

# ERA ENERGY RESEARCH ACCELERATOR

ERA Energy Research Accelerator is a national programme of research and innovation in the energy sector, funded by the UKRI and the Department of Energy and Climate Change (DECC).



## *Paths to Net Zero: A Technology Perspective*



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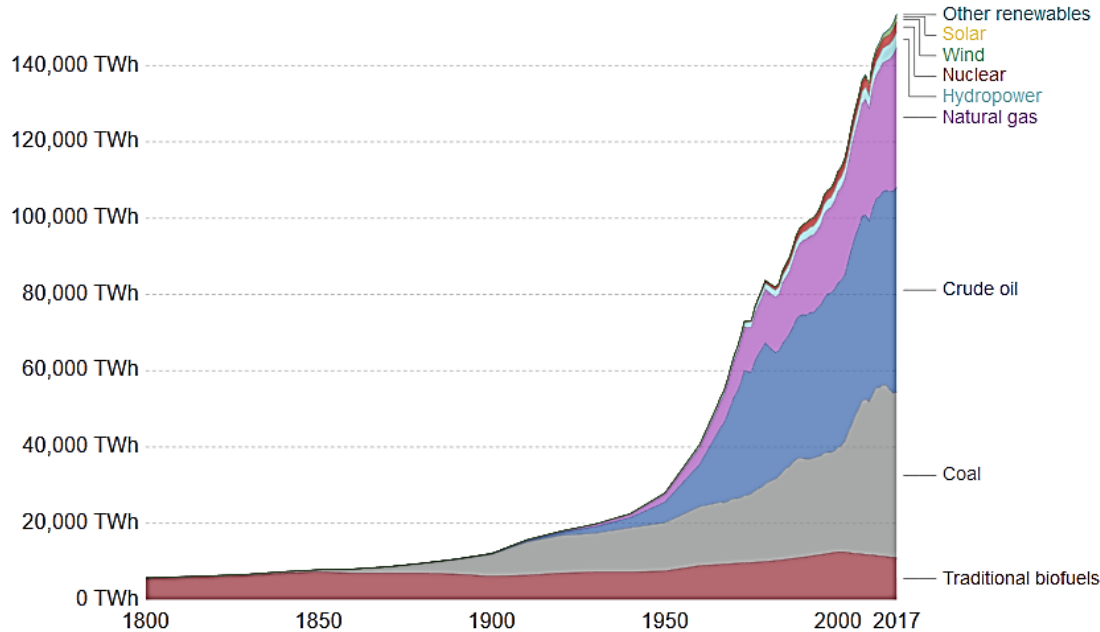


# The World and China

## Global primary energy consumption

Global primary energy consumption, measured in terawatt-hours (TWh) per year. Here 'other renewables' are renewable technologies not including solar, wind, hydropower and traditional biofuels.

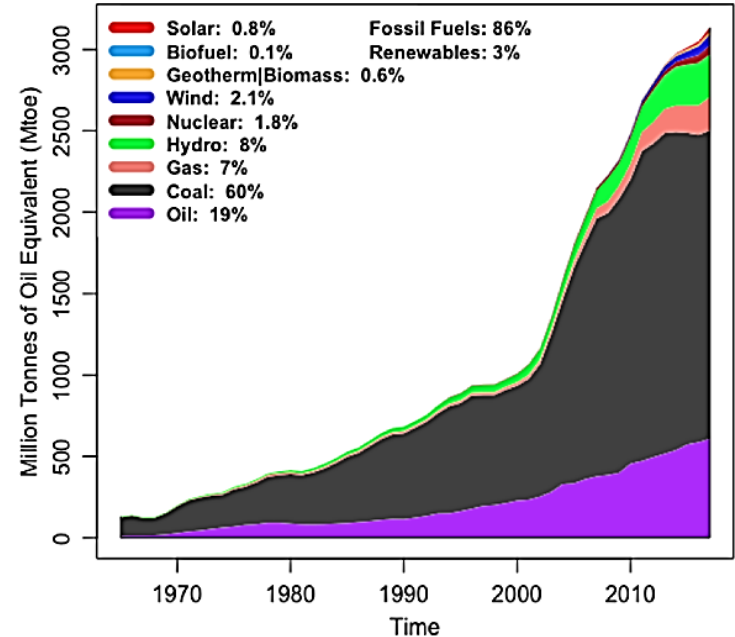
OurWorld  
in Data



Source: Vaclav Smil (2017) and BP Statistical Review of World Energy

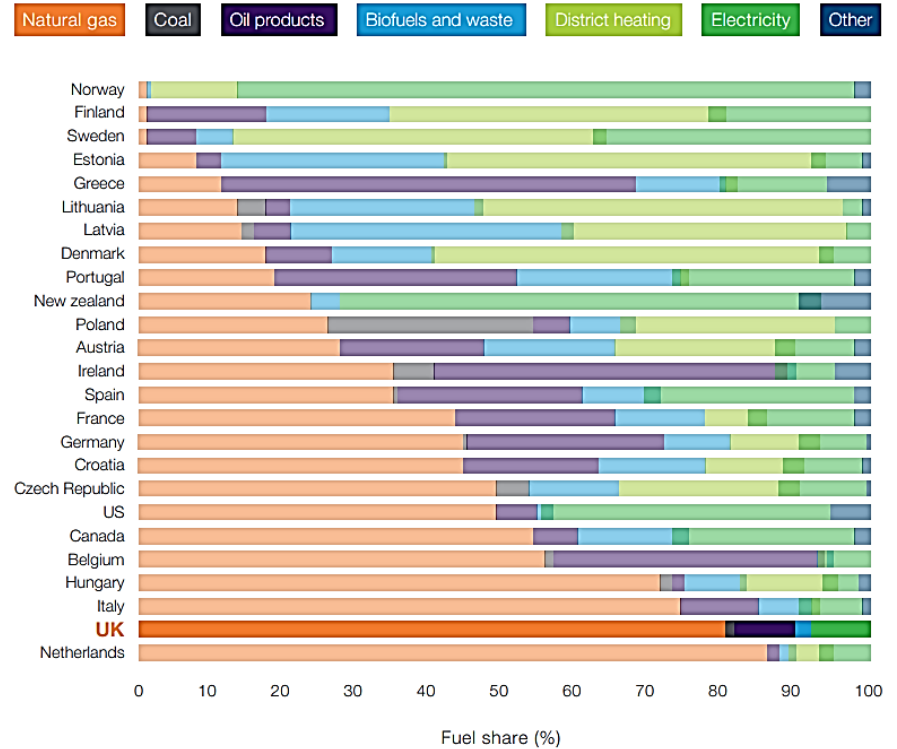
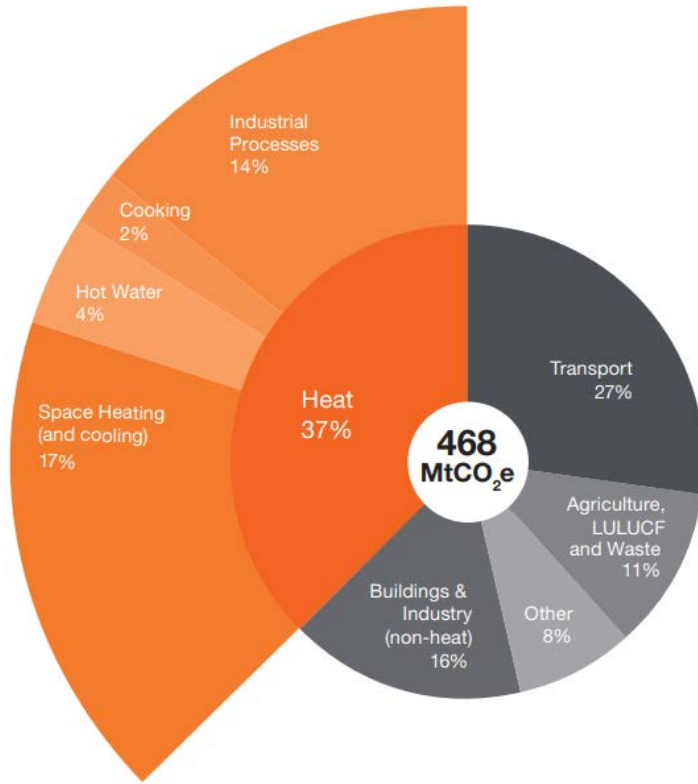
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## Fuel Use By Type, China 1965-2017



DATA SOURCE: BP Statistical Review of World Energy 2018

# Fuel Share for Residential and Commercial Heating Demand

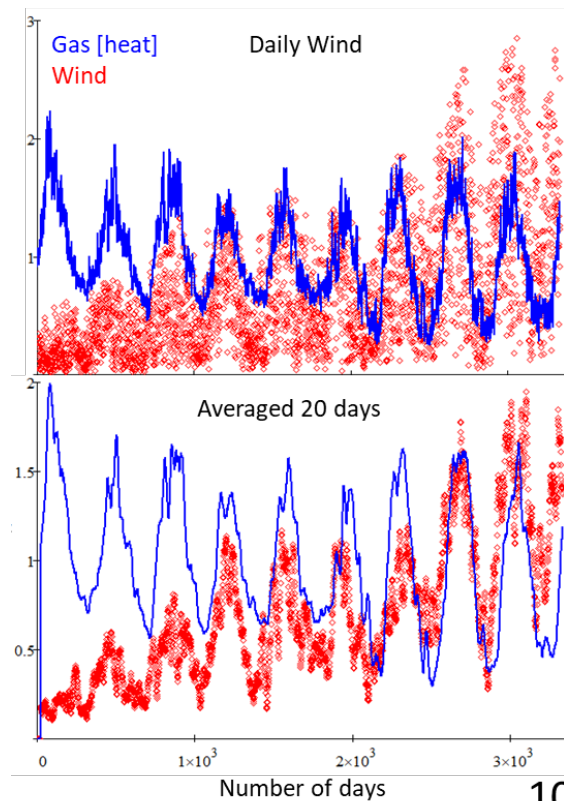


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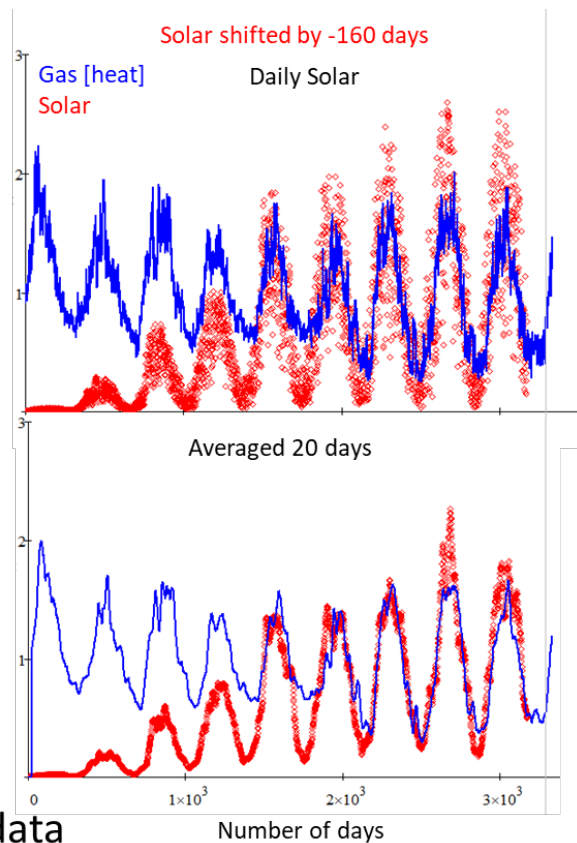


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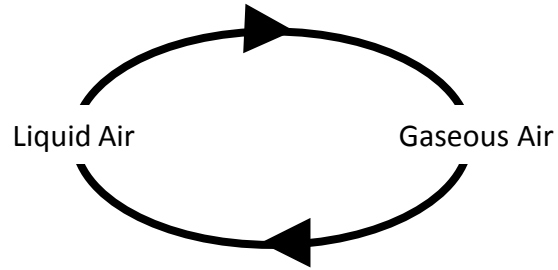




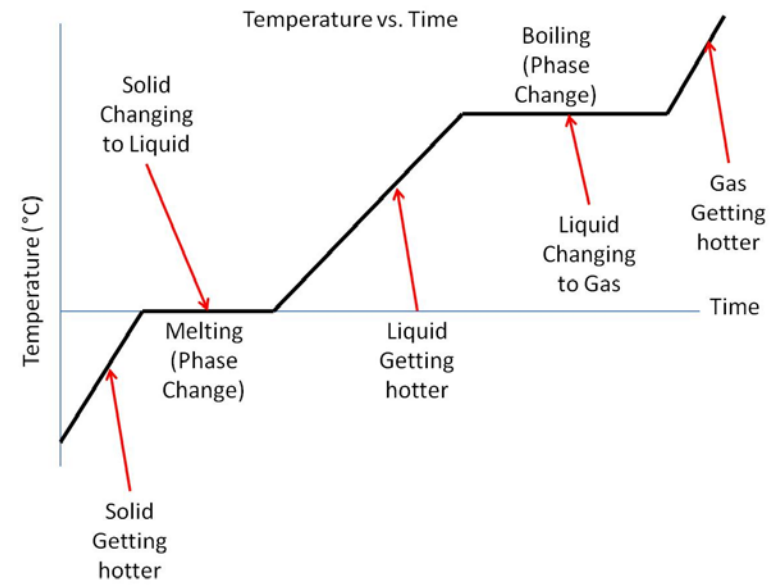
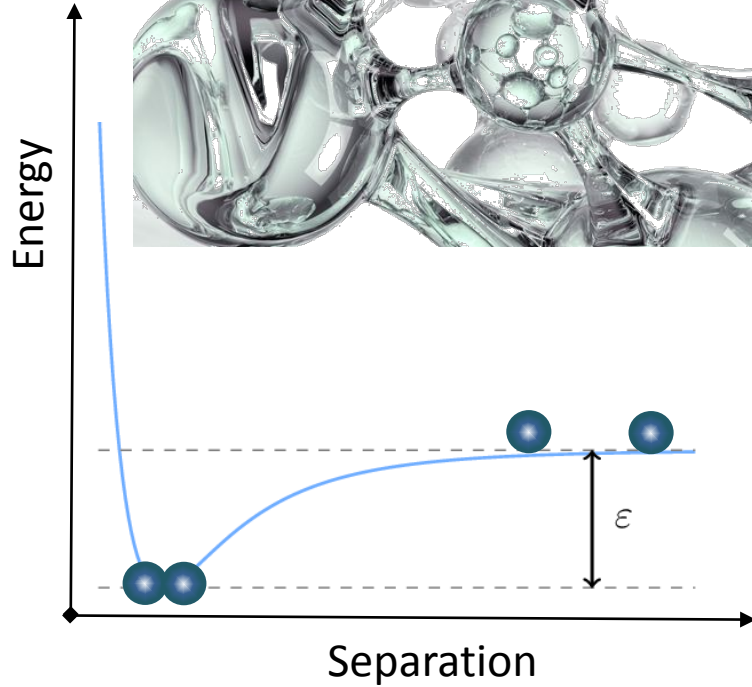
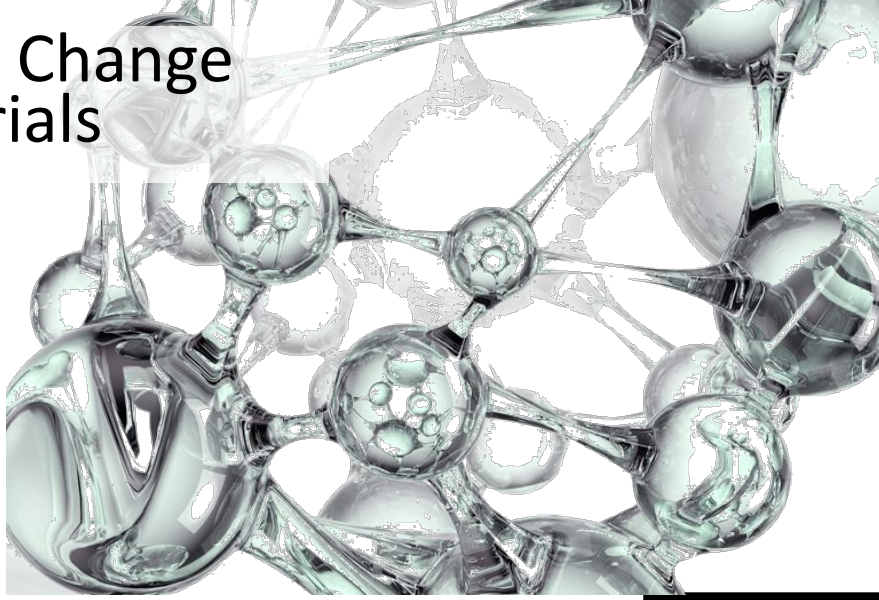
10 years of data



# Liquid Air Energy Storage



# Phase Change Materials



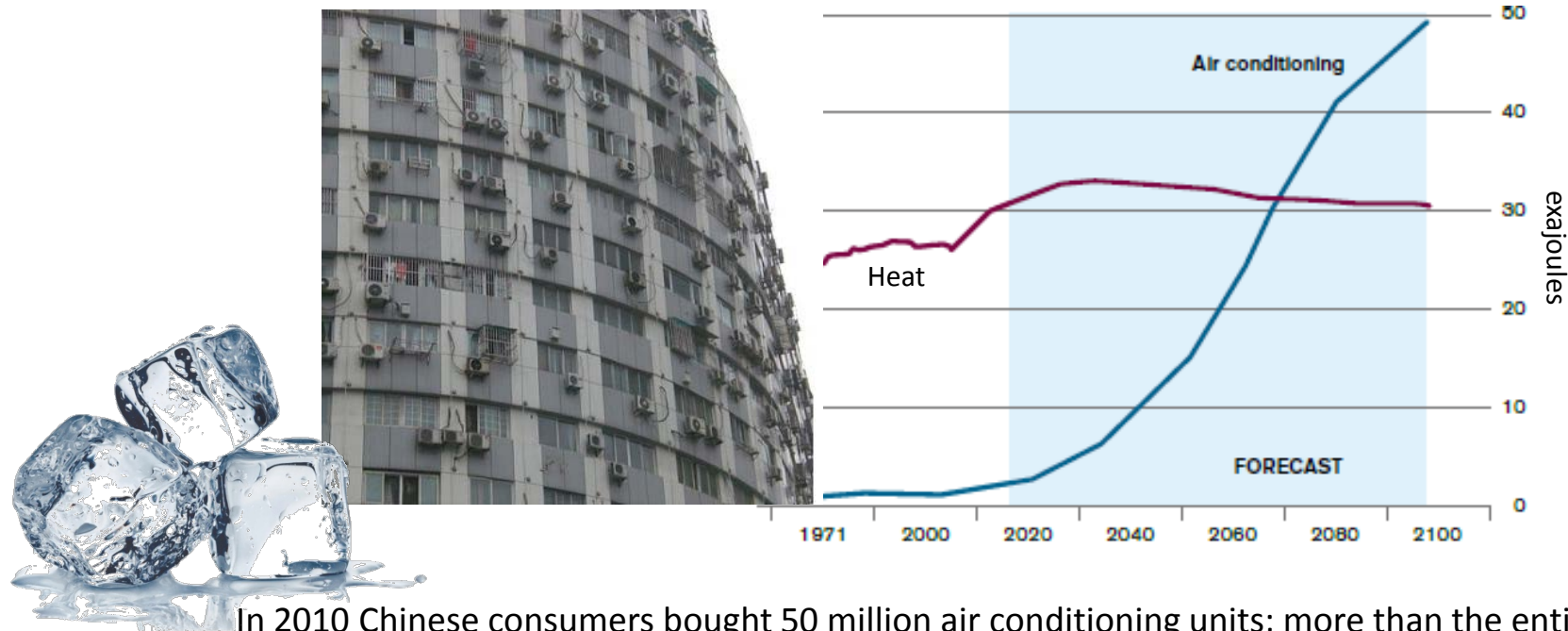
# Wind to Thermal

Nanjing Jinhe Energy Co. Ltd constructed a thermal energy store in Xinjiang to demonstrate **thermal phase change materials to store renewable energy from wind.**

Xinjiang, one of the windiest regions in China, enabled wind energy to be utilised that would have otherwise been wasted. This wind energy was then used to heat 60,000m<sup>2</sup> of space.



# Tackling major global energy challenges



In 2010 Chinese consumers bought 50 million air conditioning units; more than the entire of the US current domestic air conditioning fleet

# Outdoor Cooling



**LNG Import**

Waste heat from a nearby biomass power station raises the LAES plant's efficiency.

Liquid Air Energy Storage plant produces liquid air at off-peak times, which is used to generate electricity during peak hours and supply remote locations by tanker.

Waste Cold from imported LNG shipments captured and turned into Liquid Air to power cold economy.

**Industry**  
Liquid Air Energy Storage Plant fully integrated into industry where it makes use of waste heat while helping to balance the electricity grid.

works are both energy intensive and also require less. By using smarter thermal energy storage, cooling requirements are reduced. By further integrating waste heat, off-peak energy can generate cold which can then be used to provide cooling at peak times.

Liquid air also provides fuel for refrigerated lorries.

**Water Source Cooling**  
Efficient cooling can be achieved using natural bodies of water as a heat sink to provide cooling.

**District Cooling**  
In areas of high urban density, district cooling systems may provide a more efficient method for delivering cooling services, centralising plant and sharing services leading to greater system efficiencies.

**Ground-Source Heat Pump Heating and Cooling**  
As heat pumps play a more important role in delivering thermal comfort, the ground becomes a useful source and sink for heat.

**DOING COLD SMARTER**

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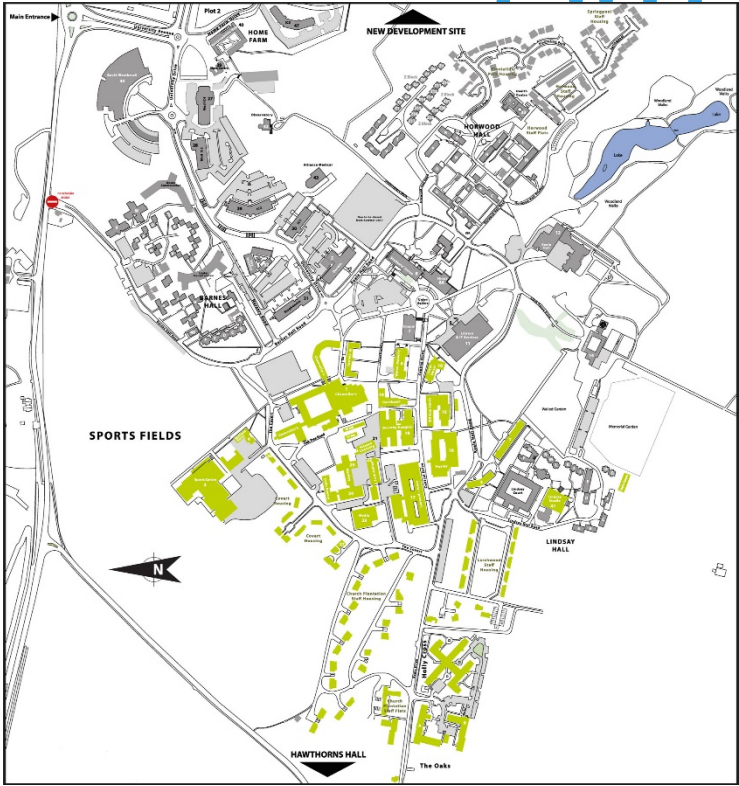
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# ING COLD SMARTER: FUTURE COLD ECONOMY

# Role of Hydrogen for heat



HyDeploy



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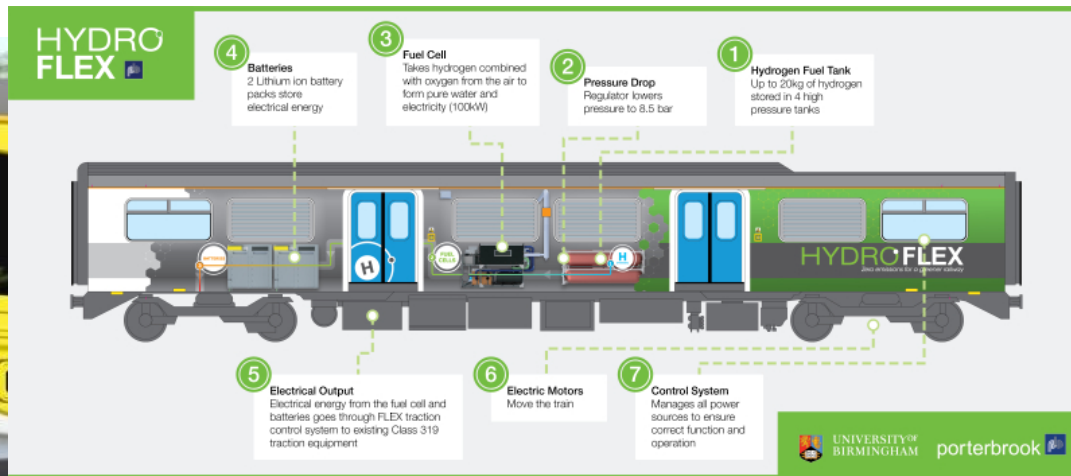
# Hydrogen Generation

The HyPER project (Bulk Hydrogen Production by Sorbent Enhanced Steam Reforming) will construct a state-of-the-art 1.5 MWth pilot plant at Cranfield University to test an innovative hydrogen production technology that substantially reduces greenhouse gas emissions.

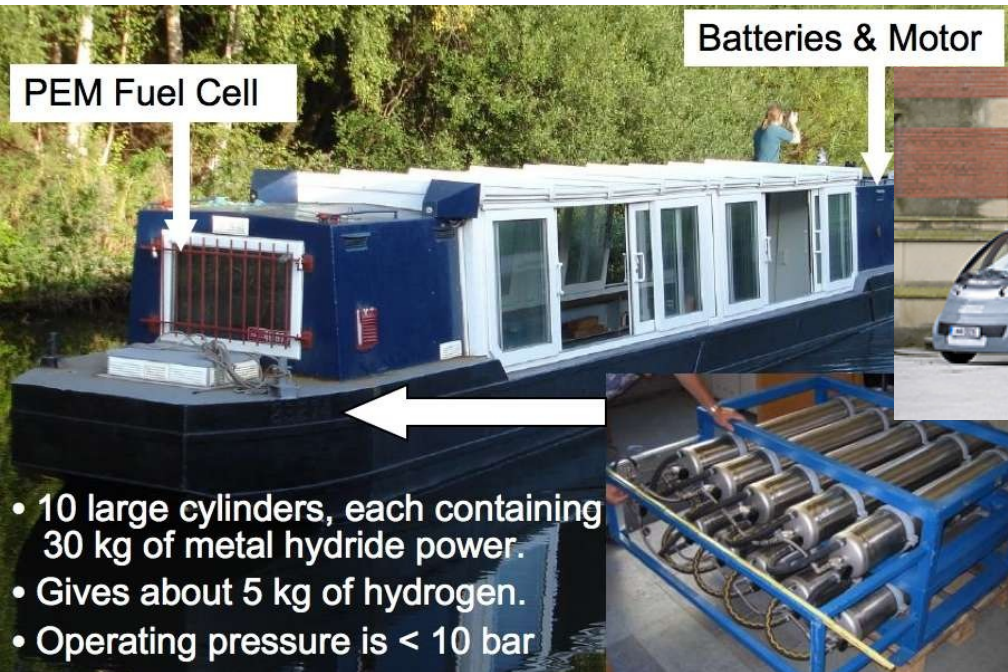
The Department for Business, Energy and Industrial Strategy's (BEIS) Energy Innovation Programme has provided £7.5million funding.



# Hydrogen Rail



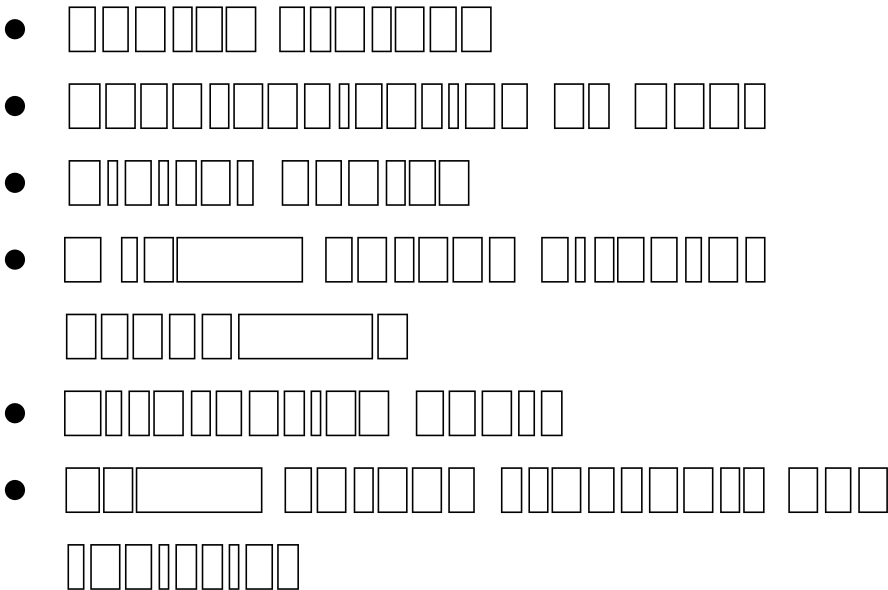
# Hydrogen Transport



# Hydrogen for freight and Logistics



- ☒ **Commercial**
  - ☐ Adelan Ltd
  - ☐ Arcola Energy
  - ☐ Baxi Heating UK Ltd
  - ☐ BP
  - ... 21 more
- ☒ **Research Facilities**
  - ☐ Cranfield University
  - ☐ University of Birmingham
  - ☐ Research Acceleration and Demonstration ...
  - ☐ Energy and Bioproducts Research Institute ...
  - ... 7 more
- ☒ **Demonstration Opportunities**
  - ☐ HyDeploy - Keele
  - ☐ East Midlands Airport
  - ☐ DIRFT - Logistics Freight
  - ☐ Theddlethorpe - OSW/CCUS Opportunity
  - ... 6 more



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