H₂ and fuel cells comes with a future large renewable energy concept

New technical parts need to be verified, such as solar collectors hydrogen generators, hydrogen storage, fuel cells etc.

How will they interact with each other in the energy systems?

Demonstration projects are needed to give feed back to the development

At Stockholm University we work with batteries and metal hydrides

Future vision: HyGrid (Hybrid Grid)

Minimum use of fossil energy and maximum use of renewables Combined electricity and hydrogen together



Power to X

Renewable hydrogen make the industrial operations sustainable



Prof. Hirose Kyushu Univ.

SMALL SCALE DEMONSTRATION PROJECT **EXPERIMENTAL PLATFORM**







0.8 kg/h

LHV 13.9 kWh/kg

HHV 15.4 kWh/kg

CH,





BATTERIES





Nilar AB Sales / Distributor Stockholmsvägen 116 B, 6tr 187 30 Täby Sweden +46 (0)8 768 00 00 sales.europe@nilar.com

Battery Module: Nominal Voltage: 12 V Rated capacity: 10 Ah Energy: 126 Wh Energy density: 53 Wh/kg Energy density: 114 Wh/dm3 Max. discharge current: 30 A Weight: 2.38 kg Volume: 1.1 dm³

12 Modules in a battery pack



Battery Pack: Number of Modules: 12 Energy: 1.5 kWh/30 kg Power charge: 500 W Power discharge: 4.5 kW

24kW from photovoltaic 48 battery packs 72 kWh MOD bus 1680 kg Concentrated Solar Power (CSP) systems based on Stirling engines use hydrogen as working fluid and could use metal hydrides for heat storage to prolong energy production into the evening





Heat storage advantage:

Metal hydrides need 10 times less material than salt.



Wet H₂ storage



Storing wet hydrogen in a metal hydride





Hydrogen discharging under water



The much hyped hydrogen economy, which has motivated a lot of basic research, seems finally to appear

Demonstration projects may figure out how the developed components can be combined and optimized