboration or help from others *for example, collaboration/partnering with companies, piloting/demo with some type of a partner, validating, testing/demoing, financing for commercialization or* ***what and with whom****?*

We seek strong partners to collaborate with in forming a solid consortium.

- What Aalto can do: Aalto University can lead system-level modeling, and AI-based optimization. We bring expertise in green hydrogen integration, and smart multi-energy systems (electricity, heat, gas, hydrogen). We can also provide access to laboratory platforms and high-performance computing resources for testing and simulation.
- What industry partners can do: We welcome companies that can provide real-world pilot sites, equipment, and technical solutions, particularly in hydrogen production, flexible industrial processes, and multi-energy integration.

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Thank you & contact information

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