Energy Systems Catapult

CATAPULT Energy Systems

"a clean, intelligent, energy system that works for people, communities and businesses"

Innovation

Growth

Jobs

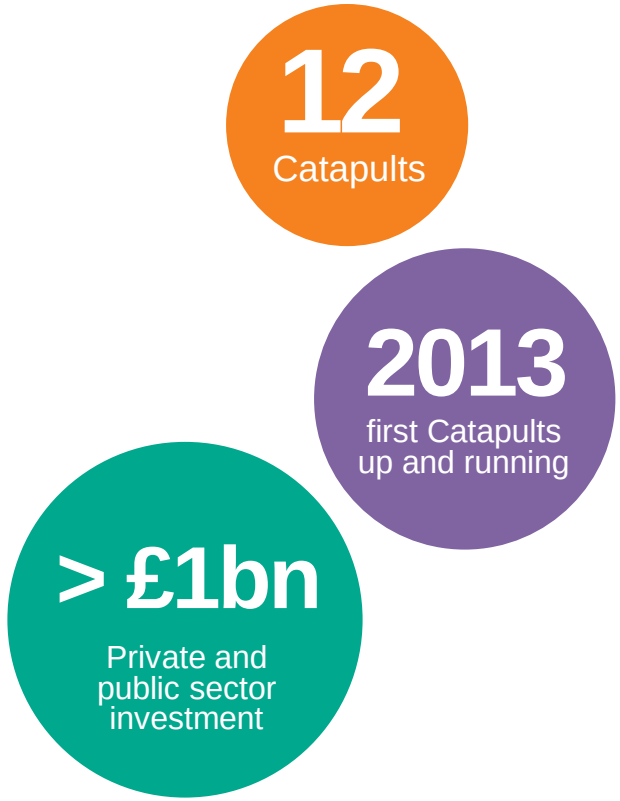
Mission of Energy Systems Catapult &
Exploiting Lab-Based Research/Innovation
Phil Lawton

Energy Storage Super-Gen Meeting

14th July 2016

What is a Catapult?

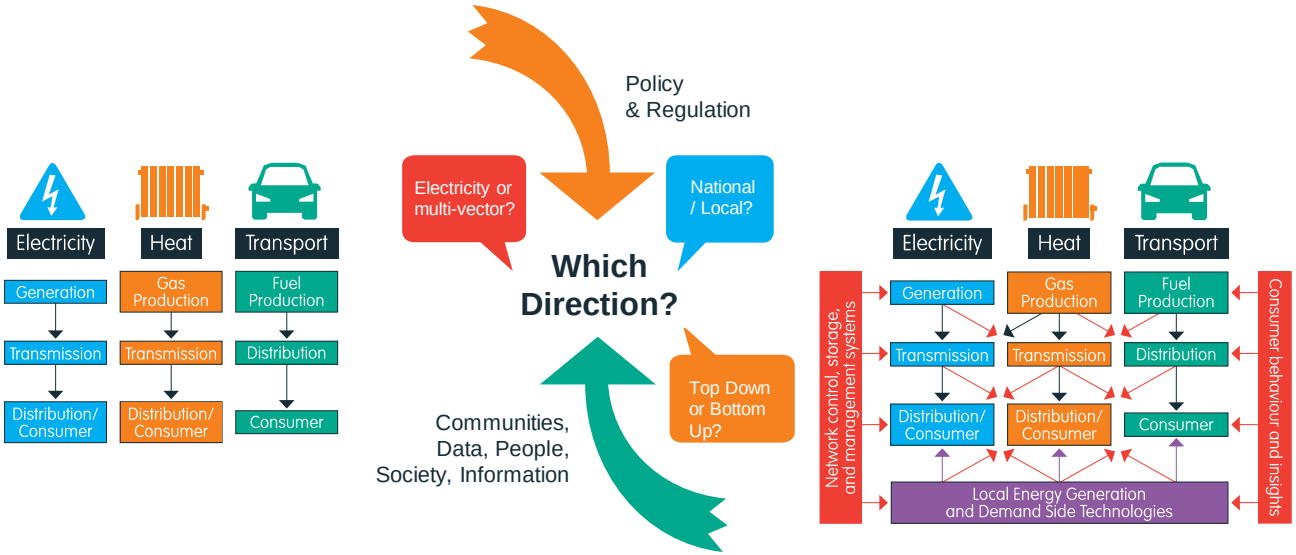
- Government business innovation intervention via BIS /Innovate UK
- World leading technology and innovation centres
- Aim:
  - Generate sustainable economic growth
  - Transform UK's ability to create new products and services
  - Open up new high growth opportunities across multi £billion markets
  - Stimulate global opportunities for UK
  - Bridge the gap between businesses, academia, research and government
  - Open up global opportunities for the UK



What do Catapults provide?

- World leading capability made available to business to solve their technical challenges
- Access to specialist technology, expertise and skills (particularly multi-disciplinary) for SMEs, supply chain, I&C and others
    - E.g. high-value capital equipment, facilities, infrastructure, data, models too risky or inaccessible for individual companies
- Reach into the knowledge/science base
- Capability to enable and undertake:
    - collaborative R&D projects
    - contract research
    - large-scale, long-term technology, market mechanism and/or business model demonstrators
- Technology/sector leadership, independent “repository of knowledge”, critical mass of activity
- Skills development

Our energy system is changing



The status quo is:

- safe
- stressed
- cheap
- ageing

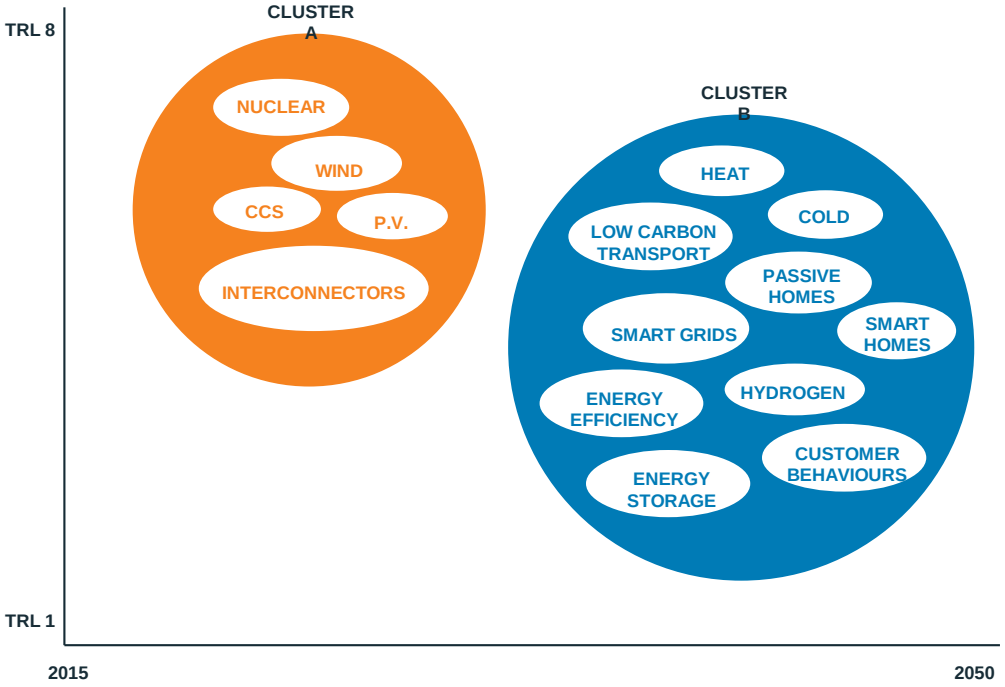
But, change is upon us:

- climate change act
- society
- technology
- digital

And, the future could be:

- multi-vector
- whole system
- distributed
- flexible
- smart

Technologies that support making the transition



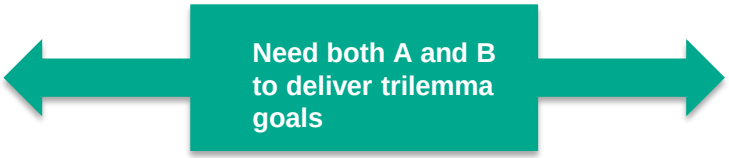
Technologies that support making the transition

Cluster A

- Higher TRLs
- Able to be deployed by incumbents
- High political attention
- Very large, lumpy costs
- Politically contentious
- Track record of slow progress
- Cannot work as an integrated system without Cluster B

Cluster B

- Lower TRLs
- New players needed
- Lower political attention
- Distributed, incremental spend pattern
- Potential to reduce bills
- Required for Cluster A to work
- More short term impact potential



Energy system technologies - the things we know

- Decarbonising electricity is crucial
- We need sources of low carbon heat and cold
- Building efficiency needs to be improved
- Energy flexibility becomes really important
- Continual system integration will be required
- Changing customer behaviours will help hugely

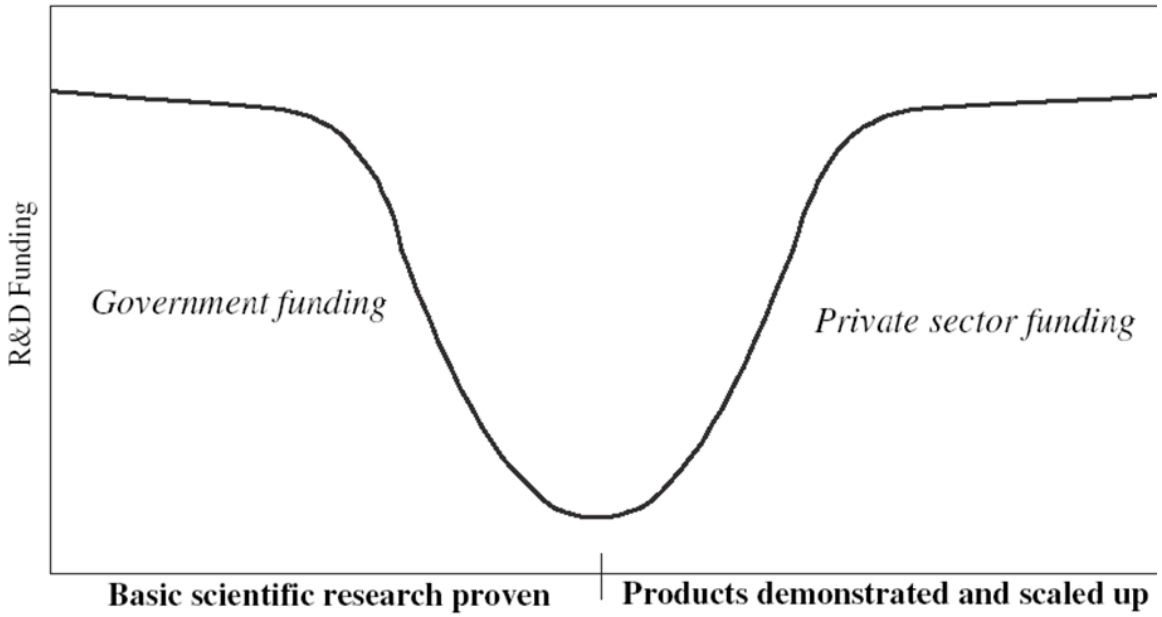
Energy system technologies - the things we're not so sure about

- The most economic way of decarbonising electricity
- How to get enough low carbon heat and cold quickly
- The balance of local, national and international
- How to improve building efficiency well and only once
- The best approaches to flexibility
- The best forms and locations of energy storage
- How to encourage new customer behaviours

Energy System innovation is crucial

- The need for action is acute
- Deploying expensive solutions will not retain public or political support
- Finding the most economic energy system of the future is complex
- We are likely to need dramatic innovation to hit our targets
- Intensive support for innovation will be vital
- A whole systems approach enables innovative options

The Valley of Death



Source: Raj Salhotra, Center for American Progress Energy

The Catapult response

Catapult Energy Systems

Catapult Response
Whole System Analysis

Convene stakeholders and develop and apply modelling and analytical capabilities to help the UK make strategic choices in collaboration with industry, Government and academia

Catapult Response
Accelerate Commercialisation

Whole systems architectures; systems integration frameworks; consumer insights; energy knowledge exchange‘; collaboration; targeted support for SMEs

Catapult Response
Test & Demonstration Platform

Whole systems; support technical development; alliances for multi-vector capabilities; enable value capture form new business models; mitigate risk and reduce time to market; realistic pricing of risk; consumer insights

Whole System: Why Use Storage?

- Mismatch between when the energy is available and when it's needed
- Shortfall of network capacity when the energy is needed
- Provide balancing services to System Operator

Whole System: Cost of a kWh coming out of storage

$$\frac{\text{Price of Energy Stored}}{\text{Round Trip Efficiency}} + \frac{\text{Annual financing + fixed operating costs}}{\text{Cycles per annum x kWh Capacity}}$$

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Illustrative example:

Cost of storage: £200/kWh
Life: 20 years
Rate of Return: 3%

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Illustrative example:
Cost of storage: £200/kWh
Life: 20 years
Rate of Return: 3%

Financing Cost:
Daily Cycle: 3.7p/kWh
Weekly Cycle: 26p/kWh
Annual Cycle: £13.50/kWh

Whole System: Alternatives to Storage

- Demand Side Flexibility
  (or Storage provided for another reason)
  - Influence charging of electric vehicles
    (not vehicle to grid)
  - Utilise thermal store/inertia in buildings

- Interconnectors provide the opportunity to arbitrage between markets:
  - Shorter links often cheaper than storage (Cross-Channel)
  - No Store to get full or empty
  - Greater round trip efficiency
  - Consider storage as European issue, not British

- Flexible Generation

- For network issues
  - Invest in network assets

Whole System: Conclusions

- Where possible, use storage that has been provided for another purpose:
  - Electric Vehicle batteries
  - Domestic heat storage

- Need large number of cycles per annum to limit cost per kWh stored. May not be suited to:
  - Inter-seasonal use
  - Coping with a wind “drought” or cold snap

- Consider alternatives:
  - Flexible generation
  - Network assets:
    - Interconnectors
    - Local network constraints

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