Sustainable energy supply for municipalities in Sri Lanka: A model project for emission-free energy generation, storage and specialist training

LNES- Laboratory for Sustainable Energy Systems

Rheinische
Hochschule
Köln

Team - NES

Professors

Prof. Bugra Turan
- ▶ Sensors, actuators, mechatronics
- ▶ Machine learning

Project experience:
- ▶ Photovoltaics, battery management
- ▶ Photoelectrochem. Water splitting

Prof. Sebastian Schiebahn
- ▶ Energy and process engineering
- ▶ Conceptual design, system analysis

Project experience:
- ▶ Electrolysis, hydrogen, RE
- ▶ Chemical and power plant processes

Prof. Jörg Lampe
- ▶ Systems theory and mathematics
- ▶ Systems engineering and modeling
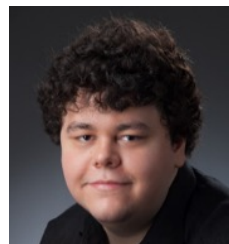
Project experience:
- ▶ Solar hydrogen production
- ▶ Simulation, Multiphysic. Energy Systems
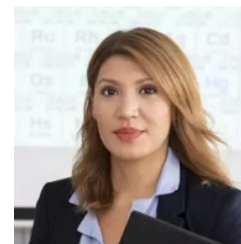
Research assistants

Christopher Wett
- ▶ Battery technology and modeling
- ▶ Machine learning

Richard Heinzen
- ▶ Communication and electrical engineering
- ▶ Planning and electrical expertise

Donia Momand
- ▶ Process engineering and process technology
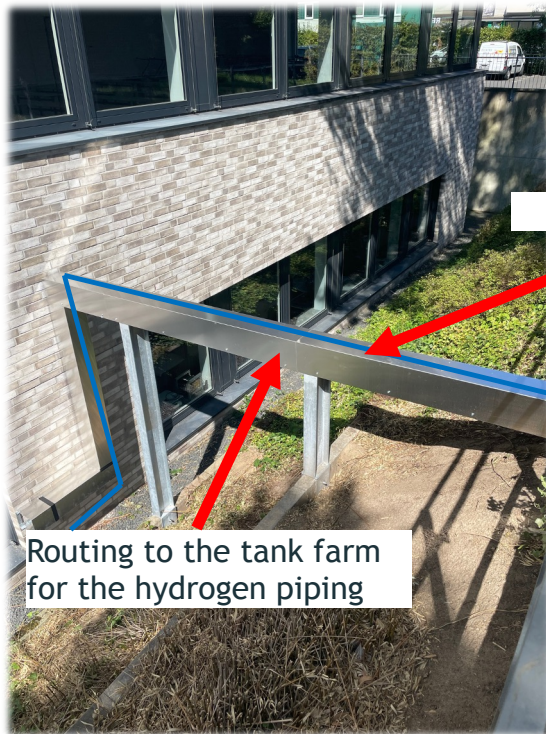- ▶ Chemical and laboratory expertise

Johannes Steingass
- ▶ Hydrogen systems & simulation
- ▶ Security expertise
- ▶ Process engineering

Hydrogen test laboratory at RH Cologne

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PV system + inverter

Inverter Batteries

Battery storage

H_2 Sensor

Forced exhaust air

PEM Fuel Cell

Water supply

AEM-Electrolysis

H_2 Drying

Hydrogen test laboratory at RH Cologne

H₂ Piping

Routing to the tank farm for the hydrogen piping

H₂ Tanks (3x50L)

Hydrogen test laboratory at RH Cologne

- Control technology based on Beckhoff (Control station)
- Current work on reading measurement data, setting operating parameters, based on the respective communication protocols
- Visualization using Grafana
- Database based on InfluxDB
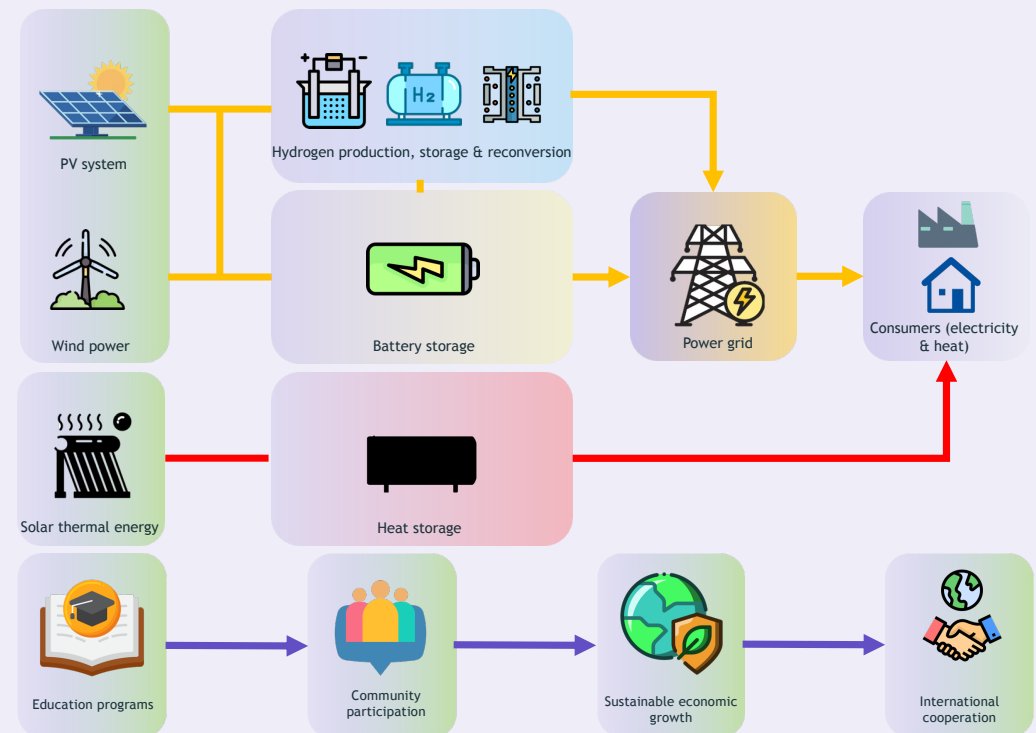- Aim of additional web-based display of measurement data

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Project content

The project aims to make a specific Municipality in Sri Lanka energy self-sufficient by using emission-free energy generation such as photovoltaic systems in combination with electrolysis. Hydrogen and battery storage systems are to be used as far as possible. The aim is to reduce dependence on unreliable energy supplies, promote economic and social development and protect the environment

Work packages

1. **Feasibility study and planning**
   - Site analysis & evaluation
   - Analysis of weather and environmental conditions.
   - Economic evaluation of energy generation and storage.
   - Consideration of extensions (wind energy, biomass).
   - Evaluation of ecological, economic and social impacts.

2. **Technology implementation and infrastructure**
   - Installation of PV systems for emission-free energy generation. (possibly solar hot water systems)
   - Installation of hydrogen and battery storage systems for security of supply.
   - Integration of smart grid technologies for optimized energy management.

3. **Training and knowledge transfer**
   - Establishment of training programs for skilled personnel. (maintenace)
   - Promoting the participation of women in technical professions.
   - Development of educational programs for schools and universities.
   - International cooperation and knowledge transfer.
   - Creation of guidelines for the replicability of the project.

4. **Social integration and acceptance**
   - Involving the local population in planning and implementation.
   - Information campaigns on climate protection and energy independence.
   - Improving the quality of life through a stable energy supply.
   - Promoting jobs and economic development.

5. **Monitoring, resilience and optimization**
   - Development of a monitoring system for energy production and use.
   - Collection of data on ageing processes & overall efficiency.
   - Ensuring system robustness against extreme weather conditions.
   - Development of emergency supply systems – energy based

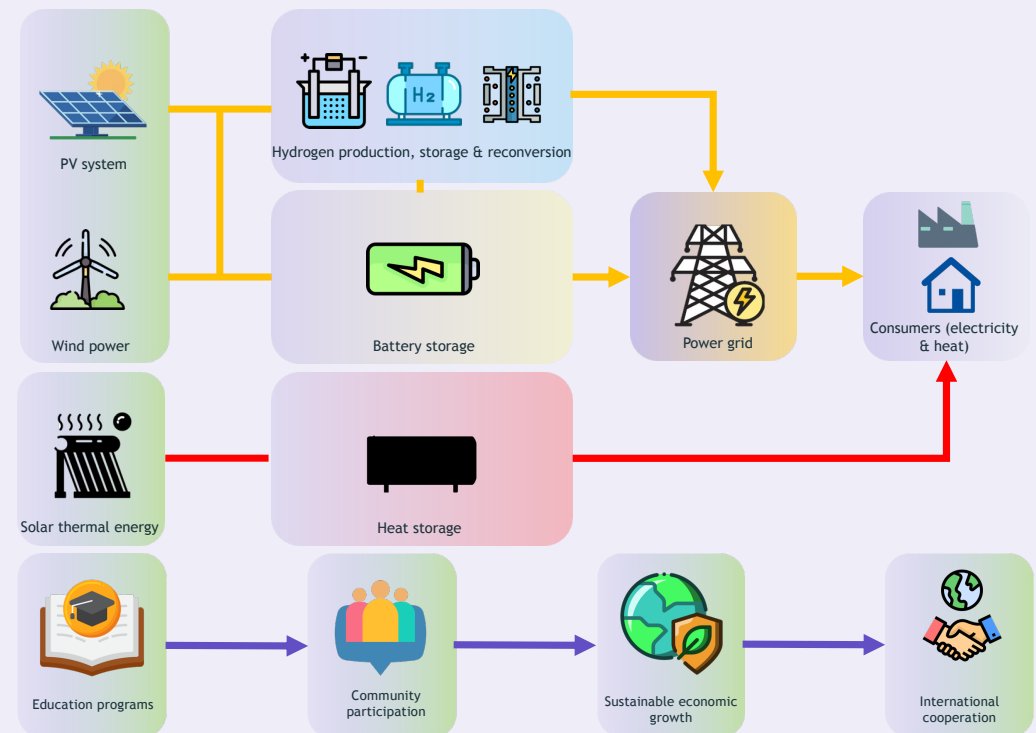6. **Political and legal framework conditions**
   - Cooperation with local authorities for conducive regulations.
   - Development of policy recommendations for the energy transition in Sri Lanka.
   - Cooperation with international partners (e.g. chemical industry).

Project objectives

- Energy independence and supply security for the selected municipality.
- Contribution to climate protection through emission-free energy production.
- Development of local expertise and creation of jobs within the municipality.
- Establishment of a transferable model for sustainable energy supply in developing countries.

Potential project partners & networks

What are we looking for?

- Local universities
- Local installation companies
- Local governmental institutions (Regulations & Import)
- Contact with several municipalities
- Partnerships for scientific projects in Sri Lanka
- Implementation of renewable energy systems in Sri Lanka
- Educational programs for local communities in Sri Lanka
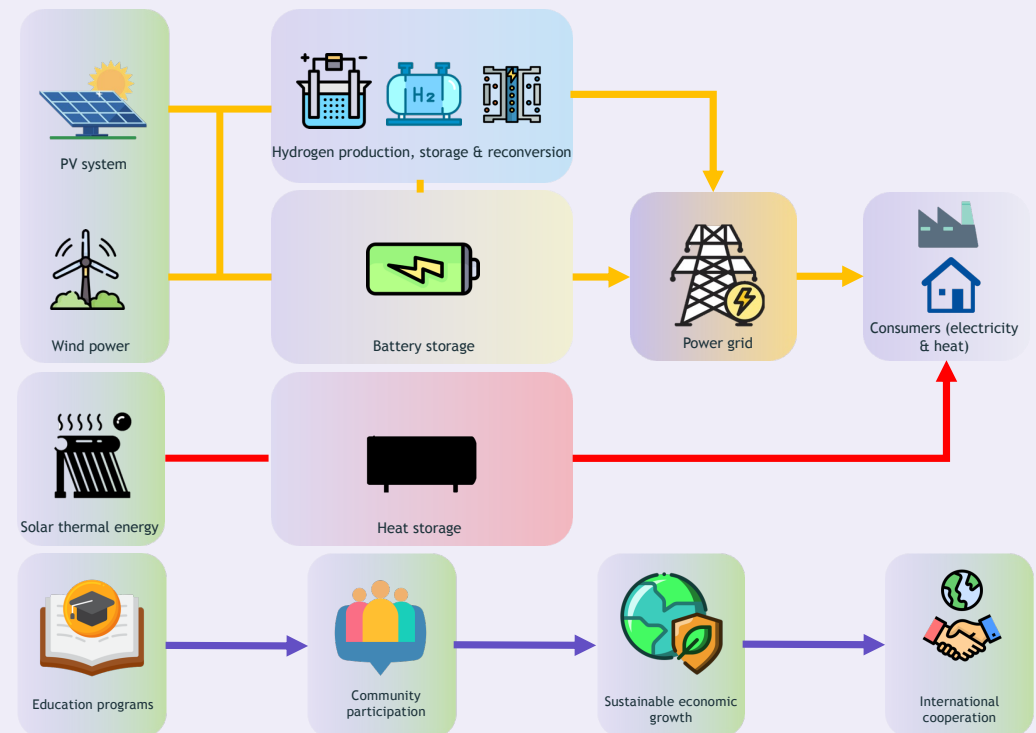
I'd love to hear your thoughts and explore collaboration opportunities!

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Research assistant

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