

ENERGY CAPITAL

Regional Energy Systems Operator Project

A place-based approach to power, heat and transport

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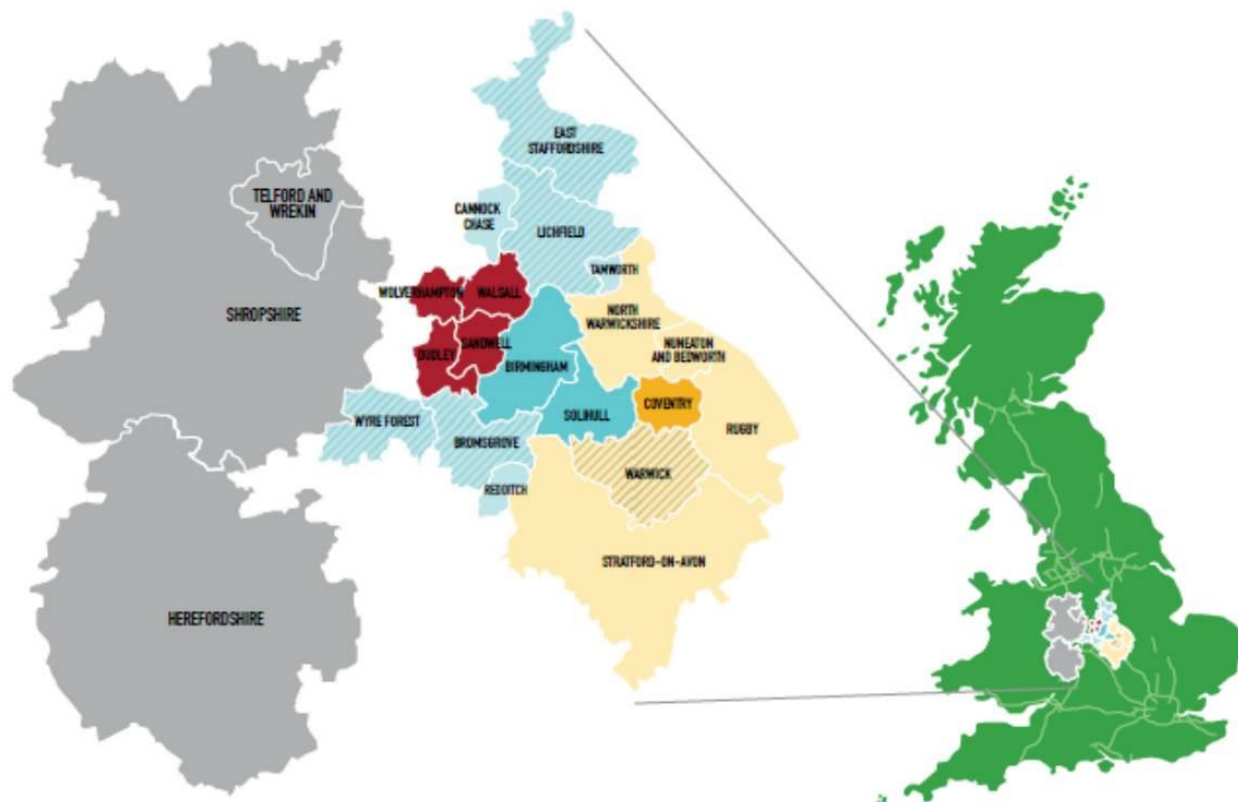
Agenda

- Introduction to Energy Capital
- The local and national context for our work
- Introduction to the RESO project
- Next steps

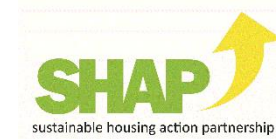
Who are Energy Capital?



Energy Capital is the policy and delivery body for energy in the West Midlands



- Responsible to the Mayor through the Energy Capital Board
- Public-private partnership
- Energy core to our local industrial strategy
- £8bn p.a. spent on energy services
- 50,000 jobs
- 4 million people
- 2 million homes
- 200,000 homes in energy poverty
- 215,000 new build
- ~21M t CO₂ p.a.
- Significant investment programmes
- Centre of UK energy industry



What do Energy Capital do?

The Energy Capital partnership wants to **demonstrate** locally, regionally and nationally, that we can work effectively together in the West Midlands, to facilitate **smart local energy systems**, which will provide significant **benefits** for the businesses and citizens of the West Midlands, as well as the energy system as a whole.



Energy
Innovation Zones



Fuel poverty
alleviation



ULEV Strategy

National and Local Context

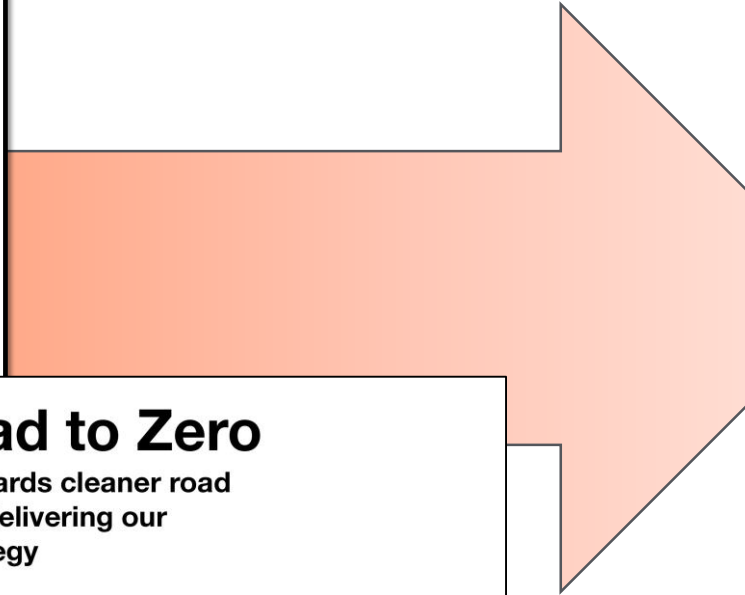
Why are we doing what we are doing?

Clear policy trajectory



The Clean Growth Strategy
Leading the way to a low carbon future

The Road to Zero
Next steps towards cleaner road transport and delivering our Industrial Strategy



HM Government
West Midlands Local Industrial Strategy
May 2019



A Regional Energy Strategy for the West Midlands
November 2018

WMCA have declared a Climate Emergency

Zero carbon by **2041**

(36% reduction by 2022, 69% reduction by 2027)

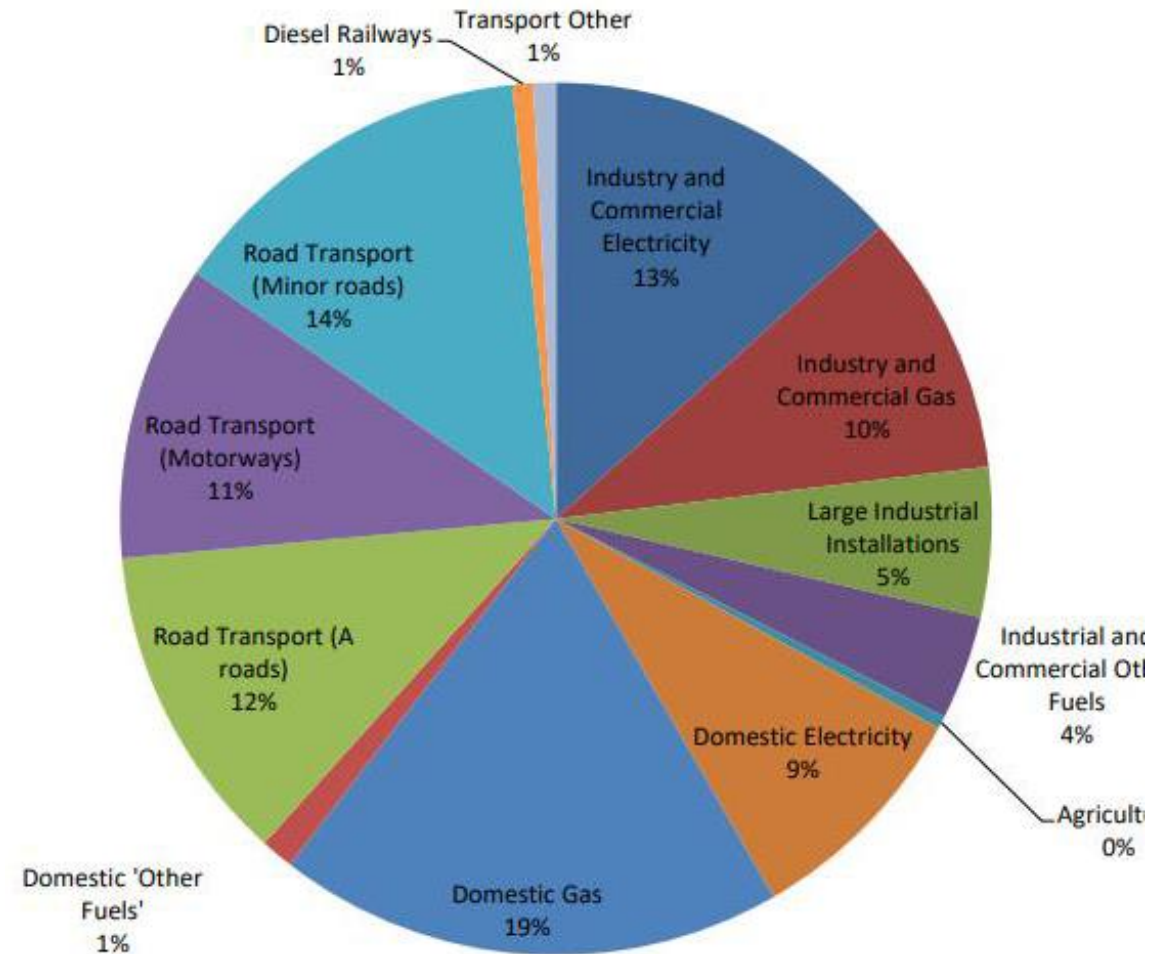
Constituent members have varying and sometimes tougher targets within this

- Birmingham 2030
- Coventry well-ahead of previous targets

We have a bigger challenge than most as the region is

- built on fossil fuels
- Relies on the automotive sector
- Historically an net energy importer

2016 CO₂ Emissions (21 MtCO₂) for WMCA Area



National pathway includes widespread electrification

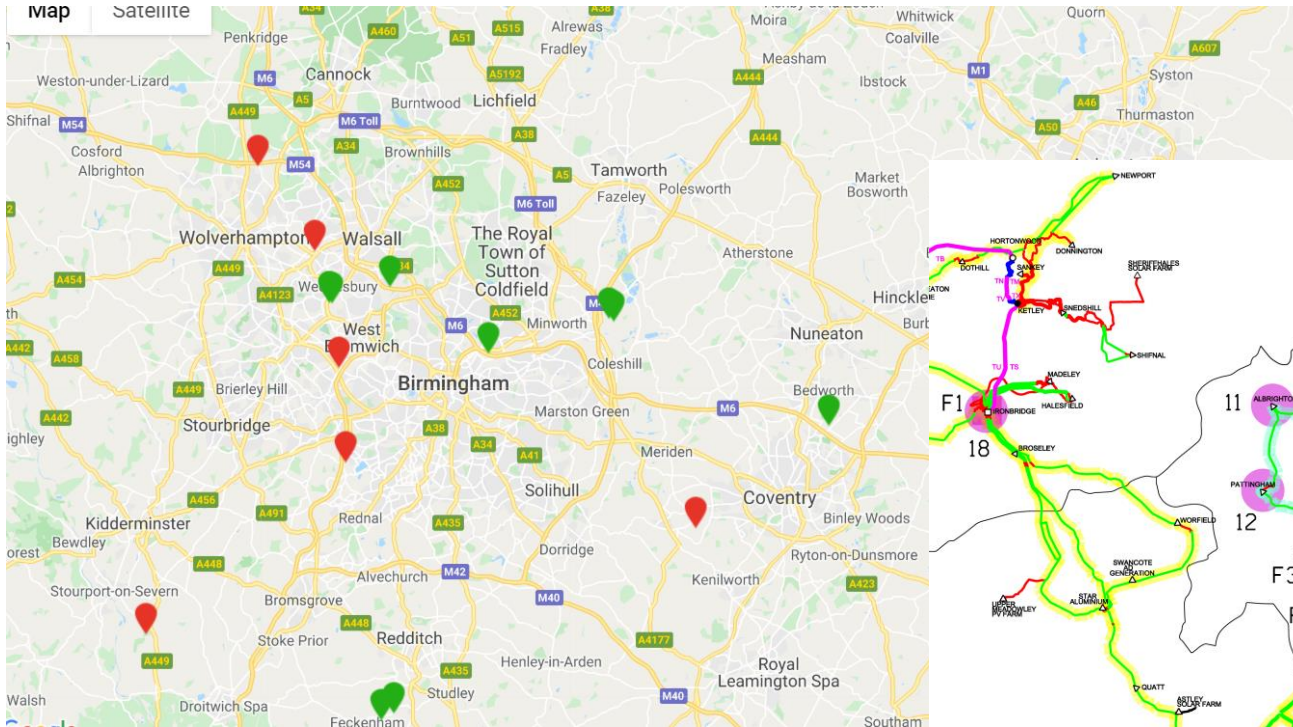


No gas boilers in new housing from 2025

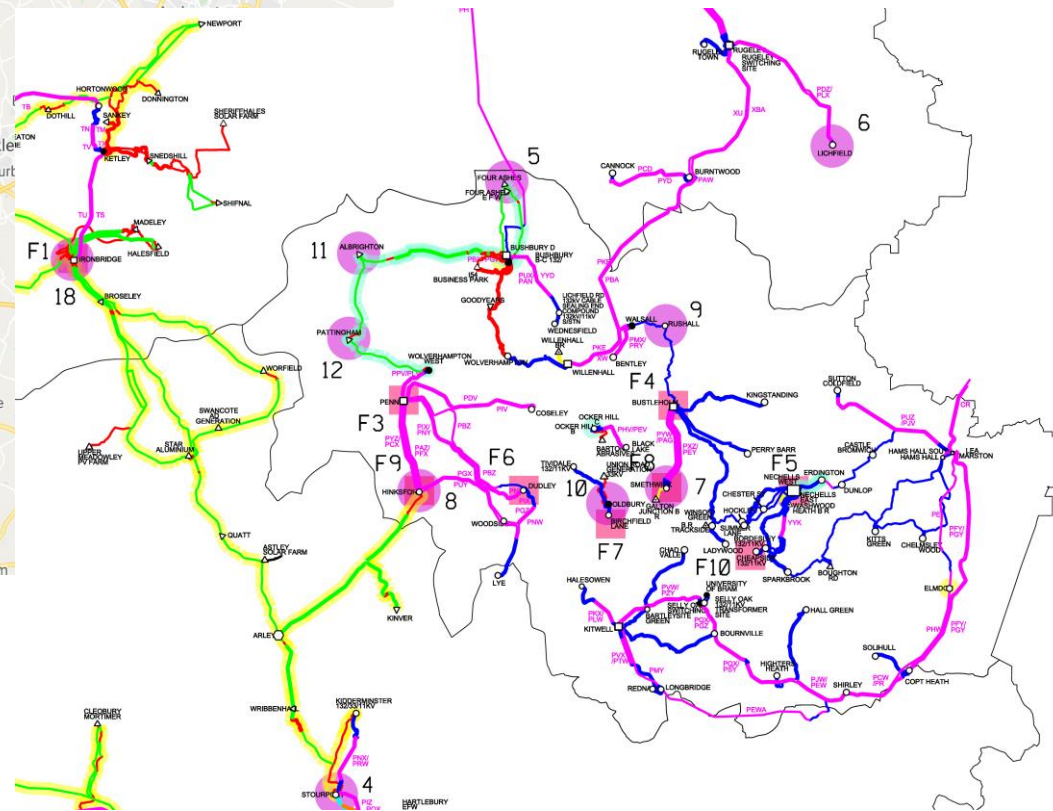


No ICE engines in cars from 2040

BUT our electrical infrastructure is becoming strained



There are areas within the West Midlands where we have **already** reached capacity



Electricity is **not** necessarily low carbon in itself, it requires **low carbon generation**

**We need
more
renewable
generation
on our
networks**



Renewable installations in WM

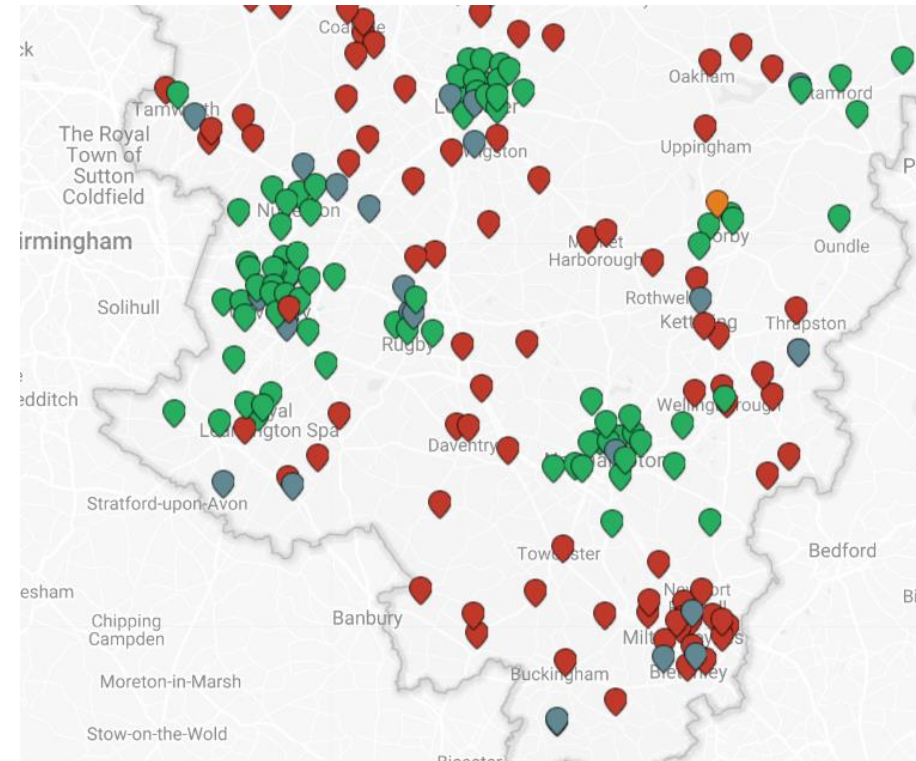
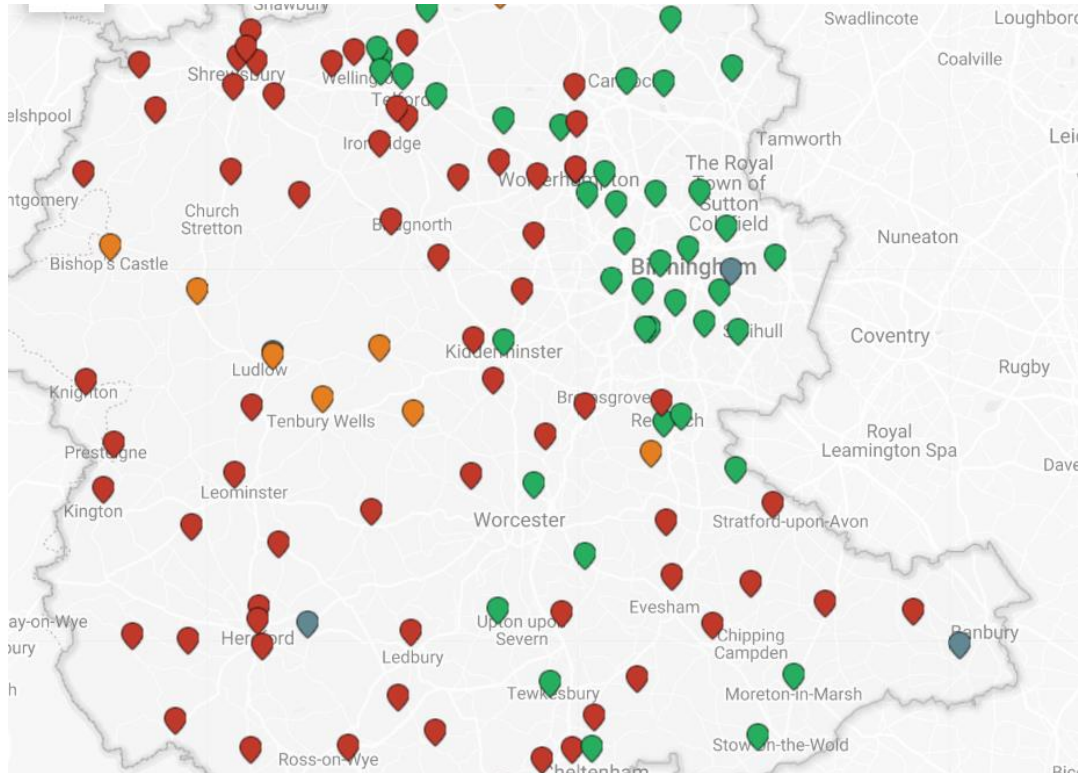
Table 1: WPD's July 2017 connections by technology in the West Midlands licence area

Generator type	Connected [MVA]	Accepted-not-yet-connected [MVA]	Offered [MVA]	Total [MVA]
Photovoltaic	591.4	282.4	22.1	895.9
Wind	48.1	4.0	4.0	56.1
Landfill gas, sewage gas, biogas and waste Incineration	202.0	64.0	5.6	271.5
CHP	13.8	32.8	303.0	349.5
Biomass and energy crops	32.9	16.5	-	49.3
Hydro, tidal and wave power	0.6	0.5	-	1.1
Storage	2.9	704.0	298.6	1,005.4

¹ www.bbc.co.uk/news/business-40198567

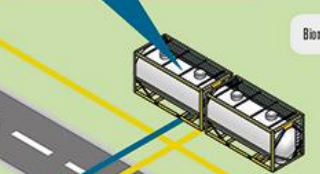
² www.gov.uk/government/uploads/system/uploads/attachment_data/file/622799/Renewables.pdf

BUT we are also constrained on infrastructure to distribute low carbon generation



LIQUEFIED PETROLEUM GAS (LPG)

Imported to the site by tanker. Stored for refuelling vehicles. Provides a lower-carbon alternative than conventional petrol and diesel.



Filling station provides clean LPG and CNG for refuelling vehicles.

Inside the biogas plant, biological residues are broken down in the absence of air and light



The waste products from the anaerobic digester can be sent to the TCR plant for further energy recovery.

Waste, low-grade heat from the district heating network used to promote anaerobic digestion.

The gas treatment plant improves the methane quality and content in order to make it suitable for injection into the gas grid.

CNG FILLING STATION

Natural Gas from the Grid is compressed for use in CNG (Compressed Natural Gas) powered vehicles.

ENERGY SKILLS ACADEMY UNIVERSITY TECHNICAL COLLEGE

A new Institute of Energy Technologies will be established to educate the next generation of energy engineers and nurture research into the latest energy technologies. This will be based in a signature building with exemplar energy performance and demonstrating cutting-edge energy technologies.

COMMUNITY ENERGY ENABLEMENT HUB

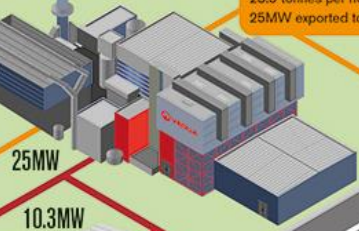
Funding from the Local Growth Fund will enable the creation of a facility to help in the development of bottom-up distributed energy solutions that meet the needs of communities. This will help communities deliver cleaner more efficient solutions for their energy services.

BUSINESS ACCELERATOR AND SME SUPPORT HUB

The SME Support Hub will help local businesses consider more sustainable and efficient ways to deliver the energy services that their business require. This could be through the introduction of new energy technologies, systems integration, or the new energy business models.

REDUCE TOTAL CO₂ EMISSIONS BY 60% BY 2027 FROM 1990 LEVELS

ENERGY FROM WASTE



The state-of-the-art Energy Recovery Facility in Tiseley takes 350,000 tonnes of Birmingham's rubbish each year and converts it into electricity at a rate of 23.5 tonnes per hour. The output is 25MW exported to the National Grid.

BIO POWER PLANT

The new 10.3MW Birmingham Bio Power Plant uses gasification technology to generate electricity from recovered wood waste.

80,000 tonnes/year
107,000 tonnes/year CO₂ SAVING

Waste wood will be gasified and turned into heat and power. This class A-C waste wood would otherwise have ended up in landfill.

The AMR centre will develop advanced technologies to recover strategic elements and critical materials using advanced processes and robotic waste separation technologies.

Advanced Materials Recycling: Research & Development Centre

SOLAR POWER RETROFIT

Solar panels mounted on the roof of industrial units generates clean electricity which can be fed into the local microgrid.

Webster & Horshall Wire Manufacturing Operation

ONSITE WIND POWER GENERATION

'Wrong time' renewable energy generated by the on-site renewables and/or taken from the grid is used to produce cryogenic 'liquid air' which can be stored easily to generate electricity at times of peak load. The liquid air can also be shipped off-site and used to power 'Dearman engines' to provide cold and power.

The new district heating network will provide heat to businesses and industry for space and process heat. Using clean energy made from waste.



LIQUID AIR

The refrigeration 'Engine' to produce cryogenic 'liquid air' which can be stored easily to generate electricity at times of peak load. The liquid air can also be shipped off-site and used to power 'Dearman engines' to provide cold and power.

CRYOGENIC ENERGY STORAGE

Low-grade waste heat from the district heating system is used to boost the efficiency of the cryogenic energy storage system.

ELECTRIC VEHICLE CHARGING STATION

Modern fuel cell vehicles can refill at the hydrogen filling station. The hydrogen is clean 'green' hydrogen from renewables, rather than 'brown' hydrogen from steam reformation of methane. The electrolyser converts wrong-time renewable electricity into hydrogen. This can be efficiently turned back into electricity using a fuel cell.

BIOCHAR BY PRODUCT

- INPUTS**
- Animal manure
 - Agricultural residues
 - Straw, husk
 - Food waste
 - Organic waste
 - Sewage sludge
 - Municipal solid waste
 - Biogas dewaterage

The site could provide a distribution point for clean fuels to river barges. Waste for the biomass plant and Energy from Waste plant could be brought in by barge as an alternative to the road

(TCR PLANT) BIO-BATTERY: THERMAL CATALYTIC REFORMING

The hydrogen is clean 'green' hydrogen from renewables, rather than 'brown' hydrogen from steam reformation of methane.

The hydrogen filling station supplies green hydrogen from both the electrolyser and bio-battery thermo-catalytic reforming process.

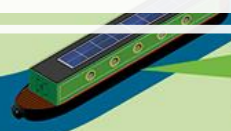
HYDROGEN ELECTROLYSER

HYDROGEN-POWERED BUSES AND TAXIS

The electrolyser can be used for grid balancing by turning energy into clean hydrogen

Energy Innovation Zones

The Tiseley Environmental Enterprise District covers over 200 businesses and around 100 hectares of traditional industrial land.



Prospering from the Energy Revolution (PFER)

Smart energy systems can intelligently link **energy supply, storage and use, and power heating and transport** in ways that dramatically improve efficiency. It's a huge market opportunity, with \$2 trillion a year estimated to be invested in global energy infrastructure.

The government is enabling the UK to take advantage of this by funding industry and researchers to create new systems. They will provide cleaner, cheaper energy, while creating high value jobs for the UK.

Doing so will meet government's priorities set out in the [Clean Growth Strategy](#), the [Smart Energy Systems and Flexibility Plan](#) and [Industrial Strategy's](#) clean growth pillar. It will help the UK to meet air quality targets at lower investment costs, avoid power cuts and ensure its compliance with the fifth [carbon budget](#) (from 2028).

PFER Funding

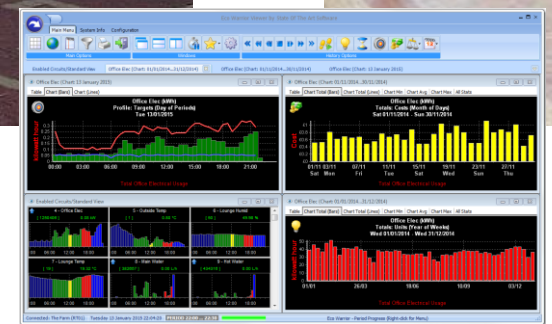
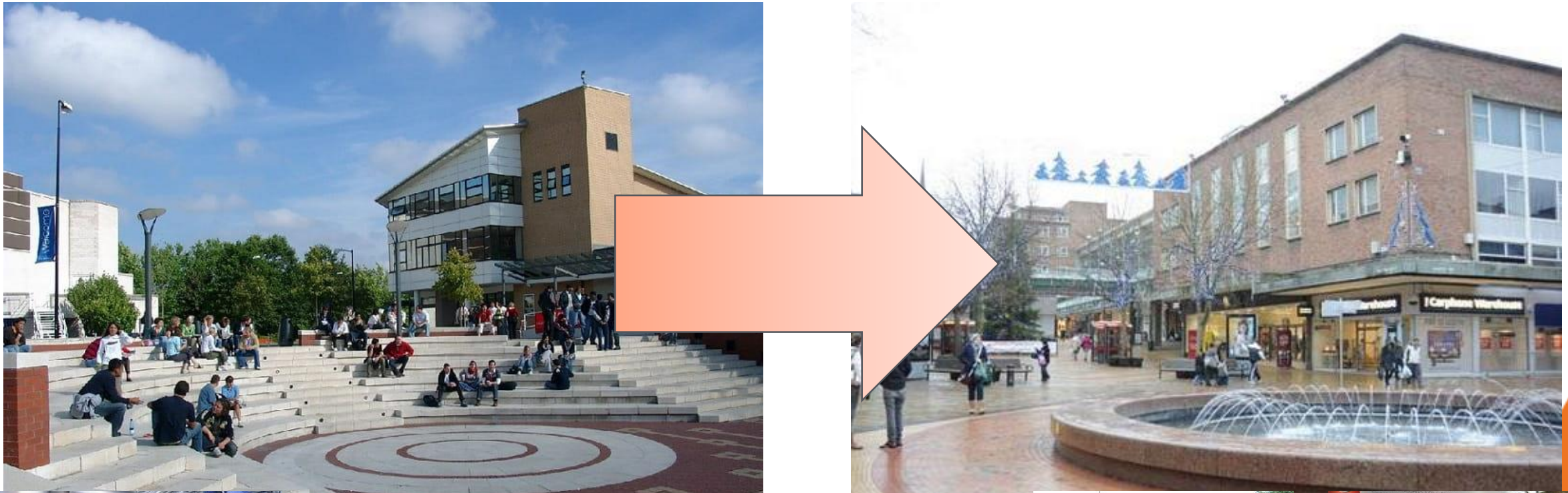
- £102.5 million under UKRI funding competition
- West Midlands secured investment of **£5.5 million** in three schemes
 - Zero Carbon Rugeley (Rugeley)
 - GreenSCIES (Sandwell)
 - **Regional Energy Systems Operator (RESO) (Coventry)**



Regional Energy Systems Operator Project

A place-based approach to power, heat and transport

RESO – What's the big idea?



RESO – Key facets



UK Research
and Innovation



Partners



UNIVERSITY OF
BIRMINGHAM

Camirus Ltd



ELECTRON



Timescales 24 month project commencing 1st January 2020

Project deliverables

The project will deliver the following three main outputs:

1. A detailed smart local energy infrastructure design for the city of Coventry, specifying an energy infrastructure vision for the city suitable to meet future energy demands for power, heat and transport up to 2050.
2. An operating model for this design (i.e. a real-time city energy asset optimisation and management framework)
3. A business model which specifies the stable regional institutional and organisational framework necessary to secure and support the long-term investments required.

Project requirements

Our project must:

Take an
inclusive
whole system
approach

- Integrate new energy technologies across heat, power and transport in a way that is replicable and scalable to multiple areas across the UK
- Reduce the whole system costs of energy provision, resulting in **significantly smaller bills for the end consumer (>25%)**
- Consider the **future role of gas** as well as electricity systems
- Show we understand the impact that varied boundaries of local authorities, gas and electricity distribution networks, and mobile energy assets (such as vehicles) have on the national and local energy system
- Consider the **policy and regulatory conditions** needed to design the local energy system
- Consider how we will work with local authorities, the Department for Business, Energy and Industrial Strategy (BEIS), OfGem and Code Administrators to implement our design

with a
financeable
business
model

- Develop **revolutionary market and business model** approaches for the provision of smart energy systems
- Validate the revenue streams and value proposition of the proposed business model
- Write sound financing and investment proposals for the implementation of the energy system design which **share the benefits and risks** fairly between investors, consumers, utilities and authorities
- Show an integrated approach to managing energy supply, distribution and consumption across heat, power and transport

underpinned
by quality data

- Develop a detailed understanding of energy supply, distribution and consumption patterns in our locality
- Be based on a clear understanding of the current and future energy assets, networks and consumer needs in our locality
- Describe how we will aim for an open data and systems design policy wherever possible

In summary...

- Start of an exciting project in Coventry and other PFER areas
- Many challenges and barriers to overcome
- Strong political support for the project at all levels
- Could result in systematic change of how energy is generated, used and managed in our region

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