

ITM POWER

HYDROGEN FUEL FOR TRANSPORT TODAY

LOWCVP ANNUAL CONFERENCE 2012
10TH MAY 2012

"I want to drive to my local petrol station and fill up
with 50 litres of wind..."

Peter Hoffmann

ITM POWER DESIGNS
AND MANUFACTURES
HYDROGEN ENERGY SYSTEMS
FOR ENERGY STORAGE AND
CLEAN FUEL PRODUCTION

ITM POWER

HYDROGEN FUEL FOR TRANSPORT TODAY

LCVP ANNUAL CONFERENCE 2012
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Background

- First stock market listed hydrogen | fuel cell company
- Listed in 2004 | secondary fundraising in 2006
- 61 employees
- Two locations in Sheffield
- £9m of cash resources
- First revenues achieved in Q1 2011
- ITM GmbH established 2011

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Contents

- Positioning
- HFuel | The Product
- Compliance
- Economics
- Fuel Projects & Strategies
- Market Dynamics

ITM POWER DESIGNS
AND MANUFACTURES
HYDROGEN ENERGY SYSTEMS
FOR ENERGY STORAGE AND
CLEAN FUEL PRODUCTION

POSITIONING

HYDROGEN
ENERGY STORAGE

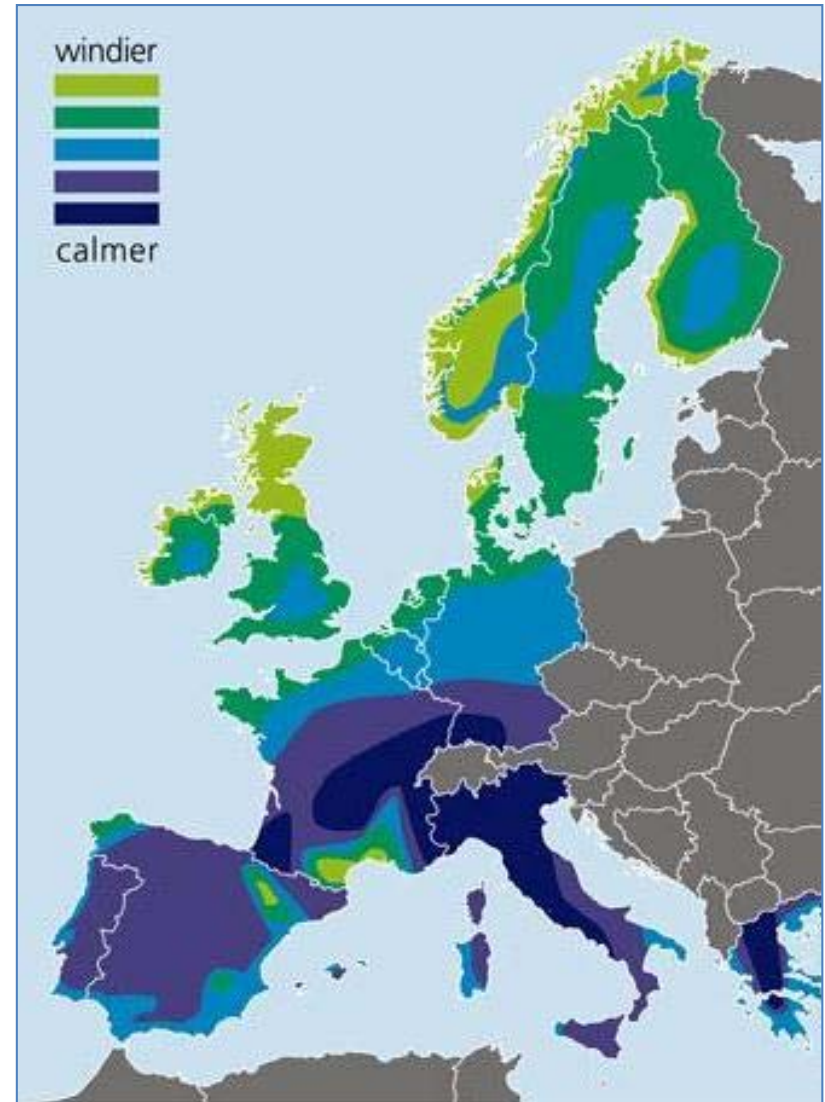
HYDROGEN
TRANSPORT FUEL



WIND ENERGY: THE UK

UK has the best wind resources in Europe

- Third best in the world
- Entering phase three construction in UK
- The problem is matching supply and demand
- The system needs energy storage



POSITIONING

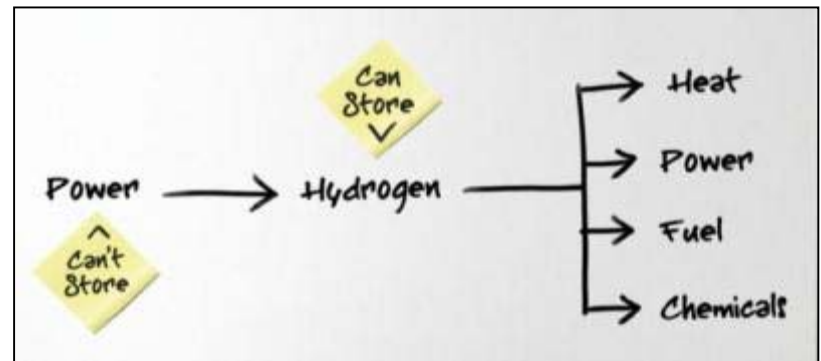
ENERGY STORAGE | CLEAN FUEL



THE CHALLENGE

Electricity cannot be easily stored

- Renewable power cannot be scheduled
- Balancing supply and demand
- Required at small & large scale
- Energy storage required for long periods
- Represents major barrier to adoption of renewables



POSITIONING

ENERGY STORAGE | CLEAN FUEL



THE SOLUTION

Energy storage by DSM hydrogen production

- Modular, scalable and rapid response
- High conversion efficiency
- Ability to accommodate intermittent input
- Separates power from energy



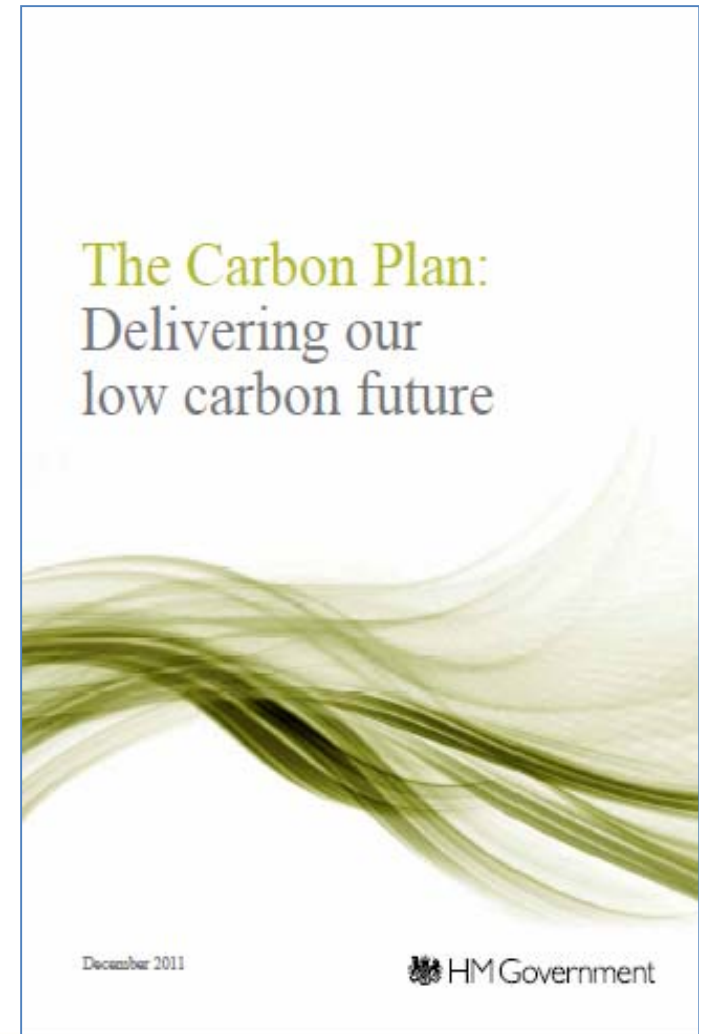
POSITIONING
ENERGY STORAGE | CLEAN FUEL



ON SITE HYDROGEN | BENEFITS

A Triple Zero Fuel

- Zero carbon in its production
- Zero carbon in its transportation – no need for fuel deliveries!
- Zero carbon vehicle emissions



POSITIONING

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HFUEL

A COMPLIANT
HYDROGEN
PRODUCTION &
REFUELLING
SYSTEM



THE HFUEL PRODUCT

A transportable on-site hydrogen production and dispensing unit

- 15kg/day; 3 van capability HOST
- 100kg/day; Dual 350:700bar for German market

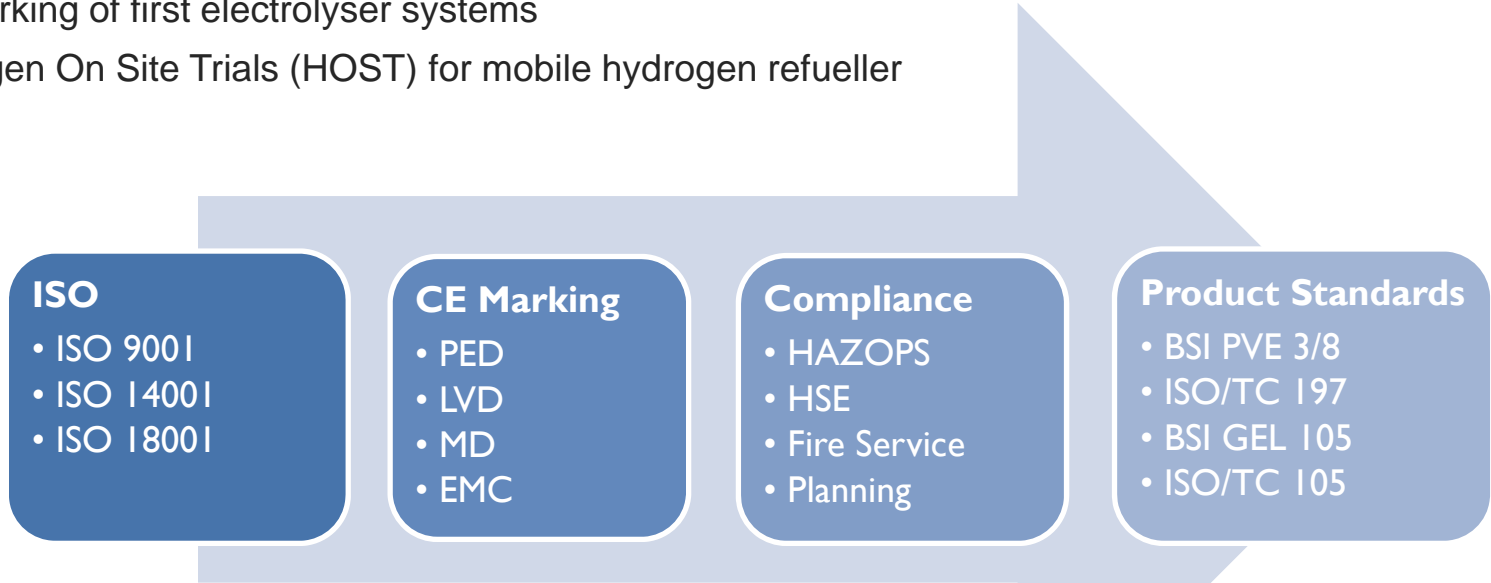


Technology Strategy Board
Driving Innovation



COMPLIANCE EXPERIENCE

- ISO accreditation
- CE marking of first electrolyser systems
- Hydrogen On Site Trials (HOST) for mobile hydrogen refueller



COMPLIANCE
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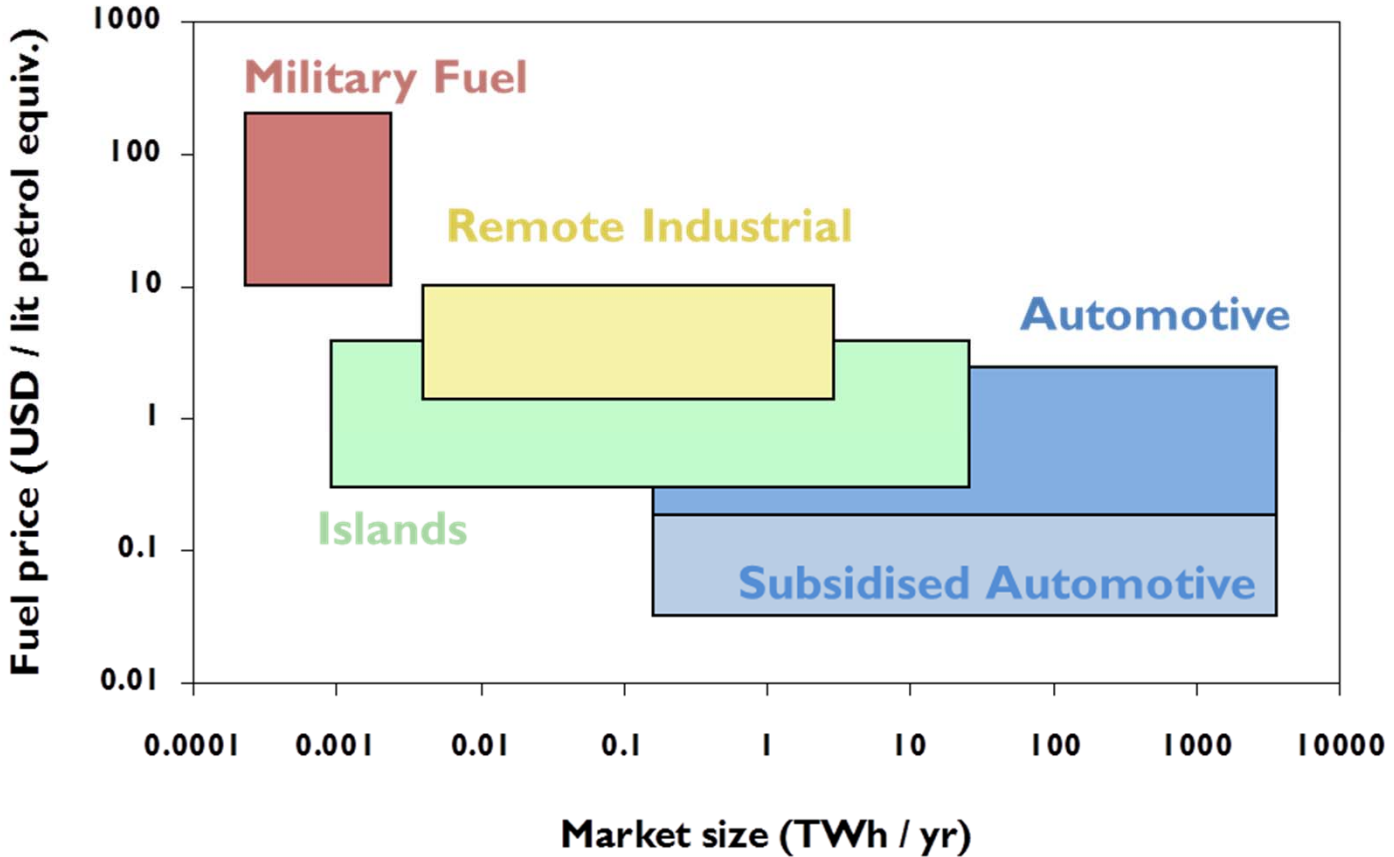


FUEL COSTS | PRICES

ENERGY STORAGE
CLEAN FUEL
FUEL SECURITY



FUEL MARKET: DEMAND CURVE



FUEL MARKET
ENERGY STORAGE | CLEAN FUEL



COSTS: HYDROGEN PRODUCTION

A range of hydrogen costs from £5/kg to £10/kg

- Hydrogen price includes amortisation of capital & electricity cost
- Assume 100% utilisation over plant life
- Compression & storage quoted separately
- Maintenance contract dependant on usage profile & location

	Hydrogen Cost (£/kg)					
	4p/kWhr		6p/kWhr		8p/kWhr	
Electricity	2.40		3.60		4.80	
Capital Grant	0%	50%	0%	50%	0%	50%
5 Years	8.31	5.35	9.51	6.55	10.71	7.75
10 Years	5.35	3.88	6.55	5.08	7.75	6.28
20 Years	3.88	3.14	5.08	4.34	6.28	5.54



HFUEL COSTS

HYDROGEN ON SITE TRIALS



FUEL PROJECTS & STRATEGIES

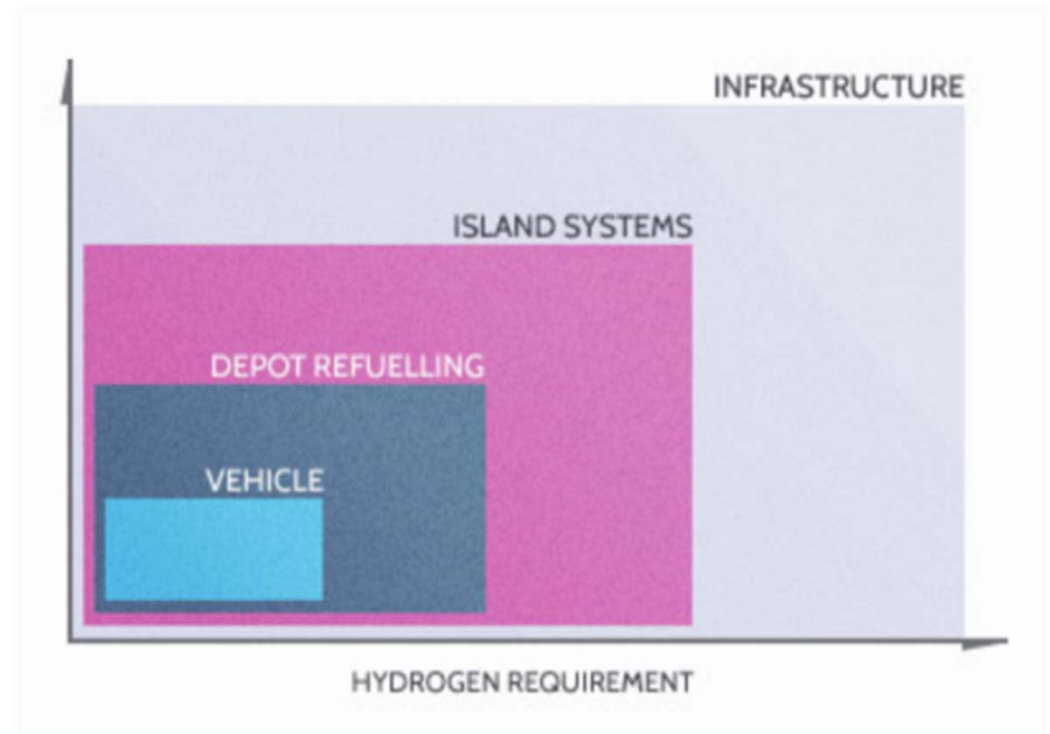
UK H₂ MOBILITY
ECOISLAND
HOST
M&S PILOT
HOSTING



FUEL STRATEGIES

Deployment of a New Fuel Requires Strategic Thinking

- Infrastructure: “Chicken & Egg”
- Island Systems: “Entry Market”
- Depot Refuelling: “Sweet Spot”
- Individual Vehicle: “Remote Security”



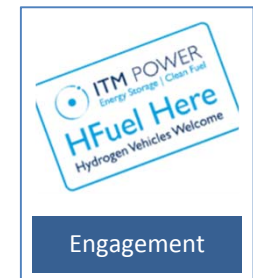
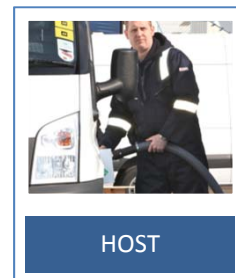
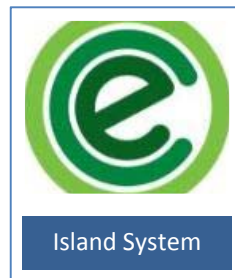
FUEL STRATEGIES

ENERGY STORAGE | CLEAN FUEL

MAJOR FUEL PROJECTS

Deployment of a New Fuel Requires Early Adopters

- UK H2Mobility: National Plan
- Ecoland: Island
- M&S: Depot (Materials Handling)
- HOST: Depot (Vans)
- HOSTING: Engagement – “HFuel Here” Events



FUEL PROJECTS

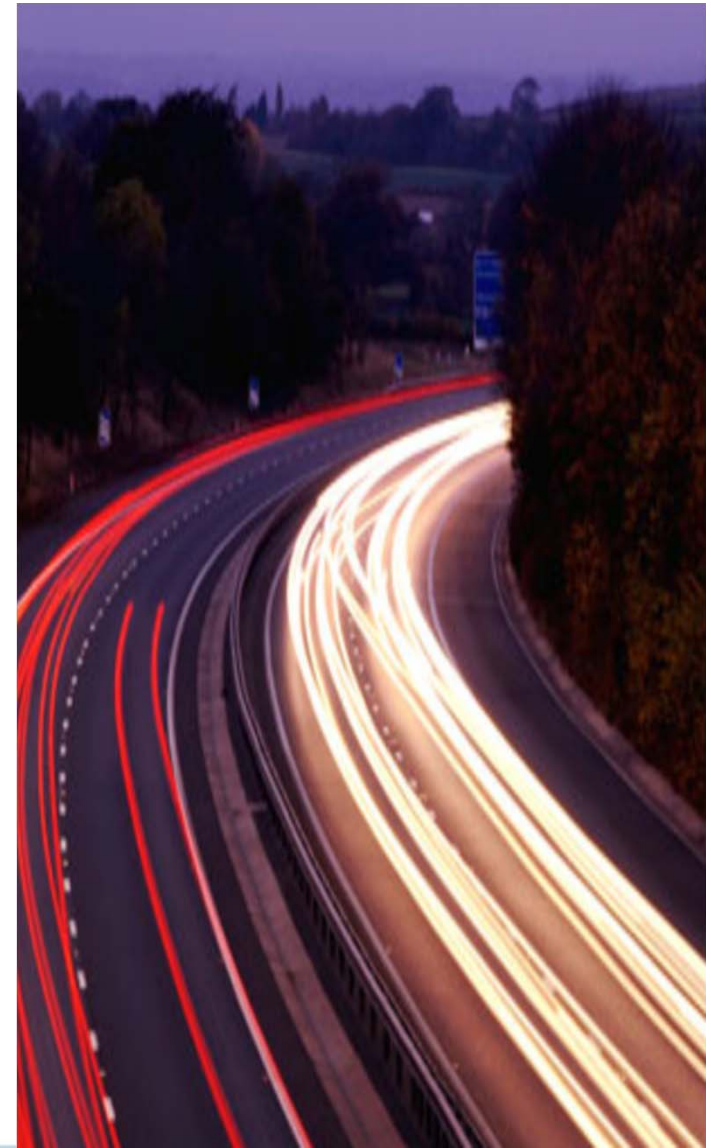
ENERGY STORAGE | CLEAN FUEL



NATIONAL INFRASTRUCTURE

“Chicken & Egg”

- Coordinating Vehicles and Fuel
- Deployment strategies for coverage
- Fuel retailers
- Third party fuelling



FUEL PROJECTS

ENERGY STORAGE | CLEAN FUEL



GERMANY LEADS THE WAY

H₂Mobility



Preview on hydrogen fueling station infrastructure roll-out in Germany (schematic)



Fueling stations: ■ Large ■ medium ■ small





UK H₂ Mobility

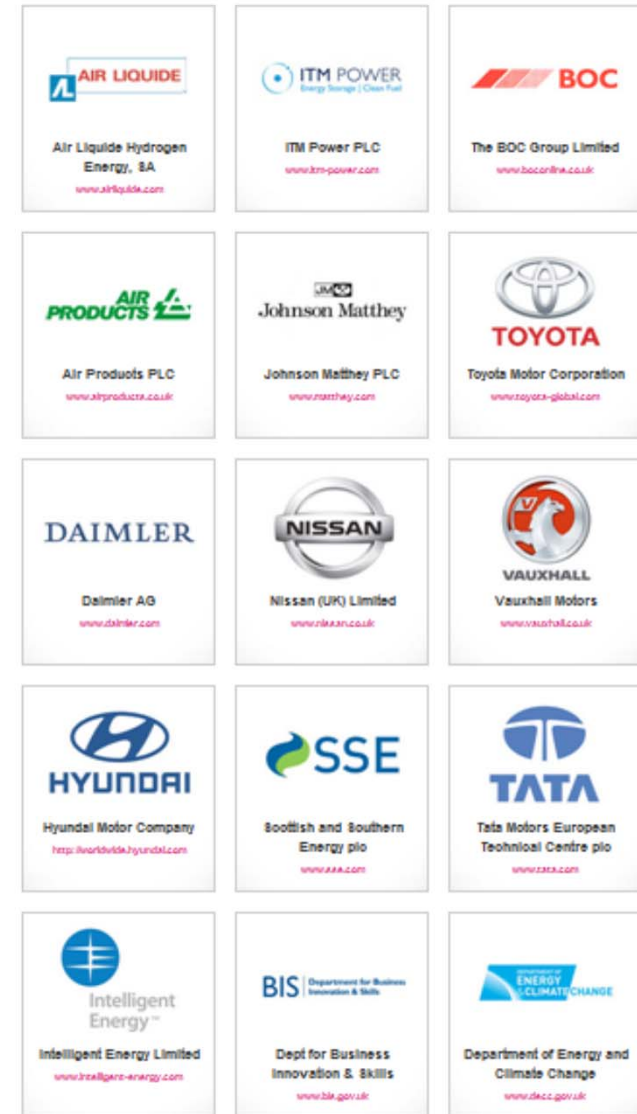
A Partnership to develop a national hydrogen plan

- To determine the infrastructure investment required
- 4 Gas companies
- 6 Automotive OEM's
- 3 Government departments
- Open membership

- Currently in evaluation stage
- Will deliver results by end 2012

If you have further questions....

- Please direct to OLEV, who hold the position as Chair
- email olev.enquiries@olev.gsi.gov.uk



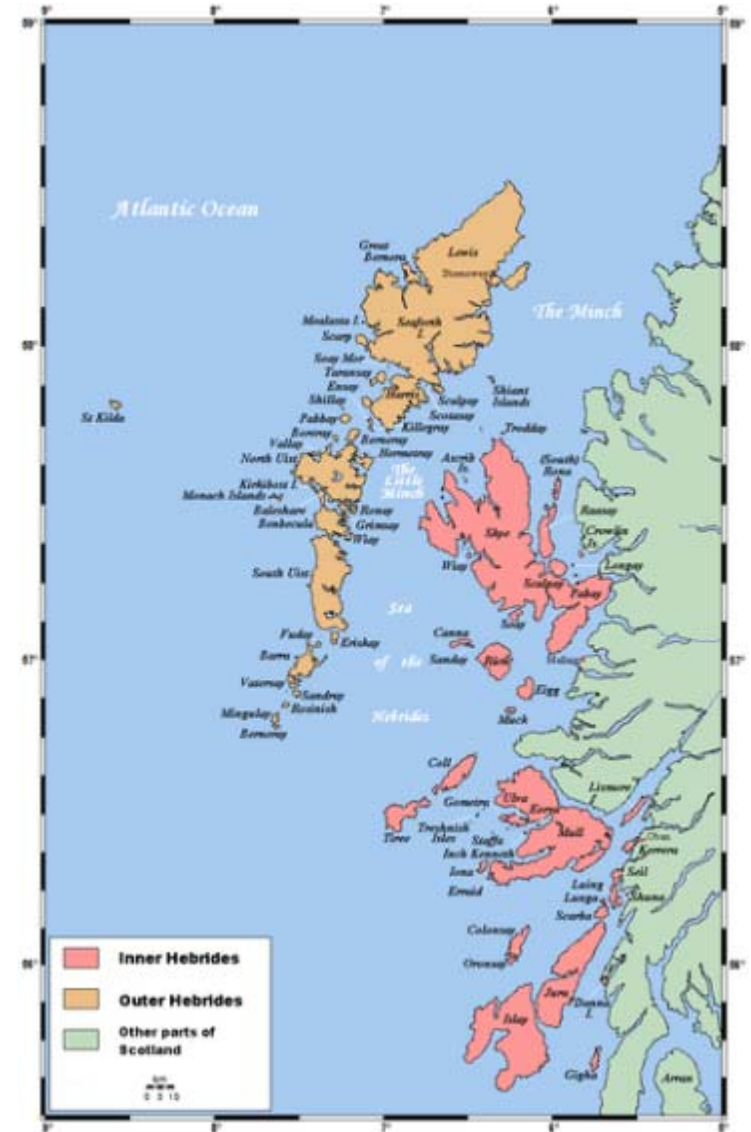
FUEL PROJECTS
ENERGY STORAGE | CLEAN FUEL



ISLAND SYSTEMS

An Entry Market

- Difficulty balancing supply & demand
- High fuel prices
- Low fuel security
- Perfect for on-site fuel production



FUEL STRATEGIES

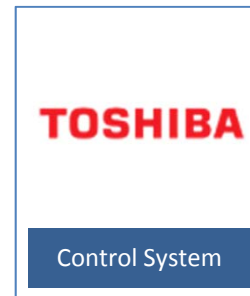
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ECOISLAND PARTNERSHIP

Hydrogen Energy Storage Smart Grid

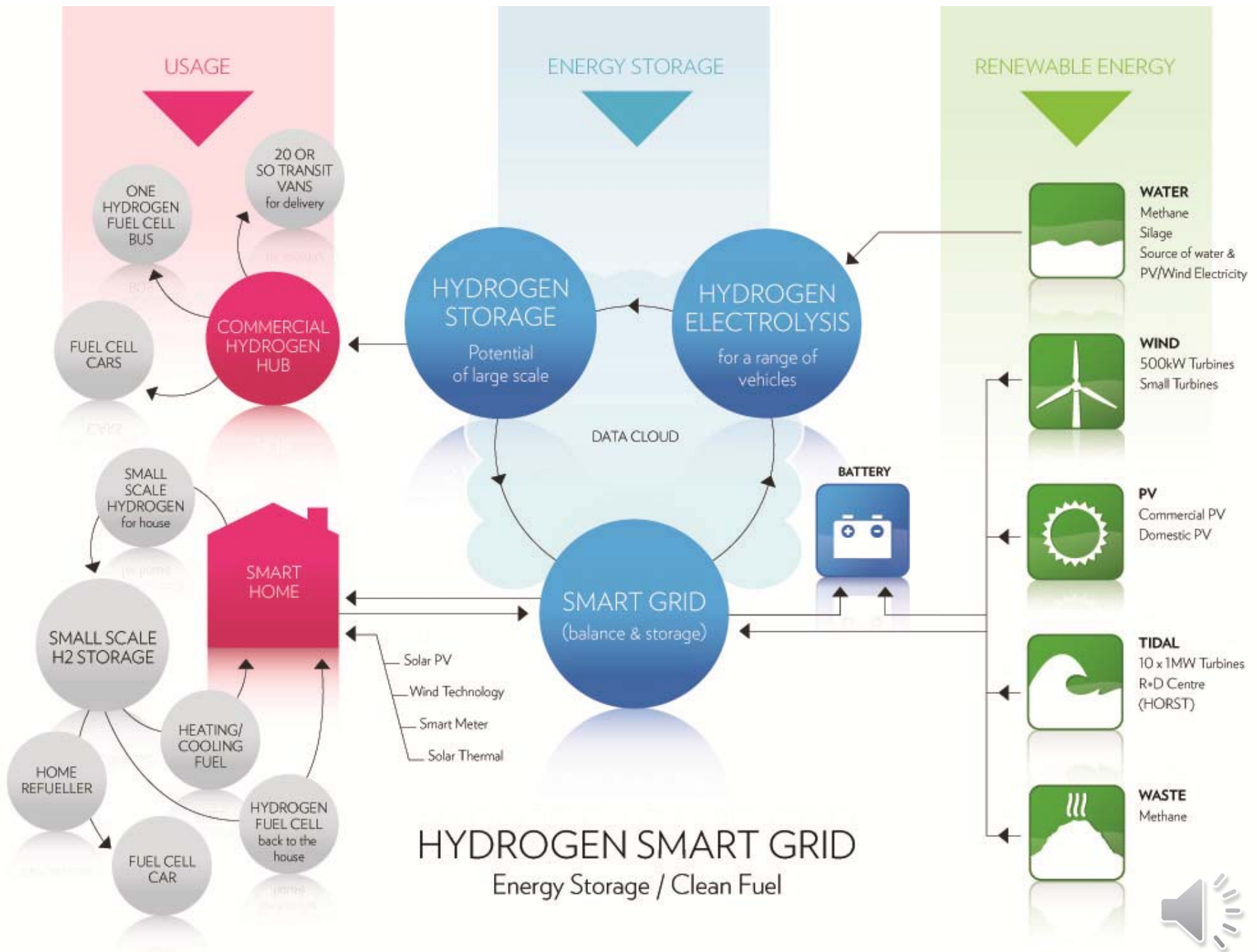
- First installation 100kg/day refueller
- Fleet of 20 vehicles
- Hydrogen balancing supply & demand



FUEL PROJECTS

ENERGY STORAGE | CLEAN FUEL





DEPOT SYSTEMS

Return-to-base | Sweet spot

- Fleet of vehicles | one refueller
- The alternative roll out scenario
- Commercial fleet managers have environmental targets
- Commercial vehicles are the early adoption market
- Hence HOST



FUEL STRATEGIES

ENERGY STORAGE | CLEAN FUEL

HOST

Steady build of operational experience

- 200+ refuelling events
- 450+ kg of hydrogen generated on-site
- 10,000+ km travelled on hydrogen
- 50+ different van drivers
- 100% availability on HFuel plant
- Technology is practical and operational



Technology Strategy Board
Driving Innovation

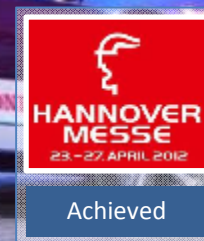
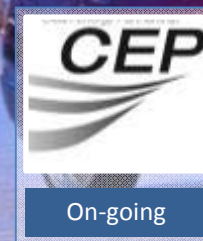
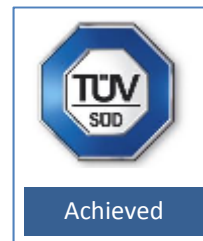
FUEL PROJECTS
HYDROGEN ON SITE TRIALS



HOSTING

HOST in Germany is about compliance

- NPL project established FC grade compliance
- HFuel CE marked
- TUV SUD to comply in Germany
- CEP determines overall criteria
- “Ride & Drive” at Hannover Messe



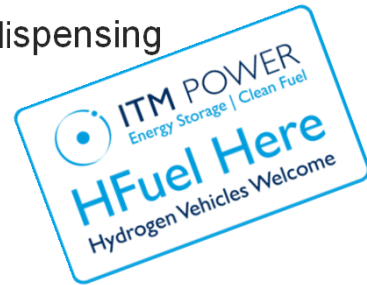
ENTERING THE GERMAN MARKET
ENERGY STORAGE | CLEAN FUEL



HFUEL HERE

To encourage fuel cell vehicles to exhibit

- Demonstrate the readiness of H₂ vehicles & infrastructure
- Demystification of sustainable refuelling technology
- Temporary on-site H₂ generation and dispensing
- Fully manned operation



ALL-ENERGY 2012
EXHIBITION & CONFERENCE

INTERNATIONAL GREEN AWARDS
FOR CREATIVITY IN SUSTAINABILITY

Home
 RailGuide Scam Warning
 Industry headlines
 About All-Energy
 Exhibiting
 Exhibitor area
 Sector-Specific Trade
 Offshore Maintenance
 2012 Exhibitors
 Conference
 2011 Exhibitor list
 2012 Technical Issues
 Networking Evening
 Masterclasses
 Supporters
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 Organisers
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 2012 Floor Plan

THE RENEWABLES SHOW
IN THE ENERGY CITY DEEN 23/24 MAY 2012

LATEST RENEWABLE ENERGY NEWS [View all stories >](#)

- ▶ Flawed KTRC energy report slammed
- ▶ Scottish power can't go it alone
- ▶ MP calls for transparency over green bonus
- ▶ Renewable Energy Directive response
- ▶ What is really fuelling energy bills
- ▶ Gov't response to IREU consultation

Time to plan for All-Energy 2012

All-Energy 2012 - the largest renewable energy exhibition and conference ever held in the UK - will be staged at Aberdeen Exhibition and Conference Centre on Wednesday 23 - Thursday 24 May 2012. Now is the time to book your space, plan sponsorship and submit abstracts for the conference. [Contact the team.](#)

NEW for 2012:

- All-Energy 2012 will span three interlinked halls
- For the first time there will be **Sector-Specific Trade** around the show enabling visitors to pre-plan their route.
- All-Energy 2012 introduces **"Offshore Maintenance - where offshore world meets oil and gas"**.
- **Key** feature areas on the show floor include **Smart Energy** (energy efficiency and energy management), **Investment and LCVs** (encompassing infrastructure and vehicles).

Familiar features:

- ASEG is once again organising the Aberdeen City & Shire regional presence in partnership with Aberdeen City Council and Aberdeenshire Council. If you would like to exhibit in the Pavilion or are interested in various associated sponsorship or advertising opportunities, please visit their website by clicking [here](#) or contact Debbie Ashworth on DAshworth@Aberdeenrenewables.com or 01224 523630 for further information.
- The world-class multi-stream **conference** will be devised by industry experts for the industry and provide invaluable updates on recent developments as well as looking to the future. [Find out how to submit an abstract.](#)
- Hear the views of industry and government (Westminster and Holyrood) luminaries.
- As always, conference sessions are free to attend for all with a business or professional interest in renewable energy.
- The **unmissable Giant Networking Evening** (23 May) proves that business and pleasure really can mix.
- The ever-popular **Jobs Zone**.

For access to the floor plan, further information on space options and prices [click here](#) or [contact the All-Energy sales team](#). And [click here](#) to see the latest press releases on the new features at All-Energy 2012.

Organized by: [Reed Exhibitions](#)

In association with: [UK TRADE & INVESTMENT](#)

Learned society patron: [SIT](#) Society for Inshore Technology

Silver sponsor: [SCOTTISH RENEWABLES](#), [areg](#) Aberdeen Area Renewable Energy Group, [REA](#) Renewable Energy Association

Official charity: [Renewable World](#) (Scottish Charities Commission No. SC042922)

SEARCH THE SITE:

HFUEL HERE
ONSITE FUEL FOR EVENTS



MATERIALS HANDLING VEHICLES

FUEL CELLS ON SITE HYDROGEN



EARLY ADOPTERS

Why? | What are the advantages?

- Fleet size
- Time
- Productivity
- Footprint



WHY HYDROGEN?

ENERGY STORAGE | CLEAN FUEL



TRIAL DETAILS

6 week trial | M&S Bradford | ITM provided:

- 4 Fuel Cells
- 3 PPTs and 1 reach truck
- HFuel refuelling station
- Full project support, data analysis and reporting



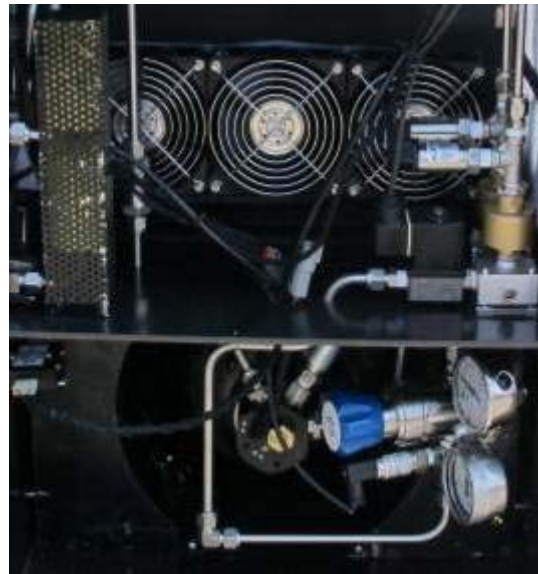
M&S TRIAL
ENERGY STORAGE | CLEAN FUEL



FUEL CELLS

MHV fuel cells

- Full fill at 350bar is 0.82kg
- Fill time 90 seconds
- Enough for 18hrs of full power
- State of fill more easily determined



M&S TRIAL | TECHNOLOGY
ENERGY STORAGE | CLEAN FUEL



MARKET
DRIVERS FOR
HYDROGEN
ADOPTION

ENERGY STORAGE
CLEAN FUEL
ENERGY SECURITY



MARKET DYNAMICS

market dynamics for hydrogen adoption
are now compelling

Oil prices and fuel security

The need for energy storage

Stalling EV sales



The Economist
The Brno club's economic
war, 1871-1914
A SURVEY OF CORPORATE GOVERNANCE
The end of the
Oil Age

Oil

Energy Storage
Revisiting Energy Storage
The Role of Battery Storage

Energy Storage

EV Sales

ITM POWER

HYDROGEN FUEL FOR TRANSPORT TODAY

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10TH MAY 2012

Summary

- A zero carbon" Route to 2050" The Carbon Plan
- Economic, competes with fossil fuel
- Increases utilisation of renewables
- Integrates - Smart Grid – Demand side management
- Flexible & versatile infrastructure for fuel cell electric vehicle rollout
- **AVAILABLE NOW - TODAY**

UNIQUE TECHNOLOGY
PRODUCT REVENUES
RAPIDLY DEVELOPING
GLOBAL MARKET
FIRST MOVER ADVANTAGE

THANK YOU

GRACIAS
ARIGATO
SHUKURIA
JUSPAXAR
DANKSCHEEN
TASHAKKUR ATU
SUKSAMA
EKHMET
MEHRBANI
PALDIES
BOLZİN
MERCİ
BIYAN
SHUKRIA
TINGKI
YAQHANYELAY
TASHAKKUR ATU
SUKSAMA
EKHMET
MEHRBANI
PALDIES
BOLZİN
MERCİ

SPASSIBO
SNACHALHUYA
NUHUN
CHALTU
WAHABEJA
MAITEKA
YUSPAGARATAM
HUI
DHANYABAD
ANISHA
ATTO
MERASTAWHY
GAEJTHO
TAVTAPUCH
MEDAWAGSE
BAIINKA
SANCO
MERASTAWHY
GAEJTHO
TAVTAPUCH
MEDAWAGSE
BAIINKA
FAKAAUE
AGUYJE
KOMAPSUMNIDA
MAAKE
LAH
MINMONCHAR

Charles Purkess,
Marketing & PR Manager
chp@itm-power.com

