

Distribution Future Energy Scenarios: Regional Review

East Midlands licence area



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 East 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



The DFES process

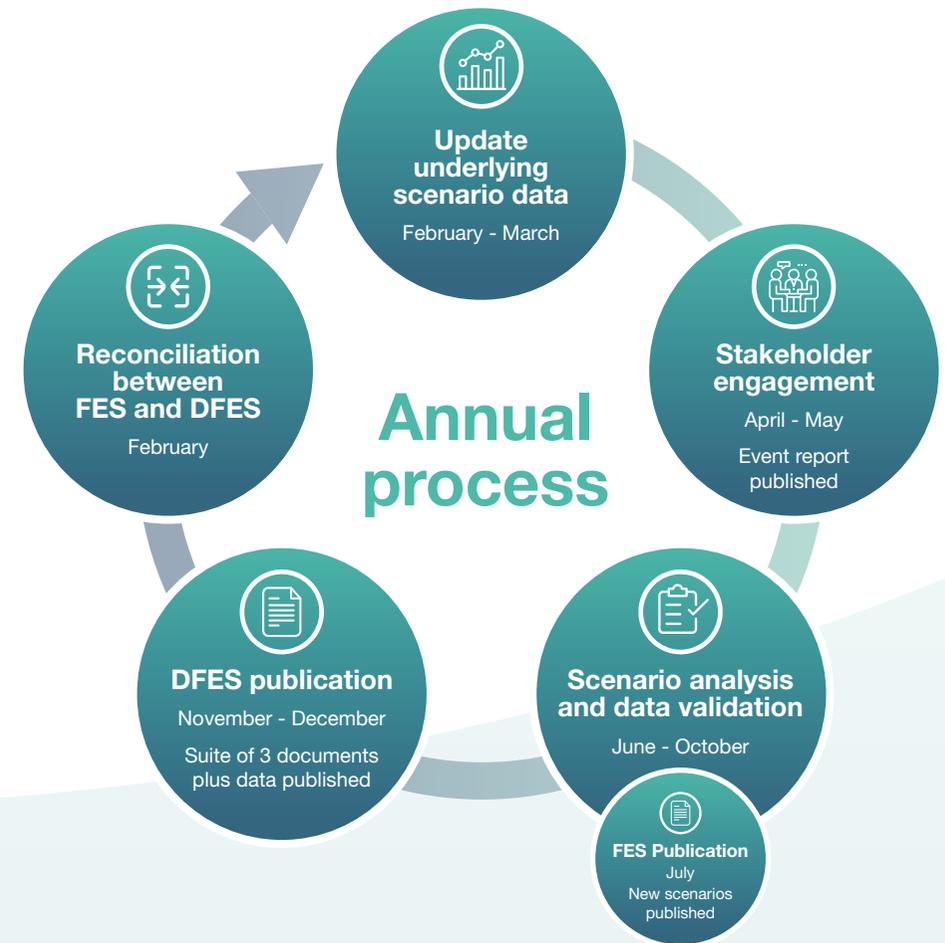


The Distribution Future Energy Scenarios outline the range of credible pathways to 2050 for the change in connections to the distribution network.

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.



East Midlands story to date



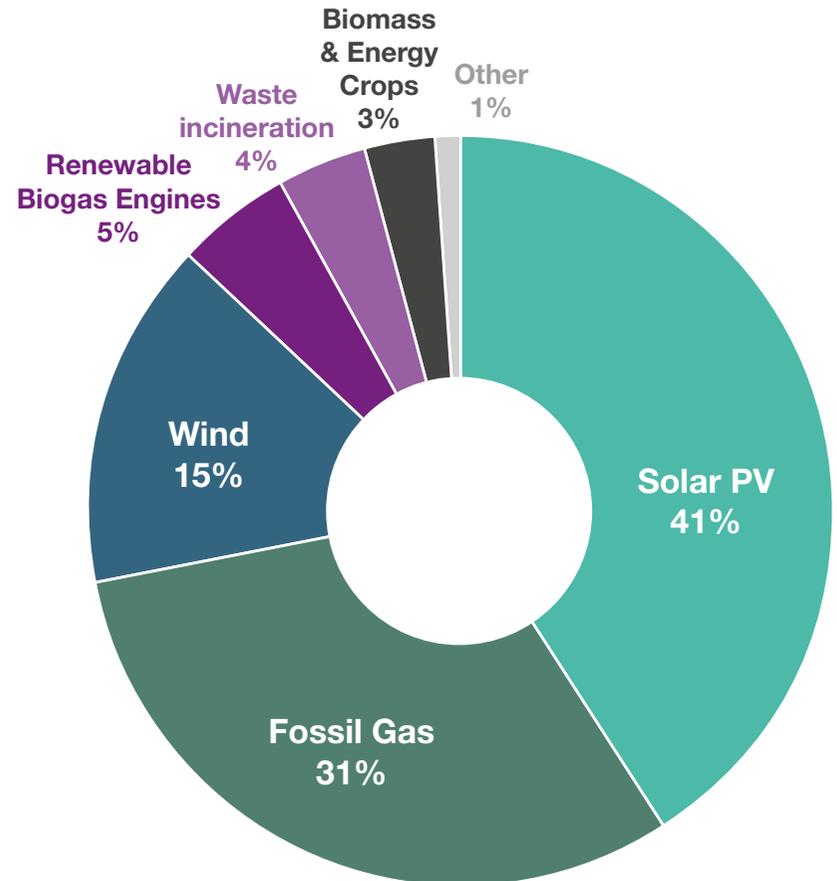
As of April 2020, there is 3.9GW of distributed generation in the East Midlands licence area, 2.6GW of this is low carbon or renewable generation.

The East Midlands accounts for around 7% of the total renewable energy capacity in GB, enough to power around 1 million homes.

Distributed electricity generation in the area has increased significantly over the last five years, with over 50% of capacity connected since 2015. The majority of this comes from two power sources, solar PV (41%) and fossil-gas (31%). Together they make up around two-thirds of the current distributed generation capacity. The remaining capacity comes from 600 MW of wind power, waste treatment and other generation types.

Electricity demand has changed more slowly. Only 1% of East Midlands homes currently have a heat pump and 0.6% of cars are electric, however widespread change is expected with as new policies are brought forward to encourage electrification of heat and demand.

Total distributed energy generation in the East Midlands licence area



Distributed energy generation in the East Midlands licence area

Distributed generation is concentrated in the north east and south of the licence area.

Onshore wind sites are mainly located west of Coventry, in areas of high wind speed and close to the electricity network. The more evenly distributed nature of solar PV can be seen across the licence area. To date, distributed generation tends not to be located in the high agricultural-grade land of The Fens in East Anglia.

In contrast to the widely distributed solar PV sites, fossil gas sites have a much larger average installed capacity and several large sites make up a significant amount of the total.

The largest site is the Corby Power Station, as well as sites near Derby and Nottingham.



Near term pipeline summary



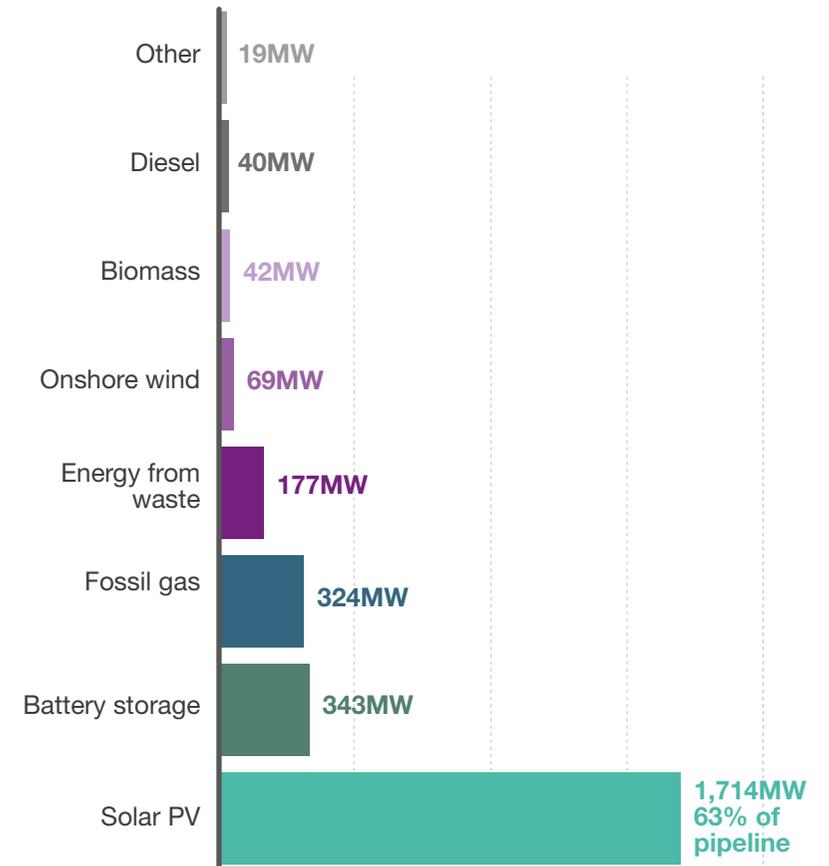
There are over 150 projects poised to connect to the East Midlands distribution network in the near future, totalling 2.7GW of additional generating capacity.

Most of the pipeline sites accepted a network connection offer with WPD in 2018 or later and over 1GW of the pipeline of solar sites accepted a network connection in the last 12 months. This shows clear interest for developing new solar capacity in the area.

Almost two thirds of the pipeline capacity comes from solar PV. We have projected that around 1.7GW which could connect in the next five years. The largest proposed solar farm in the pipeline is a 60MW site however this is the only pipeline site over 50MW, over half of the solar pipeline capacity is from sites 40-50MW.

Energy storage is projected to play a larger role in the energy system as the country decarbonises, there are 25 battery sites with accepted connection offers which could connect in the near term. With a capacity of over 300MW, the energy storage pipeline is over six times the current installed capacity.

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



Stakeholder engagement



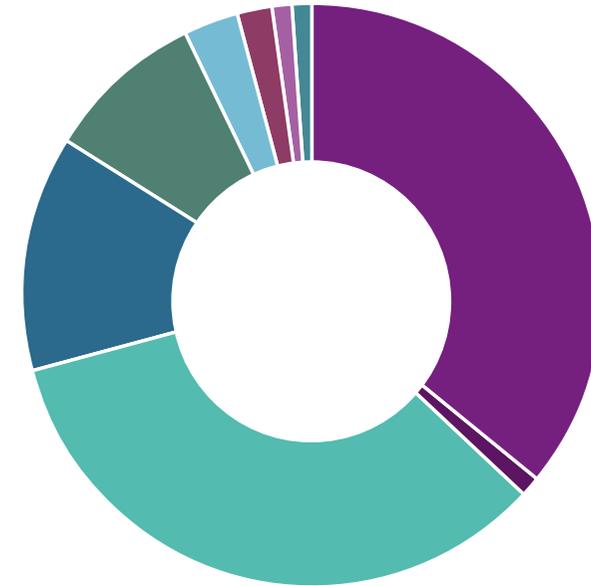
Stakeholder insight is critical to the shaping of the DFES projections and ensuring they are accurate and relevant.

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 East Midlands consultation webinar, 44% of respondents were already aware of the WPD DFES process, and 94% felt well engaged by WPD.

Local policies identified by stakeholders are included within the DFES projections. Policies such as the East Northamptonshire District 'Wind and Solar Energy Supplementary Planning Document' are projected to influence renewable energy development locally. Details of local policies which may support electric vehicle infrastructure are included in the weightings, for example, the proposed Clean Air Zone in Leicester could increase uptake of electric vehicles.

East Midlands webinar



- 36% Local Government
- 34% Energy industry
- 13% Other consultancy
- 9% UK Networks
- 3% Academia
- 2% Other industry
- 1% Community energy groups
- 1% Consumer

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.	2.6GW Including: 1.6GW of solar 0.6GW of wind	3.7GW	15.5 Equivalent to: 0.4% of total vehicles	1,092 Equivalent to: 27% of total vehicles
	Low levels of decarbonisation and societal change.				1,730 Equivalent to: 43% of total vehicles
System Transformation Net zero compliant 	High level of decarbonisation with lower societal change. Larger, more centralised solutions are developed. This scenario has the highest levels of hydrogen deployment.		6.3GW		2,764 Equivalent to: 69% of total vehicles
Consumer Transformation Net zero compliant 	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.		6.1GW		3,041 Equivalent to: 77% of total vehicles
Leading the Way Net zero compliant 	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.				

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.	50MW Around 9% of the GB total installed battery storage capacity.	347MW	7,463 Heat pumps Equivalent to: 0.3% of total homes. < 10 hybrids	22,112 Heat pumps c.0.8% of homes, and 0.9% with hybrids	
	Low levels of decarbonisation and societal change.				87,960 Heat pumps c.3.2% of homes, plus 2.6% with hybrids	
System Transformation Net zero compliant	High level of decarbonisation with lower societal change. Larger, more centralised solutions are developed. This scenario has the highest levels of hydrogen deployment.				313MW	545,383 Heat pumps c.19.6% of homes, plus 1.9% with hybrids
Consumer Transformation Net zero compliant	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.				681MW	537,170 Heat pumps c.18.8% of homes, plus 6.8% with hybrids
Leading the Way Net zero compliant	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.		966MW			

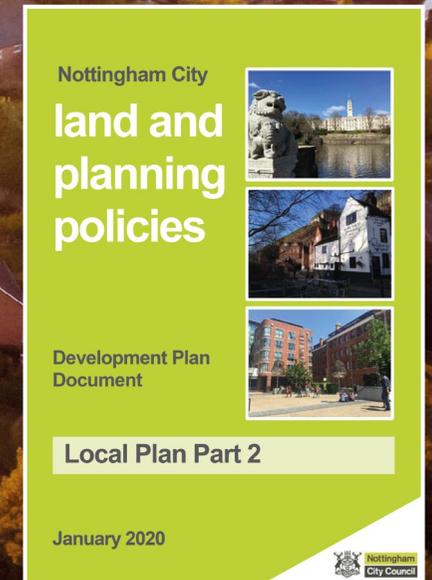
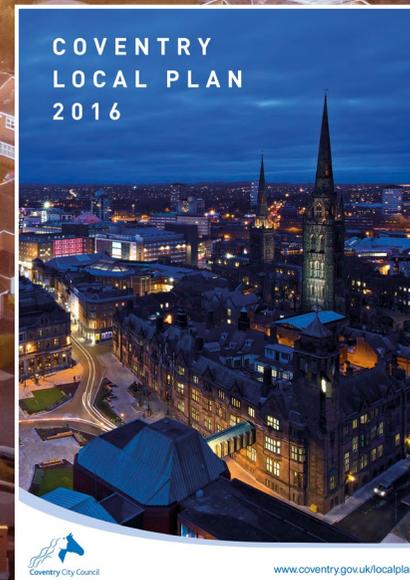
Working with local authorities

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 4,500 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 110,000 and 190,000 homes are projected be built over the next 5 years, with some of the largest domestic developments around Rugby, Leicestershire and Milton Keynes.



Renewable energy



There is currently over 1.5GW of solar power connected in the East Midlands licence area, combining large scale solar farms and rooftop installations.

Around two-thirds of rooftop solar installations are at the domestic scale, with an average capacity of 3kW.

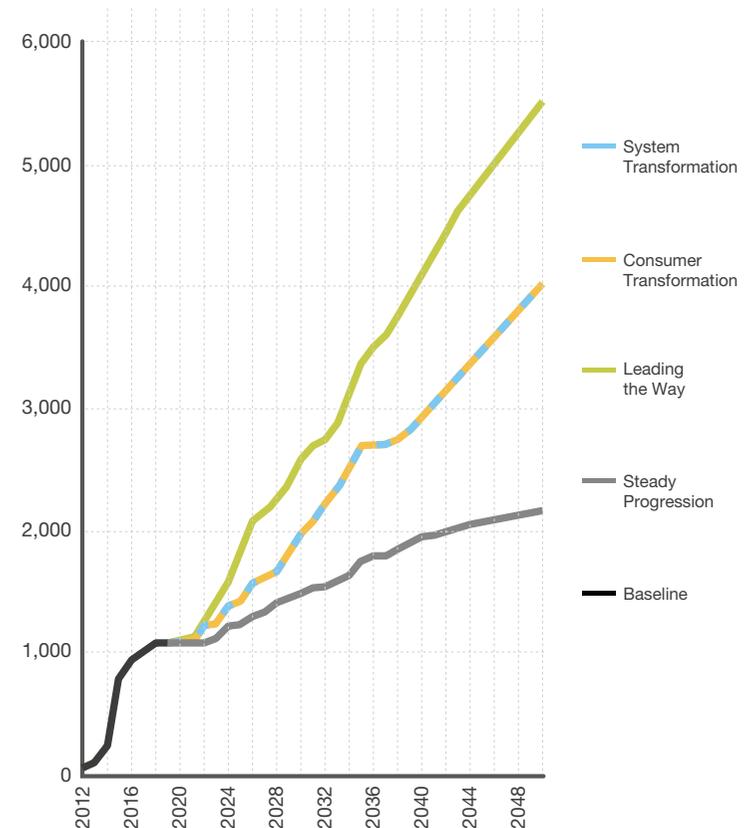
The East Midlands has become a key area for the deployment of ground mounted solar PV. The area has the largest installed capacity of the four WPD licence areas, and a very large pipeline of projections with accepted network connection offers.

The cost of solar **reduced by 82%** over the last decade, however deployment in the East Midlands has slowed in the last few years as government subsidies reduce and market uncertainties mean that fewer sites have been completed. However, DFES analysis shows clear developer interest remains with a large pipeline of sites that have recently accepted a network connection offer, totalling 1.7GW – potentially doubling the current total.

In the highest growth scenarios, this solar pipeline is built out in full by 2030, and one in three homes have solar panels installed by 2050.

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

Installed Capacity (MW)



Fossil Gas



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

The 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 in the East Midlands licence area is Corby Power station, with an export capacity of 350MW. This site forms a significant portion of the total 1.2GW of fossil gas power currently connected. Most of the current sites are towards the western part of the licence area, around Derby and Nottingham, however there are some pipeline applications to the east, nearer Lincoln.

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 regulation, 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.

There is a large pipeline of sites that could connect in the near term in the East Midlands licence area, as well as scope for energy storage co-located alongside the significant deployment projected for solar power.

The DFES has modelled the deployment of a range of energy storage applications, from domestic batteries to large sites co-located with renewable energy. Due to the scenario specific assumptions around the deployment of other providers of network services, there is a wide envelope of storage capacity between the scenarios. Overall battery storage capacity in 2050 in the East Midlands licence area ranges from c.0.5GW in System Transformation to over 2GW in Leading the Way.

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 East Midlands licence area currently has c.160,000 properties electrically heated of which c.7,500 are non-hybrid domestic 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.

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 East Midlands licence area compared to the UK average leads to lower deployment of hybrid heat pumps in these areas.

By 2050

Steady Progression



System Transformation



Consumer Transformation



Leading the way



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 15,000 battery electric cars (excluding hybrids) registered in the East Midlands licence area, just over 1% of the total. This is around the average level nationwide. The projections include a series of local factors that influence take up in the near term including:



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



Initiatives to encourage electric vehicle chargers or potential Clean Air Zones, e.g. in Leicester

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



1,092,000
battery electric vehicles



578,000
domestic charge points

System Transformation Net Zero Target compliant



1,730,000
battery electric vehicles



858,000
domestic charge points

Consumer Transformation Net Zero Target compliant



2,764,000
battery electric vehicles



1,511,000
domestic charge points

Leading the way Net Zero Target compliant



3,041,000
battery electric vehicles



1,605,000
domestic charge points

Next steps

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

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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