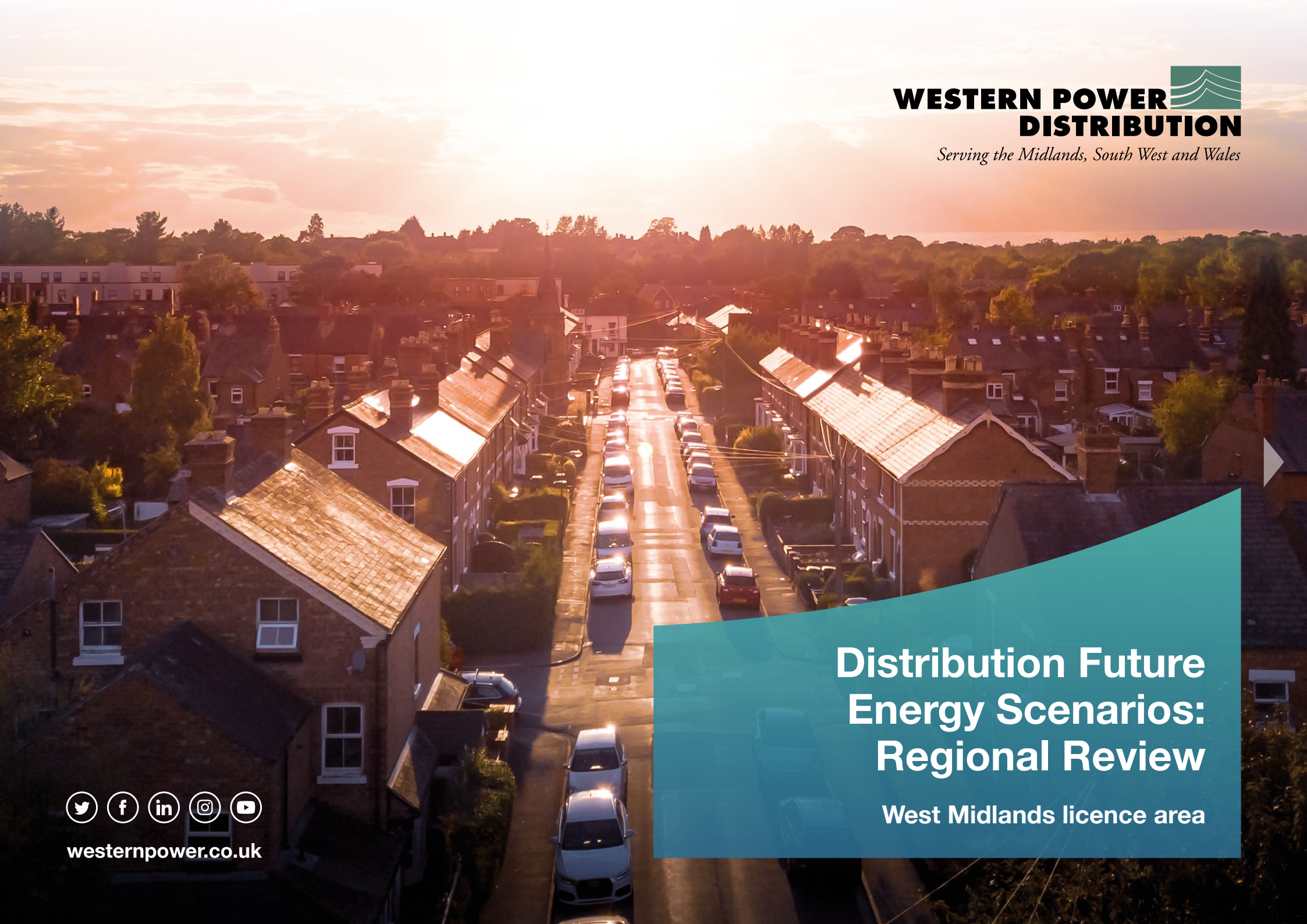

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Distribution Future Energy Scenarios: Regional Review

West Midlands licence area

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Foreword by WPD

The electricity distribution network across the four Western Power Distribution (WPD) licence areas has changed dramatically in the last ten years.

Primarily designed to operate as a passive network, WPD has connected 10GW of distributed energy resources and transitioned to operating a more active distribution system. In addition, annual electricity demand has decreased during this time as we start to use more energy efficient devices in everyday life.

The next decade will see even more far-reaching changes. That is why we have worked with Regen to help us understand what these changes might mean for our distribution network and the investment that may be needed to meet customers' changing needs.

This report summarises the 2020 Distribution Future Energy Scenarios (DFES) study for the West Midlands licence area. During the next 30 years, we are predicting to see a large increase in distributed generation connected to the network, a large proportion being supplied from renewable sources.

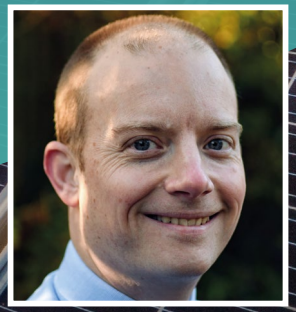
The network will also see electricity storage technologies and high levels of new low-carbon technologies, such as electric vehicles and heat pumps, increasing household demand for electricity.

The scenario framework used in this study is heavily influenced by the UK government targets to reach Net Zero greenhouse gas emissions by 2050, our projections out to 2050 provide a granular breakdown of the customers connected to the distribution network in a Net Zero compliant future.

The DFES projections are used to assess the distribution network and identify areas of strategic network investment, which can be delivered through conventional reinforcement or a range of smart and flexible solutions. By performing this study, WPD is able to demonstrate that we will be able to continue to meet the needs of our customers as we transition to a low carbon future.

This regional review is part of a wider suite of DFES documents, which along with an interactive map of the data can be found on our **website**.

Ben Godfrey
Network Strategy Manager



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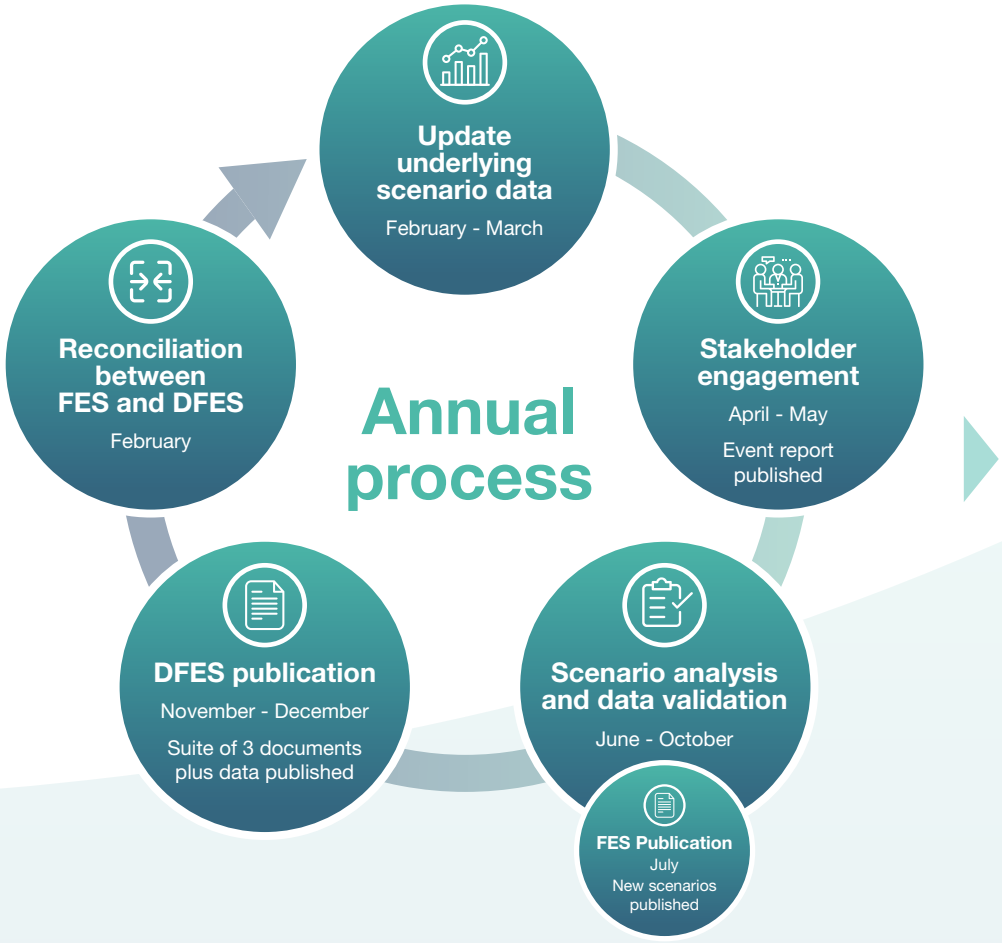
The DFES process

The Distribution Future Energy Scenarios outline the range of credible pathways to 2050 for the change in connections to the distribution network.

Using a scenario framework consistent with other distribution network operators and National Grid ESO (known as the Future Energy Scenarios or FES), these local stakeholder informed projections are created on an annual cycle and encompass changes in demand, storage and distributed generation, including electrified transport and heat.

The four scenarios include three compliant with UK's target to reduce carbon emissions by 100%, **achieving 'net zero' by 2050.** A fourth, non-compliant scenario is also modelled.

The factors used to project deployment at a local level are the result of consultation with developers, local authorities and community energy groups, as well as analysis of existing trends, spatial data and technological innovation.



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West Midlands story to date

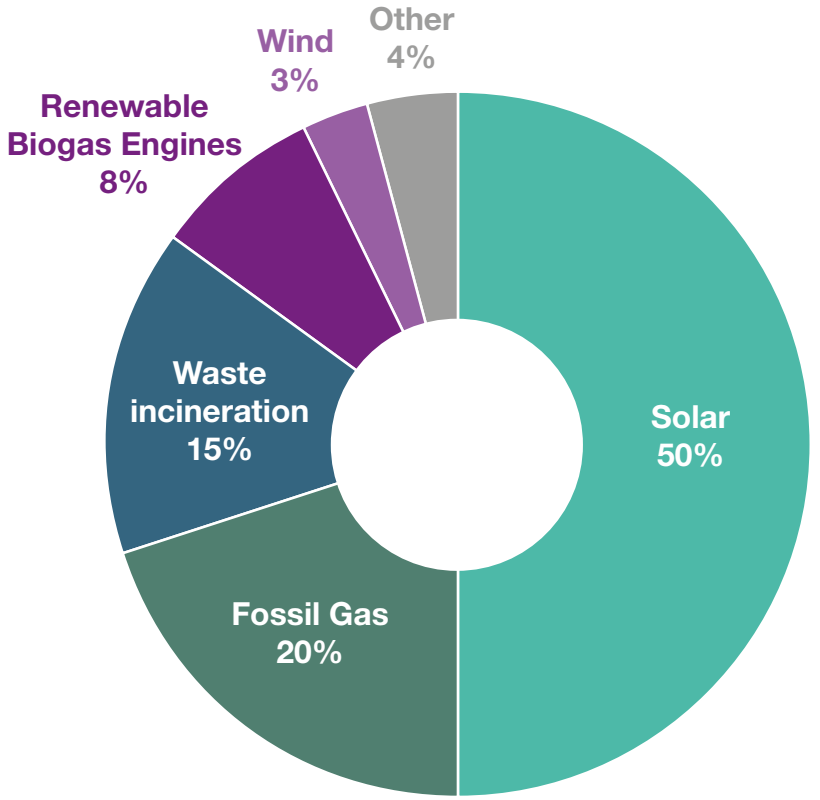
As of April 2020, there is 1.8GW of distributed generation in the West Midlands licence area, 1.4GW of this is low carbon or renewable generation.

The West Midlands accounts for around 3% of the total renewable energy capacity in GB, enough to power around half a million homes.

Distributed electricity generation in the area has increased significantly over the last five years, with over 50% of capacity connected since 2015. Over three quarters of this comes from solar PV (50%), fossil-gas sites (20%) and waste processing facilities (15%). The remaining capacity comes from 50MW of wind power, and biomass and biogas power generation sites.

Electricity demand has changed more slowly. Only 0.3% of West Midlands homes currently have a heat pump and 1.4% of cars are electric, however widespread change is expected as new policies are brought forward to encourage electrification of heat and demand.

Total distributed energy generation in the West Midlands licence area



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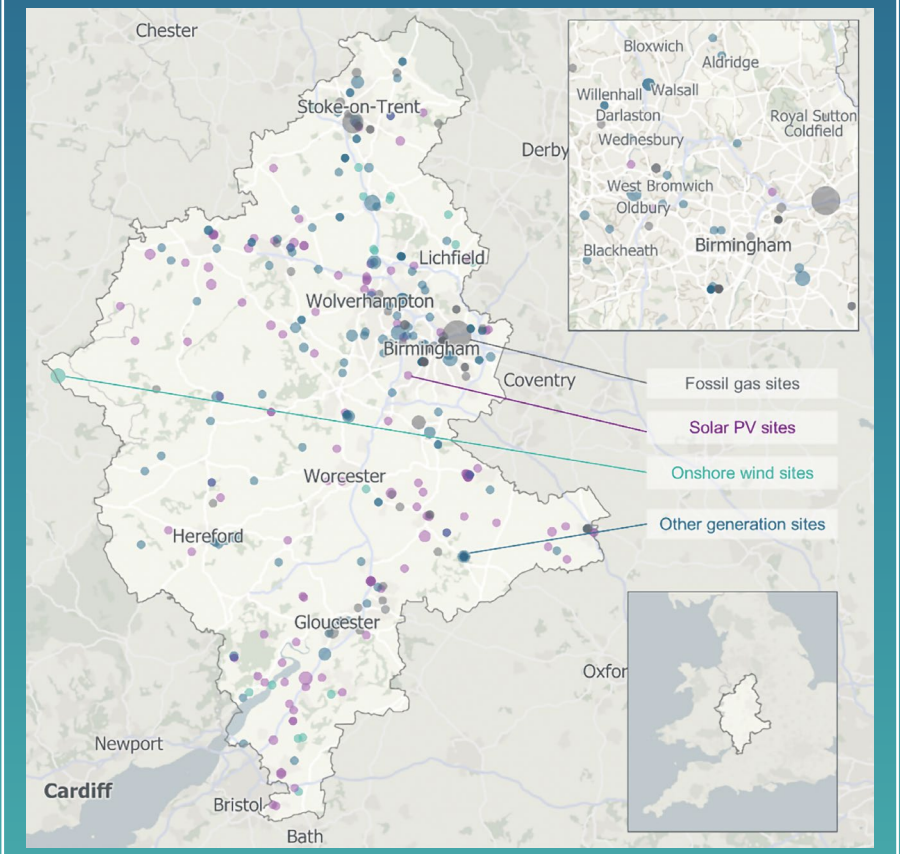
Distributed energy generation in the West Midlands licence area

The smaller average capacity and distributed nature of solar PV can be seen with deployment across the licence area, though deployment has avoided the Shropshire and Malvern Hills 'Areas of Outstanding Natural Beauty'.

Compared to solar PV, few onshore wind sites have been developed, the largest in Powys, Wales which makes up the majority of total installed capacity and is the largest renewable energy site in the licence area.

Fossil gas sites have a much larger average installed capacity than solar PV and several large sites make up a significant amount of the total. Several large generators are located near urban centres, for example the largest fossil gas sites are in Stoke-on Trent and in Birmingham as shown in the inset.



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Near term pipeline summary

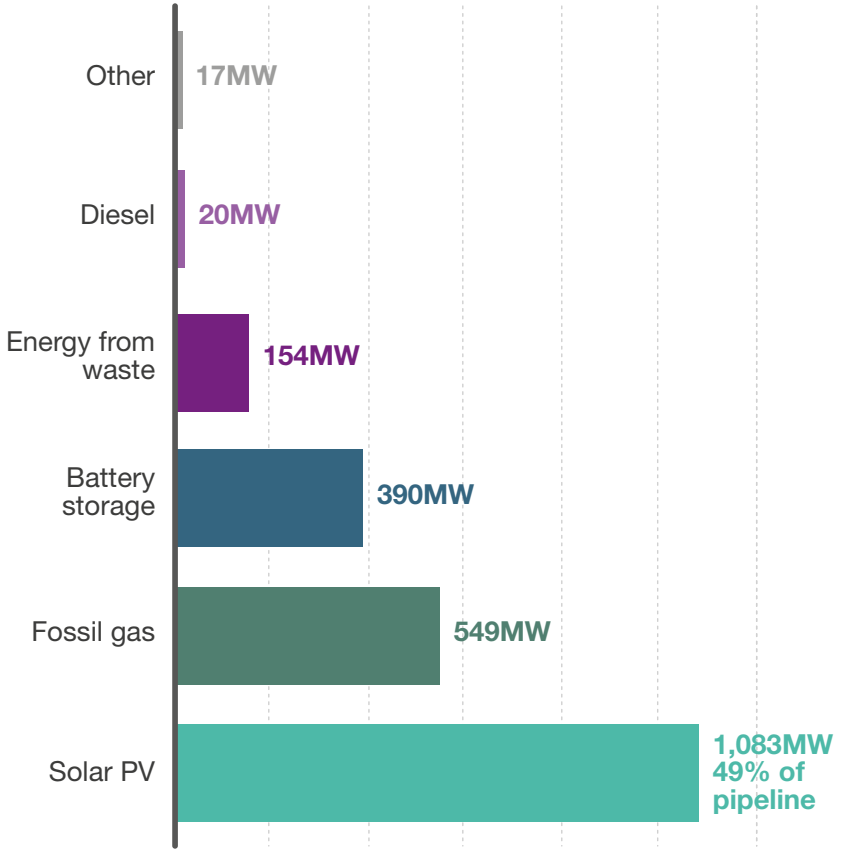
There are over 170 projects poised to connect to the West Midlands distribution network in the near future, totalling 2.2GW of additional generating capacity.

Around 900MW of the pipeline of solar sites accepted a network connection in the last 12 months. This shows clear interest in developing new solar capacity in the area.

There are 21 solar pipeline sites above 40MW, and almost half of the total pipeline capacity comes from solar PV. DFES analysis projects that an additional 340MW could connect in the next five years. The largest pipeline site is the Meaford Energy Centre, a large proposed 299MW fossil gas power plant, followed by a 100MW battery storage site.

Energy storage is projected to play a larger role in the energy system as the country decarbonises, there are 23 battery sites with accepted connection offers which could connect in the near term. With a capacity of 390MW, the energy storage pipeline is over four times the current installed capacity.

Sites with an accepted connection offer in the West Midlands licence area



Stakeholder engagement

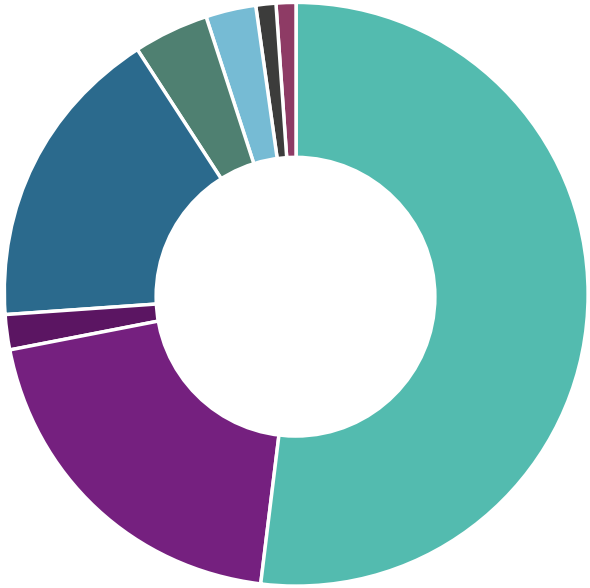
Stakeholder insight is critical to the shaping of the DFES projections and ensuring they are accurate and relevant.

Four consultation events were held in May 2020 with 266 attendees across the four licence areas. Each local authority in the WPD areas were also contacted as part of the analysis of planned new developments.

In the West Midlands consultation webinar, 46% of respondents were already aware of the WPD DFES process, and 71% felt well engaged by WPD.

Local policies identified by stakeholders are included as positive weightings within the DFES projections, as an example, the Herefordshire Council Carbon Plan, the Shropshire Climate Change Plan and the West Midlands Regional Energy Strategy increased the local uptake of renewable energy such as wind or solar deployment.

West Midlands webinar



- **52%** Energy industry
- **20%** Local Government
- **2%** National Government
- **17%** Other consultancy
- **4%** UK Networks
- **3%** Academia
- **1%** Legal
- **1%** Other industry

Summary of results in 2035

DFES scenario	Description of scenario	Baseline Renewable energy capacity	2035 Renewable energy capacity	Baseline Battery electric vehicles (000s)	2035 Battery electric vehicles (000s)
Steady Progression Not net zero compliant	Not compliant with the net zero emissions target.	**1.4GW** Including: 0.9 GW of solar	**2.0GW**	**25.6** Equivalent to: 1.4% of total vehicles	**1,185** Equivalent to: 27% of total vehicles
	Low levels of decarbonisation and societal change.				
System Transformation Net zero compliant (NET ZERO)	High level of decarbonisation with lower societal change. Larger, more centralised solutions are developed. This scenario has the highest levels of hydrogen deployment.		**2.7GW**		**1,759** Equivalent to: 43% of total vehicles
Consumer Transformation Net zero compliant (NET ZERO)	High levels of decarbonisation and societal change. Consumers adopt new technologies rapidly, and more decentralised solutions are developed. This scenario has significant electrification of domestic heat.		**3.6GW**		**3,057** Equivalent to: 69% of total vehicles
Leading the Way Net zero compliant (NET ZERO)	Very high levels of decarbonisation and societal change. Consumers adopt new technologies rapidly, and a mix of solutions are developed. This scenario aims for the "fastest credible" decarbonisation pathway.		**3.3GW**		**3,161** Equivalent to: 77% of total vehicles

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Summary of results in 2035

DFES scenario	Description of scenario	Baseline Energy storage capacity	2035 Energy storage capacity	Baseline Heat pumps	2035 Heat pumps
Steady Progression Not net zero compliant	Not compliant with the net zero emissions target.	**93MW** c.17% of total capacity in GB.	340MW	**7,515** Heat pumps Equivalent to: 0.3% of total homes. **< 10** hybrids	**19,075** Heat pumps c.0.8% of homes, and 0.9% with hybrids
	Low levels of decarbonisation and societal change.				
System Transformation Net zero compliant (NET ZERO)	High level of decarbonisation with lower societal change. Larger, more centralised solutions are developed. This scenario has the highest levels of hydrogen deployment.		322MW		**87,515** Heat pumps c.3.5% of homes, plus 2.6% with hybrids
Consumer Transformation Net zero compliant (NET ZERO)	High levels of decarbonisation and societal change. Consumers adopt new technologies rapidly, and more decentralised solutions are developed. This scenario has significant electrification of domestic heat.		558MW		**484,995** Heat pumps c.19.3% of homes, plus 1.9% with hybrids
Leading the Way Net zero compliant (NET ZERO)	Very high levels of decarbonisation and societal change. Consumers adopt new technologies rapidly, and a mix of solutions is developed. This scenario aims for the "fastest credible" decarbonisation pathway.		805MW		**481,597** Heat pumps c.18.8% of homes, plus 6.8% with hybrids

Working with local authorities

New homes, industry, and commercial properties can have a significant impact on local electricity demand. These homes and commercial properties are also likely to be more energy efficient, heated by new technologies or be designed to facilitate low carbon transport.

Over 3,200 individual data records were brought together to model the impact of new developments on the WPD network in the future. Local authorities were also asked about plans which may affect uptake of low-carbon technologies in their areas, for example support for electric chargers or renewable generation.

Where and when these buildings and new technologies are expected to connect is projected using the scenario frameworks and based on data from local authority plans along with historic data on the number of new homes per year. High and low scenarios were produced to model the variable building rates of these developments over the scenario period.

Between 68,000 and 115,000 homes are projected be built over the next 5 years, the largest domestic development is the Broomhall Norton Barracks Community Urban Extension in Worcester.

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Renewable energy

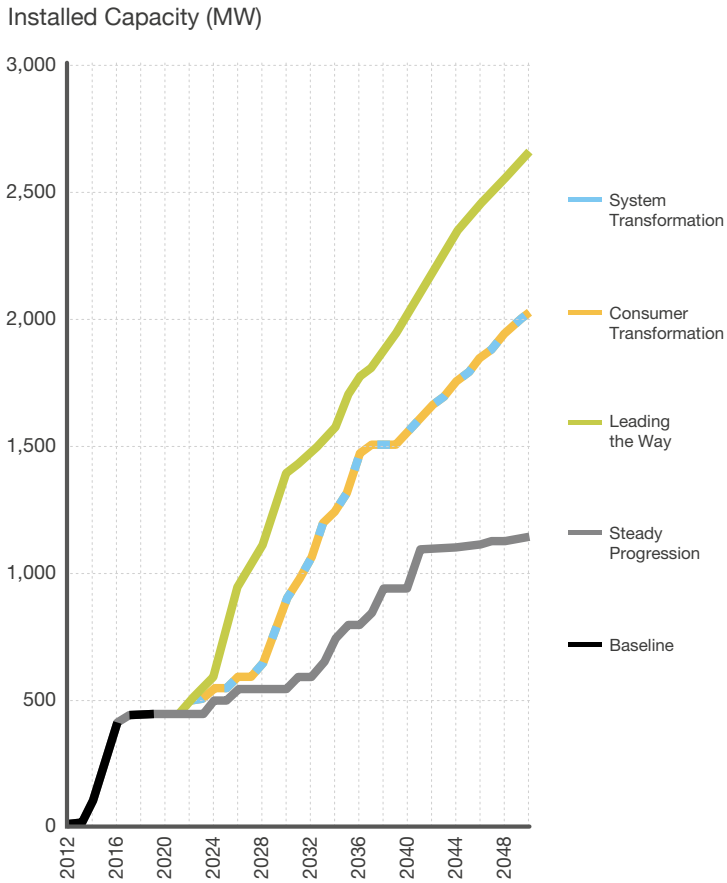
There is currently c.895MW of solar power generation in the West Midlands licence area, split evenly between ground mounted solar arrays and rooftop installations.

The cost of solar **reduced by 82%** over the last decade, however deployment in the West Midlands has slowed significantly in recent years as a result of market uncertainties and a reduction in government subsidies. Though less than 2MW has connected since January 2019, there is still scope for high levels of deployment in the longer term with the highest DFES scenario projecting over 4GW of additional solar capacity by 2050, including rooftop installations which are sited on one-in-four homes.

There is also currently a very low level of deployment of onshore wind in the West Midlands licence area, with only two sites above 1MW. The largest site is connected in Powys, Wales with a capacity of 34MW.

Despite the low current onshore wind deployment, there is still some scope for increased capacity, the DFES projects an increase to 2050 of between 20 and 200MW.

Scenarios for ground mounted solar power in the West Midlands licence area



Fossil Gas

Another of the key distributed energy generation technologies in the licence area is fossil gas fired power stations.

The overall energy output of the fossil gas power plants significantly decreases in all net zero complaint scenarios, though the installed capacity may remain stable in the near term. The largest site currently connected in the West Midlands licence area is Fort Dunlop power plant, at a capacity of 100MW.

This site forms a significant portion of the total 400MW of fossil gas power currently connected. Most of the current sites are towards the Eastern part of the licence area, around urban areas such as Gloucester, Birmingham, and Stoke-on-Trent. The gas projects in the pipeline also follow this general spatial trend.

The DFES analysis shows the potential for near term increase in fossil gas capacity all scenarios based on the successful planning and Capacity Market applications of sites in the pipeline. However, the operational hours of large plant are limited by emissions regulations, and a significant reduction in energy output and capacity is projected for the net zero scenarios.

Energy storage

Energy storage is expected to be critical for balancing a high renewables electricity system.

National Grid ESO announced in 2019 that it will be able to operate a **zero carbon electricity system by 2025** and will need new technologies like storage to provide network services to support this. The four scenarios include a variety of assumptions regarding these network service providers, a key uncertainty is the development of energy storage technologies.

DFES analysis suggests that there are 17 sites totalling just over 390MW in the pipeline,including a 100MW project in Birmingham. Other potential areas of growth that are modelled include smaller installations in homes and sites in non-domestic properties with high energy usage.

Due to the scenario specific assumptions around the deployment of other providers of network services, there is a wide envelope of deployment between the scenarios. Overall battery storage capacity in 2050 in the West Midlands licence area ranges from c.0.6GW in System Transformation to 1.4GW in Leading the Way.

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Low carbon heat

A key area of change in the energy system is the decarbonisation of heat.

The four DFES scenarios model a variety of decarbonisation pathways, all showing a large increase in domestic heat pump deployment in the medium and long term.

The West Midlands licence area currently has c.200,000 homes heated electrically, of which 7,500 are domestic non-hybrid heat pumps. This heat pump total represents c.0.3% of homes, a slightly lower baseline than the national average.

There is a dramatic shift to low carbon heating in all net zero compliant scenarios. In the near term, deployment is supported by national policies such as the Renewable Heat Incentive and the Green Homes Grant. Stakeholders also raised potential heat network developments in Stoke-on-Trent and Worcestershire.

National policy is also expected to target off-gas homes over the next decade (Clean Growth Strategy 2017), the slightly higher than average proportion of off-gas homes in the West Midlands licence area compared to the UK average leads to lower deployment of hybrid heat pumps.

By 2050

Steady Progression

275,000 heat pumps
150,000 hybrid heat pumps
234,000 direct electric heating units

System Transformation Net Zero Target compliant

452,000 heat pumps
324,000 hybrid heat pumps
205,000 direct electric heating units

Consumer Transformation Net Zero Target compliant

1,811,000 heat pumps
250,000 hybrid heat pumps
195,000 direct electric heating units

Leading the way Net Zero Target compliant

1,375,000 heat pumps
648,000 hybrid heat pumps
210,000 direct electric heating units

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Low carbon transport

The UK government ban on new petrol and diesel vehicles from 2040 drives a significant increase in uptake of electric vehicles over the next 10 years. However to be net zero compliant, DFES scenarios assume that this ban is brought forward to the early 2030s, in line with assumptions in National Grid ESO FES.

There are more than 36,000 battery electric cars (excluding hybrids) registered in the West Midlands licence area, almost 1.5% of the total. This is above the average level nationwide, which can be explained by local factors influencing take up in the near term including:

The good availability of off-street parking, and the level of second-car ownership

Initiatives to increase the number of electric vehicle chargers or potential clean air zones such as in Birmingham.

For electricity networks the key factor is how and when these electric vehicles are charged. The deployment of chargers is also projected in the DFES by charger size and type such as domestic chargers, car parks or refuelling stations.

By 2050, all road transport is projected to be decarbonised, the majority being electric vehicles. By 2035:

Steady Progression

1,185,000 battery electric vehicles

645,000 domestic charge points

System Transformation Net Zero Target compliant

1,759,000 battery electric vehicles

886,000 domestic charge points

Consumer Transformation Net Zero Target compliant

3,057,000 battery electric vehicles

1,705,000 domestic charge points

Leading the way Net Zero Target compliant

3,161,000 battery electric vehicles

1,688,000 domestic charge points

Next steps

The WPD DFES 2020 suite of output documents is now available online:

- **Stakeholder feedback summary reports for all licence areas**
- **Data available through the map hub**
- **Technology results and assumptions reports for all licence areas**
- **Methodology walkthrough slides**
- **'DFES regional review' summaries for all licence areas**

The DFES is an annual process conducted by WPD and Regen, the WPD DFES 2021 process will begin in February 2021.

WPD Distribution Managers are in contact with local authorities to discuss the results. The stakeholder engagement process for DFES 2021 runs from February to July 2021.

If you have any questions in relation WPD's Network Strategy work, please contact WPD on the details below:

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