

# COMPANY UPDATE

## FEBRUARY 2017



# COMPANY UPDATE

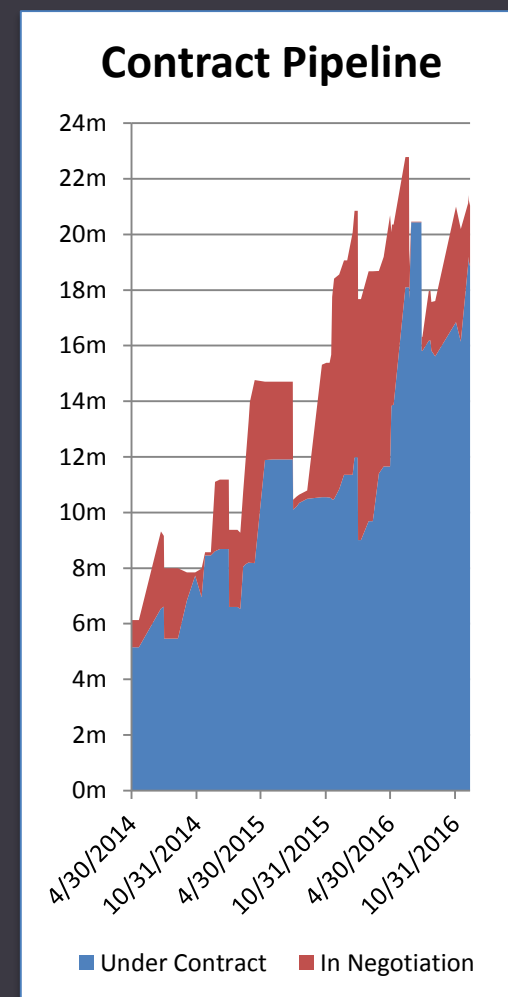
## FEBRUARY 2017

### Presentation Contents:

- Funding Round Rationale
- Company Snapshot and Deal Flow
- Introduction
- Products
- Power-to-Gas Projects
- Clean Fuel Projects

£16.98m under contract | £1.37m in negotiation | £18.35m total\*

\*As at 26<sup>th</sup> January 2017



ORDERS OF  
**£15.68m**  
OVER THE LAST  
12 MONTHS



DEAL PIPELINE OF  
**£21m**



LOSSES  
**DECREASED**  
BY



HEAD COUNT  
UNCHANGED



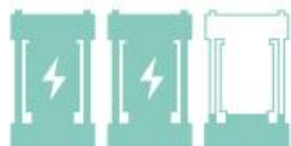
ACHIEVED



LONG RUN  
COST TARGET  
**€1m/MW**



SOLD  
**5.25MW**



OF LARGE SCALE  
ELECTROLYSERS

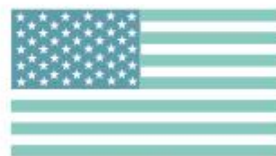
**1st**  
UK

POWER-TO-GAS  
CONTRACT WITH

**nationalgrid**



OPENED **THREE**  
NEW REFUELLING  
STATIONS IN UK



AND **ONE** IN USA

FUEL CONTRACTS  
WITH



TOYOTA



HYUNDAI



COMMERZBANK

GROUP



ARCOLA  
energy



ARVAL  
BNP PARIBAS GROUP

**Europcar**



ANGLO  
AMERICAN



**Shell**























REFUELLING STATION  
ON SHELL FORECOURT

# ACHIEVEMENTS IN CALENDAR YEAR 2016

## HYDROGEN ENERGY SYSTEMS

# TRANSITIONING FROM GRANTS TO SALES

- Only major transactions included (above £0.5M)
- 2014: First major transactions
- 2015: Dominated by grant income
- 2016: Transitioning from grant income to sales revenue

 HyFive Refuelling Grant <b>€3,759,745</b> 03/04/2014	 AgriTech Development Grant <b>£607,800</b> 09/04/2014	 Riverside Refuelling Grant <b>\$2,125,000</b> 02/05/2014	 HELES Development Grant <b>£896,648</b> 27/11/2014	 RWE Power-to-Gas Sale <b>€814,134</b> 11/12/2014	 Megastack Development Grant <b>€1,096,000</b> 28/03/2015	 H2ME OLEV Refuelling Grant <b>£1,890,000</b> 28/03/2015	 OLEV Upgrades Refuelling Grant <b>£1,000,000</b> 28/03/2015	 EMEC Power-to-Gas Sale <b>£1,794,694</b> 16/04/2015	 H2ME Refuelling Grant <b>€2,340,923</b> 24/09/2015
 ZEAG Power-to-Gas Sale <b>€1,546,101</b> 31/03/2016	 HPEM on Grid Development Grant <b>€915,650</b> 19/04/2016	 ELY4OFF Development Grant <b>€877,350</b> 19/04/2016	 BIG HIT Power-to-Gas Grant <b>€2,274,764</b> 28/04/2016	 H2ME2 Refuelling Grant <b>€5,296,050</b> 14/06/2016	 Bordeaux HRS Refuelling Sale <b>€1,508,121</b> 29/06/2016	 Mehrlin: Bus HRS Refuelling Grant <b>€827,500</b> 01/08/2016	 Major EPC Industrial Sale <b>£1,633,375</b> 18/11/2016	 HyDeploy Power-to-Gas Sale <b>£1,084,452</b> 30/11/2016	 GasCo. Refuelling Sale <b>€692,860</b> 19/12/2016

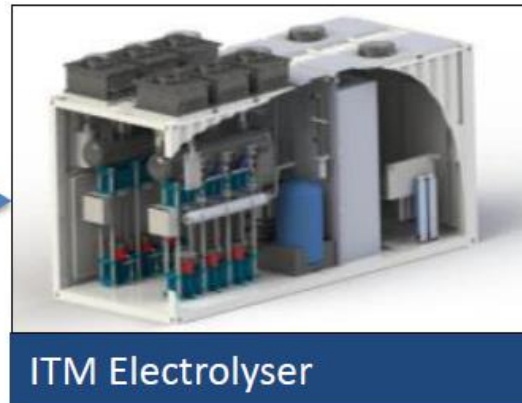
MAJOR TRANSACTIONS  
HYDROGEN ENERGY SYSTEMS

# POWER-TO-GAS ENERGY STORAGE



# RAPID RESPONSE ELECTROLYSER

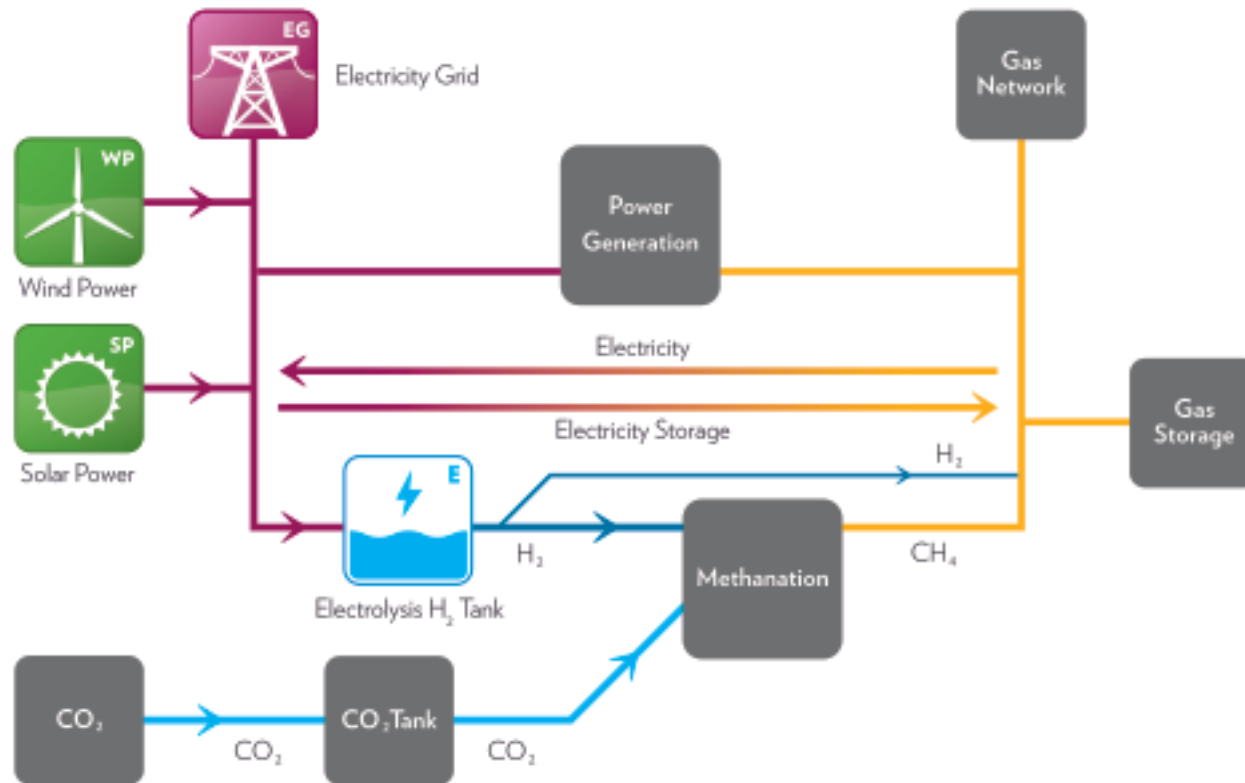
Available in 1MW modules | responds in 1sec | self pressurises to 80bar



RAPID RESPONSE  
HYDROGEN ENERGY SYSTEMS

# WHY POWER-TO-GAS?

Electricity cannot be stored easily | Hydrogen can be stored easily in the gas grid

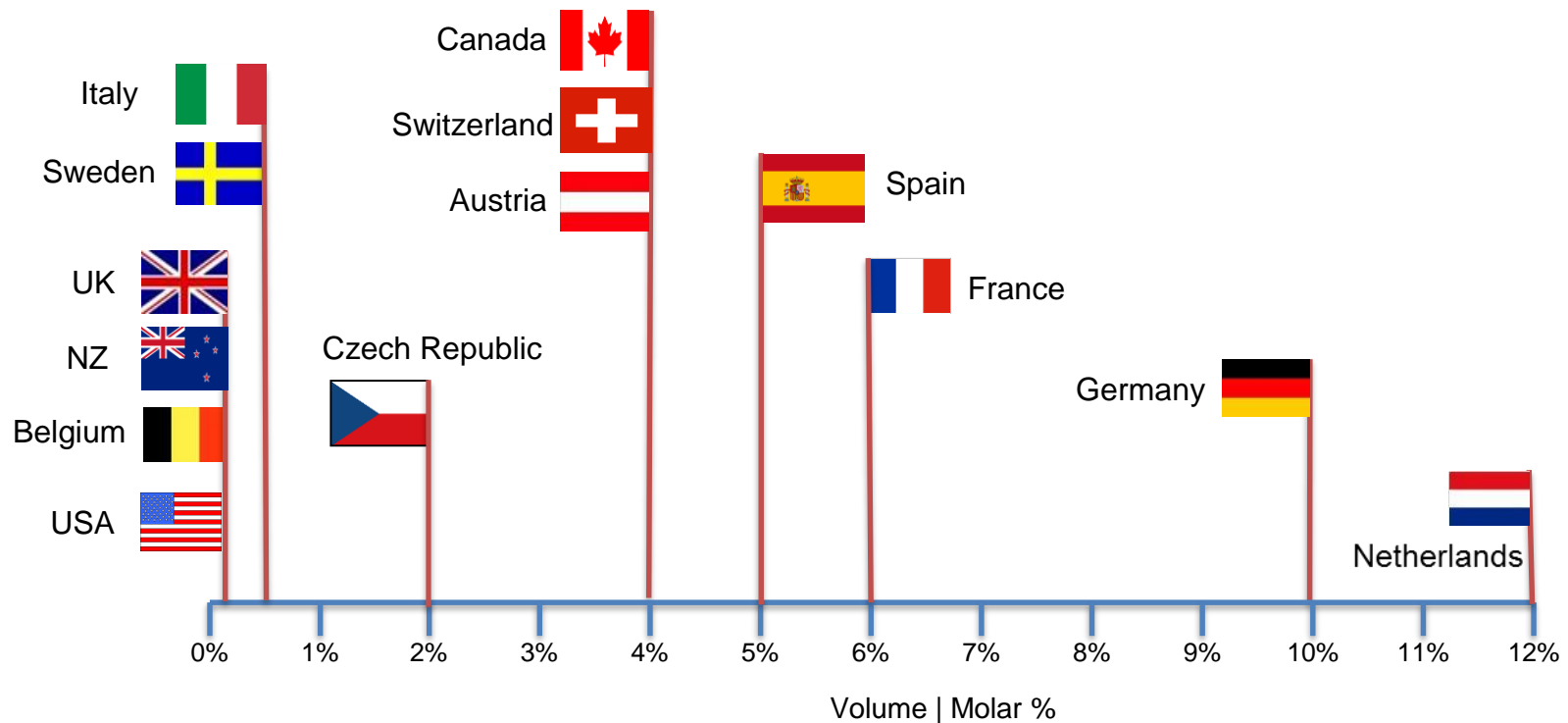


## POWER-TO-GAS RATIONALE

### HYDROGEN ENERGY SYSTEMS

# Current Hydrogen Limits for Gas Grid Injection

Covered by a range of local laws and directives



POWER TO GAS ENERGY STORAGE

ENERGY STORAGE | CLEAN FUEL

## Great Britain energy vectors daily demand - TWh Gas vs Electricity 29th September 2010 - 28th January 2013 (28 months)

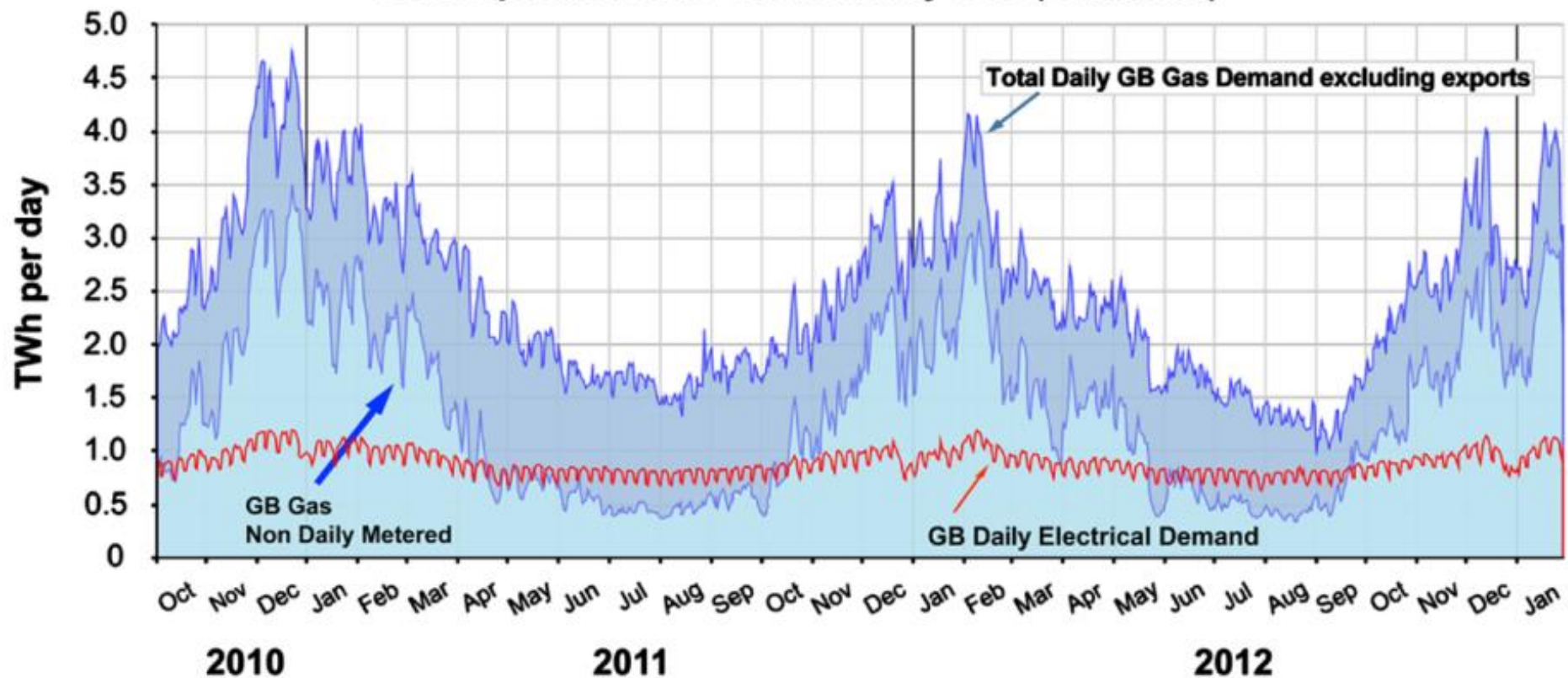


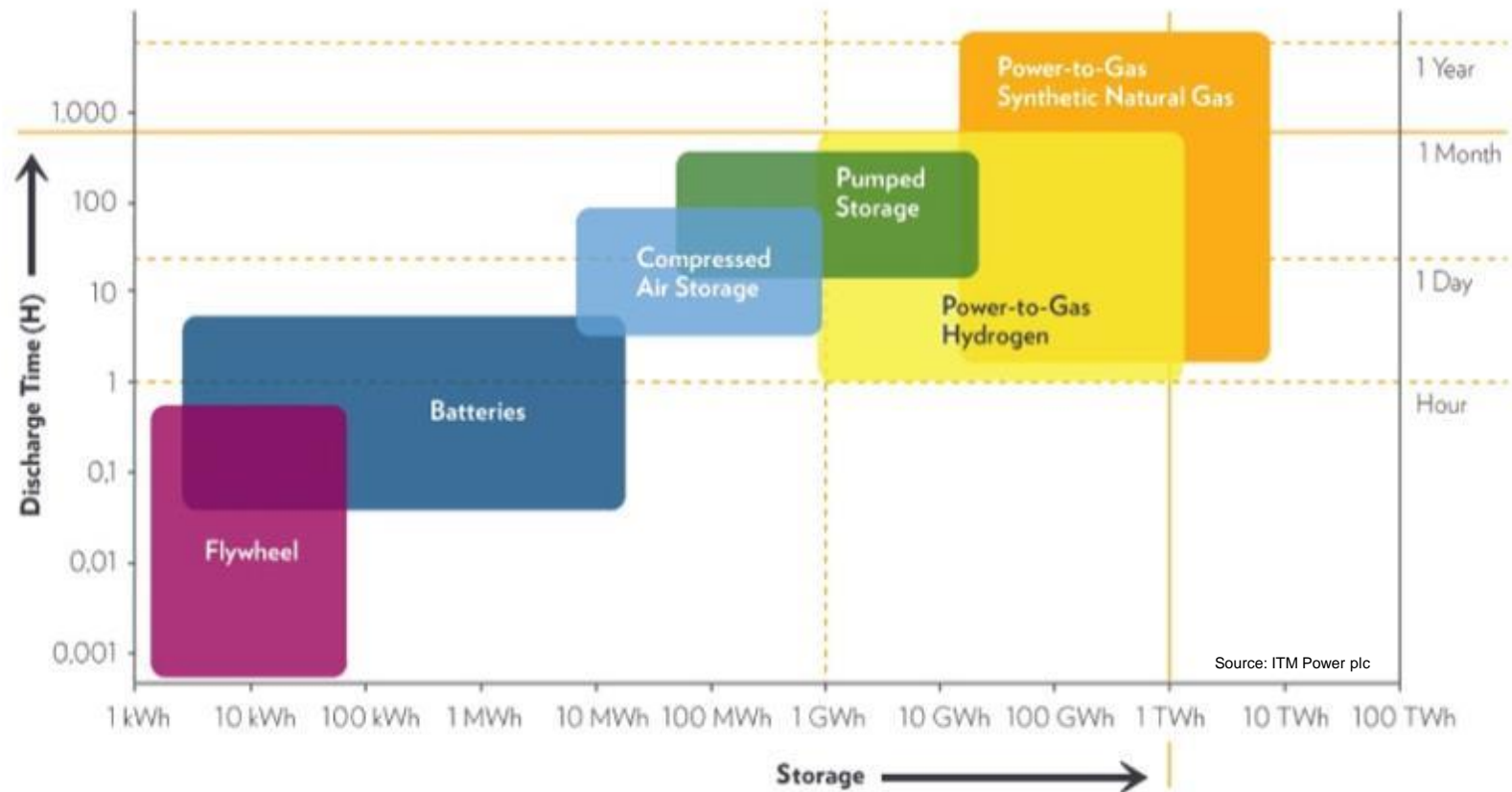
Fig. 1. Daily GB Gas and Electricity Demands (TWh). Data sourced from National Grid website (NGDIE, 2013; MHHED, 2013).

# ELECTRIFY HEAT?

## ENERGY STORAGE | CLEAN FUEL

# ENERGY STORAGE TECHNOLOGIES

Power-to-gas is efficient | long term | low energy cost



## ENERGY STORAGE TECHNOLOGIES

ENERGY STORAGE | CLEAN FUEL

# 32MWH BATTERY | P2G COST COMPARISON

## Lithium Ion System (6,300 sqft)

- Project will cost \$53.5m
- 8MW with 4hr duration | 32MWh
- \$6.7m/MW | \$1.67m/MWh



## Power-to-Gas System (3,530 sqft)

- Project will cost \$21.6m
  - 8MW with 4hr duration | 32MWh
  - \$2.7m/MW | \$0.67m/MWh
- 
- 8MW with 12hr duration | 192MWh
  - \$2.7m/MW | \$0.22m/MWh



Tehachapi Energy Storage Project

The Tehachapi Energy Storage Project features 604,832 lithium-ion battery cells, housed in 10,872 modules of 56 cells each, stacked in 604 racks arranged in rows.

## BATTERY | P2G COST COMPARISON

### HYDROGEN ENERGY SYSTEMS



# P2G PRODUCTS



# MARKET OFFERING

## Rapid Response | High Pressure | High Efficiency | MW scale

- Rapid response: less than 1s; for primary grid balancing
- High pressure: up to 80bar; for direct injection
- High efficiency: 77% measured by Thuga Group; 86% measured by RWE (with heat recovery)
- MW scale: 1MW modules available today
- Compliant: EU and USA
- Operations: 3yrs in the field



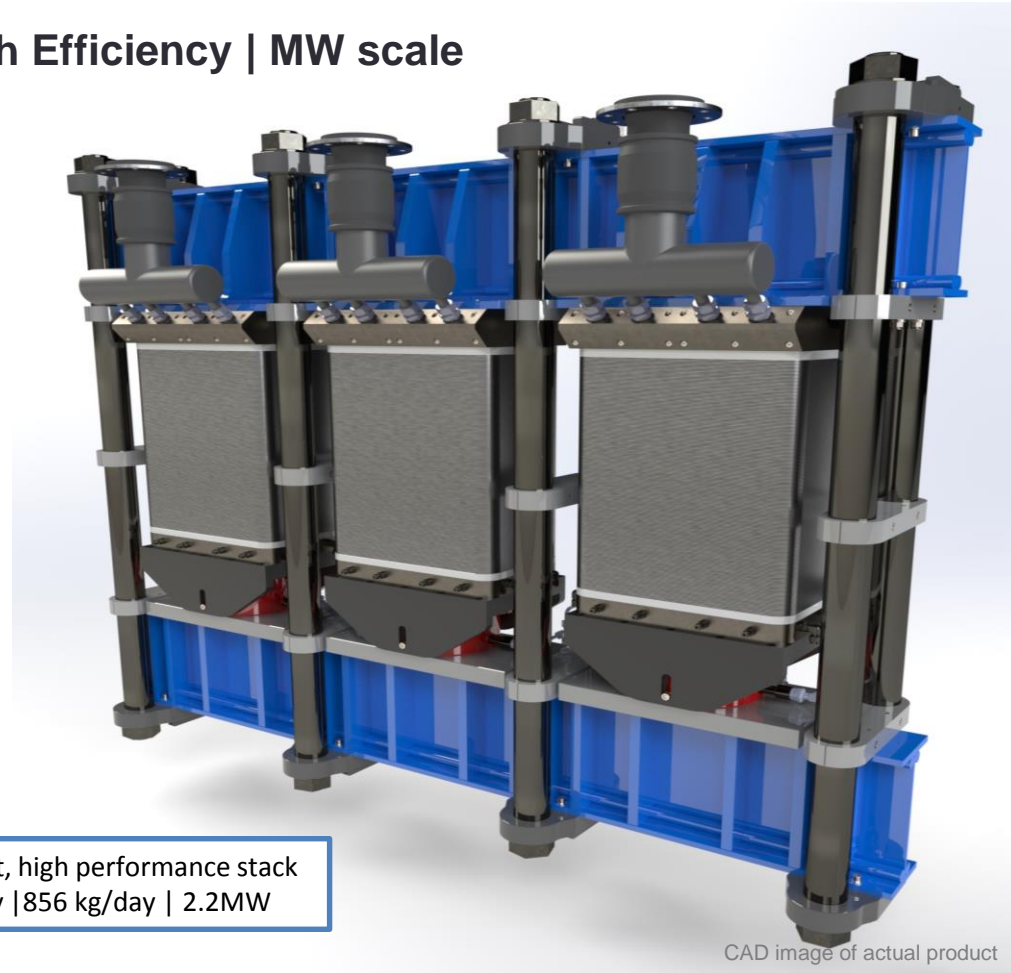
# MARKET OFFERING

## ENERGY STORAGE | CLEAN FUEL

# MARKET OFFERING

**Rapid Response | High Pressure | High Efficiency | MW scale**

- Rapid response: less than 1s
- High pressure: up to 80bar
- High efficiency: 75% measured
- MW scale: 1MW modules
- Compliant: EU and USA



New low cost, high performance stack  
technology | 856 kg/day | 2.2MW

CAD image of actual product

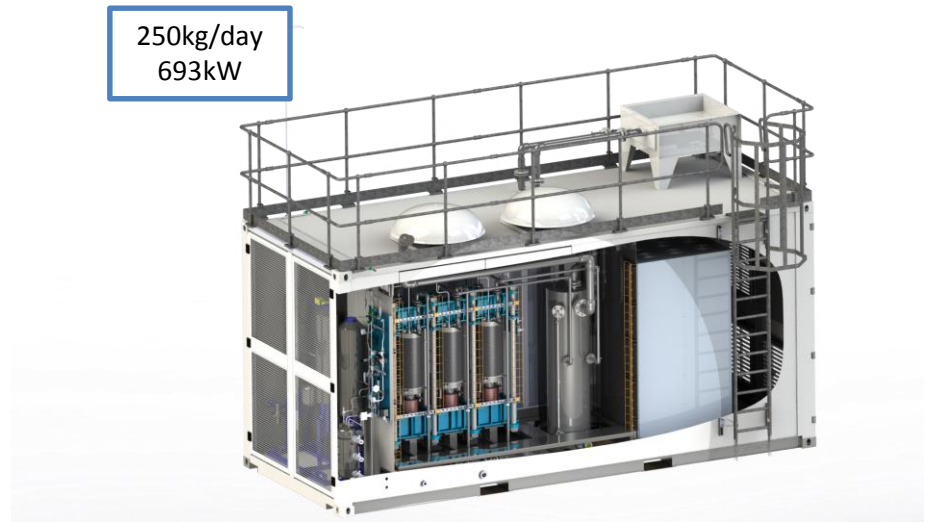
## MARKET OFFERING

ENERGY STORAGE | CLEAN FUEL

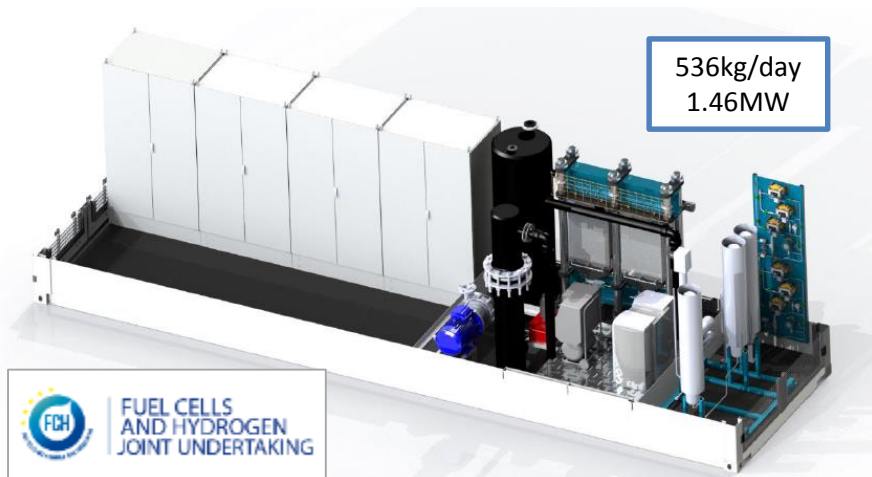
# STANDARD PRODUCTS



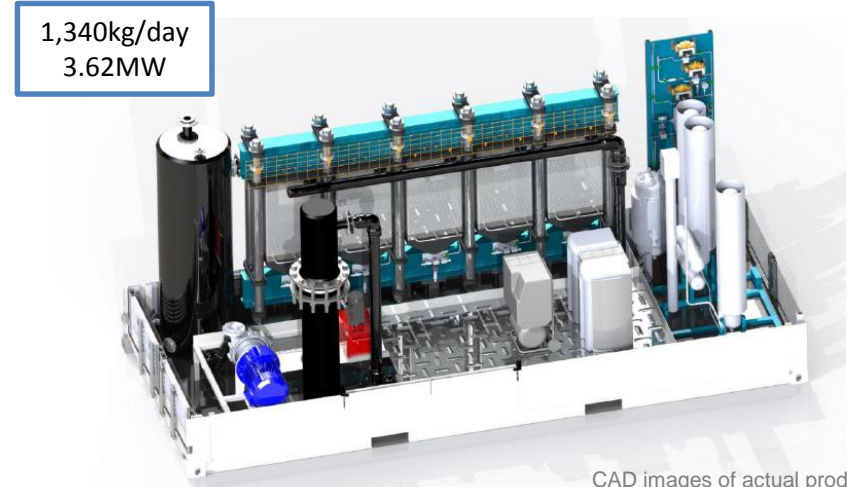
83kg/day  
245kW



250kg/day  
693kW



536kg/day  
1.46MW



1,340kg/day  
3.62MW

CAD images of actual product

MARKET OFFERING  
ENERGY STORAGE | CLEAN FUEL

# 100MW DESIGN

## 1MW to 10MW

- Bus refuelling stations
- Small P2G demonstrations

## 10MW to 60MW

- Large transport schemes
- Power-to-Gas installations
- Chemicals Industry

## 60MW to 100MW

- Power-to-Gas installations
- Chemicals Industry
- Refineries



Stock image

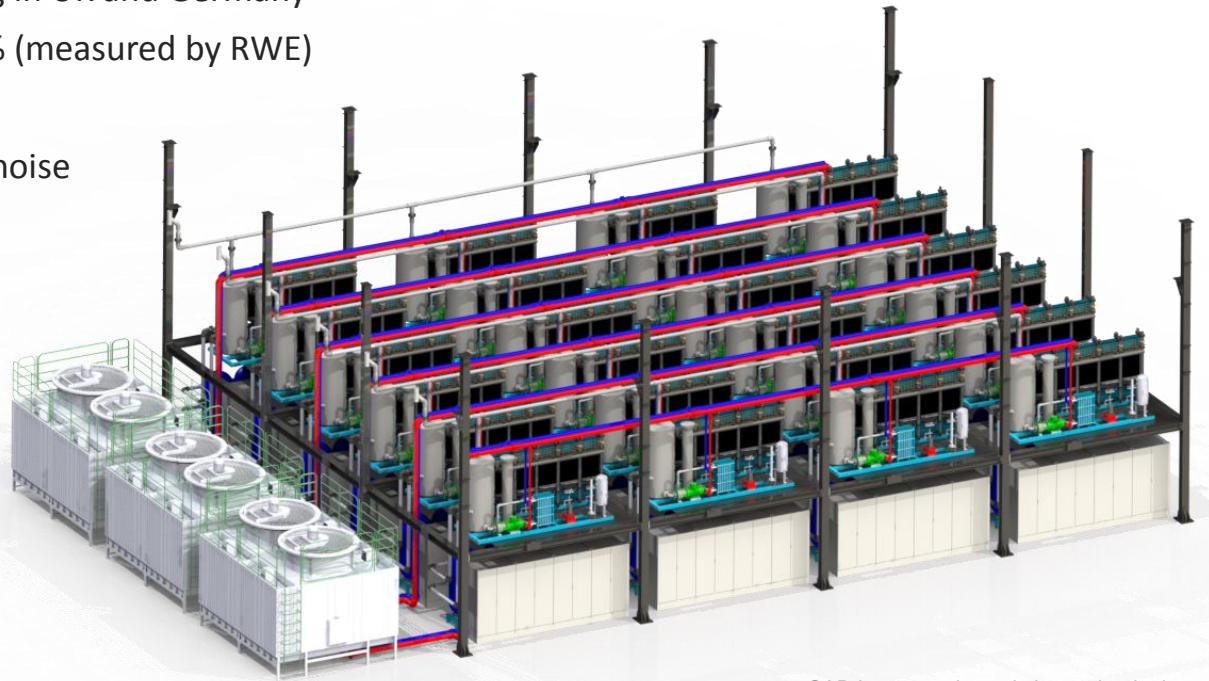
# 100MW DESIGN

## HYDROGEN ENERGY SYSTEMS

# 100MW DESIGN | COMPLETE TURN KEY SOLUTION

## Modular Design | Thermal Integration | Heat Recovery

- Avoids compounding container costs | Enables two storey construction
- Modular approach | wide capacity offering | Pathway to large scale without technology risk
- Qualified for grid balancing in UK and Germany
- Efficiency from 77% to 86% (measured by RWE)
- Integrated heat recovery
- Compact | modular | low noise



CAD images using existing technologies scaled up

## COMPLETE TURN KEY SOLUTION

## HYDROGEN ENERGY SYSTEMS

# CLEAN FUEL



# WHAT IS A FUEL CELL VEHICLE?

**An EV drive train that's refuelled rather than recharged**

- Refuel in 3 mins
- Range 300-420 miles
- Managed energy export

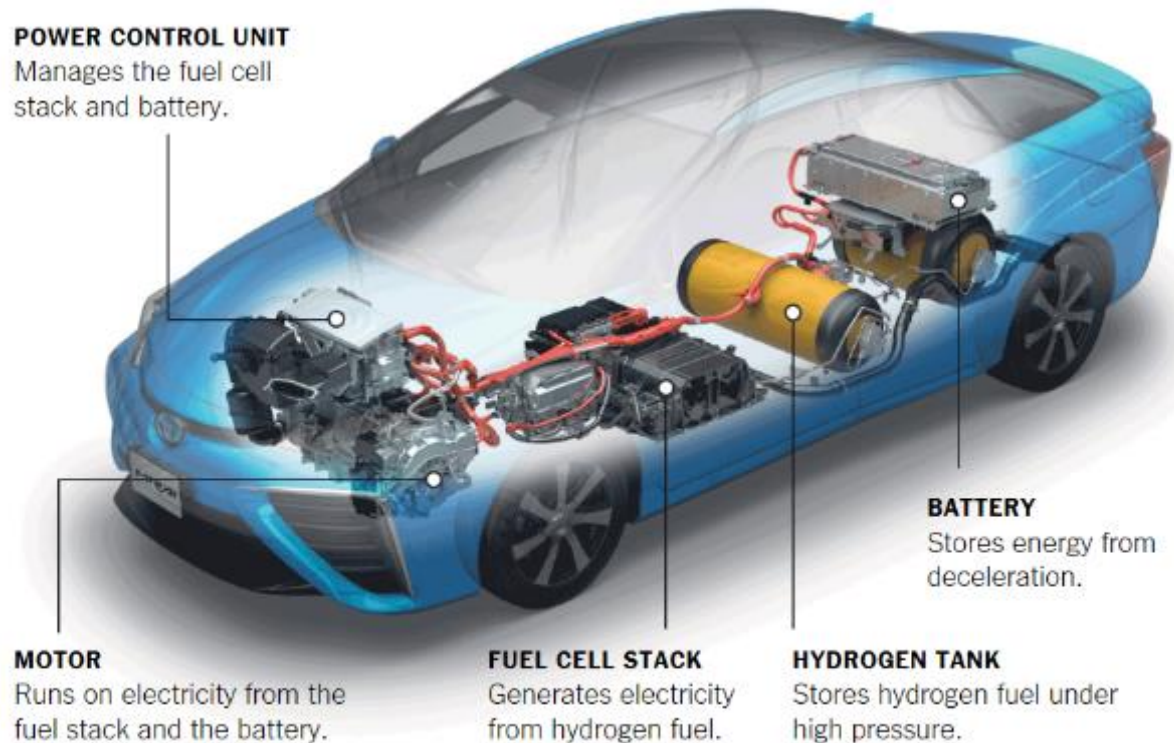


Image by Toyota

FUEL CELL VEHICLES  
VEHICLES | ROLL OUT

AVAILABLE TODAY



RENAULT



HYUNDAI



TOYOTA

**HONDA**  
The Power of Dreams

2014

2015

2016

2017

2018

2019

2020

ANNOUNCED



Audi



Mercedes-Benz  
DAIMLER



NISSAN



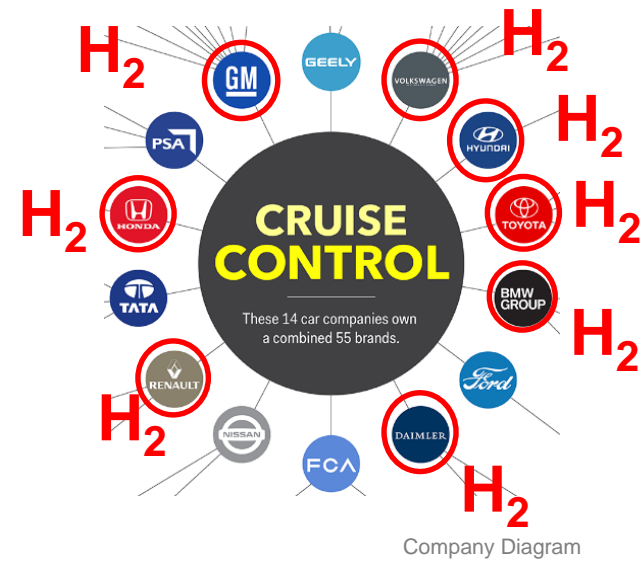
KIA



LEXUS



BMW

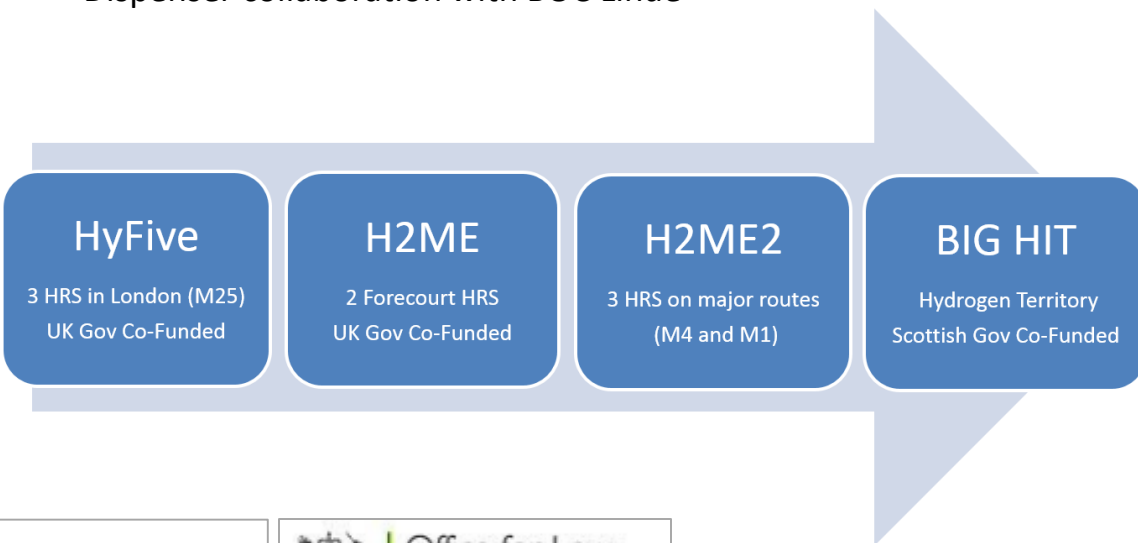


FUEL CELL CAR ROLLOUT  
ENERGY STORAGE | CLEAN FUEL

# ITM POWER HRS SITES

## Four FCH JU projects that define UK hydrogen fuel

- Build | Own | Operate model
- 3 operational HRS by December 2016
- Siting collaboration with Shell
- Dispenser collaboration with BOC Linde



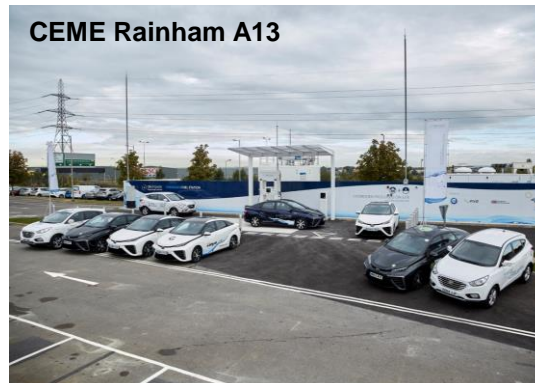
ITM POWER HRS SITES

ENERGY STORAGE | CLEAN FUEL

# HYFIVE | LONDON

**FCH JU Project number: 621219**

- NPL                      Teddington London                      Opened May 2016
- CEME                    Rainham London                      Opened Oct 2016
- Cobham                M25 Shell forecourt                      Opening Feb 2017



Company images

## HYFIVE | LONDON

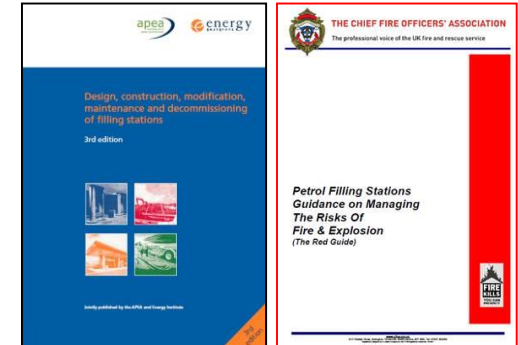
ENERGY STORAGE | CLEAN FUEL



# H2ME | UK

FCH JU Project number: 671438

- Beaconsfield M40 Shell Forecourt Opening Q2 2017
- Gatwick M23 Shell Forecourt Opening Q2 2017
- Forecourt integration with dispenser under the main canopy



Beaconsfield M40



H2ME | UK

ENERGY STORAGE | CLEAN FUEL



# H2ME2 | UK

FCH JU Project number: 700350

- H2ME2 1 Swindon Q4 2017
- H2ME2 2 Birmingham Q4 2017
- H2ME2 3 TBC Q2 2018



## H2ME2 | UK

ENERGY STORAGE | CLEAN FUEL



# BIG HIT | ORKNEY

FCH JU Project number: 700092

## Eday: Curtailed wind and tidal turbines

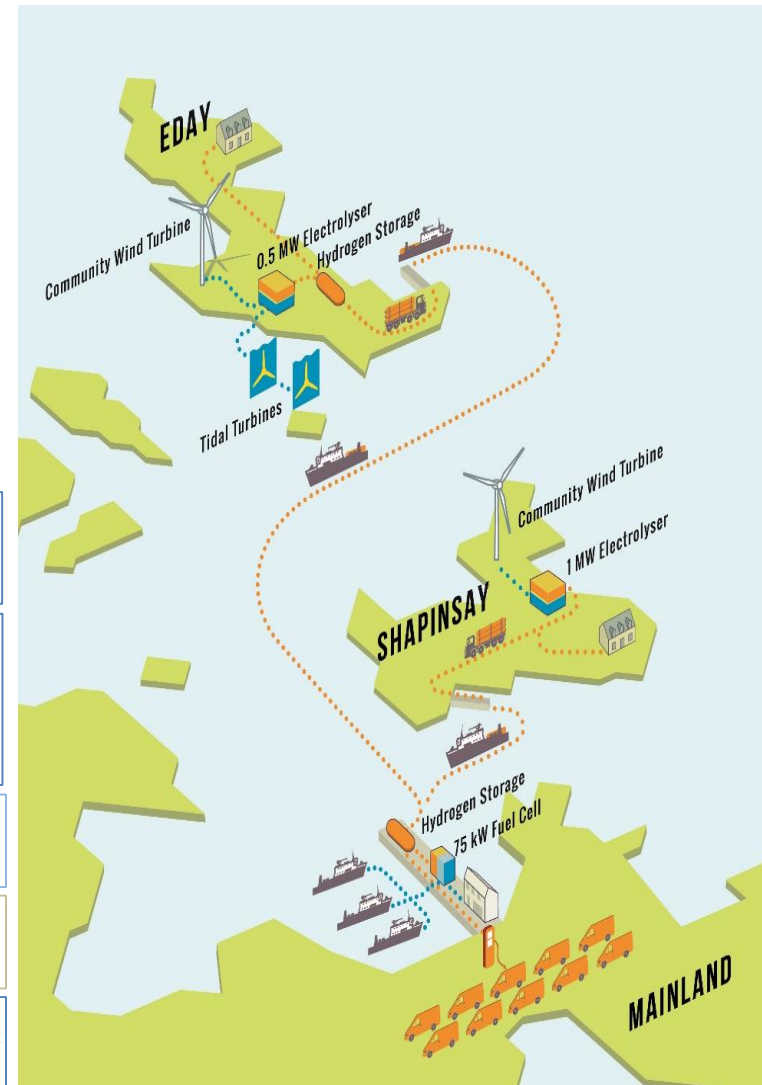
- 0.5 MW of electrolysis | 500kg storage
- Heating of school

## Shapinsay: Curtailed wind

- 1MW of electrolysis
- Heating of school

## Orkney Mainland:

- 75 kW FC: heat and power to marina
- H2 refuelling station | 10x Symbio FC vans
- Transport: 5x 250 kg tube trailers



## POWER-TO-GAS | ORKNEY

## ENERGY STORAGE | CLEAN FUEL



# ITM POWER | FUEL CONTRACTS

UK stations | £10/kg | dispensing 1tonne/day by the end of 2018



## ITM POWER | FUEL CONTRACTS

ENERGY STORAGE | CLEAN FUEL



# FUEL CELL BUSES



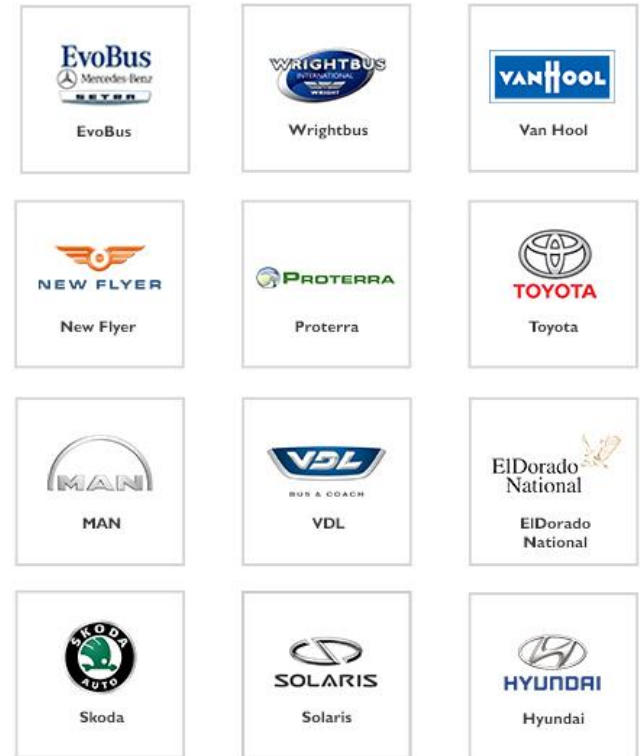
# HYDROGEN BUSES

## An EV drive train that's refuelled rather than recharged

- Refuel of 40kg in 6 mins
- Range 200 miles
- Managed energy export



Sadiq Khan said there will be no more pure diesel double-decker buses will be added to the capital's fleet from 2018 (Source: Greater London Authority)



# HYDROGEN BUSES

## VEHICLES | ROLL OUT



- 1 Aberdeen**
- Linde
  - Aberdeen City Council



- 9 Oslo/Akershus**
- HYOP
  - Akershus City Council
  - Kunskapsbyen Lillestrom Forening



- 2 Birmingham**
- ITM Power
  - Birmingham City Council



- 7 London**
- Air Products
  - London Bus Services Limited



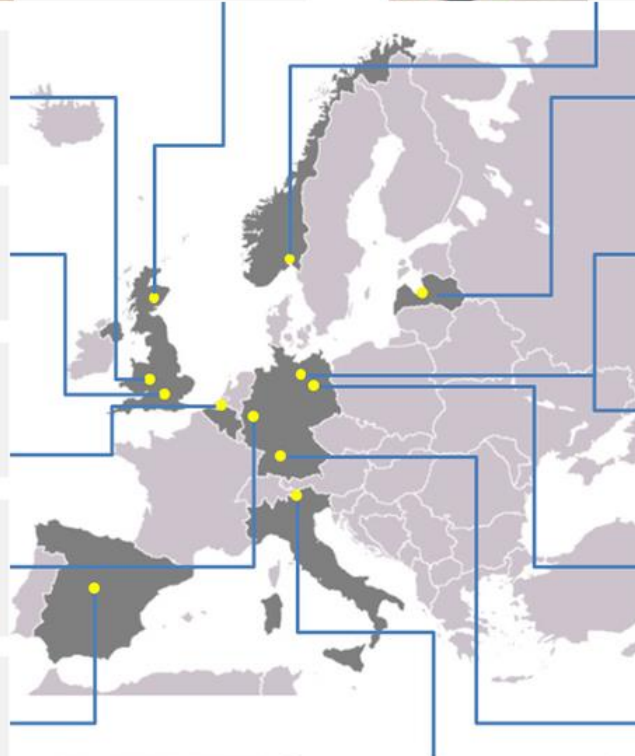
- 4 De Lijn**
- Linde
  - De Lijn



- 13 Wuppertal**
- Hydrogenics
  - Wuppertaler Stadtwerke



- 8 Madrid**
- Abengoa Hidrógeno
  - Empresa Municipal de Transportes de Madrid



**11 Riga**

- Industry role to be tendered
- Riga Satiksme



**5 Hamburg 1**

- Vattenfall Innovation
- Hamburger Hochbahn
- Siemens



**6 Hamburg 2**

- Air Products
- Hamburger Hochbahn



**10 Potsdam**

- McPhy Energy
- ViP Potsdam
- H2 Logic



**12 Stuttgart**

- Siemens
- Stuttgarter Strassenbahnen



**3 Bolzano**

- Ingenieurbüro Bergmeister
- Institut für Innovative Technologien Bozen Konsortial
- Siemens, Linde



# NEWBUSFUEL STUDY

ENERGY STORAGE | CLEAN FUEL



# COMPANY UPDATE

## FEBRUARY | LONDON

