Verso una piattaforma italiana per l'idrogeno e le celle a combustibile

2° WORKSHOP TOSCANO SULL'IDROGENO e TECNOLOGIE COLLEGATE OPPORTUNITA' e FINANZIAMENTI

Firenze, 25 Luglio 2014

REGIONE TOSCANA

Comune di Pontedera

PONTECH
Pontedera & Tecnologia

HYER

2do Workshop Toscano Sull'Idrogeno e Tecnologie Collegate
25 July 2014
Diana de Rosmini – Sales Manager

INNOVATION & AMBITION PART OF MCPHY'S DNA

2000

8 years of development within CNRS & CEA

Academic and Entrepreneurship roots

Piel product expertise rely on long industrial history

2008 — 2010 — 2012 — 2014

CORPORATE

- Creation — *4 staff*
- Fund raising €1.6m
- Fund raising €13.6m — *13 staff*
- Commercial development start
- Fund raising €10.1m — *38 staff*
- Piel acquisition
- Enertrag HYTEC acquisition — *70 staff*
- *IPO* €32.0m — *84 staff*

PRODUCTION

- **1st production line fully operating**
- **2nd production line**
- **Electrolysers production line**

PRODUCTS

Lab scale ***1kg H_2***

Electrolyser

1st small commercial storage ***4kg H_2***

Range of large H_2 storage ***100 kg H_2***

Electrolyser

Integrated units with electrolyser

McPhy at a glance

based in

A portfolio of innovative products …

Small & mid electrolyzers

Large electrolyzers

Disruptive H_2 solid storage technology

… addressing 2 main high-growth markets

INDUSTRIAL HYDROGEN

ENERGY & MOBILITY

Hydrogen: essential today, disruptive tomorrow

Massively used in the industry as raw material

- Produced / used / transported for over a century
- 60 million tons per year ≈ €30 Bn

Unlimited resource

- Can be extracted from water (H_20) through electrolysis

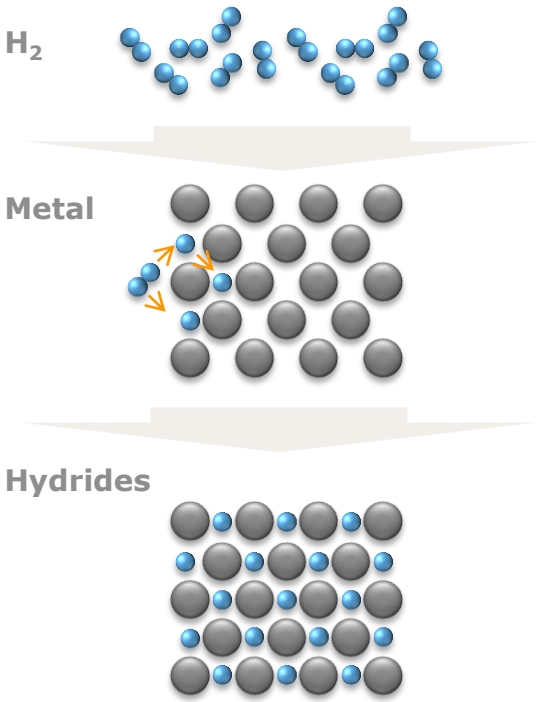
High energetic capacity

- Used as fuel for rocket engines
- 1kg H_2 = 33.3 kWh (3 times more than other conventional fuels)
- 1kg H_2 = 100 km car drive

But an extremely light gas, particularly difficult to store …

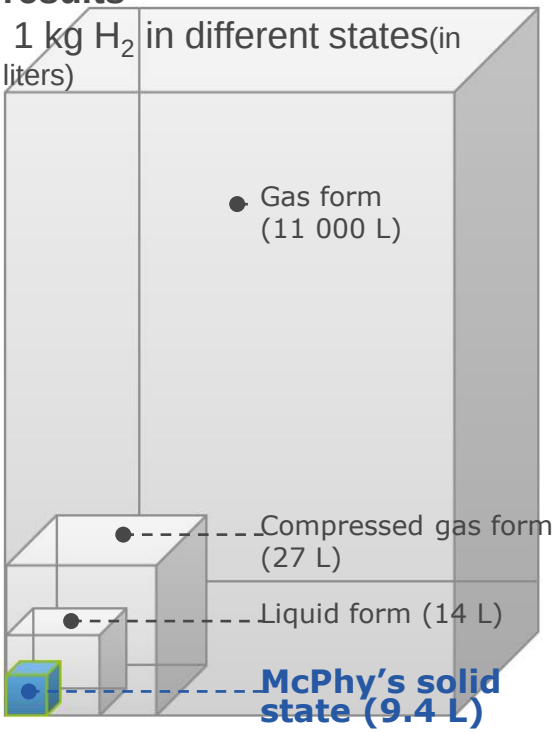
H_2 storage has now been mastered

➲ **A hydrogen "sponge" …**



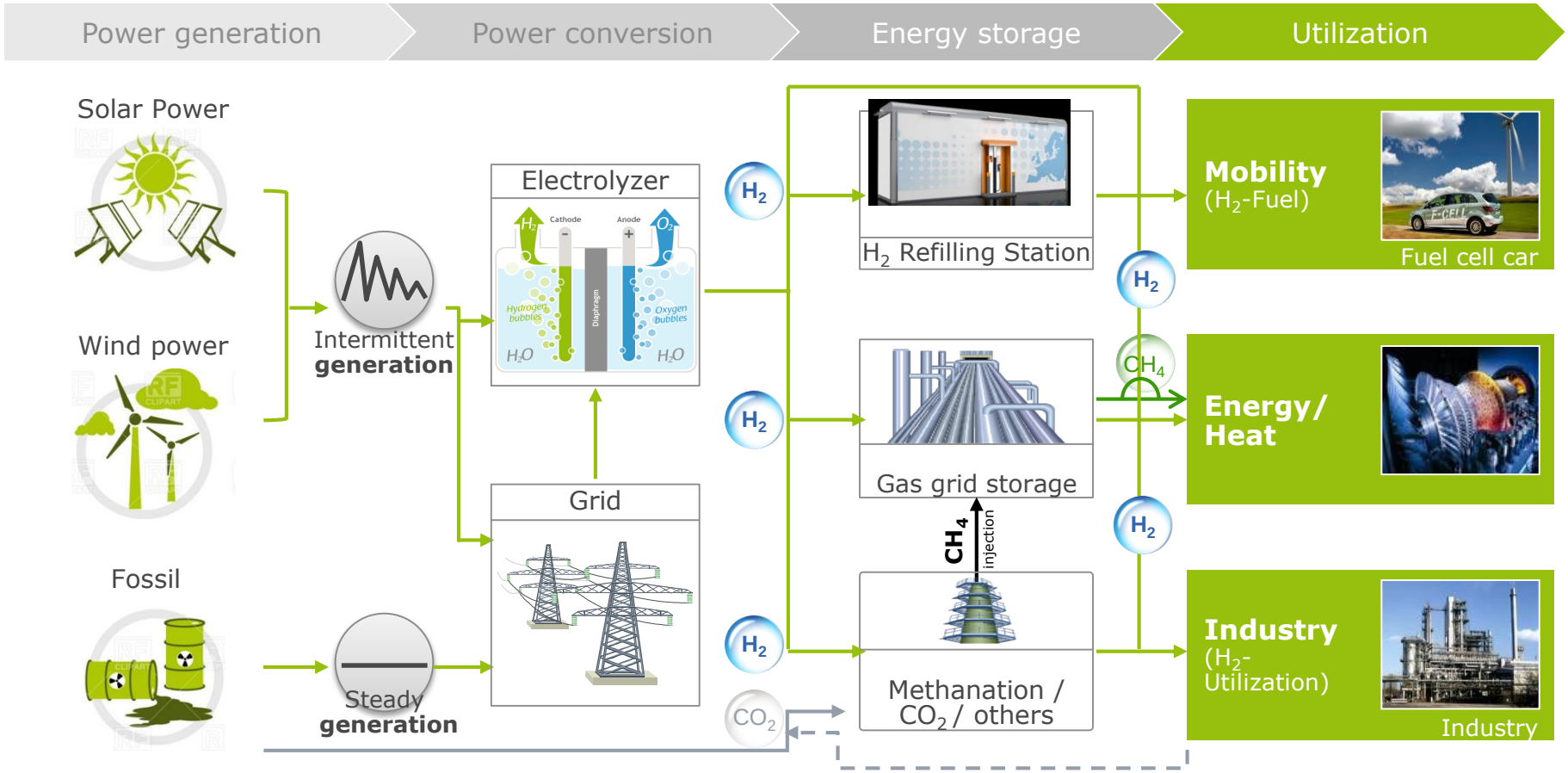
➲ **Coming from 13 years of R&D …**

➲ **Achieving significant results**



Solid storage is a disruptive technology

Hydrogen: essential today, disruptive tomorrow



A WORLD OF OPPORTUNITIES

Merchant hydrogen calling for modernization

CHALLENGE

The traditional H_2 production cycle

- **€29 Bn* estimated worldwide H_2 demand market growing ≈ 7% / year**
- 95% from steam methane reforming
- 10 kg CO_2 / kg H_2

Compression / Liquefaction

Transport

Limits of current technologies

- Low flexibility
- Limited reliability
- Cost increase with distance and infrastructure scarcity (i.e. emerging markets)
- High environmental impact

Industrial and environmental constraints pushing for a H_2 supply chain management enhancement

* Source: Freedonia, World Hydrogen – July 2012

Decarbonating the merchant H_2 market

Decarbonated H_2 onsite production and storage

Cost Competitive

- Electrolyzers: €1,000 / kW
- €5 / kg of H_2
- vs. €5 to €50 for traditional routes (highly dependant to transport)
- ROI: 2 to 3 years

Benefits for final clients

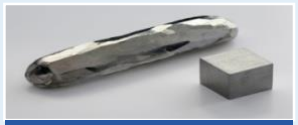
- No logistics
- Secured sourcing
- Improved safety

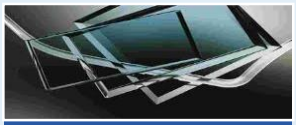
Benefits for industrial gas suppliers

- New opportunity to increase service portfolio
- Secure long term contract with customers
- From a commodity to a services business

An already sizeable addressable market

Small/Mid-size H_2 users (< 800 Nm^3 / h)


Metals finishing


Glass industry


Micro electronics

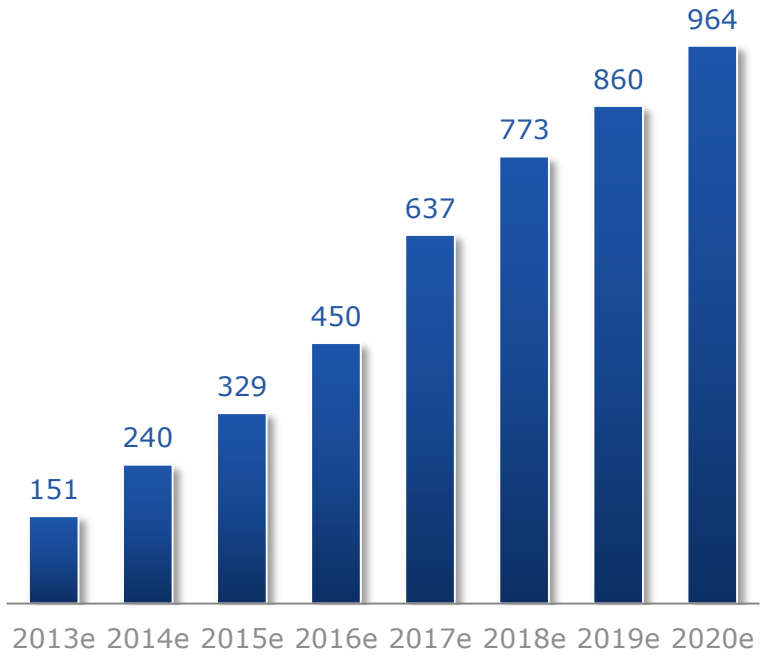

Food


LED / PV


Cooling PP

➲ **Addressable market: H_2 electrolysis equipment (€m)**

Source: Freedonia & McPhy



Fast growing industrial electrolysis equipment market driven by the needs for new capacities and limited & progressive replacement of IGS hydrogen delivery contracts

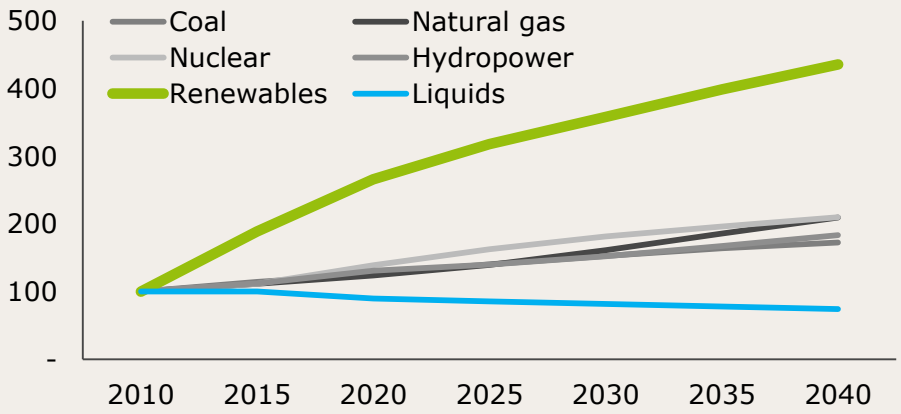
H_2 for Industrials

Increasing ‘’fatal’’ renewable energy

CHALLENGE

World net electricity production growth

Source: U.S. Energy Information Administration 2013



The Economist

How to lose half a trillion euros

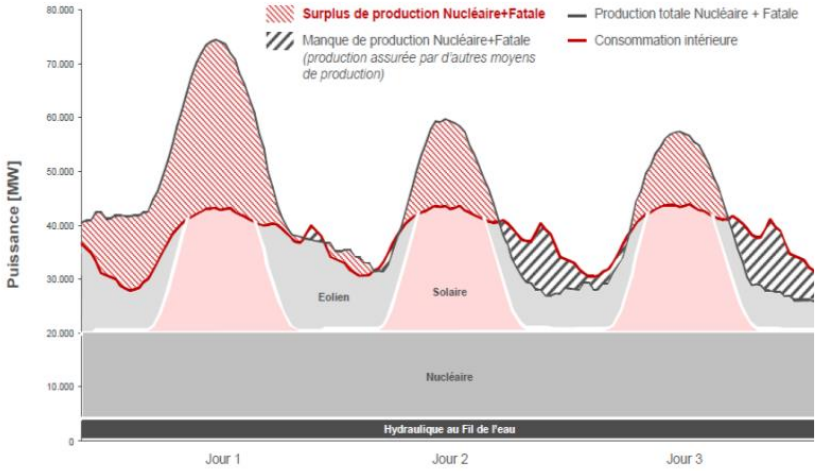
Europe’s electricity providers face an existential threat

Oct 12th 2013 | From the print edition

ON JUNE 16th something very peculiar happened in Germany’s electricity market. The wholesale price of electricity fell to minus €100 per megawatt hour (MWh). That is, generating companies were having to pay the managers of the grid to take their electricity. It was a bright, breezy Sunday. Demand was low. Between 2pm and 3pm, solar and wind generators produced 28.9 gigawatts (GW) of power, more than half the total. The grid at that time could not cope with more than 45GW without becoming unstable. At the peak, total generation was over 51GW; so prices went negative to encourage cutbacks and protect the grid from overloading.

Limits of current technologies

- Irregular output
- Grid saturation
- Low predictability

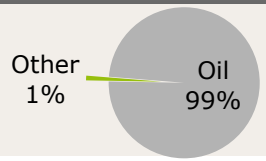


Smoothing and storage are critical for continued penetration of renewable energy in the energy mix

Valuing energy surpluses through decarbonated road transport

European road transport ≈ 17% of CO_2 emissions

95% abatement required



H_2 for Energy

Hydrogen vehicles
Carbon-free, delivering same customer value as traditional vehicles

Batteries

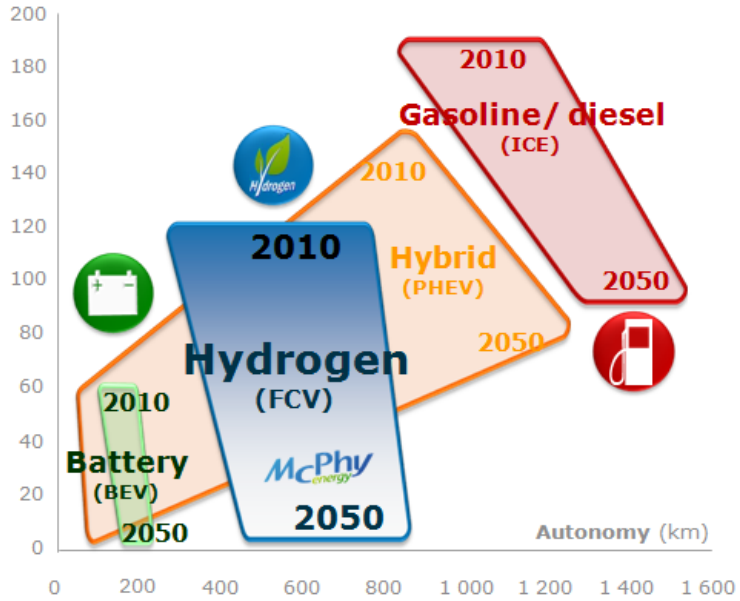
- 150-250 km
- Refueling: 2 to 8 hours
- Small vehicles only

Hydrogen

- 500 km
- Refueling: <€50 , 3 to 5 min.
- Small to large vehicles

➲**Comparing energy sources(g CO_2 / km)**

Source: McKinsey, Power trains for Europe



As H_2 mobility is gaining momentum worldwide

FCEV cars now available

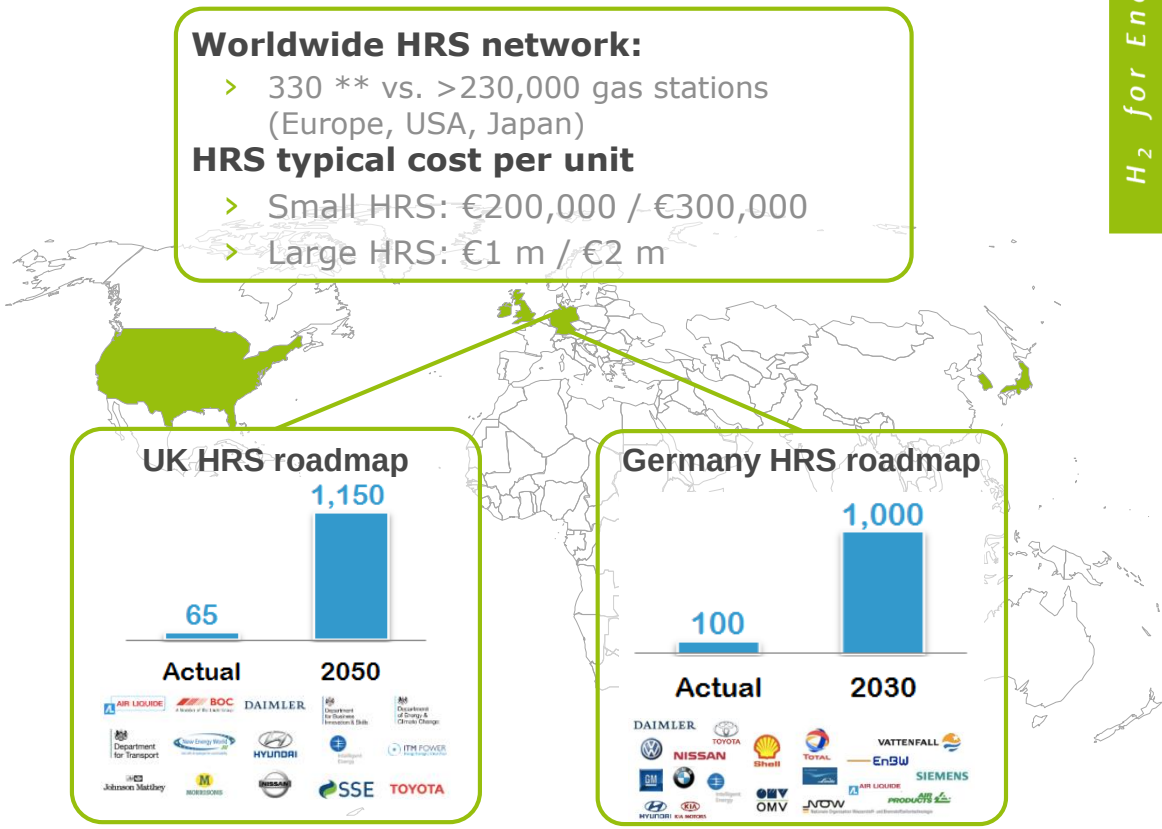
… HRS* network expansion will drive the growth of the mobility H_2 market

Worldwide HRS network:

- 330 ** vs. >230,000 gas stations (Europe, USA, Japan)

HRS typical cost per unit

- Small HRS: €200,000 / €300,000
- Large HRS: €1 m / €2 m



Pioneers: Germany, UK, California, Japan, South Korea

* HRS: Hydrogen Refueling Station
** source: H2mobility.org

H_2 for Energy

Valuing energy surpluses through gas networks

SMART USE OF SURPLUS ENERGY ENABLED BY POWER TO GAS

- Stored energy is not restricted to the site of generation
- Connection of energy networks increase flexibility
- Improvement of overall efficiency
- No modification on existing infrastructures up to 6% of H2 in CH_4 grid
  = potentially 200 Bn m³ per year*
  (≈ 600 TWH)

* World CH_4 consumption in 2010 estimated at 3,200 billion m³
Source: EIA, July 2013

H2 for Energy

READY FOR GROWTH

Ideally positioned for growth

13 years of R&D

€25 m raised to date

2 strategic acquisitions

- Piel: small electrolyzers
- Enertrag: large electrolyzers

2 product lines

Storage

Electrolyzers

Energy market

Industry market

Today

2020

A mature electrolysis technology…

EQUIPEMENTS		Small & mid-size electrolyzers **<500 kW** **1/100 Nm³/h**	Typical project size: €50,000 / 500,000 (*€10,000/20,000 historically for PIEL*)
		Large electrolyzers **>500 kW** **100/500 (or more) Nm³/h**	Typical project size: >€1,000,000
SERVICES & MAINTENANCE	› Services: Deployment services on new product sales › Maintenance: Recurring revenue on installed equipment base (parts and stack replacements)		

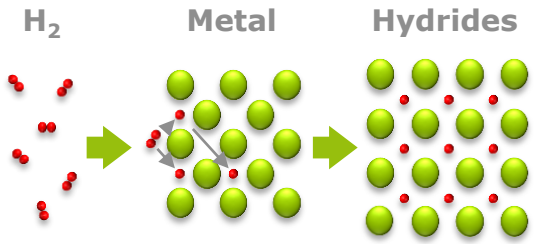
Only supplier capable of offering full range of scale and pressure

Moving up-market on larger commercial projects

… combined with a disruptive H_2 storage technology

LABS	DISK	MODULAR STACK	STORAGE UNIT	INTEGRATED SOLUTION
				
Based on metal hydrides (43 g / 0.5 Nm³ of H_2)		**100 disks (4 kg of H_2)**	**Stack bundle**	**Alkaline electrolyzer + storage unit**

The « sponge » concept

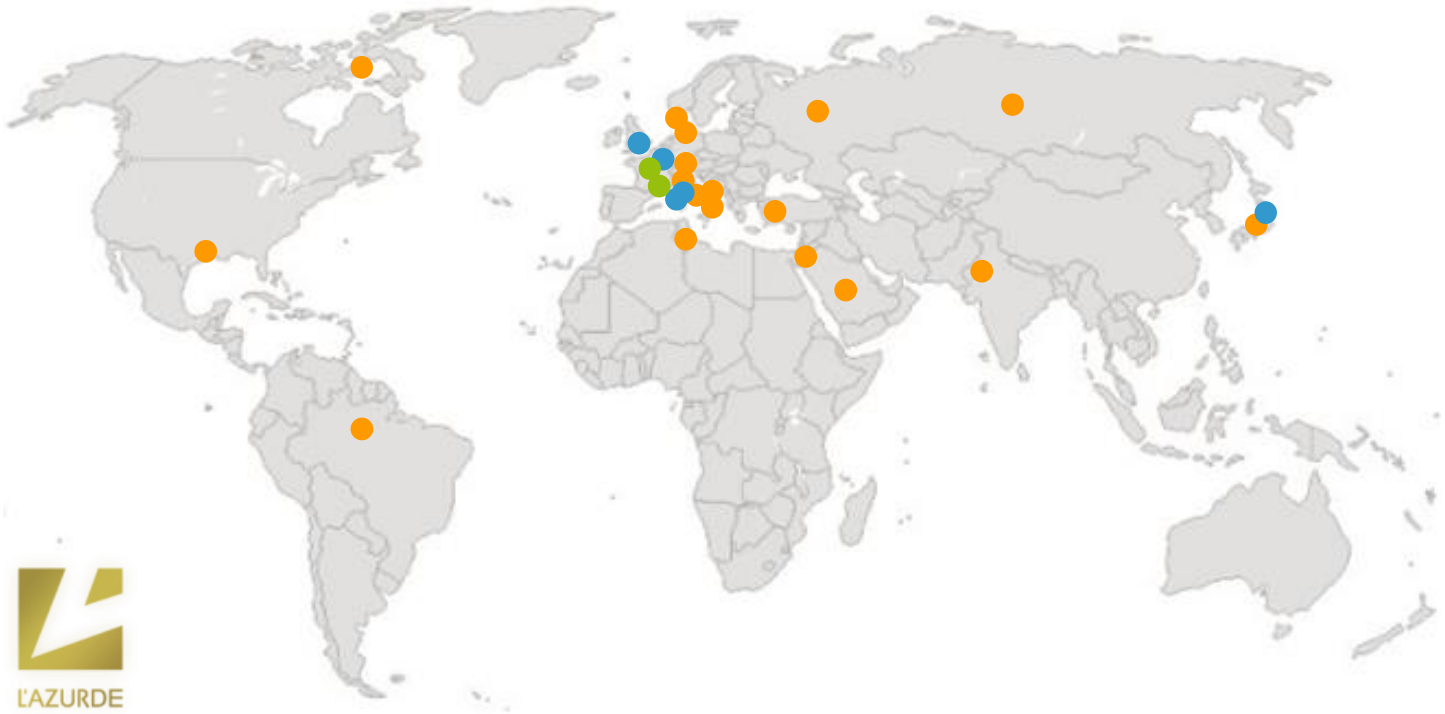


McPhy's key advantages

- 13 years of R&D, 8 patents :
  - 3 under licence, 3 co-owned, 2 proprietary patents
- Metal hydrides based technology
- Much higher volume density than compressed liquid or gas
- High level of safety

Proven track record

International client base
Installed base: +1,000 clients / 3,000 electrolyzers (*)



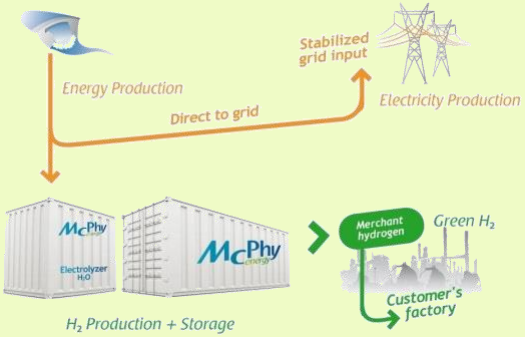
- Hydrogen generation solution
- Hydrogen generation solution with embedded flexibility
- Hydrogen storage solution

* note: including electrolyzers sold by PIEL before its acquisition by McPhy in December 2012

Energy flagship projects

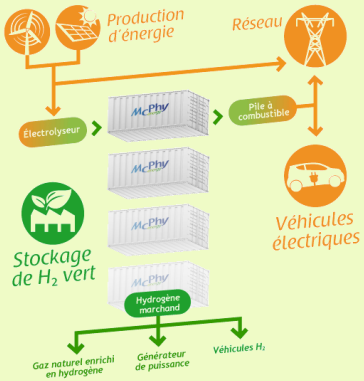
LASSY PROJECT

- 250 kg H_2
- 8.3 MWh
- Industrial green H_2
- France
- 2015

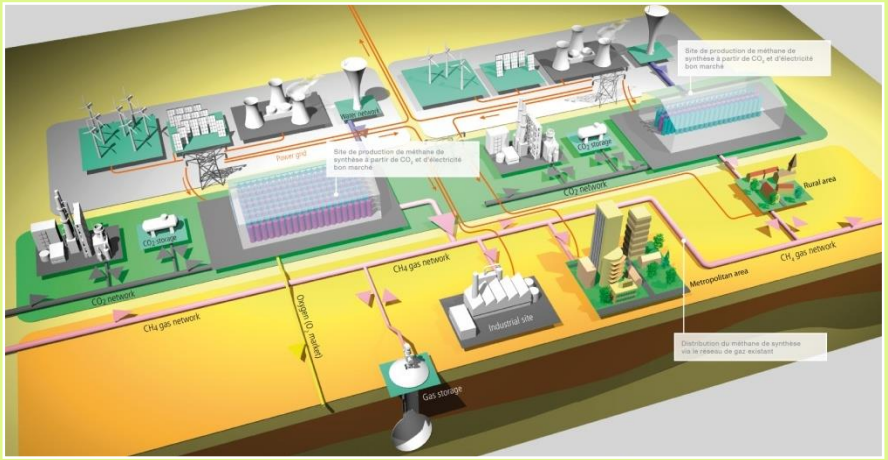


INGRID PROJECT

- 1000 kg H_2
- 33.3 MWh
- PtG & green H_2 for industry/transport
- Italy
- 2014



GRHYD PROJECT



- **Power to Gas & green H_2 for industry/transport**
- **2015/2016**
- **150 kg H_2 (4.5 MWh)**
- **Leader: GDF-Suez**

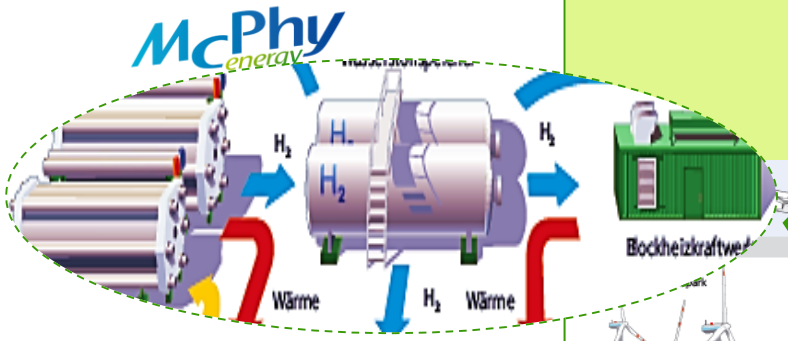
GDF SUEZ · Dunkerque Grand Littoral · GNVERT GDF SUEZ · INERIS · AREVA · GrDF · CETIAT · CETH2 · cea

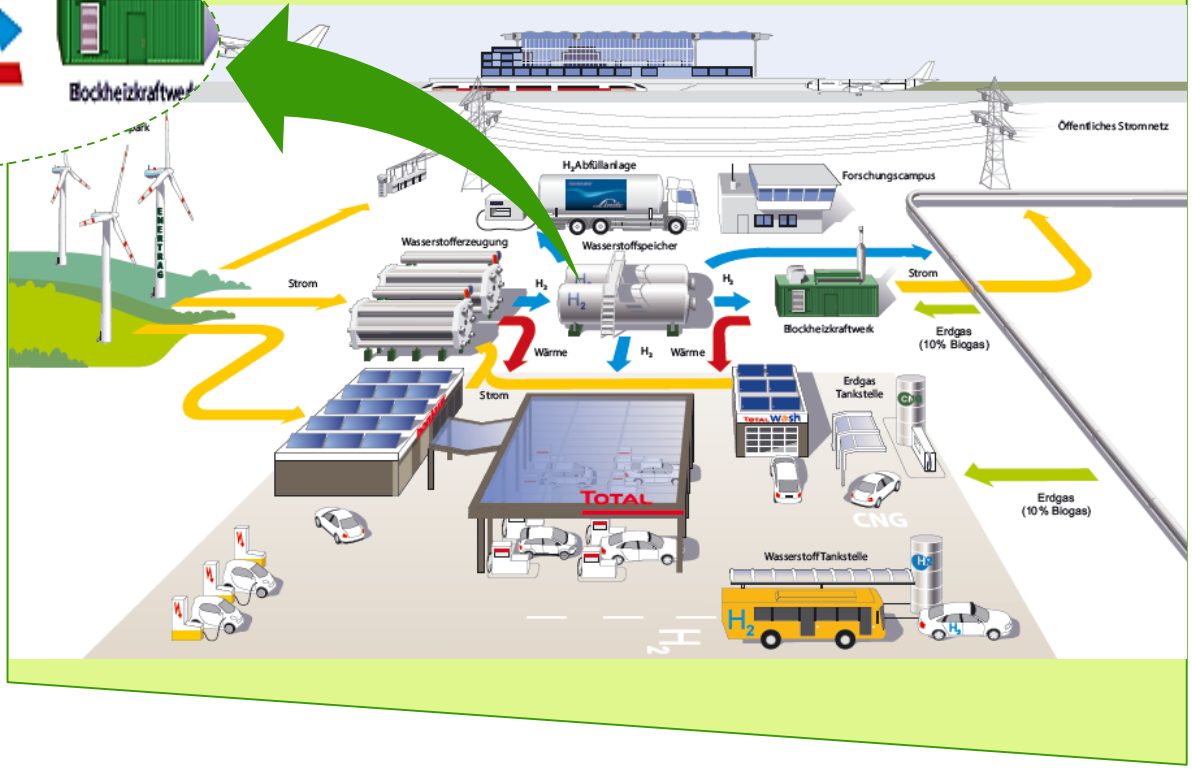
H_2 for Energy

Mobility flagship project

BERLIN AIRPORT

- H_2 refueling station
- May 2014
- Electrolyzer: 0.5 MW - 100 Nm^3/h
- Storage: 100 kg H_2





WERLTE PROJECT

- 6 MW
- In operation
- Germany

'' Yes, my friends, I believe that water will be one day used as fuel, that the hydrogen and the oxygen, which make it, used separately or simultaneously, will provide a source of inexhaustible heat and light and with an intensity the coal could never reach"

Jules Verne, L'Île Mystérieuse - 1874

For further information contact:
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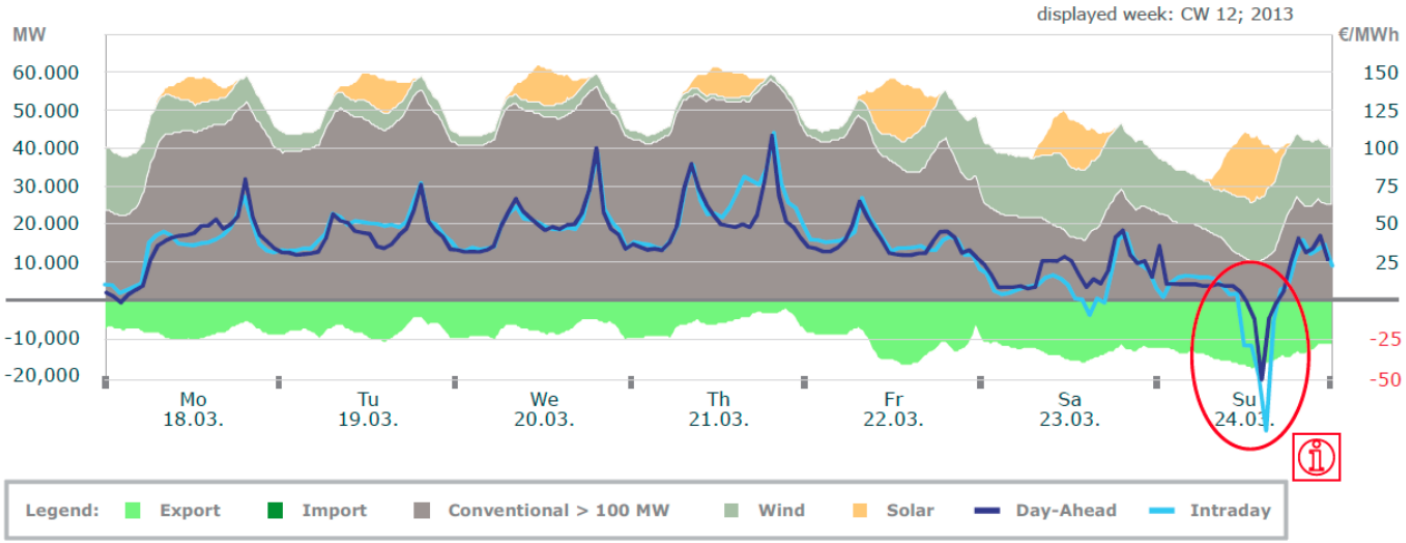
Electricity Production and Spot-Prices: CW 12 2013



€ / MWh	Period Mean	Period Min	Period Max	Trading / GWh
Day-Ahead	36.12	- 50.00	108.60	4 821
Intraday	36.33	- 83.20	110.40	177

Source: Johannes Mayer, Bruno Burger, Fraunhofer Institute for Solar Energy Systems; Data: EEX, Entso-e

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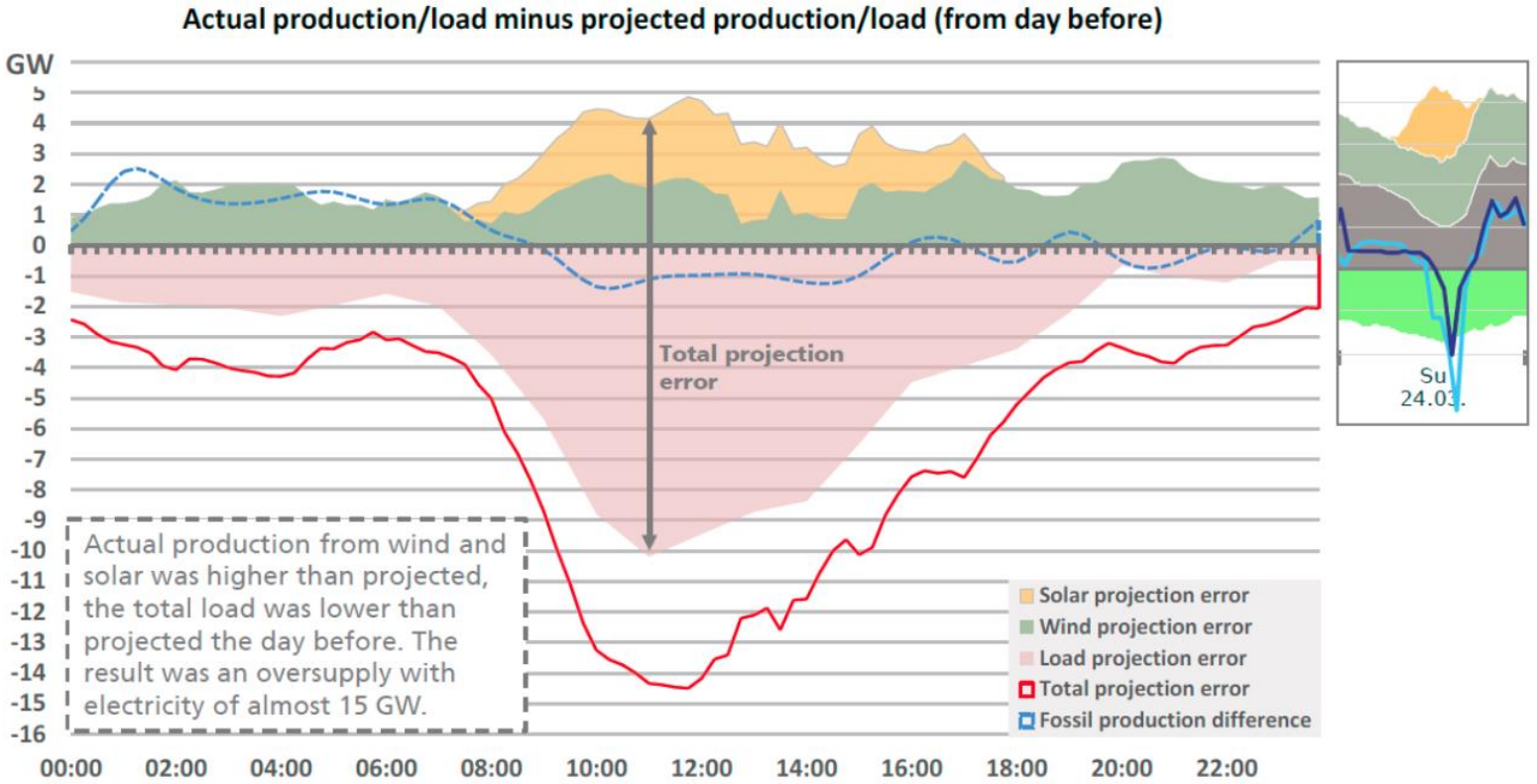
Analysis of the Negative Spot-Prices on 24.03.2013



Source: Johannes Mayer, Fraunhofer Institute for Solar Energy Systems; Data: EEX, Entso-E

Back to month chart

Back to week chart

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