CRES activities on Sustainable Hydrogen Production

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ΚΑΠΕ
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CRES activities on hydrogen technologies

CRES is active in the real-scale development and demonstration of RES – hydrogen systems

- Hydrogen production
- Hydrogen storage
- Hydrogen use as fuel

- Integrated system design and analysis
- Component testing and evaluation
- Evaluation of demonstrations and systems
- Techno-economical studies
- Modeling and simulation

Wind hydrogen test site (RES2H2)

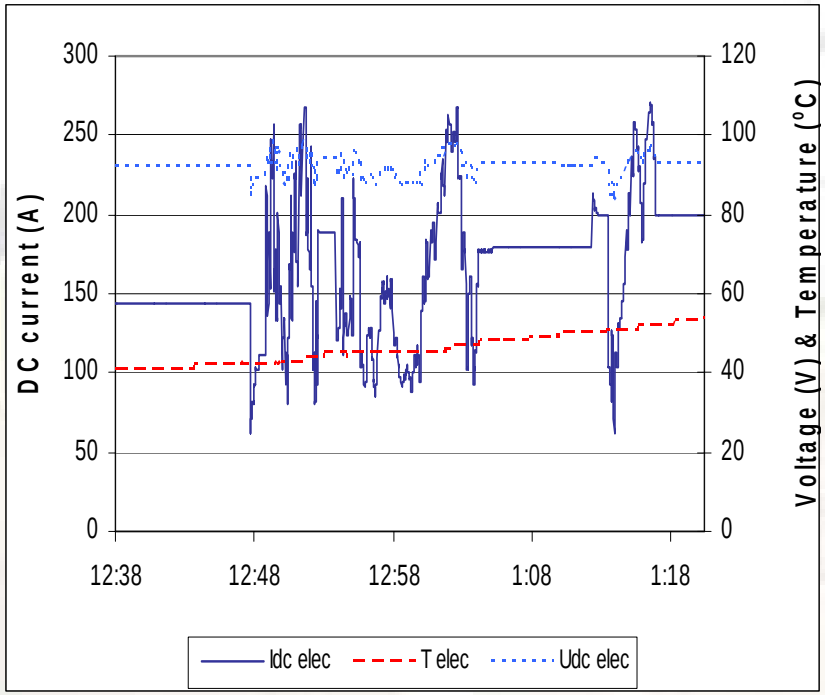
Key Components	Key data
Start-up	October 2005
Wind Turbine	500 kW
Alkaline Electrolyser	25 kW, 5 Nm^3/h H_2 20 bar 99.98 %v. purity
Metal hydride tanks	$LaNi_5$ type 40 Nm^3 in MH tanks
Hydrogen compressor	Single stage 10 - 220 bar
Filling station	100 Nm^3 in cylinders

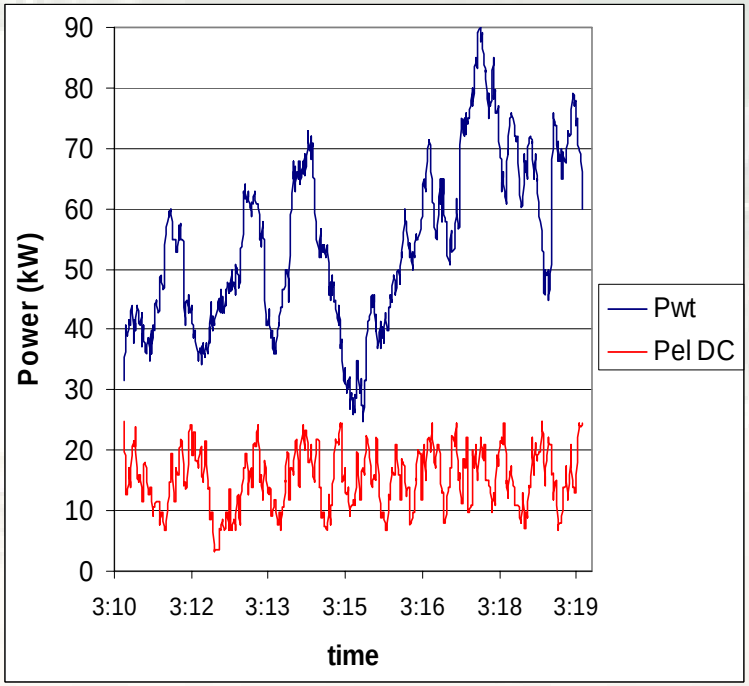
General View of wind-hydrogen installation

Wind hydrogen test site (RES2H2)

Wind hydrogen test site (RES2H2)

Electrolyser operation under stable and variable power input





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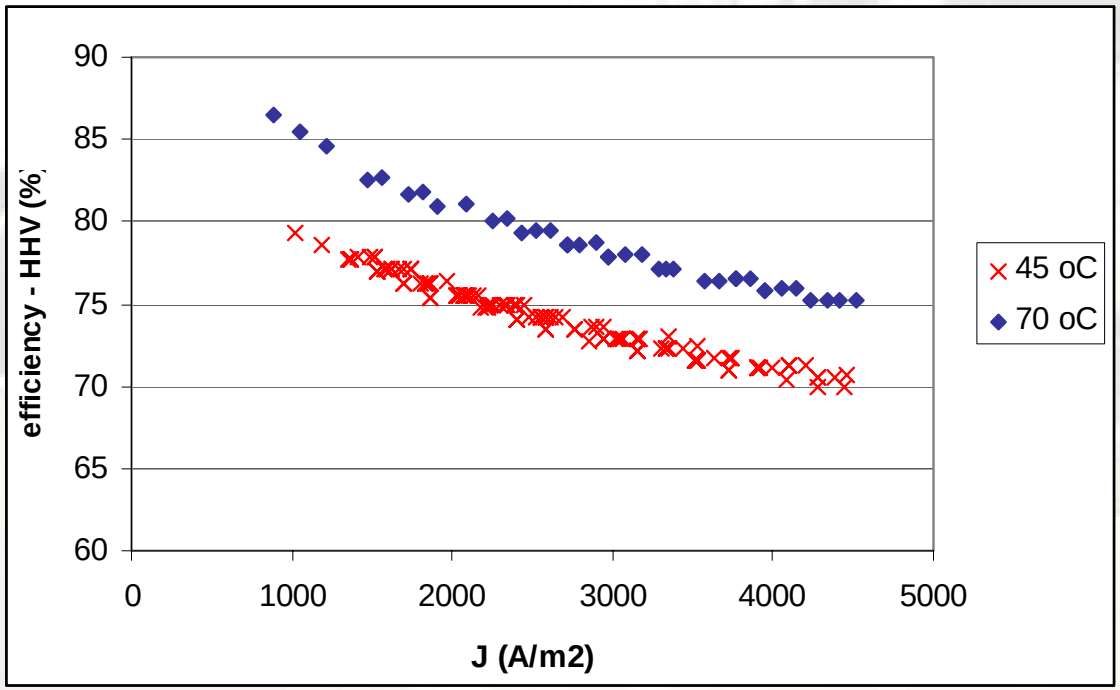
Wind hydrogen test site (RES2H2)

Electrolyser stack efficiency as a function of applied current density



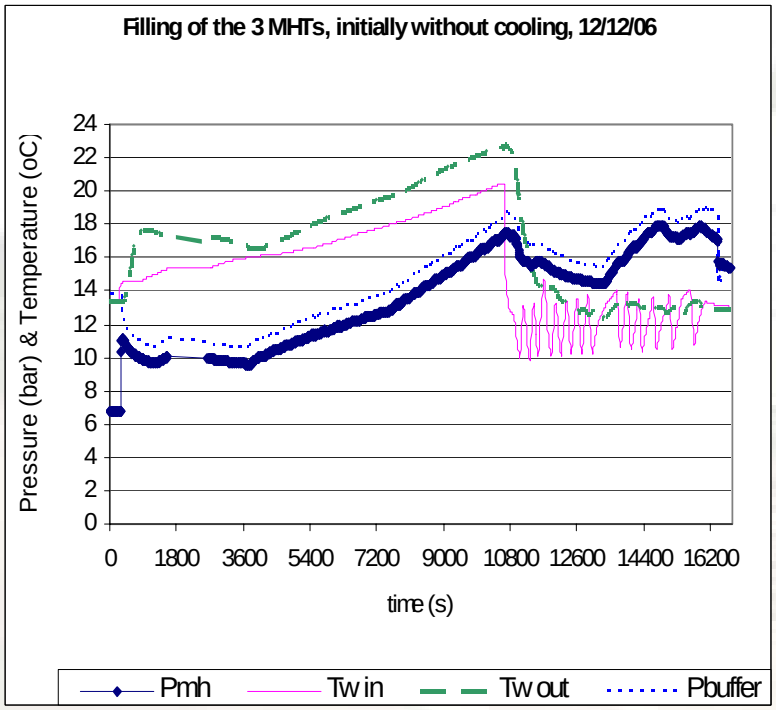
Operating temperature under variable power lies in the range 45-70^{o}C

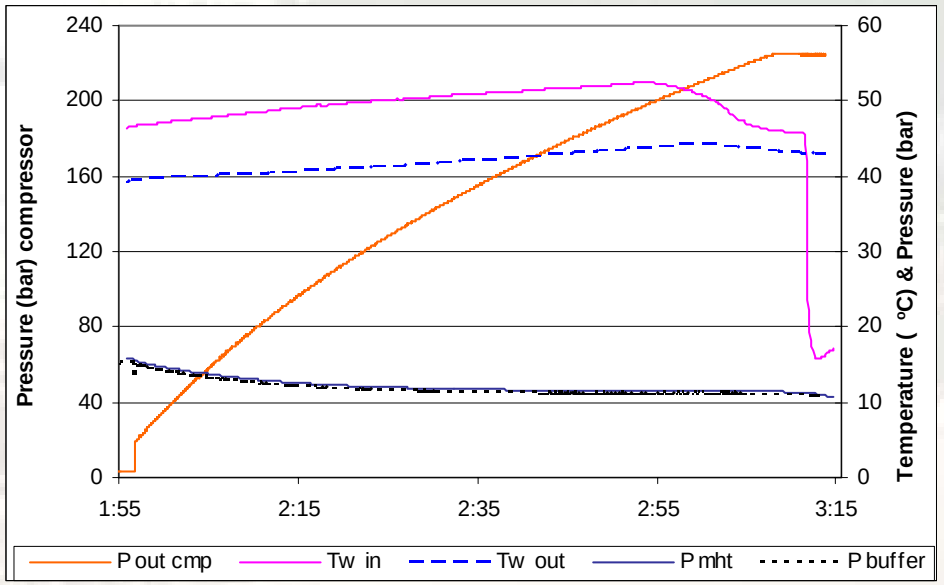
Stack efficiency: 70-88% (HHV)

AC power efficiency: 60-75% (HHV)

Wind hydrogen test site (RES2H2)

Operation of Metal Hydride tanks





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Wind hydrogen test site (RES2H2)

- Optimisation of component size and interfacing,
  with respect to hydrogen flow, electricity and information flow
- Efficiency/cost analysis of the alkaline Electrolyser
- Efficiency/cost analysis of the Metal Hydride tanks
- Important margins for efficiency increase exist in:
  - power electronics of the electrolyser
  - wind turbine – electrolyser interface
  - optimisation of auxiliaries
  - heat management of the metal hydride tanks' operation

PV-Hydrogen laboratory

PEM electrolyser
Hogen RE

3 kW
0.5 Nm^3/h H_2
13 bar
99.999 %v. purity

Alkaline electrolyser
ErreDue

3 kW
0.5 Nm^3/h H_2
6 bar
99.5 %v. purity

Bioethanol Reformer
HELBIO

0.6 Nm^3/h H_2
1.3 bar
68 %v. purity

PV-Hydrogen laboratory

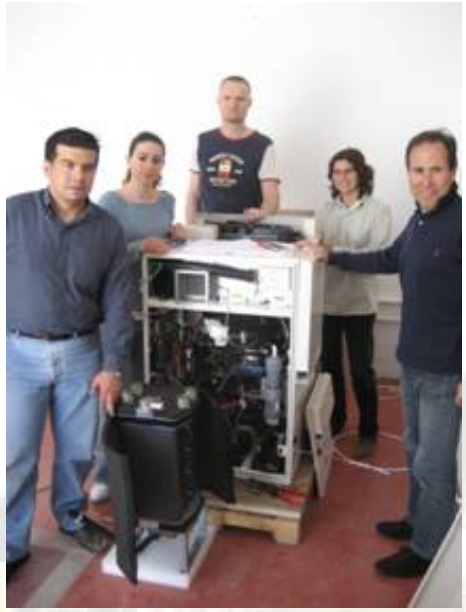
Conventional hydrogen storage tank

3 m^3 volume
16 bar
40 Nm^3 H_2 capacity

Metal Hydride Tanks

AB_5 type alloy
25 units of 1.1 Nm^3 H_2 each
28 Nm^3 H_2 capacity

PV-Hydrogen laboratory



PEM Fuel Cell
Plug Power (GenCore)

5 kW DC
99.95 %v. H_2 purity
4.5 Nm^3/h H_2
8-12s for start-up
DC/AC inverter

Alkaline Fuel Cell
Astris Energy

1.8 kW DC
99.99 %v. H_2 purity
1.2 Nm^3/h H_2
3 min. for start-up

Other components

Fuel cell test bench
Data control and acquisition system
Water deioniser
Water boiler
Water chiller