WESTERN POWER DISTRIBUTION

INNOVATION

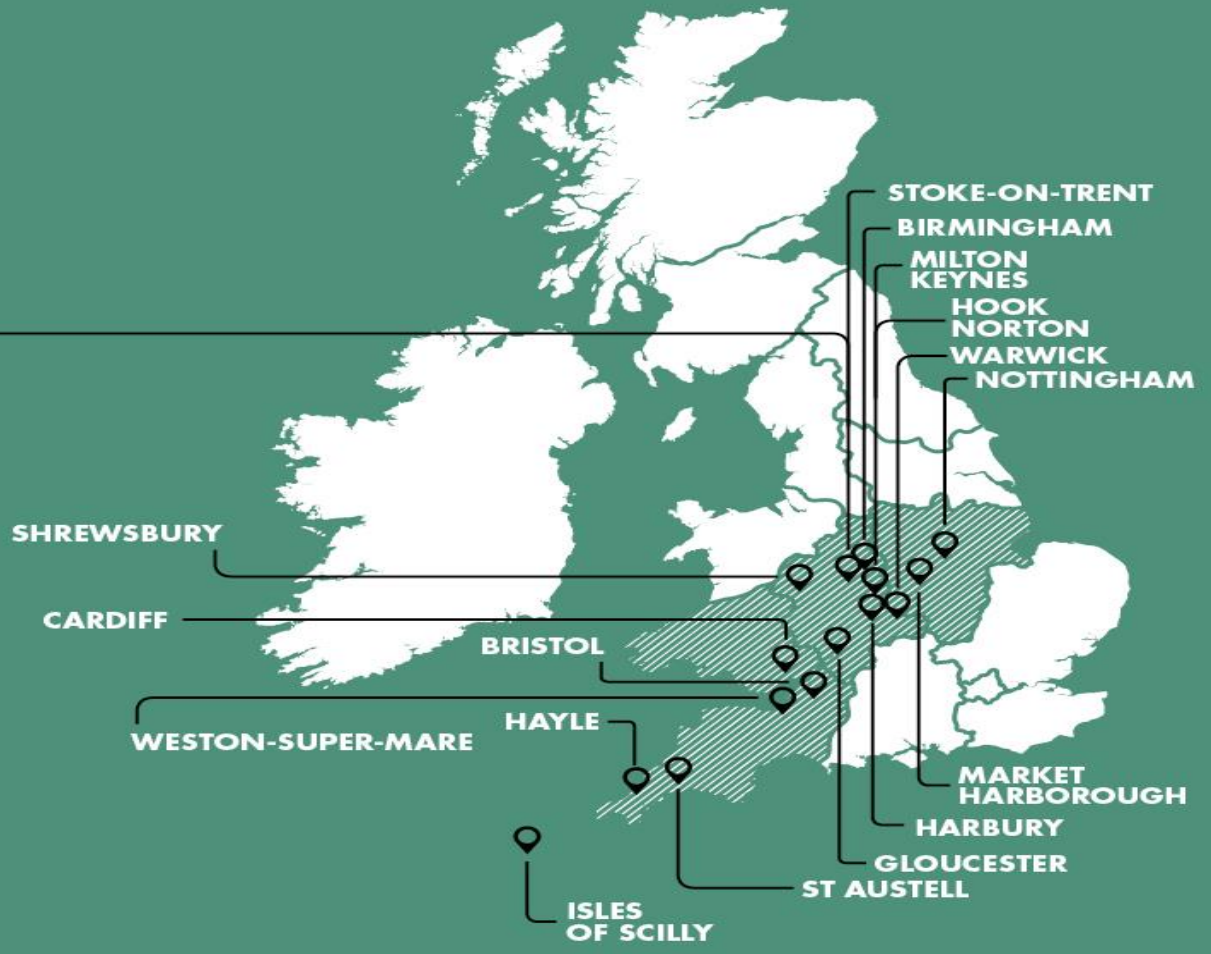
NEXT GENERATION NETWORKS

Hydrogen Heat and Fleet Study

Wessex Energy & Environmental Management
Blandford Forum, Dorset, DT11 7AJ

Faithful Chanda

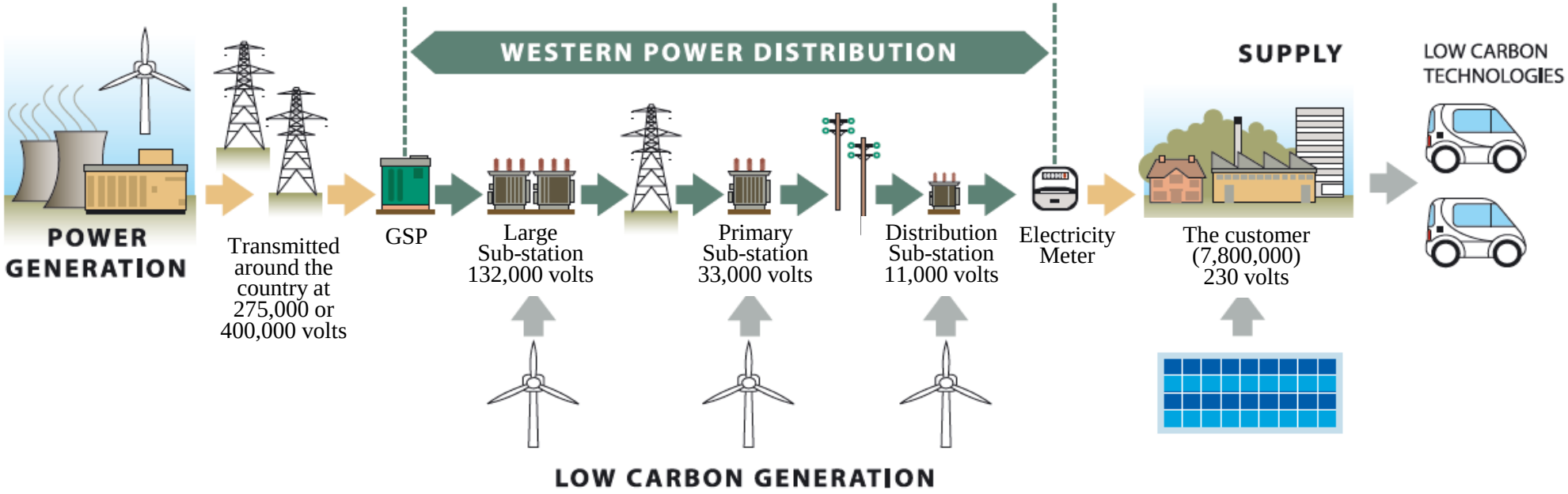
Innovation & Low Carbon Networks Engineer



Western Power Distribution

- 7.8 Million customers over a 55,500 sq kms service area
- WPD network consists of 216,000 kms of overhead lines and underground cables, and 184,000 substations
- LV to 132kV Network ownership
- Network - East Midlands, West Midlands, South Wales, and South West

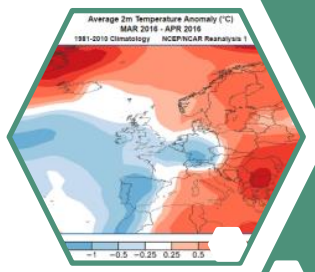
What is a DNO?



- A DNO, keeps the lights on, maintains/repairs equipment, upgrades the network and connects customers
- The growth in DG and potential growth in electrification of transport and heat are causing challenges in managing voltage, thermal capacity, fault levels and power quality (harmonics)

The Changing grid

Network Issues



Climate change is happening

Constrained and overloaded grid

Reduction in centralised generation

New loads and load profiles on the grid

Rapidly increasing sale of EVs

EVs are part of electrical energy systems

Increase in distributed generation

Smart systems require control

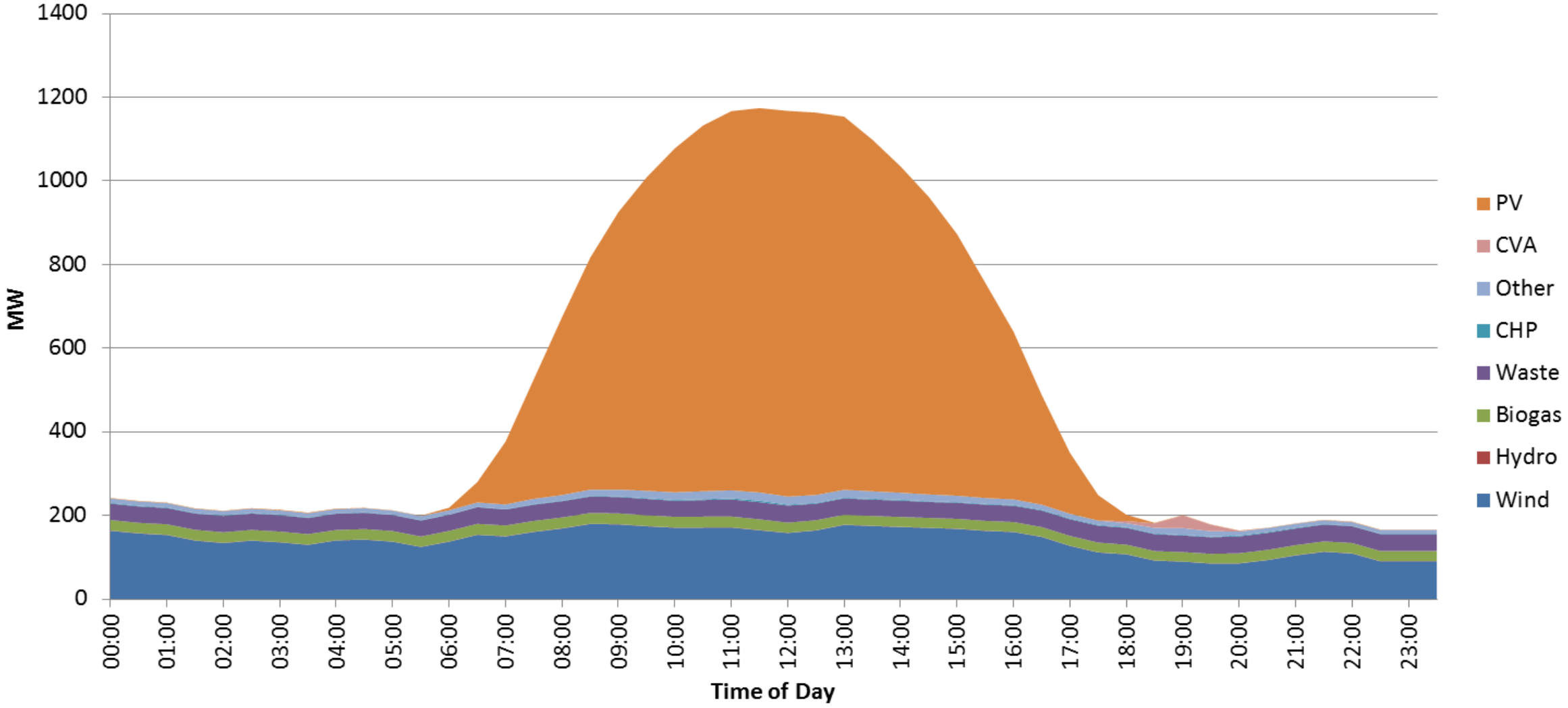
A strong future for distributed storage

Embedded/Distributed Generation

South West

- At privatisation in 1990, no generators connected to the DNO network
- Abundance of renewable resources in the South West
- WPD's South west licence area has experienced significant growth in the connection of Distributed Generation (DG)
- c2.3GW of generation connected within the South West licence area
  - A further c0.7GW accepted-not-yet -connected
  - A further c1.1GW offered-not-yet-connected
  - Demand for new connections is still high
- Max demand c2.6GW, Min demand c0.8GW

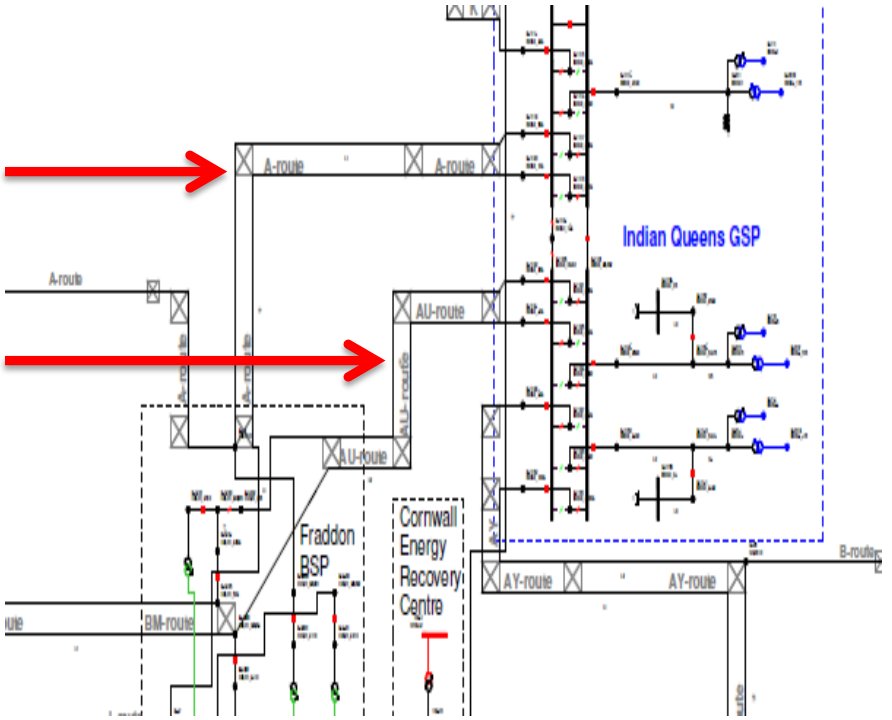
Breakdown of summer day generation mix by technology, MWh per half



Distribution Network Constraints

Cornwall region

- As a result of large amounts of connected and committed generation at all voltage levels within the Cornwall region, reinforcement of the grid transformers (GTs) at Fraddon BSP and associated 132kV circuits was triggered.
- The following equipment has recently been installed at Fraddon BSP:
  - 2 new grid transformers,
  - 2 new indoor 33kV boards,
  - 4 new 132kV cables,
  - 5 new 132kV circuit breakers, and
  - 1 new 132kV termination tower.
- The 4 132kV overhead line circuits between Indian Queens GSP and Fraddon BSP have also been reprofiled, increasing their ratings without reconductoring.



Transmission Network Constraints

SoW/CUSC Code

- All changes to demand or generation on the distribution network have some effect on the transmission system
- CUSC Code has a requirement in it to seek National Grid's assessment of the impact and any necessary works that they need to undertake where it is deemed that there will be an impact.
- The initial assessment is carried out via a Statement of Works (SoW) which confirms whether NGET work or connection conditions will be required.
- Where works are required, a Modification Application (Mod App) is made to NGET.
- NGET then specifies the precise works or conditions needed before connection can take place

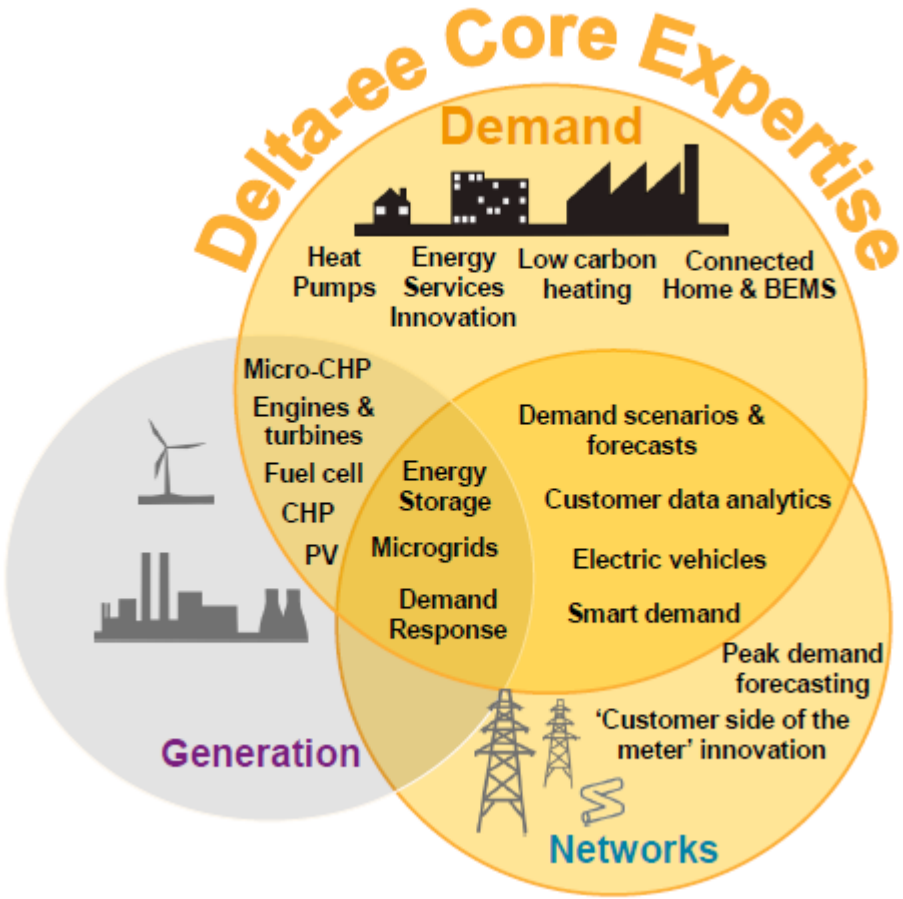
What does this mean to WPD?

- An increase in intermittent renewable generation on networks leads to an increase in uncontrollable supply of electricity due to volatility/intermittency
- There are a number of networks within the WPD licence areas:
  - That are already at capacity
  - Where no further renewable generation can be connected without significant reinforcement
  - Solutions that enable the further connection of generation are being explored
- When a new generation connection is requested at a constrained network, current practice is to:
  - Reinforce the network at the customers cost or
  - Offer the generator alternative network connection arrangements
- Novel techniques for reducing constraint issues explored by WPD:
  - Batteries to shift load and
  - Active Network Management (ANM) technologies.

The Project – Hydrogen Heat and Fleet

Project information

- NIA funded
- £60,000
- 6 month feasibility study
  - Start 01/07/2018
  - Finish 31/01/2019
- Project Partner: Delta-ee
  - An expert consultancy specialising in heat and alternative fuels



Methodology

Delivery – 4 stages

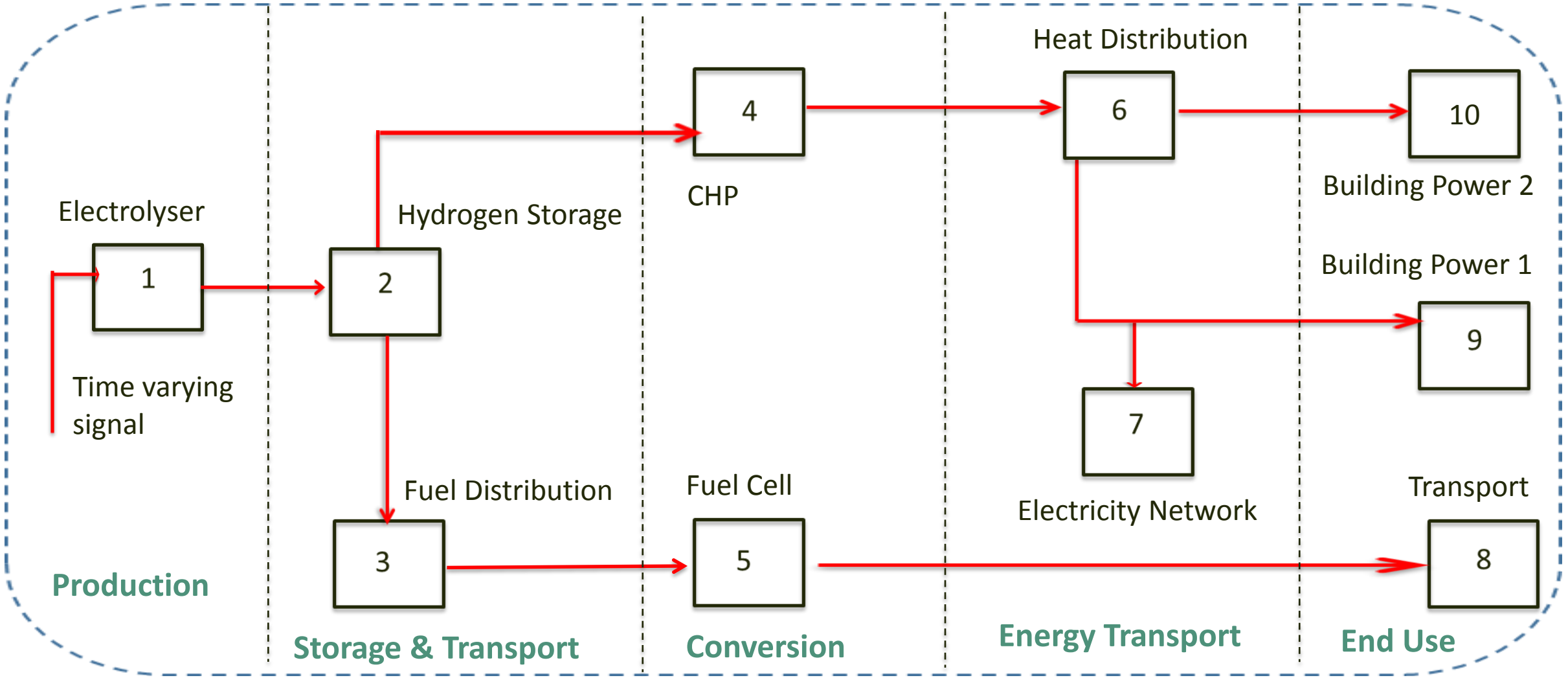
Aims & objectives	Definition	Review	Learning
Stage 1	Stage 2	Stage 3	Stage 4
Project initiation	Technical & economic feasibility	Market study	Level of innovation

The Project – Hydrogen Heat and Fleet

What are we doing?

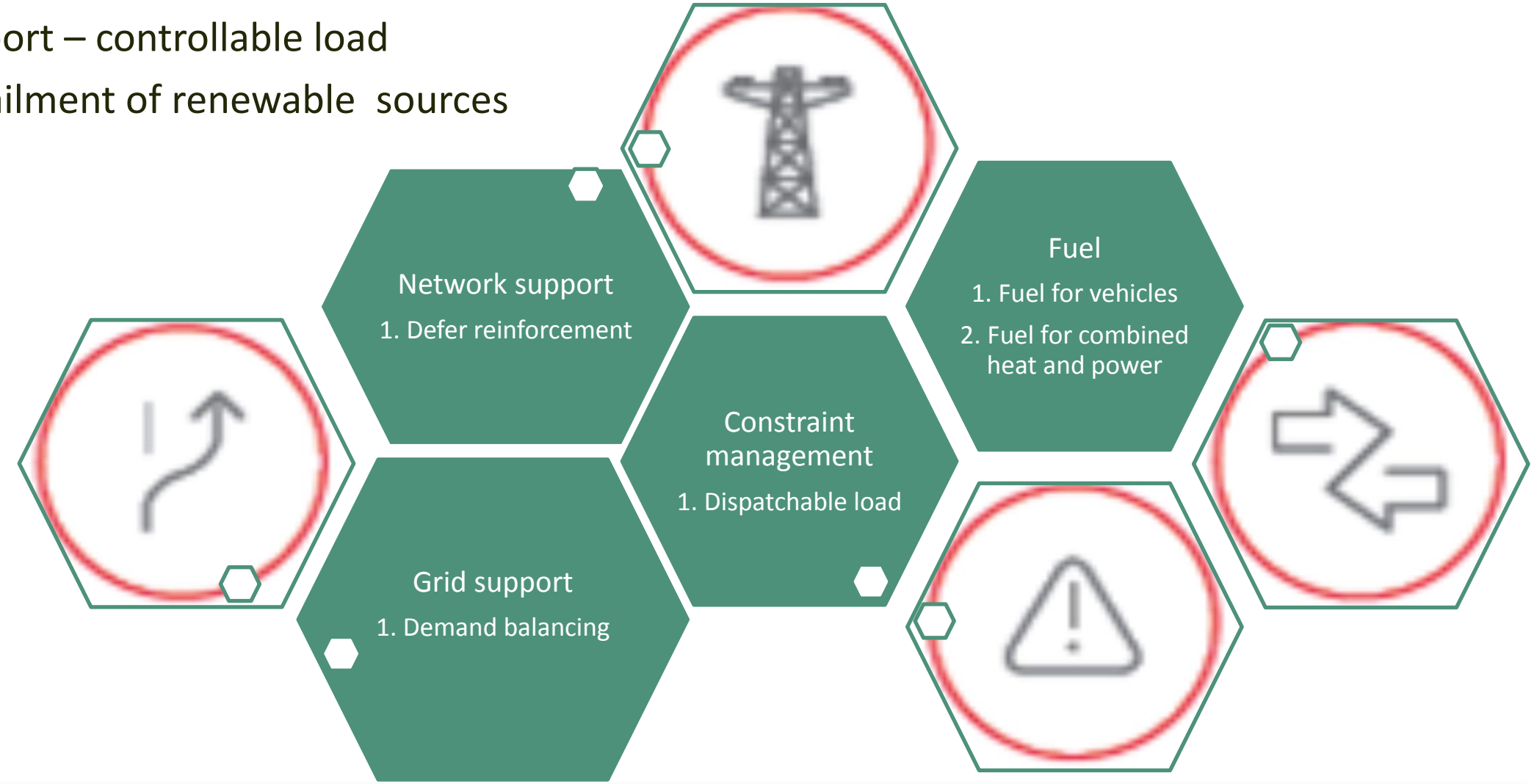
- Aim of this project is to research the viability of using hydrogen electrolysers as a controllable load;
- In areas with large penetrations of renewable generation, such a controllable load will could increase the capacity for further generation connections;
- This concept could result in less curtailment of renewable resources, and provide a highly controllable demand allowing energy storage in the form of hydrogen gas;
- Controllable loads can also be used to help with other network services such as demand balancing and as an ancillary service (like the recently implemented NGT demand turn up service);
- The controllable load can could be dispatched when there is excess generation or insufficient customer load on the network;
- The requirement for this controllable load will vary through the day and seasonally, with the load most required in the summer minimum demand day in the case of an excess of Solar PV generation.
- The hydrogen generated by the electrolysers will would be used as a fuel for vehicles and as fuel for combined heat and power.

Hydrogen system overview



In general we can use Hydrogen for….

- Grid Support – controllable load
- Less curtailment of renewable sources
- Fuel



WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

THANKS FOR LISTENING

Faithful Chanda

Western Power Distribution

Innovation and Low Carbon Networks Engineer

+44 7595 434811

fchanda@westernpower.co.uk

wpdinnovation@westernpower.co.uk

www.westernpowerinnovation.co.uk