Distribution Future Energy Scenarios 2020

West Midlands licence area

Results and assumptions report

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WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

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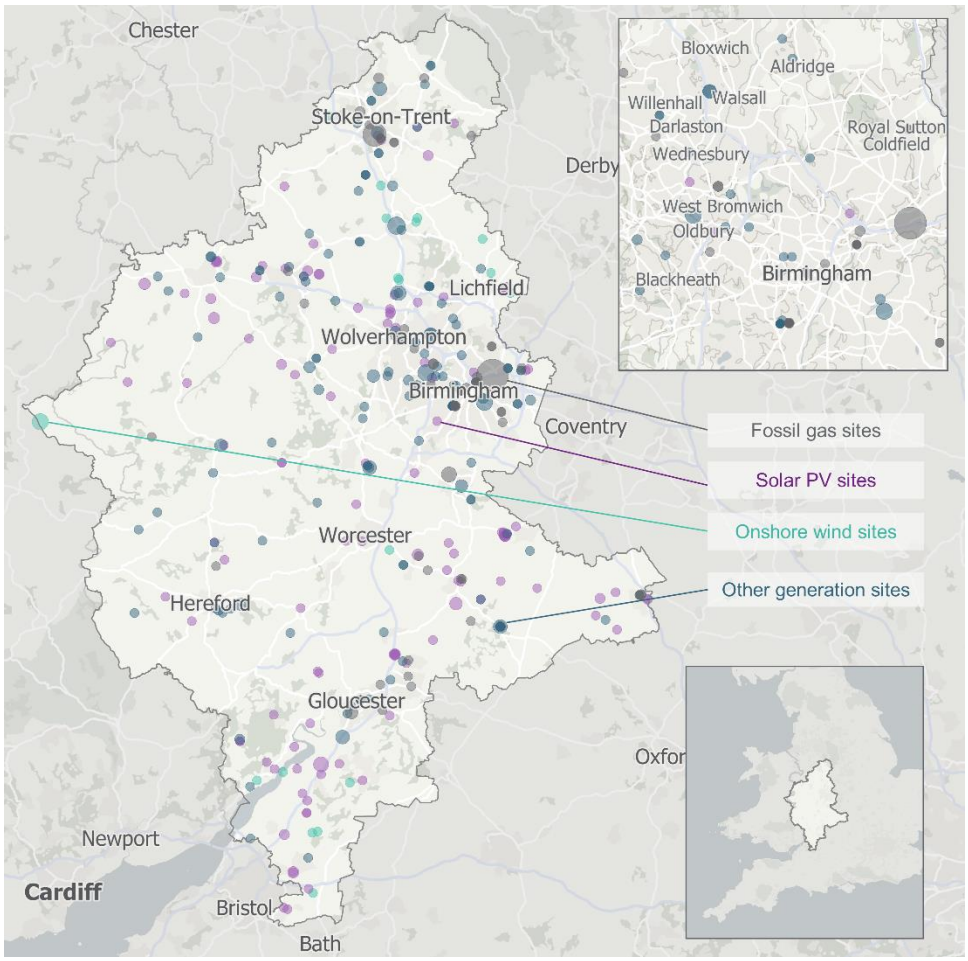
The West Midlands licence area

The West Midlands licence area runs from Stroud in the South to Stoke-on-Trent in the North, and includes large, urbanised areas, as well as many national parks and rural regions. There are a number of cities along the M5 and M6 which run south to north through the licence area. The large urban and industrial conurbation in the centre of the licence area, includes Birmingham (the UK's second most-populous city), Wolverhampton and Solihull. However, the licence area covers many rural areas, as well as national parks such as the Cotswolds, the Wye Valley, the Peak District, Cannock Chase and the Shropshire Hills.

Distributed electricity generation has increased significantly over the last five years, with over 50% of capacity having only connected since 2015. Solar PV, fossil gas, and waste processing sites make up almost three quarters of the total distributed power generation capacity in the licence area. The largest generation site in the licence area is the gas-fired 100 MW Fort Dunlop power plant, shown in the inset in Figure 1.

Electricity demand is also changing. Average annual domestic energy demand has fallen over the last 10 years, however new low-carbon technologies are expected to change consumption patterns of both homes and businesses within the next two decades. Though only 0.3% of homes currently have a heat pump and 1.4% of cars are electric, widespread change is expected across all sectors as the UK decarbonises which is likely to radically change the current shape of demand.

Figure 1 – The West Midlands licence area with key generation sites



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Introduction to the WPD DFES 2020

Background:

Distribution Future Energy Scenarios (DFES) provide granular scenario projections for the growth (or reduction) of generation, demand and storage technologies which are expected to connect to the GB electricity distribution networks. The WPD DFES 2020 also includes projections for new housing growth and increase in commercial and industrial developments. The projections are also informed by stakeholder engagement to understand the needs and plans of local authorities and other stakeholders.

For the DNOs, DFES allows network planners to model and analyse different future load scenarios for their network. This data then informs integrated network planning and investment appraisal processes.

They also provide a key data resource and evidence base to enable WPD to appraise different investment options and develop the business case necessary to support future investment, including regulated business plans.

The scope:

The WPD DFES 2020 analyses the baseline of existing connections and pipeline of future projects expected to connect to the distribution network in the four WPD licence areas, South Wales, South West, East Midlands, and West Midlands. The results exclude any asset connected at transmission level.

The DFES analyses technology types which are of a similar scope to the National Grid FES 2020, and these are standardised against the "building blocks" as reported in the FES 2020. The full list of technology types in the analysis is shown in Table 1.

The scenarios used for projection purposes extend from 2019 to 2050 and are aligned to the four FES 2020 scenarios: Steady Progression, Consumer Transformation, System Transformation, and Leading the Way. These scenarios are described in more detail in the methodology review in this document. The technology types and assumptions are under constant review and may change with future FES and DFES rounds in line with stakeholder feedback.

The Results and assumptions:

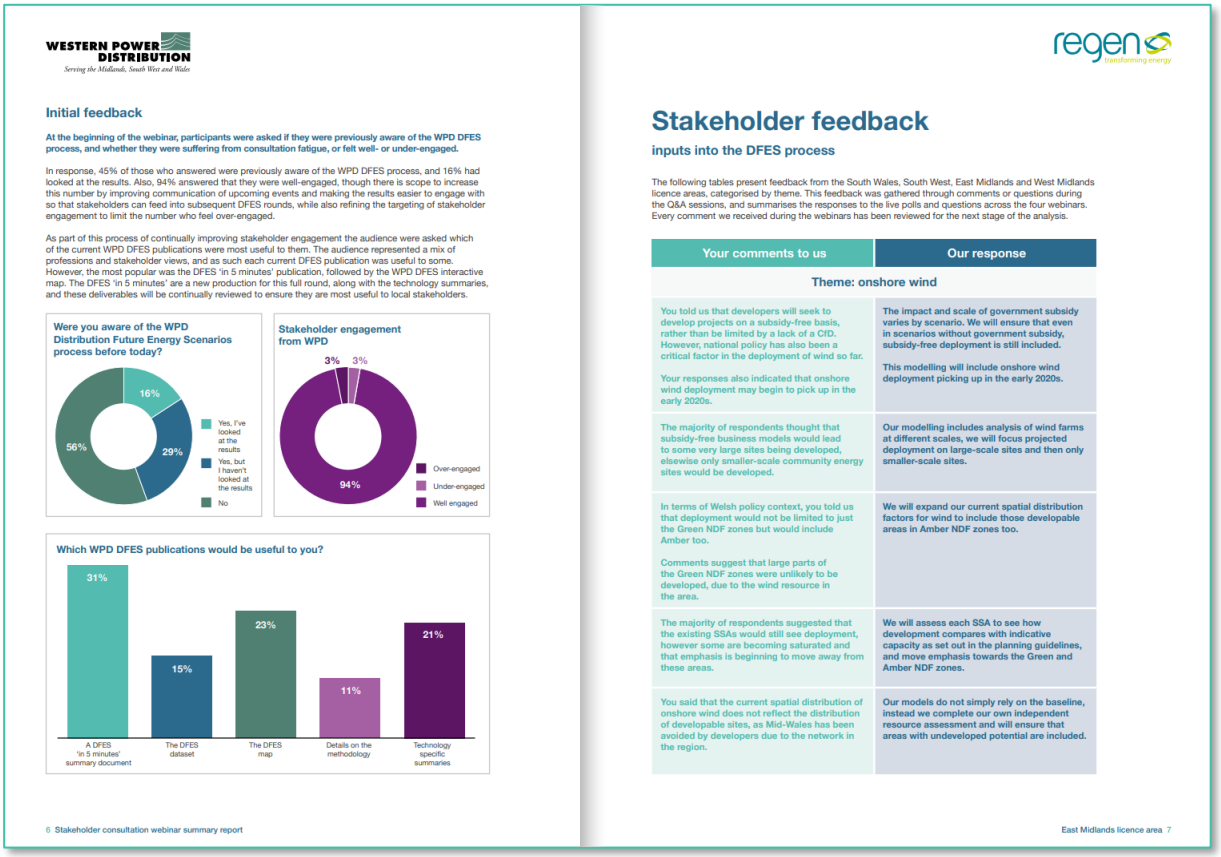
The WPD DFES 2020 is reported to areas known as Electricity Supply Areas (ESAs), which are defined as '*the geographical area supplied by a Primary Substation (which contains WPD-owned distribution substations) providing supplies at a voltage below 33 kV, or a customer directly supplied at 132, 66 or 33 kV or by a dedicated Primary Substation'.* These ESAs are also split by local authority boundaries meaning that the data can be viewed as local authority totals, or by primary substation totals. There are over 3,000 unique ESAs across the four WPD licence areas. The ESAs can be collated up to the level at which National Grid present regional FES data. The DFES is therefore reconciled to the FES 2020 results as far as possible.

The DFES does not include analysis of network loads, load profiles or peak demand etc. This network load analysis is run by WPD network strategy and planning teams. WPD has published the results of this process on their website.

Local stakeholder influences:

The DFES has supported WPD to take a more proactive approach to network planning. Stakeholders were consulted via a series of consultation events, as well as direct engagement with local authority planners and climate emergency officers. For technology projections detailed discussions were held with project developers.

This year the events were held online due to restrictions on large gatherings, and there were more attendees than ever before. To watch a recording of the stakeholder engagement events, or to read the reports summarising how the feedback has been incorporated into the DFES, visit the WPD DFES website.



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Initial feedback

At the beginning of the webinar, participants were asked if they were previously aware of the WPD DFES process, and whether they were suffering from consultation fatigue, or felt well- or under-engaged.

In response, 45% of those who answered were previously aware of the WPD DFES process, and 16% had looked at the results. Also, 94% answered that they were well-engaged, though there is scope to increase this number by improving communication of upcoming events and making the results easier to engage with so that stakeholders can feed into subsequent DFES rounds, while also refining the targeting of stakeholder engagement to limit the number who feel over-engaged.

As part of this process of continually improving stakeholder engagement the audience were asked which of the current WPD DFES publications were most useful to them. The audience represented a mix of professions and stakeholder views, and as such each current DFES publication was useful to some. However, the most popular was the DFES 'in 5 minutes' publication, followed by the WPD DFES interactive map. The DFES 'in 5 minutes' are a new production for this full round, along with the technology summaries, and these deliverables will be continually reviewed to ensure they are most useful to local stakeholders.

6 Stakeholder consultation webinar summary report

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Stakeholder feedback

inputs into the DFES process

The following tables present feedback from the South Wales, South West, East Midlands and West Midlands licence areas, categorised by theme. This feedback was gathered through comments or questions during the Q&A sessions, and summarises the responses to the live polls and questions across the four webinars. Every comment we received during the webinars has been reviewed for the next stage of the analysis.

Your comments to us	Our response
Theme: onshore wind	
You told us that developers will seek to develop projects on a subsidy-free basis, rather than be limited by a lack of a CfD. However, national policy has also been a critical factor in the deployment of wind so far. Your responses also indicated that onshore wind deployment may begin to pick up in the early 2020s.	The impact and scale of government subsidy varies by scenario. We will ensure that even in scenarios without government subsidy, subsidy-free deployment is still included. This modelling will include onshore wind deployment picking up in the early 2020s.
The majority of respondents thought that subsidy-free business models would lead to some very large sites being developed, elsewise only smaller-scale community energy sites would be developed.	Our modelling includes analysis of wind farms at different scales, we will focus projected deployment on large-scale sites and then only smaller-scale sites.
In terms of Welsh policy context, you told us that deployment would not be limited to just the Green NDF zones but would include Amber too. Comments suggest that large parts of the Green NDF zones were unlikely to be developed, due to the wind resource in the area.	We will expand our current spatial distribution factors for wind to include those developable areas in Amber NDF zones too.
The majority of respondents suggested that the existing SSAs would still see deployment, however some are becoming saturated and that emphasis is beginning to move away from these areas.	We will assess each SSA to see how development compares with indicative capacity as set out in the planning guidelines, and move emphasis towards the Green and Amber NDF zones.
You said that the current spatial distribution of onshore wind does not reflect the distribution of developable sites, as Mid-Wales has been avoided by developers due to the network in the region.	Our models do not simply rely on the baseline, instead we complete our own independent resource assessment and will ensure that areas with undeveloped potential are included.

East Midlands licence area 7

Methodology summary

A full and detailed methodology report is available on the WPD DFES website, which is summarised in brief in this report.

Baseline analysis:

A database of current distribution network connected assets is created based primarily on WPD connection data, and supplemented with subsidy registers, Department for Transport data, and other national datasets. This data is used to analyse the spatial trends within a licence area, and how those trends have changed up to the present day.

Pipeline analysis:

Once a baseline is established, an analysis of sites that may connect in the next five-to-ten years is completed. This includes sites that have accepted a connection offer from the DNO but that have not yet connected, or sites that are active, for example having no connection offer but have applied for planning permission. Where possible, a discussion is held with a developer or interested group directly to inform the connection dates in the scenario projections.

Demand from new domestic and non-domestic property developments is also included in the analysis. The local plans from each local authority that intersect the licence areas are analysed. The local authority planners are contacted to verify the information and to provide insight into the rate of development within their planning period (in most cases the next 10-15 years). This consultation with local authorities also identifies where there are plans or strategies for supporting energy efficiency measures, renewable energy deployment, or decarbonising heat and transport. These are then reflected in the analysis and spatial distribution.

Annual iteration:

Having been published every two years, the WPD DFES is now scheduled to be published on an annual basis. The National Grid ESO FES is developed through the spring and launched in the summer while the WPD DFES will use the latest FES to build the analysis, which is produced over the summer and published in the autumn.

Data will be collected and refreshed in this yearly cycle, and the scope and scenarios may differ year to year depending on changes to the FES. Stakeholder feedback will be gathered throughout the year and may continue after the main DFES process, to be incorporated in the following year.

The WPD DFES uses the FES as a framework and benchmark though is a bottom-up analysis of a changing energy system at a regional and sub-regional level that reflects regional and local factors. It is, therefore, likely that there will be some variance between the WPD DFES view and the FES view. This regular cycle should allow also for greater data sharing between the WPD DFES and the National Grid ESO FES teams, facilitating continuous improvement of the data quality and processes.

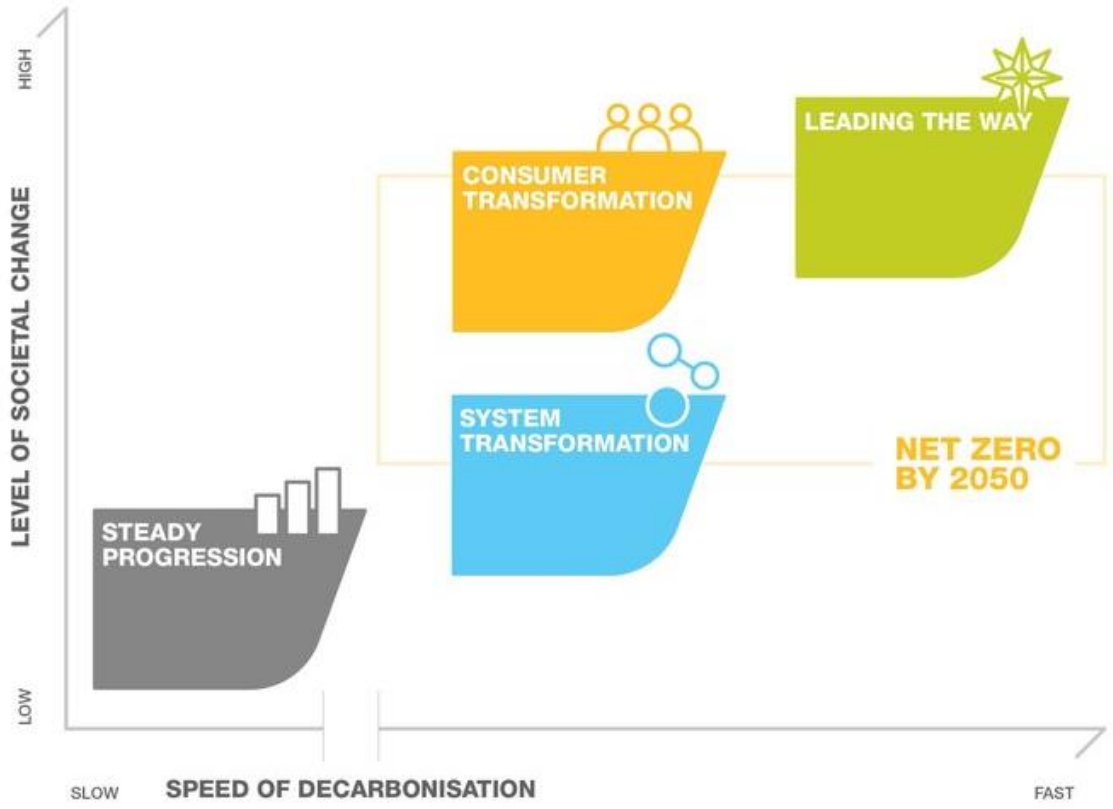
Scenario projections:

The WPD DFES 2020 uses the same four future scenarios as the National Grid ESO FES 2020. These scenarios are significantly different from those used in previous studies, reflecting changing legislation and incorporating new technology types in the analysis. The scenarios each have a different speed of decarbonisation and assume various levels of societal change. The location of these scenarios on those axes are shown in Figure 2.

Three of the four scenarios assessed in the WPD DFES 2020 meet the government target of net zero emissions by 2050, however they achieve these emissions reductions in different ways and at different rates. The net zero compliant scenarios are Leading the Way, Consumer Transformation, and System Transformation. The Steady Progression scenario is not compliant with the 2050 net zero target and has lower levels of societal change.

There are published assumptions made by in the FES 2020 which have been included in the DFES analysis and shown throughout this report. Further DFES assumptions including technology costs, spatial distribution, the development of sites in the pipeline are detailed in the technology specific sections of this report.

Figure 2 – The National Grid ESO FES 2020 scenario framework



List of technology types analysed as part of the WPD DFES 2020:

Table 1

DFES technology	DFES sub-technology	Equivalent Building block ID number
Air conditioning	-	-
Battery storage	Domestic batteries (G98)	Srg_BB002
Battery storage	Grid services	Srg_BB001
Battery storage	Co-location	Srg_BB001
Battery storage	High energy user	Srg_BB001
Biomass & Energy Crops (including CHP)	-	Gen_BB010
CCGTS (non CHP)	-	Gen_BB009
Electric vehicles	Pure electric motorcycle	Lct_BB001
Electric vehicles	Pure electric car (non autonomous)	Lct_BB001
Electric vehicles	Hybrid car (non autonomous)	Lct_BB002
Electric vehicles	Hybrid motorcycle	Lct_BB002
Electric vehicles	Pure electric bus and coach	Lct_BB003
Electric vehicles	Pure electric LGV	Lct_BB003
Electric vehicles	Pure electric HGV	Lct_BB003
Electric vehicles	Hybrid LGV	Lct_BB004
Electric vehicles	Hybrid bus and coach	Lct_BB004
Electric vehicles	Hybrid HGV	Lct_BB004
Electric vehicles	Pure electric car (autonomous)	-
Electric vehicles	Hybrid car (autonomous)	-
EV charge point	Domestic	-
EV charge point	Workplace	-
EV charge point	En route	-

EV charge point	Destination	-
Floating wind	-	Gen_BB014
Geothermal	-	Gen_BB019
Heat pumps	Electric back-up	Lct_BB005
Heat pumps	Gas back-up	Lct_BB006
Hydropower	-	Gen_BB018
Marine	Tidal stream	Gen_BB017
Marine	Wave energy	Gen_BB017
Non renewable engines (CHP)	> 1 MW	Gen_BB001
Non renewable engines (CHP)	< 1 MW	Gen_BB002
Non renewable engines (CHP)	(G98/G83)	Gen_BB003
Non-renewable Engines (non CHP)	Diesel	Gen_BB005
Non-renewable engines (non CHP)	Gas	Gen_BB006
OCGTS (non CHP)	-	Gen_BB008
Offshore wind	-	Gen_BB014
Onshore wind	Large scale (>1MW)	Gen_BB015
Onshore wind	Small scale (<1MW)	Gen_BB016
Other generation	-	-
Renewable engines (landfill gas, Sewage Gas, Biogas)	-	Gen_BB004
Solar PV	Ground mounted (>1MW)	Gen_BB012
Solar PV	Commercial rooftop (10kw - 1MW)	Gen_BB013
Solar PV	Domestic rooftop (<10kw)	Gen_BB013
Waste Incineration (including CHP)	-	Gen_BB011

Results and assumptions

Demand technologies

New demand in the West Midlands licence area

Summary of modelling assumptions and results.

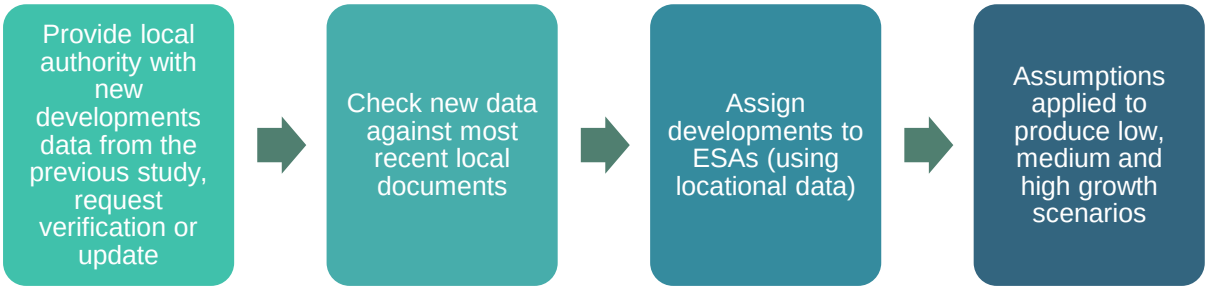
Specification:

New domestic and non-domestic development data is projected using the four FES 2020 scenarios based on an assessment of local authority plans.

Summary:

- New domestic and non-domestic buildings can have significant impact on local electricity demand. The development local plans of each local authority are analysed to create a record of the planned developments, their location, likely use, and the years over which they are expected to be built. The methodology is summarised in Figure 3.

Figure 3 – Summary of methodology for the assessment of new developments

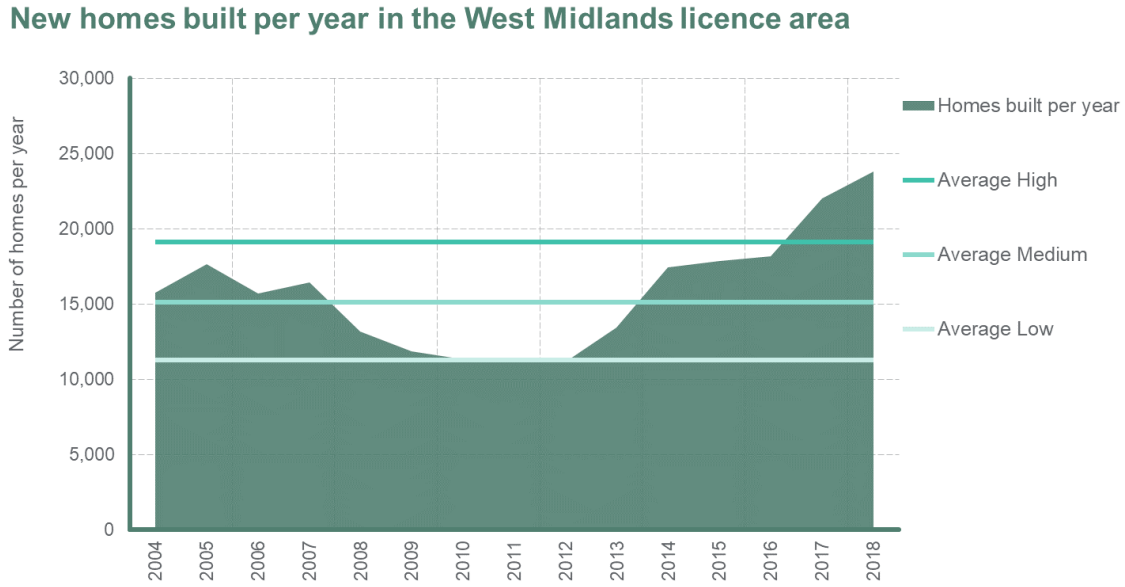


- The data from local authorities is used to create low, medium, and high growth scenarios for domestic and non-domestic developments, reported at ESA level.
- Every local authority within the licence area was contacted, with the existing DFES data presented for verification or modification. The local authorities were also asked about existing or draft decarbonisation strategies for energy, transport, waste, and heating in their local area. This data was used throughout the WPD DFES 2020.
- The minimum size of development captured through the direct analysis of local authority plans was 20 homes, with additional sites allocated based on historic development rates.

Results and assumptions:

- Historic trends in new developments are used to provide upper and lower estimates for a low, medium, and high level of deployment. These are then assigned to the FES 2020 scenarios for the near and medium term as detailed below. All scenarios trend towards the average medium trajectory in the long term.
    - Steady Progression – Low
    - Consumer Transformation – Medium
    - System Transformation – Medium
    - Leading the Way – High

Figure 4 – Example of how the levels of deployment are determined



- The numbers of homes or amount of commercial floorspace, the location, and the building type are taken from the local authority plans, or from a survey filled out by local authority planners.
- Each individual site is assigned to an ESA within the WPD network area and the rate at which new buildings will be completed is noted according to the plan. To create trajectories that fit the historic low, medium, or high rates, the scenarios apply different levels of assumed delay to building completion. In this way, the precise spatial data and scale of development is maintained, but the period over which the sites are built is varied.
- Not all plans extend out to 2030 or later, and therefore there is a natural reduction in the data for planned developments. To compensate for this reduction, additional dwellings and commercial floorspace is modelled, with location weighted towards areas of similar housing density to those of recent deployment.
- For the West Midlands licence area, the high trajectory assumes around 18,000 homes per year, and the low is around 11,000 homes per year. These building rates interact with the new demand and generation scenarios for domestic technologies such as electric vehicles, heat pumps and rooftop solar PV. The spatial data from the local plans define where on the WPD network these technologies are connected.
- A more detailed methodology is presented in the full WPD DFES 2020 methodology report, published alongside this results summary document.

Figure 5

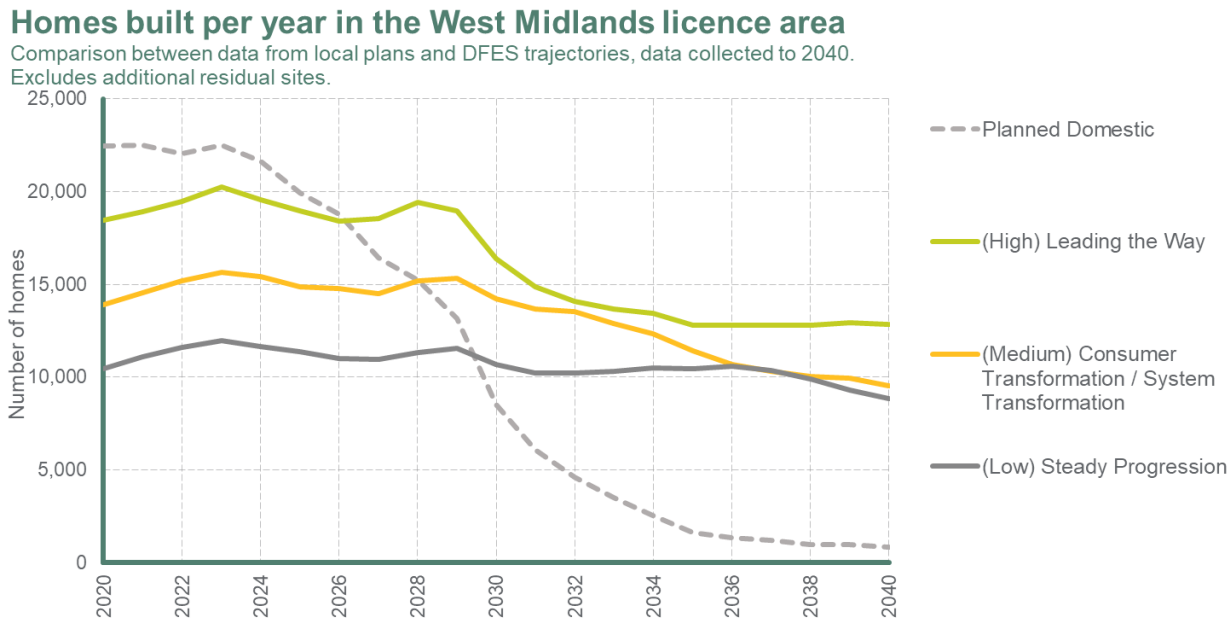
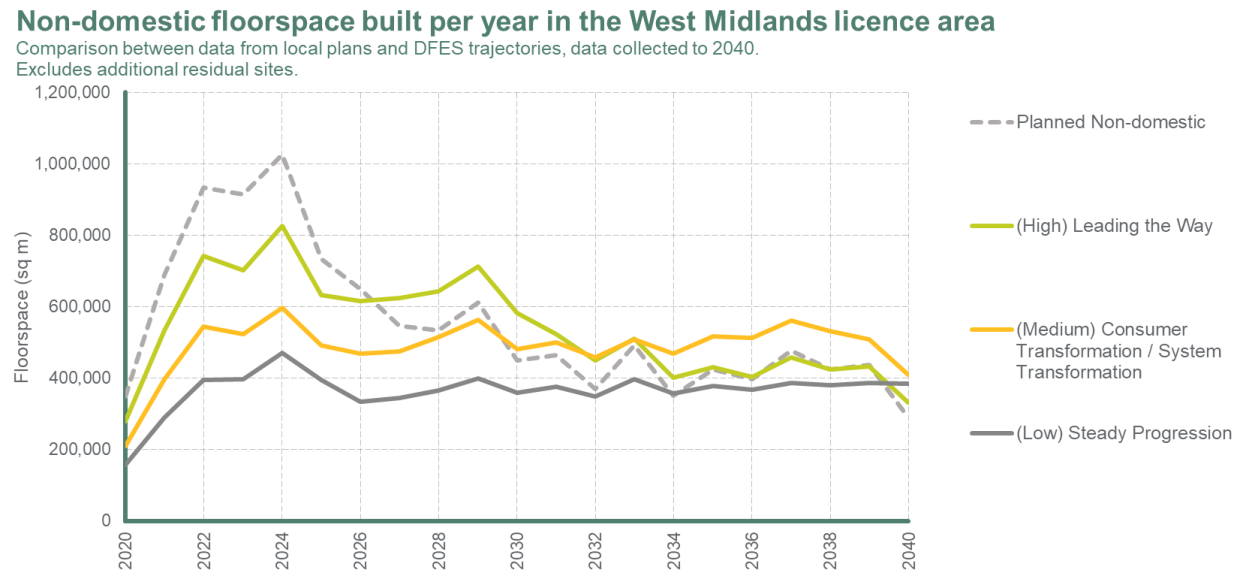


Figure 6



Stakeholder feedback from the consultation events:

Your comments to us	Our response
Theme: new developments	
You asked how the DFES can effectively feed into Local Plan Infrastructure Delivery Plans.	The DFES is designed to account for the most up to date Local Plan information available, and these projections are used in network analysis to determine potential reinforcements required. Our DFES projections are also disseminated to Local Authorities to review our assumptions and understand how WPD can feed into future Infrastructure Delivery Plans.
You asked at what point in the Local Plan process do WPD want to know about development sites – when the plan has been adopted or when it is in draft.	Draft local plans offer an updated position over previously adopted local plans. Plans in the draft stage are therefore preferred.
You asked if half-hourly metered data is used or peak figures with a diversity factor applied, and whether WPD has their own benchmarks to forecast demand based on floor area.	WPD use a combination of half hourly metered customer data and profiles derived from innovation projects applied to the DFES projections for electrical analysis. More information on the electrical profiles used can be found in our Shaping Subtransmission reports: www.westernpower.co.uk/smarter-networks/network-strategy/strategic-investment-options-shaping-subtransmission

References:

Local plan data as verified with all local authorities which intersect the WPD region.

Heat pumps in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Domestic heat pumps – electric heat pump systems providing space heating and hot water to domestic buildings. This technology is divided into two sub-categories:

- Non-hybrid heat pumps - powered purely by electricity
- Hybrid heat pumps - a combination of a gas boiler and electric heat pump.

Data summary for heat pumps in the West Midlands licence area:

Thousands of heat pumps		Baseline	2025	2030	2035	2040	2045	2050
Non-hybrid	Steady Progression	8	14	19	51	99	194	275
	System Transformation	8	36	88	154	227	352	453
	Consumer Transformation	8	176	485	861	1,190	1,499	1,811
	Leading the Way	8	172	482	723	1,004	1,328	1,375
Hybrid	Steady Progression	0	3	22	47	61	93	150
	System Transformation	0	31	66	139	173	251	324
	Consumer Transformation	0	15	49	107	163	202	250
	Leading the Way	0	56	175	310	474	651	648

Summary:

- In line with changes nationwide, there is a dramatic shift in the West Midlands licence area to low carbon heating in all three of the net zero compliant scenarios. In the more electrified Consumer Transformation and Leading the Way scenarios, c.75% of homes are primarily heated by a heat pump by 2050.
- Due to the similarities in the West Midlands housing stock to the national average, heat pump uptake in this licence area is projected to fall broadly in line with the GB FES average over the scenario time frame.
- Hybrid systems are slightly less prevalent in this licence area than GB overall due to a higher rate of off-gas homes which are unsuitable for the technology. West Midlands has 20% of homes off-gas compared to 15% nationally.

Results and assumptions:

Baseline

- The West Midlands licence area has c.7,500 heat pumps, all of which are non-hybrid. This represents 0.3% of homes, half of the national average of 0.6%.
- The primary deployment driver for domestic heat pumps in GB in recent years has been the domestic Renewable Heat Incentive, under which 6% of heat pumps accredited have been in the West Midlands licence area.

Near term

- Heat pump uptake increases slowly under the net zero scenarios in the near term. The technology is supported by the Domestic RHI and the Green Homes Grant, which is available from September 2020 and supports the installation of domestic energy efficiency measures which are required to run heat pumps efficiently.
- From 2022, there is a step change in installation rates under the more electrified Consumer Transformation and Leading the Way scenarios, as national heat strategy leans towards electrification and drives significant change in the heating industry. Installation rates also increase notably in System Transformation, despite a stronger focus on gas network solutions.
- With national policy likely to be targeted in off-gas homes over the next decade (indicated in the Clean Growth Strategy 2017), in the near term this licence area sees higher than average deployment of heat pumps.
- Under all net zero scenarios the proposed ban on gas connections in new build housing is implemented, resulting in an uptick of non-hybrid deployments from 2025 onwards.

Medium term

- Installations of heat pumps in the late 2020s and 2030s are driven largely by national heat strategy and policy rather than consumer choice.
- Under System Transformation, hydrogen boilers served by a repurposed gas network are pursued as the dominant low carbon heating technology and heat pump uptake is largely limited to off-gas housing.
- Uptake in off-gas, and on-gas homes is modelled separately. Within these two separate areas, homes with a larger than average floorspace are assumed to have a slightly higher uptake of heat pumps, with more space to fit hybrid units and typically higher heat demand giving an incentive to install an efficient heating system. Those with smaller floorspace are assumed to have slightly higher preference for direct electric heating in the near and medium term.
- Under Leading the Way and Consumer Transformation, heat pumps replace high carbon heating technologies in both on- and off-gas housing. Heat pumps represent over half of heating system replacements in off-gas homes in the 2030s.

Long term

- In the Consumer Transformation and Leading the Way scenarios, continually improving domestic energy efficiency results in almost all homes becoming suitable for a heat pump by 2050.
- Market conditions mean that electrified heat is the optimal heating solution for the vast majority of homes, with c.75% of the licence area's homes served by a non-hybrid or hybrid heat pump by 2050 under these scenarios.
- Heat pump uptake under System Transformation and Steady Progression remains low, as heating fuelled by hydrogen and fossil gas boilers respectively, is preferred.

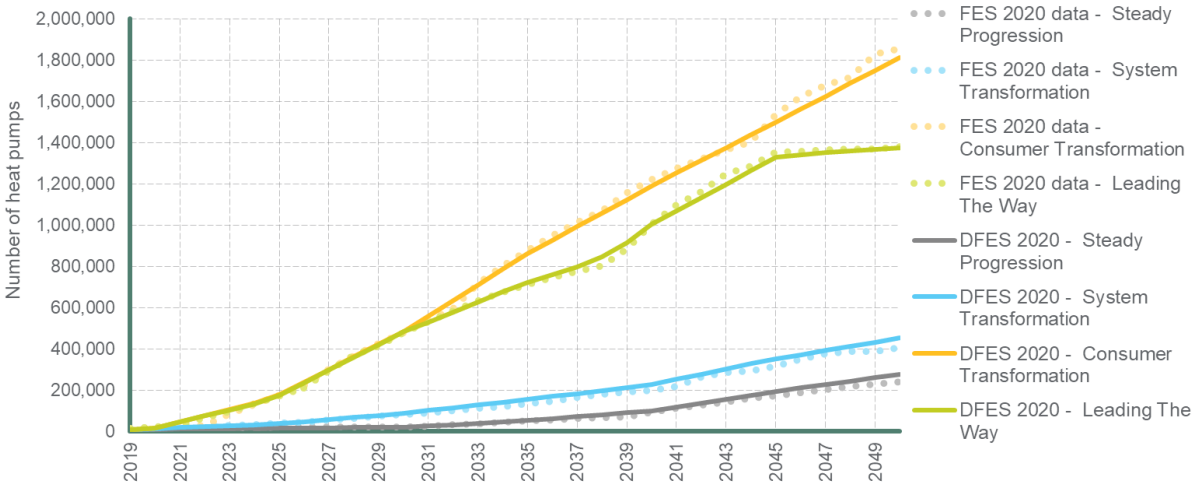
Reconciliation with National Grid FES 2020:

Results in this section relate to the FES 2020 data as reported for the Building Block ID numbers Lct_BB005 and Lct_BB006.

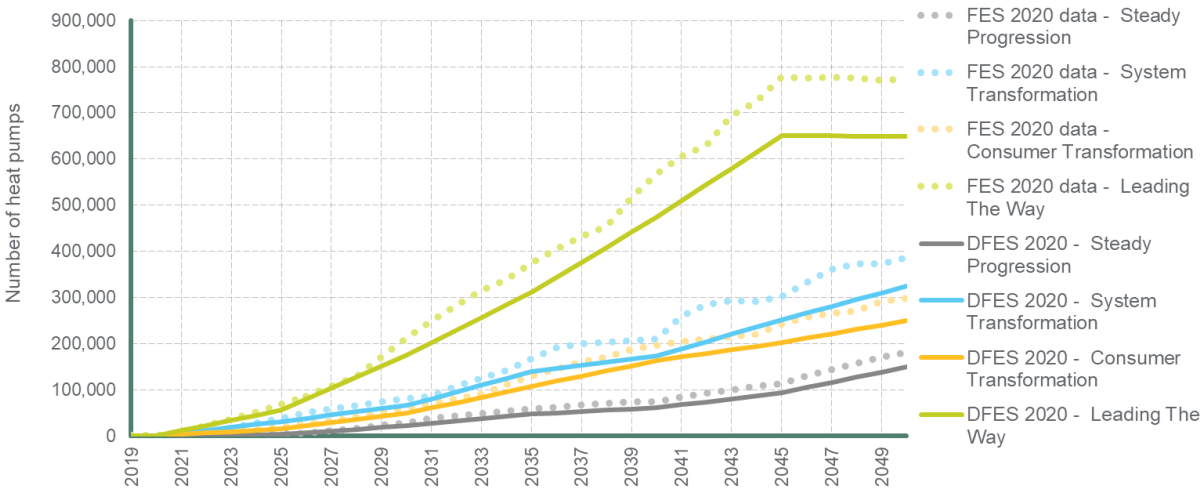
- The WPD DFES 2020 projections are in line with FES 2020 GSP-level projections for non-hybrid heat pumps, and are slightly lower than FES 2020 for hybrid uptake.
- This reflects the characteristics of housing and households in the West Midlands being of similar makeup to GB as a whole, in terms of affluence, home ownership, social housing levels and detached/semi-detached houses.
- While the average floorspace in West Midlands is 20% above the GB average, this is counteracted by a higher level of poorly insulated homes. Only 9.2% of homes have an EPC rating of a C or better, below the GB average of 12.3%, offsetting the impact of having a greater proportion of larger homes in the licence area.
- The lower proportion of hybrid heat pumps reflects the availability of gas connections in the licence area. Currently, 80% of homes are connected to the gas network, compared to 85% nationally.

Figure 7

Domestic - Non-hybrid heat pumps by scenario
Comparison to FES 2020 GSP data for the West Midlands licence area



Domestic - Hybrid heat pumps by scenario
Comparison to FES 2020 GSP data for the West Midlands licence area



Factors that will affect deployment at a local level:

- Under Consumer Transformation and Leading the Way where heat pumps become the dominant heating technology, the spatial weightings focus on those areas which are 'first movers' in the near term, and identifies which areas play catch up later on.
- In the near term detached, semi-detached, and owner-occupied properties see higher uptake reflecting analysis of existing RHI supported heat pump installations. Detached and semi-detached properties make up 81% of current installations, despite representing 27% of the housing stock. At a national level, 11% of accreditations displaced domestic gas heating systems.
- Additionally, as heat pumps perform best in a well-insulated building, properties with an EPC band of a C or higher see higher projected uptake in the near term.
- Weightings in the near term such as affluence, tenure and building type reduce towards zero as heat pumps become the heating solution of choice under some scenarios. Subsequently, homes that are currently less likely to adopt heat pumps, such as rental properties and poorly insulated buildings, drive the distribution of heat pump uptake in the long term.
- Hybrid heating distribution is driven by the above factors in homes with access to the gas network, with an additional weighting towards homes with high floor space (i.e. with the requisite space to house the dual heating appliances and likely higher peak heat demand) and with maximum potential EPC ratings of a D or below, which would be unlikely to be suitable for a non-hybrid heat pump.
- All local authorities in the West Midlands licence area were asked whether they had specific plans or strategies for low carbon heat. Those with a positive heat pump strategy were given a small positive weighting, deployment was also weighted away from areas with a district heat network strategy in the near term.

Relevant assumptions from National Grid FES 2020:

Assumption number	3.1.3
Steady Progression	Consumers continue to buy similar appliances to today
System Transformation	Low willingness to change lifestyle results in hydrogen being the preferred low carbon heating technology for consumers
Consumer Transformation	High energy prices and consumer willingness to adapt results in high levels of heat pump uptake
Leading the Way	High income, energy prices and consumer green ambition results in high levels of non-hybrid and hybrid uptake

Stakeholder feedback from the consultation events:

Your comments to us	Our response
Theme: domestic heat	
You asked what analysis of the potential uses of hydrogen do we include in our modelling?	The uptake of domestic hydrogen heating or electric heat pumps differs across the net zero scenarios, and the analysis includes both. However, we focus on electric heat pumps as we are reporting connections to the WPD network.
You told us that hydrogen produced in industrial clusters could be used to generate electricity.	We will review this for the next round of DFES and incorporate stakeholder feedback for including hydrogen peaking plants as an emerging technology by 2050.
The majority of the respondents suggested that gas boilers would continue to be installed in new homes up until 2025, however a significant minority thought that the rate would fall towards 2025.	We will incorporate these into the assumptions which feed our heat modelling work, keeping gas boiler deployment high in new builds out to 2025.
The majority of respondents suggested that though new homes and off-gas areas would receive higher heat pump installation rates, on-gas areas would also see uptake.	We will incorporate this into our spatial modelling, focussing most deployment in the early years in off-gas areas, but widening it out into other areas too.

References:

Energy Performance Certificates, Census 2011, Renewable Heat Incentive data, Climate Emergency declaration data, Regen consultation with local stakeholders and local authorities.

Direct electric heating in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

A system using electricity to provide primary space heat and hot water to domestic buildings, that is not driven by a heat pump. Typically, this is night storage heating or direct electric heating. This does not include heat networks.

Data summary for direct electric heating in the West Midlands licence area:

Number of households (1,000s)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	192	200	206	212	219	227	235
System Transformation	192	201	205	206	207	206	205
Consumer Transformation	192	201	203	203	202	199	195
Leading the Way	192	202	207	210	211	211	210

Summary:

- The number of electric heating units declines in existing homes as it is gradually replaced by low-carbon heating, the majority of which are non-hybrid heat pumps. There are some installations in homes with homes with smaller floorspace, though there is an overall net reduction in existing homes. Overall, numbers increase as electric heating is projected to be installed in some new build homes. The result is a small increase in overall numbers in the near and medium term.
- In the long term, the uptake rate flattens in Leading the Way, and begins to fall in the long term in Consumer Transformation and System Transformation due to the prevalence of electric heat pumps and hydrogen heating alternatives.

Results:

Baseline

- The baseline number of direct electric heating units is based on analysis of domestic heating technology types from Energy Performance Certificate (EPC) data.
- The installation rate of direct electric heating in new builds is also based on local EPC data. The most recent national data shows that c.11% of new builds are heated by direct electric heating, a proportion which has been relatively stable over recent years.

Near term (2020 – 2025)

- In the net zero compliant scenarios, electric heating units are projected to be replaced by other or more efficient low carbon heating solutions, projected to be mainly non-hybrid heat pump systems.
- Though electric heating has a higher running cost than a heat pump, they are assumed to not be the target of national policy to decarbonise domestic heating, based on the relative emissions of other domestic heating solutions such as oil and LPG. Therefore, in the near term there is projected to be a limited decrease in electric heating in existing homes.
- The WPD DFES 2020 analysis of new build domestic properties is used to project increases in the number of direct electric heating installations, starting at the current average of c.11% of new homes with direct electric heating, falling to c.10% in the net zero compliant scenarios by 2025.

Medium term (2025 – 2035)

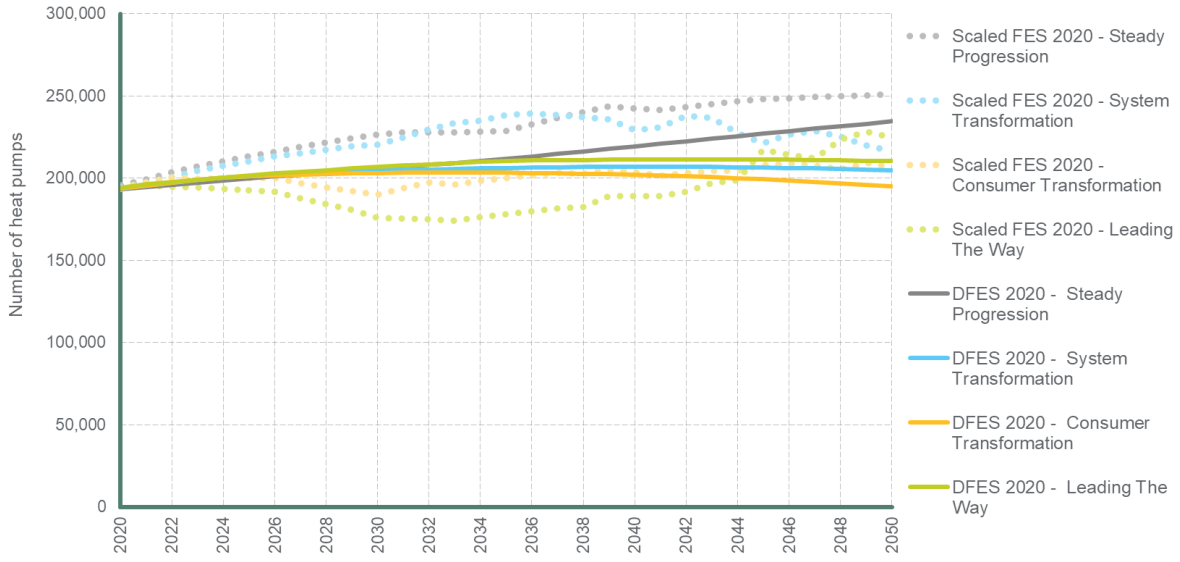
- In the medium term, there is a steady decline in the numbers of domestic direct electric heating units in existing homes. It is assumed to be a steady annual reduction in the absence of clear policy drivers within the medium term. In Steady Progression, the baseline installations are not projected to decrease across the projection period.
- The percentage of direct heating units in new builds is assumed to decrease in the medium term from c.11% to c.3-5% in the net zero compliant scenarios. No change in installation rate is assumed in the Steady Progression scenario in the medium term.

Long term (2035 – 2050)

- The installation rate of direct electric heating in new build domestic properties reduces to zero in Consumer Transformation, and to c.2% in Leading the Way and System Transformation. This reduction in new installations and the continued replacement of the baseline installations leads to a falling total in Consumer Transformation, and a flattening projection in Leading the Way and System Transformation.
- In Steady Progression, the total number of installations rises to 235,000, compared to a 195,000 in Consumer Transformation.

Figure 8

Domestic direct electric heating by scenario
Comparison to scaled FES 2020 data for the West Midlands licence area



Reconciliation with National Grid FES 2020:

- There are no direct electric heating numbers presented at GSP level in the FES 2020, therefore the comparison is presented to FES 2020 totals scaled to the baseline level of domestic direct electric heating installations in the licence area.
- The WPD DFES 2020 is broadly in line with FES 2020, although the WPD DFES 2020 trajectory shows less variation within the projection period. At a more granular level the trajectories are less smooth due to the discrete location of planned new domestic developments in the licence area and the clustering of current direct electric heating installations in off-gas areas.

Factors that will affect deployment at a local level:

- The spatial distribution of the baseline installations, and therefore the reduction in total numbers of direct electric heating units, is based on EPC data and are typically located in off-gas properties and homes with smaller floorspace.
- The spatial distribution of new builds is based on data collected from the plans of local authorities.

References:

Energy Performance Certificate data, BEIS local off gas properties data, Regen consultation with local stakeholders and analysis of local authority local plans.

Electric vehicles in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Electric vehicles (EVs) – including non-autonomous cars, autonomous cars, buses and coaches, HGVs, LGVs and Motorcycles, including battery EVs and plug-in hybrid EVs.

Data summary for EVs in the West Midlands licence area:

Number of EVs (total, 1000s)		Baseline	2025	2030	2035	2040	2045	2050
Battery EVs	Steady Progression	26	187	521	1,185	2,365	3,551	3,922
	System Transformation	26	192	638	1,759	3,255	3,801	3,645
	Consumer Transformation	26	528	1,580	3,057	3,978	4,046	3,753
	Leading the Way	26	429	1,507	3,161	3,795	3,561	2,872
Hybrid EVs	Steady Progression	41	150	287	450	575	405	161
	System Transformation	41	122	227	316	244	123	64
	Consumer Transformation	41	100	158	183	138	79	57
	Leading the Way	41	116	181	153	100	59	59

Summary:

- At present, EVs represent approximately 1.4% of all vehicles in West Midlands licence area, which is above the average GB uptake of EVs of around 0.8%. The area is projected to align with the GB average as EVs become ubiquitous by the late 2020s.
- Road traffic estimates from the Department for Transport show that traffic in the West Midlands licence area has increased at a similar level to national average over the past 20 years. However, in the large urban area incorporating Birmingham, Wolverhampton, Dudley, Solihull, Walsall and Sandwell, traffic has increased at half the rate of the national average – a 13% increase since 1993, compared to 28% nationally.
- While the number of plug-in hybrid EVs is currently higher than battery EVs, due to higher efficiencies across all scenarios battery EVs become the dominant technology in the near term and quickly eclipse plug-in hybrids. All net zero compliant scenarios have zero plug-in hybrids by the 2040s, and so this report focusses on trends for battery EVs.
- Analysis of Autonomous Vehicles (AVs) was introduced in FES 2020. FES expect these vehicles represent between 9% and 23% of all cars by 2050. This is, therefore, the first WPD DFES to include a preliminary analysis of AVs.

Results and Assumptions:

Baseline

- There are a total of 25,559 battery EV cars in the West Midlands licence area.
- There are a total of 41,440 plug-in hybrid EV cars in the West Midlands licence area.

Near term (2020 – 2025)

- Across all scenarios the uptake of EVs is expected to increase dramatically by 2025.
- It is projected that by 2025, there could be between 187,000 battery EVs in Steady Progression and 528,000 in Consumer Transformation.
- Autonomous vehicle uptake starts at the earliest in 2023 under all scenarios, however, uptake is very slow in the near term.
- Though there is high uptake in rural areas, uptake in urban areas increases with initiatives such as the delayed Birmingham Clean Air Zone, which is assumed to go ahead in 2021 in all scenarios.

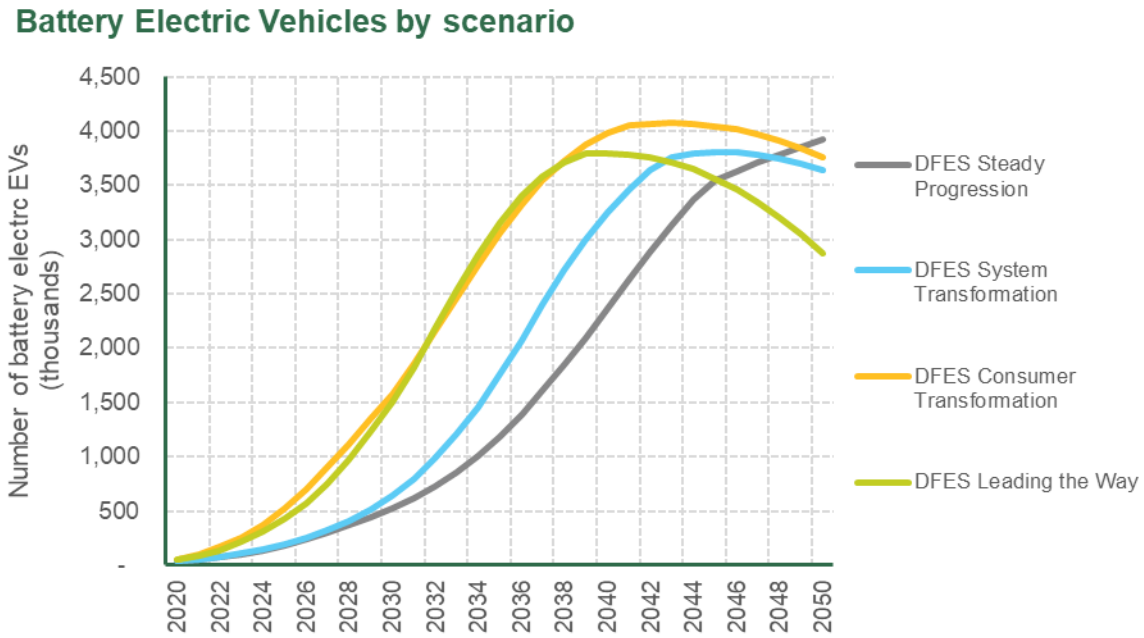
Medium term (2025 – 2035)

- Uptake of EVs is expected to accelerate between 2025 and 2035 across all scenarios.
- Steady Progression has the fewest estimated battery EVs in 2035, with around 1.2 million. Leading the Way has the most, with nearly 3.2 million battery EVs by 2035.
- EV uptake begins to slow in the mid-2030s as EV adoption approaches saturation and only the hardest-to-electrify vehicles, such as HGVs, remain as fuelled by petrol or diesel. Other factors contribute to uptake slowing, including the total number of vehicles reducing, increased use of AVs, and increased use of public transport and active travel.

Long term (2035 – 2050)

- The uptake of EVs continues to increase in Steady Progression, right up until 2050 when battery EVs total nearly 3.9 million. In System Transformation, the uptake of battery EVs approximately flattens from the early 2040s at around 3.8 million.
- In Leading the Way and Consumer Transformation, the numbers of EVs reduces from the late 2030s and mid 2040s, respectively. This results from high levels of societal change resulting in high use of AVs, public and active travel, which results in many homes opting to have fewer cars or no car at all.
- In Leading the Way, the number of battery EVs and total vehicles reduces substantially, peaking at around nearly 3.8 million before reducing to 2.9 million in 2050.

Figure 9



Reconciliation with National Grid FES 2020:

The WPD DFES 2020 projections are in line with the FES 2020 projections in this licence area, as reported for the Building Block ID numbers Lct_BB001, Lct_BB002, Lct_BB003, Lct_BB004.

- Interim assumptions have been made as to the uptake of distribution of AVs in the absence of other information including:
    - Their spatial distribution is treated the same as non-autonomous EVs due to a lack of information about their future uptake.
    - It is assumed that the uptake of EVs in on and off street settings is the same as for non-autonomous EVs
- The uptake and distribution of AVs is an area that needs to be considered for future analysis when more evidence is available.

Factors that will affect deployment at a local level:

- The spatial distribution of EVs in the near term is based on affluence, rurality, existing vehicle baselines and the distribution of on and off street parking. However, in the late 2020s under all net zero scenarios uptake is assumed to be ubiquitous. This means that almost all consumers are assumed to have the same likelihood of adopting an electric vehicle.
- The level for households with two or more cars is slightly higher in the West Midlands licence area than the average in England – 38% compared to 35%. These households are assumed to be more likely to adopt an electric vehicle in the near term.

Relevant assumptions from National Grid FES 2020:

Assumption number	4.1.3
Steady Progression	Steady Progression assumes autonomous vehicles will be privately owned. This increases average miles travelled.
System Transformation	System Transformation assumes that in some cases a twocar household becomes a one car household, where shared autonomous vehicles meet some transport needs. However, most households still have two vehicles, which leads to a modest decrease of only 8% in the number of vehicles compared to Steady Progression.
Consumer Transformation	In Consumer Transformation autonomous vehicles, acting as a taxi service, often replace the need for a second car. They are used by consumers to commute to work or for leisure trips. Combined with greater use of public transport, this results in a 15% decrease in vehicles in this scenario, compared to Steady Progression.
Leading the Way	In Leading the Way, the high levels of societal change have led us to assume that use of autonomous vehicles and public transport reduces the overall number of cars as many homes opt to have no car at all, relying instead on shared mobility solutions, using AVs, which can accommodate four people. Total number of cars is one third less in 2050 than in Steady Progression.

Stakeholder feedback from the consultation events

Your comments to us	Our response
Theme: electric vehicles (EVs)	
You told us that in the long term under a net zero scenario, that both the number of vehicles, and the miles those vehicles drive, would be reduced.	Only 9% of respondents thought there would be no change, a clear message, though vehicle number reduction is not an assumption that is currently included in the FES. We will seek to include it in this round of the DFES under the most ambitious net zero scenario.
You asked what assumptions our model makes about the planned phase-out of petrol and diesel vehicles.	The previous FES incorporated the 2040 target, which has now been brought forward. Our modelling incorporates the new 2035 target, however there are other barriers and drivers which will strongly impact near-term uptake too.
You asked if the projections take into account the new houses and commercial buildings planned in the area, and how does we model deployment in existing homes?	Home-based electric vehicles such as electric cars, motorcycles, and some LGVs are modelled used demographic data such as off-road parking and vehicle ownership. Projected new builds are used to inform the spatial distribution of domestic electric vehicle chargers.

References:

Department for Transport data, National Travel survey data, Climate Emergency declaration data, Regen consultation with local stakeholders, Census 2011,

Electric vehicle chargers in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Electric vehicle chargers – including eight charger archetypes:

1. Off street domestic – homes with somewhere to park a private vehicle off street
2. On street residential – charging at roadside car parking spaces
3. Car parks – charging at areas solely provided for parking only, thus excludes supermarkets
4. Destination – supermarkets, hotels for instance where parking is provided
5. Workplace – daytime parking for commuters, at places of work
6. Fleet/depot – charging for vehicles which return to a depot to park
7. En-route local – charging service stations excluding motorway or A-road services
8. En-route national – motorway or A-road charging stations

Data summary for EV chargers in the West Midlands licence area:

Number of EV chargers (thousands)		2020	2025	2030	2035	2040	2045	2050
Domestic off-street EV chargers	Steady Progression	19	112	289	635	1,209	1,709	1,776
	System Transformation	19	112	339	886	1,561	1,759	1,759
	Consumer Transformation	19	353	958	1,706	2,004	2,006	2,006
	Leading the Way	19	276	874	1,688	1,904	1,904	1,904
Non-domestic EV chargers	Steady Progression	7	13	23	47	88	128	138
	System Transformation	7	13	28	73	132	156	162
	Consumer Transformation	7	30	57	102	135	146	151
	Leading the Way	7	24	56	114	137	142	146

Summary:

- At present, the installation of public EV chargers in the West Midlands is below the GB average for the number of EVs in the licence area. However, it is expected that the licence area will align with the GB average quickly in the 2020s as demand for charging increases.
- These projections aim to represent the envelope of the possible spread and rate of deployment of EV chargers. In many modelling areas there is a lack of behavioural evidence and so interim assumptions have been made.

Results and Assumptions:

Baseline

- There are a total of 728 public EV chargers in the West Midlands licence area
- It is estimated that there are around 19,000 domestic EV chargers in the West Midlands licence area.

Near term (2020 – 2025)

- Across all scenarios the uptake of EV changers is expected to increase dramatically in the near term, supported by initiatives such as the Birmingham Clean Air Zone.
- It is projected that by 2025, there could be between 112,000 domestic off street chargers in Steady Progression and 353,000 in Consumer Transformation.
- In addition, it is projected that by 2025, there could be between 196 MW of non-domestic off street chargers in Steady Progression and 435 MW in Consumer Transformation.

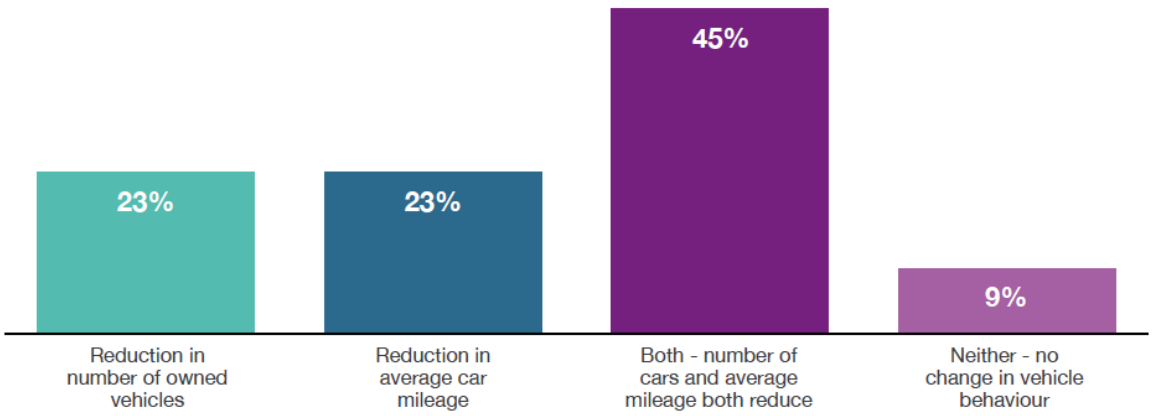
Medium term (2025 – 2035)

- Charger installations are expected to accelerate between 2025 and 2035 across all scenarios.
- Steady Progression has the lowest estimated EV charger capacity in 2035, with around 0.6 million domestic EV chargers and 0.75 GW of non-domestic capacity. Leading the Way has the highest capacity, with 1.7 million domestic EV chargers and over 1.8 GW of non-domestic capacity.
- EV uptake begins to slow in the mid-2030s as EV adoption approaches saturation. Therefore, the installation rate of EV chargers also slows.

Long term (2035 – 2050)

- While the uptake of EVs slows and total vehicle numbers reduce in some scenarios in the long term, it is assumed that charger capacity will not reduce in line with EVs. EV charger capacity therefore remains at the peak achieved in the years between 2040 – 2050, although utilisation may decrease.
- A reduction in car mileage and numbers of vehicles was supported by stakeholders during the engagement events, as shown in Figure 10.
- The uptake of EVs and EV chargers continues to increase in Steady Progression, right up until 2050 when there are nearly 1.8 million domestic EV chargers.
- In Leading the Way and Consumer Transformation, the total capacity of EV chargers is static from the late 2030s and mid 2040s, respectively.

Figure 10 - Stakeholder responses regarding future changes in vehicle owner behaviour

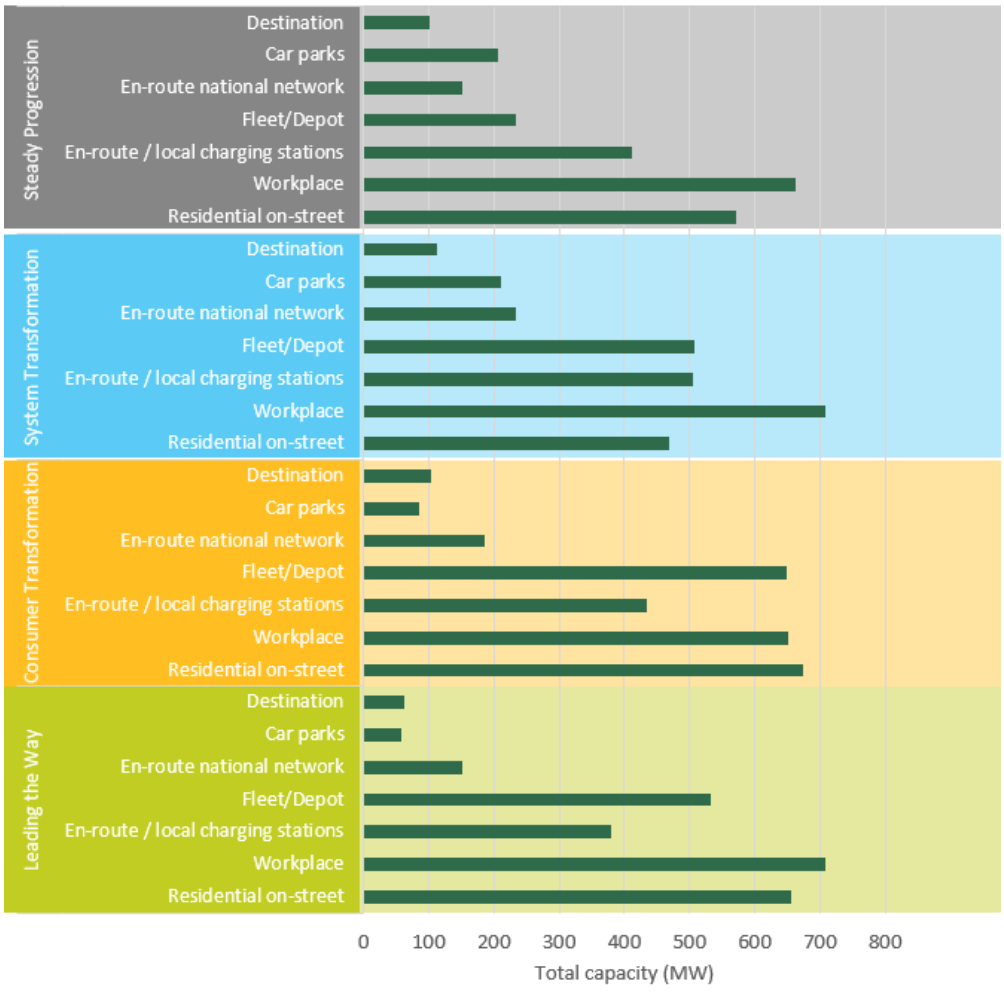


Reconciliation with National Grid FES 2020:

- The FES 2020 results do not provide sufficient breakdown of information to reconcile the EV charger information within the DFES with national projections
- To project EV charger capacities without a FES 2020 framework, assumptions have been made as to the behaviour of EVs and subsequent use of EV chargers, including:
    - Where each EV category will charge (and at which type of EV charger e.g. at home, on street, at work etc.).
    - The EV charger utilisation at each type of charger.
    - These assumptions have been made using industry input and Regen analysis. As more behavioural data and other evidence becomes available, these assumptions will be further refined in the future.
- Interim assumptions have been made as to the behaviour of AV cars in the absence of other information, including:
    - The proportion of AVs that are private or shared in the absence of further information.
    - AV charging behaviour is similar to EVs, the key difference being an increase in fleet/depot charging.
    - AVs are associated with on and off street households and charging at the same rate as EVs.
- The uptake and distribution of chargers associated with AVs is an area that needs to be considered for future analysis.

Figure 11

Non-domestic EV charger capacity results arranged by scenario (2050)



Factors that will affect deployment at a local level:

- The take up of home EV chargers is distributed in the near term towards more rural and affluent areas and those where there are high levels of off street parking.
- The spatial distribution of non-domestic chargers was produced differently for each archetype.
    - En-route local and national charging locations were distributed based on the density of local housing, the volume of local traffic, the distribution of existing petrol stations and the road classification on where the site is located.
    - Car parks, workplace and fleet depot locations were identified from Ordnance Survey data.
    - The on street residential analysis was undertaken in parallel with the off street parking analysis to identify vehicles associated with on street parking.
- The distribution analysis uses affluence as one of the key factors driving the uptake of EV chargers in the near term. For the more ambitious scenarios, from mid to late 2020s, the underlying assumption is that EVs will become ubiquitous. Therefore, the growth in demand for EVs in both on street and off street areas, lower and higher affluence areas begins to increase at equivalent rates.

Relevant assumptions from National Grid FES 2020:

Stated assumptions (not numbered in FES 2020 publications)	
Steady Progression	Charging at home is limited by a lack of viable solution for those without off street parking.
System Transformation	Emphasis on public rollout of fast chargers to allow rapid charging. More rapid and fast public charging is demanded from consumers.
Consumer Transformation	Charging predominately happens at home. Emphasis on home chargers, taking advantage of consumer engagement levels in flexibility. Leads to some disruption (e.g. reinforcing local networks)
Leading the Way	Charging happens similarly to how it happens today, with various types receiving investment to support an accelerated uptake of electric vehicles. Accelerated rollout of charging infrastructure at home and in public places.

References:

Department for Transport data, Climate Emergency declaration data, Regen consultation with local stakeholders, Census 2011,

Air conditioning in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Number of domestic air conditioning units.

Data summary for air conditioning uptake in the West Midlands licence area:

Percent of homes (%)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	1.1	2.1	4.1	8.2	16.3	32.2	63.6
System Transformation	1.1	1.9	3.4	6.1	10.9	19.6	35.0
Consumer Transformation	1.1	1.9	3.4	6.1	10.9	19.6	35.0
Leading the Way	1.1	1.1	1.1	1.1	1.1	1.1	1.1

Summary:

- Air conditioning has limited uptake in the UK at present. However, higher extremes of temperatures from heatwaves and warmer summers due to climate change increases demand for air conditioning towards the end of the scenario period.
- There are c. 2,300,000 homes in the West Midlands licence area, projected to increase to c. 2,800,000 by 2050.
- Uptake of air conditioning is likely to be focused in cities and towns such as Birmingham and the surrounding urban areas, not only due to the number of homes but also the higher temperatures from heat island effects

Results:

Baseline

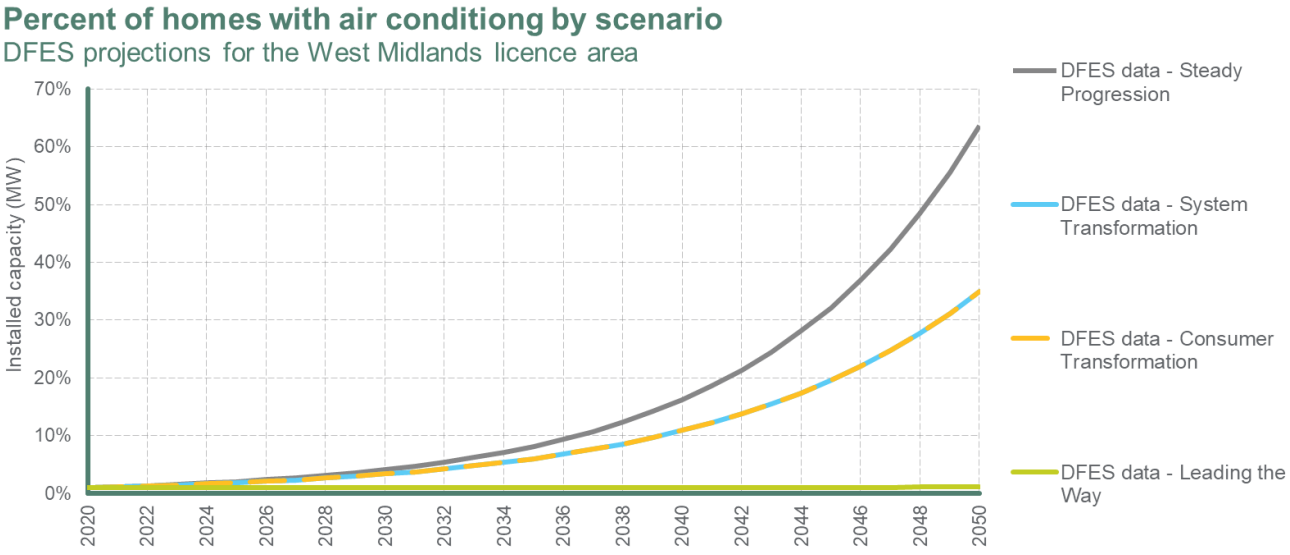
- There is a lack of reliable baseline data for air conditioning installations, although one study estimates that 203,000 air conditioning units were sold in the UK in 2018, up from 153,000 in 2013.[1]
- Due to the lack of data on current installation rates of air conditioning, national data from FES 2020 has been used as a benchmark. According to FES 2020, 1.1% of homes in GB have air conditioning installed in 2019, which equates to 25,000 units in the West Midlands licence area. To create the baseline, FES 2020 data has been distributed pro rata to the licence area based on the number of homes.
- The analysis for this section is limited to domestic air conditioning.

[1] https://www.jraia.or.jp/english/World_AC_Demand.pdf

Projections (2020 – 2050)

- Near and medium term deployment of air conditioning is limited, with under 10% of homes installing air conditioning in all scenarios. This reflects the high upfront cost and the relative lack of demand in the current climate.
- Deployment accelerates after 2035, due to assumed higher extremes of temperatures, as a result of climate change, and some economies of scale, however air conditioning is a mature technology with relatively small cost reductions expected.
- In Steady Progression there are much higher levels of uptake for air conditioning in UK homes, due to higher increasing temperatures and limited regulation to avoid active cooling measures in this scenario.
- From a baseline of 25,000 homes (1.1%) in 2019, 100,000 homes in Steady Progression have air conditioning by 2030, and 1,700,000 by 2050.
- Leading the Way has very little increase in the number of air conditioning units installed as more sustainable means of cooling and improved building design are preferred.
- Consumer Transformation and System Transformation both have medium levels of uptake as society adopts a mix of different actions to maintain comfort levels. In these scenarios 85,000 homes have air conditioning by 2030, and 1,000,000 by 2050.

Figure 12



Reconciliation with National Grid FES 2020:

- The DFES projection results broadly align with the FES 2020 projections at national level. There are no licence area level projections to compare directly against in FES 2020.
- The FES 2020 percent of homes projection was used as a starting point before applying local factors relative to GB, such as:
    - Cooling degree days (number of days that average temperature is below 15.5°C)
    - Population density
    - Affluence
    - Home ownership
- The FES 2020 projects that 63.7% of homes in GB will have air conditioning installed by 2050 in Steady Progression. Although the West Midlands has above average levels of affluence and home ownership, the average population density in the area is less than the GB average which results in a DFES projection that almost matches the FES 2020 (63.6% of homes by 2050).

Factors that will affect deployment at a local level:

- The spatial distribution of air conditioning units in the West Midlands licence area is influenced by factors such as:
    - New developments – new-build regulations aim to improve passive cooling measures e.g. the Future Homes Standard.
    - Affluence – early uptake is heavily influenced by upfront and running cost therefore affluence is a key factor. As deployment becomes more widespread in the long term, affluence becomes less of a factor and uptake is weighted more towards urban areas.
    - Home ownership – homeowners are assumed to be more likely to invest in home improvements.
    - Population density – reflects the impact of heat islands in high density urban areas in the licence area.

Relevant assumptions from National Grid FES 2020:

Assumption number	3.1.2 'Uptake of Residential Air Conditioning'
Steady Progression	Low willingness to change means society takes the easiest route to maintain comfort levels, therefore increased levels of air con.
System Transformation	Medium level of uptake as society takes a mix of actions to maintain comfort levels (mix of aircon, tolerance of higher temperatures, changes to building design)
Consumer Transformation	Medium level of uptake as society takes a mix of actions to maintain comfort levels (mix of aircon, tolerance of higher temperatures, changes to building design)
Leading the Way	Low level of uptake as society changes to minimise uptake (e.g. personal tolerance of higher temperatures, changes to building design)

References:

National Grid FES 2020 data, UK Heat Degree Days data.

Results and assumptions

Generation technologies

Onshore wind in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Onshore wind - including comparison to FES 2020 small scale (< 1 MW) and large scale (≥ 1 MW) data.

Data summary for onshore wind in the West Midlands licence area:

Installed capacity (MW)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	50	50	50	52	58	63	72
System Transformation	50	50	50	55	62	76	80
Consumer Transformation	50	50	66	100	150	194	231
Leading the Way	50	50	52	74	115	141	164

Summary:

- The West Midlands licence area has had low deployment of onshore wind capacity, and there are no projects currently in the pipeline with accepted connection offers.
- There are limited areas of technically developable resource. However, in the medium term there is high capacity growth relative to the baseline under both a Consumer Transformation and Leading the Way scenario.

Results and assumptions:

Baseline

- There are only two sites above 1 MW in the West Midlands licence area: one site at 4 MW capacity, and a single much larger wind farm in Powys, Wales connected at a capacity of 34 MW.
- There are also 12 MW of small scale wind sites in the West Midlands licence areas.

Near term (2020 – 2025)

- There are no sites which have accepted a connection offer in the West Midlands licence area, and under the projections no large scale sites are connected in the near term.

Medium term (2025 – 2035)

- Following an extended period of no onshore wind capacity increase, deployment increases under Leading the Way and Consumer Transformation in the medium term. However, System Transformation and Steady Progression see very low deployment up to 2035.
- Higher deployment in the medium term reflects the results of the resource analysis, which identified developable areas in the West Midlands. Some of these are in Wales, though there are developable areas in England. The two areas are currently subject to different planning regimes which make Welsh sites more likely to go ahead.
- According to stakeholder feedback, a more supportive planning environment for onshore wind would unlock areas in England with good wind resource for development. This is shown in the high deployment scenarios.

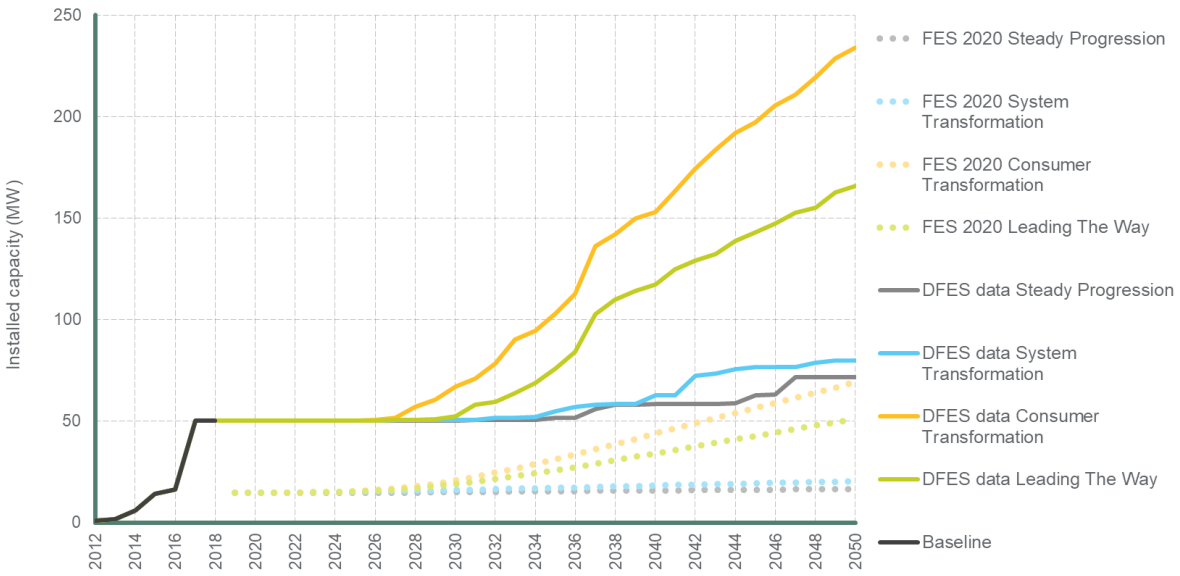
Long term (2035 – 2050)

- Consultation with developers suggests that larger sites with high tip heights and better capacity factors (e.g. the best areas for wind resource) are being targeted for subsidy-free onshore wind deployment. As a result, the sites in the projection period have a larger size than the current average.
- In the long term, some large sites are built out in the West Midlands licence area, taking installed capacity up to 233 MW in 2050 under a Consumer Transformation scenario.
- There are two above 1 MW sites in the baseline which will come to the end of their operational life before 2050 and are expected to repower. An assumption has been made that the scenarios with greater green ambition result in earlier repowering with greater increases in capacity. The project life ranges from 20 to 30 years across the scenarios, with an overall average repowered capacity of 125% of initial capacity in Steady Progression, increasing up to 150% in Consumer Transformation.

Figure 13

Onshore wind capacity by scenario

Comparison to FES 2020 GSP data for the West Midlands licence area



Reconciliation with National Grid FES 2020:

Results in this section relate to the FES 2020 data as reported for Building Block ID numbers Gen_BB015 and Gen_BB016.

- There is a significant difference in baseline capacity in the FES 2020 data and the WPD DFES 2020 data. A single site that is technically sited in Wales but connected to the West Midlands licence area network makes up the difference.
- Though there are no pipeline sites, the resource analysis identifies limited areas of high wind speed, including in Wales which would be valuable for subsidy-free developments. As a result, there is the potential for a higher level of development under the net zero scenarios and the WPD DFES 2020 projections significantly exceed those in FES 2020.

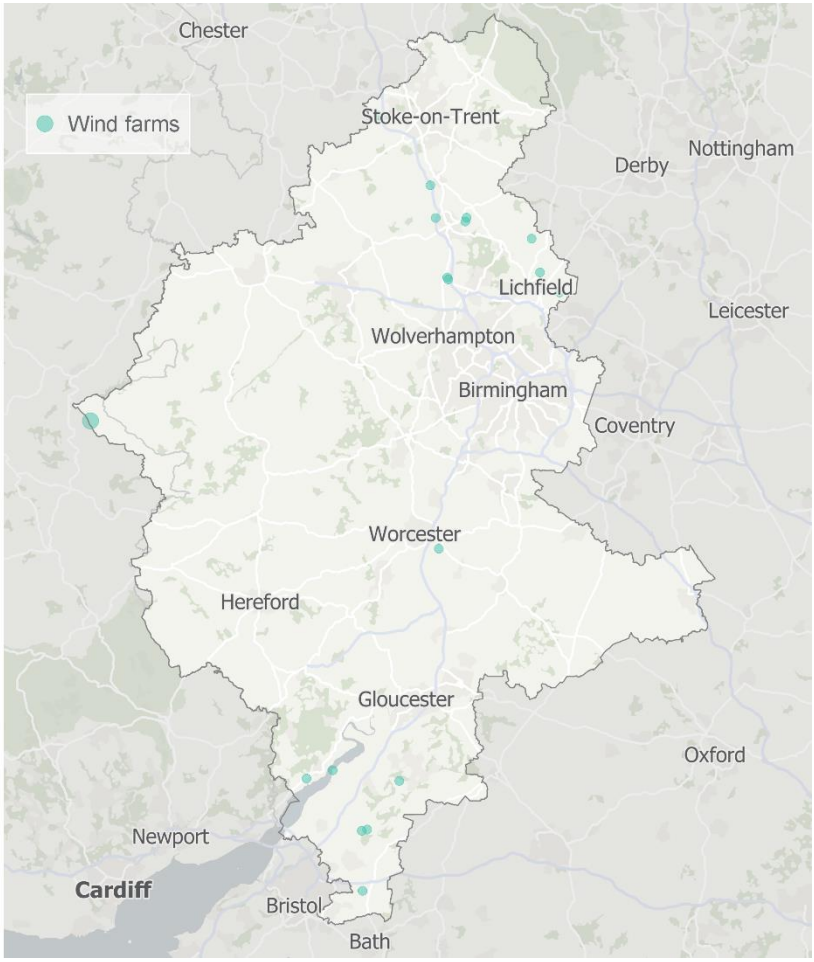
Factors that will affect deployment at a local level:

- The spatial distribution of new onshore wind sites in the medium and long term is weighted towards the results of the resource analysis, incorporating areas of high wind speed among other local factors including:
    - Areas close to the existing electricity network outside of environmental designations such as AONBs or National Parks and excluding areas of housing.
    - Areas with significant wind speed
    - Planning permission records for the local authority
- Local policies identified are included as positive weightings within the spatial distribution, for example policy PD7 in the Derbyshire Dales District supporting renewable energy planning and development, and South Northamptonshire has commenced work on a renewable strategy for their area.

Figure 14

Onshore wind sites in the West Midlands licence area

Showing baseline sites only as there are no sites in the pipeline in this licence area. The largest site is 34 MW and is sited in Powys, Wales.



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Relevant assumptions from National Grid FES 2020:

Assumption number	4.1.3
Steady Progression	Slower pace of decarbonisation.
System Transformation	Focus on renewables but limited by societal preference for offshore turbines (less impact on land use and visibility)
Consumer Transformation	Strong support for onshore wind across all networks. Some of these projects may be in community ownership.
Leading the Way	High growth driven by the decarbonisation agenda and high demands from hydrogen production from electrolysis.

Stakeholder feedback from the consultation events:

Your comments to us	Our response
Theme: onshore wind	
You told us that developers will seek to develop projects on a subsidy-free basis, rather than be limited by a lack of a CfD. However, national policy has also been a critical factor in the deployment of wind so far. Your responses also indicated that onshore wind deployment may begin to pick up in the early 2020s.	The impact and scale of government subsidy varies by scenario. We will ensure that even in scenarios without government subsidy, subsidy-free deployment is still included. This modelling will include onshore wind deployment picking up in the early 2020s.
The majority of respondents thought that subsidy-free business models would lead to some very large sites being developed, elsewise only smaller-scale community energy sites would be developed.	Our modelling includes analysis of wind farms at different scales, we will focus projected deployment on large-scale sites and then only smaller-scale sites.

References:

WPD connection offer data, System Wide Resource Registers (GB), the TEC register, the Renewable Energy Planning Database, Climate Emergency declaration data, Regen consultation with local stakeholders and discussion with developers.

Solar generation in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Ground mounted solar PV - solar generation sites of installed capacity of 1 MW and above.

Data summary for ground mounted solar PV in the West Midlands licence area:

Installed capacity (MW)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	449	509	548	797	946	1,113	1,144
System Transformation	449	547	909	1,322	1,563	1,795	2,029
Consumer Transformation	449	547	909	1,322	1,563	1,795	2,029
Leading the Way	449	791	1,405	1,775	2,093	2,462	2,725

Summary:

- The West Midlands licence area has the lowest amount of ground mounted solar PV installed of the four WPD licence areas. In comparison to other regions of the country, development came to the area relatively late.
- Pipeline analysis suggests that there is now a strong pipeline of over 1 GW of projects which could lead to a rapid increase in installed solar capacity.

Results and assumptions:

Baseline

- The West Midlands has slightly lower levels of solar irradiance than the GB average and has smallest installed level of ground mounted solar PV of the four WPD licence areas at around 450 MW.
- Just two relatively small MW scale projects have connected since 1st January 2019, an additional 1.4 MW in total.

Near term (2020 – 2025)

- Since 2018, a pipeline of ground mounted solar PV projects has secured network connections across the UK as technology costs have fallen and interest from investors in 'subsidy-free' business models has grown. These projects are typically 50 MW scale.
- The West Midlands has a large pipeline of projects that have accepted network connections totalling over 1 GW capacity, although only two projects had secured planning permission at the time of the WPD DFES 2020 analysis.
- Engagement with stakeholders indicates the COVID-19 pandemic has delayed these projects being built. Developers and investors currently expect the projects in the pipeline to begin to be built in 2022. The speed at which the pipeline is built out is the key assumption in the scenarios.

Medium term (2025 – 2035)

- The strong pipeline of projects shows the West Midlands licence area is now attractive to ground mounted solar PV developers due to the availability of network connections.
- In all the net zero scenarios the pipeline of projects will be built out by 2030 leading to a tripling of the installed capacity.
- In a Steady Progression scenario most of the current pipeline of projects would not be built as the investment case for ground mounted solar PV remains challenging.

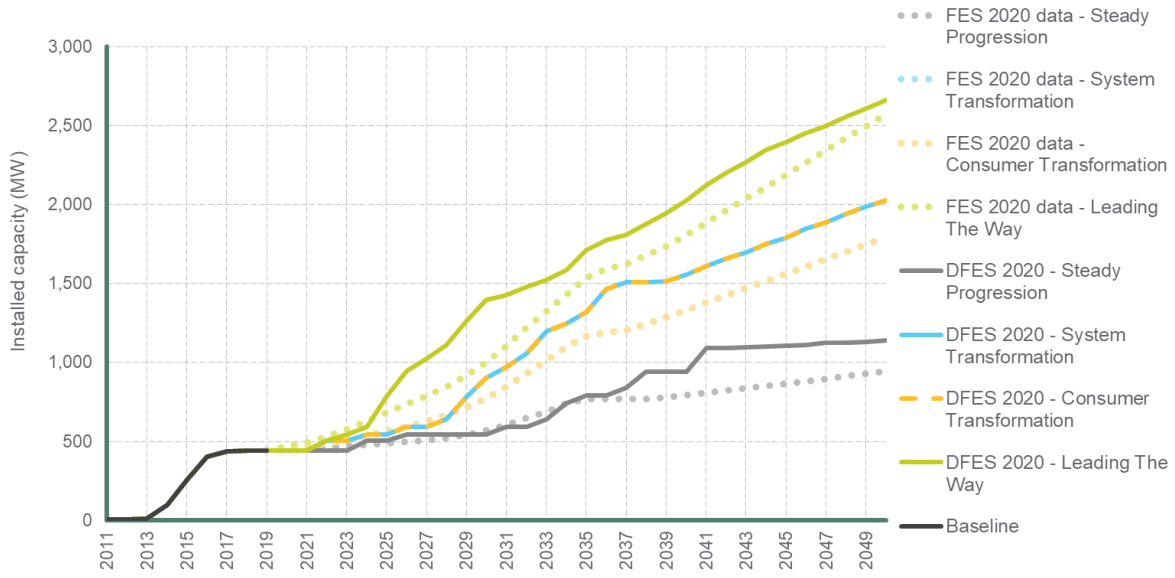
Long term (2035 – 2050)

- The continued development of ground mounted solar PV could be limited by the relatively low demand for power during summer daytime.
- Price cannibalisation during peak solar periods as the amount of solar installed increases is a key concern for investors looking at merchant projects with no guaranteed price for the power generated. Co-location with storage or using surplus power to produce hydrogen may be required to overcome this.
- The Leading the Way scenario shows over 2.5 GW of ground mounted solar PV installed in the West Midlands licence area as this technology becomes a key part of the UK's energy mix.

Figure 15

Ground mounted solar PV capacity by scenario

Comparison to FES 2020 GSP data for the West Midlands licence area



Reconciliation with National Grid FES 2020:

Results in this section relate to the FES 2020 data as reported for Building Block ID number Gen_BB012, Solar Generation - Large (G99).

- Stakeholder feedback indicates the COVID-19 pandemic will delay the point at which investors are comfortable to make final investment decisions to build ground mounted solar PV projects in West Midlands. WPD DFES 2020, therefore, shows the first new projects being energised later than FES 2020 GSP data.
- There is more ground mounted solar PV in WPD DFES 2020 in this licence area than FES 2020 due to the strong pipeline of projects where developers have obtained network connections.

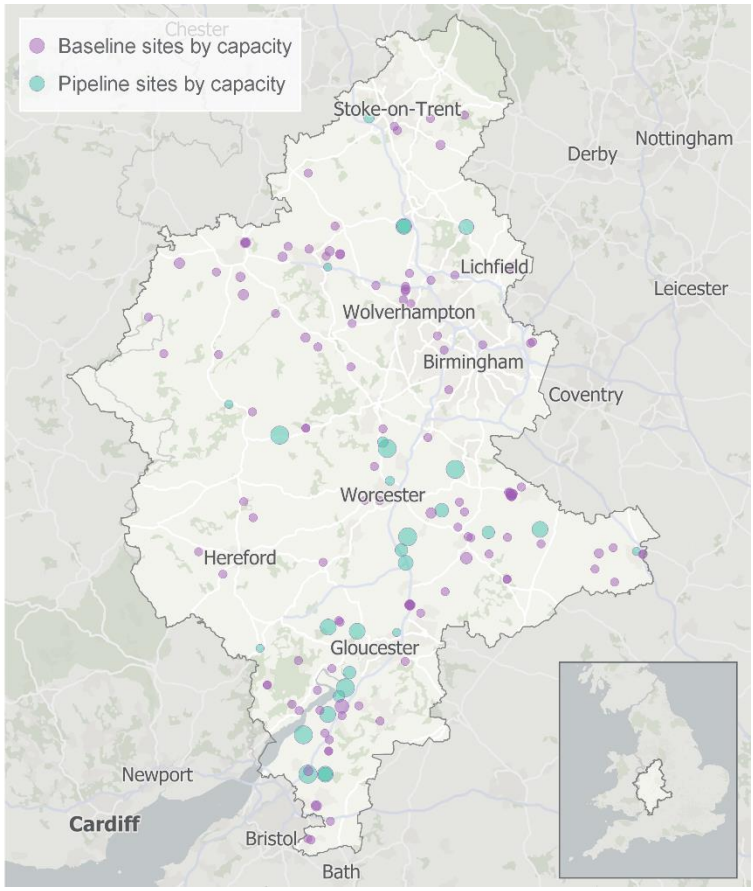
Factors that will affect deployment at a local level:

- The spatial distribution of new ground mounted solar PV in the West Midlands licence area out to 2030 is based on the location of projects in the pipeline with an accepted network connection offer. This shows a similar distribution to the current baseline sites which are located close to the high voltage electricity network.
- The other local factors that are used to develop these scenarios are:
    - Areas close to the existing electricity network outside of environmental designations such as AONBs or National Parks
    - Solar irradiance
    - Planning permission records for the local authority
    - Renewable energy strategies as raised during the consultation events
- 42 out of the 44 local authorities in the West Midlands licence area have declared a climate emergency. Local policies raised during the stakeholder consultation are included as weightings within the spatial distribution, including the West Midlands Regional Energy Strategy.

Figure 16

Ground mounted solar sites in the West Midlands licence area

Baseline and pipeline sites. The relatively large size of the pipeline sites can be seen, compared to the baseline average.



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Relevant assumptions from National Grid FES 2020:

Assumption number	4.2.15
Steady Progression	Slower pace of decarbonisation.
System Transformation	Transition to net zero results in strong deployment of large solar.
Consumer Transformation	Transition to net zero results in strong deployment of large solar.
Leading the Way	Very high ambition to decarbonise drives a focus on technologies that are low carbon. Supports production of hydrogen by electrolysis.

Stakeholder feedback from the consultation events:

Your comments to us	Our response
Theme: solar PV	
You suggested that solar farm deployment would begin to increase again in the early 2020s, from 2022 onwards.	We will incorporate this trajectory into our models. There are many projects with accepted connection offers which could potentially be sites of development in the early 2020s.
You said that there is high potential for solar farm deployment, which could deploy at a high rate in the medium to long term.	

References:

WPD connection offer data, System Wide Resource Registers (GB), the TEC register, the Renewable Energy Planning Database, Climate Emergency declaration data, Regen consultation with local stakeholders and discussion with solar developers.

Solar generation in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Small scale solar generation - commercial rooftop installations up to 1 MW, and domestic solar PV installations below 1 MW.

Data summary for solar generation in the West Midlands licence area:

Installed capacity (MW)	2020	2025	2030	2035	2040	2045	2050
Steady Progression	453	497	574	678	789	903	1,023
System Transformation	453	563	846	1,152	1,437	1,681	1,877
Consumer Transformation	453	703	1,289	1,956	2,627	3,261	3,837
Leading the Way	453	577	886	1,242	1,557	1,841	2,084

Summary:

- There is currently 453 MW of small scale solar PV in the West Midlands, 64% of installations are at the domestic scale with an average capacity of 3.3 kW.
- Over one-in-four homes in West Midlands host rooftop solar PV by 2050 in Consumer Transformation, the highest capacity growth scenario. This is alongside widespread adoption of electric cars and electric domestic heating provided by heat pumps.

Results and Assumptions:

Baseline

- The West Midlands licence area currently has 70,000 domestic solar PV installations, representing 2.9% of homes.
- 5,000 commercial properties currently have a solar PV array, with an average capacity of 45 kW.
- The vast majority of existing capacity has been commissioned since 2011 in line with government support via the feed-in-tariff, with deployment slowing significantly since 2015 following a reduction in the subsidy rate.

Near term (2020 – 2025)

- There is very low deployment in the early-2020s due to the challenging business case for smaller scale solar, as well as construction delays due to COVID-19 This reflects stakeholder feedback.
- There is a pipeline of 59 commercial solar sites totalling 7 MW that have accepted a grid connection offer, which are assumed to connect between 2021 and 2023.
- New build homes are modelled separately. Stakeholder feedback from the consultation events suggested that the current rate of rooftop solar PV deployment on new domestic development is between 5% - 10% which provided the baseline in the modelling.

Medium term (2025 – 2035)

- Capacity growth is projected to accelerate from 2025 in the net zero scenarios as the cost of solar panels continue to decrease. This is combined with increasing financial viability due a combination of the Smart Export Guarantee, uptake of electric vehicles, domestic batteries and heat pumps. The highest level of deployment is under Consumer Transformation, with high consumer engagement leading to significant uptake of electric vehicles and heat pumps.
- The installed capacity of small scale solar increases to just under 2 GW by 2035 in Consumer Transformation and to under 700 MW in Steady Progression.

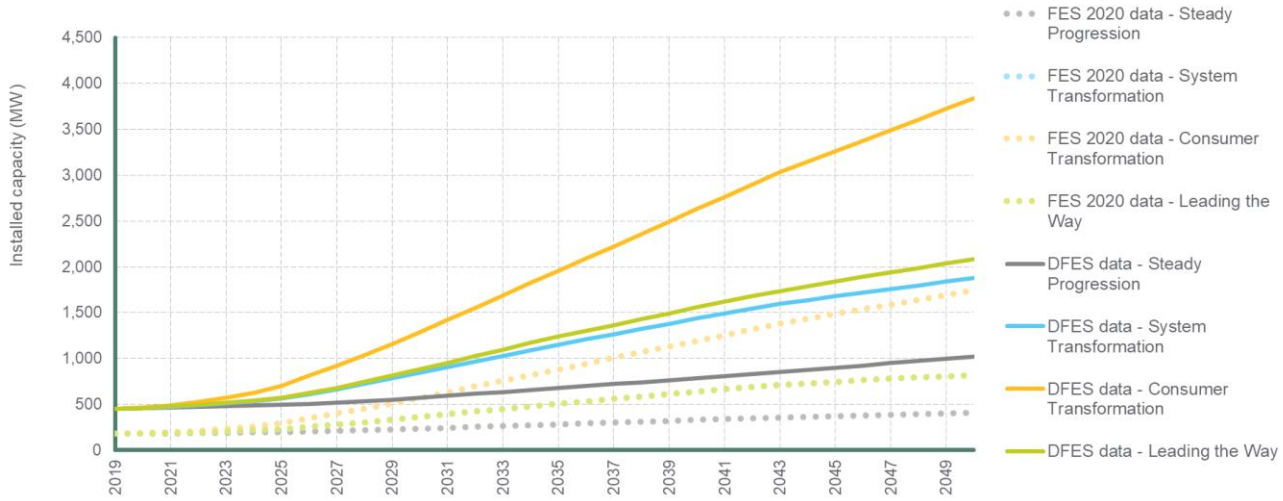
Long term (2035 – 2050)

- The continued growth of small scale solar PV capacity begins to slow in the long term as the most suitable homes and commercial properties are already fitted with solar PV.
- Over a quarter of homes have rooftop PV by 2050 in Consumer Transformation, and almost a sixth in Leading the Way.
- Three quarters of new-build homes are being fitted with rooftop PV in 2050 in Consumer Transformation and Leading the Way, and around half in System Transformation and Steady Progression. The spatial distribution of new homes with solar PV is based on data from the local plans and new developments in the West Midlands licence area.
- The number of commercial properties with PV installed goes up from 5,000 in 2020 to 31,000 in Consumer Transformation, 15,000 in Leading the Way and System Transformation, and 9,000 in Steady Progression by 2050.

Figure 17

Solar (sub 1 MW) capacity by scenario

Comparison to FES 2020 GSP data for the West Midlands licence area



Reconciliation with National Grid FES 2020:

Results in this section relate to the FES 2020 data as reported for the Building Block ID number Gen_BB013.

- Regen has used the FES 2020 GSP data as well as Feed-In-Tariff data, WPD's connections data, and stakeholder feedback. All of these factors result in a WPD DFES 2020 trajectory that is above the FES 2020 projections.
- WPD connections data and Feed-In-Tariff data identifies a significantly higher baseline capacity than the FES 2020 baseline for the West Midlands licence area. This impacts the projections and contributes to the WPD DFES 2020 being higher than FES 2020 in all scenarios.
- The West Midlands licence area has slightly above average levels of affluence (23.3% in social grade A and B compared to 20.3% in GB) and home ownership (67.1% compared to 64.3% in GB). The WPD DFES 2020 projections are higher than the FES 2020, with a total of 3.8 GW in 2050 in the Consumer Transformation scenario.
- The area also has the largest number of commercial properties (c. 200,000) in WPD's four network areas which means there is high potential for growth in commercial rooftop solar PV capacity.

Factors that will affect deployment at a local level:

- The spatial distribution of new small scale solar PV in the West Midlands licence area has been divided into domestic scale solar PV (<10 kW) and commercial scale (10 kW – 1 MW).
- Domestic uptake is mainly influenced by factors such as affluence, home ownership, and social housing. In the early years, uptake is weighted towards affluent areas and social housing where solar is installed by housing associations and becomes more spread across all affluence levels towards 2050, especially in Leading the Way and Consumer Transformation.
- Approximately 500,000 new homes are projected to be built in the West Midlands licence area between now and 2050. In Consumer Transformation, new build homes have a total of 600 MW of rooftop solar capacity installed, a quarter of the total domestic projection. Areas such as Birmingham, Sandwell and Stoke-on-Trent have particularly high numbers of new builds with rooftop PV installed.

Relevant assumptions from National Grid FES 2020:

Assumption number	4.1.5 'Solar generation (plant smaller than 1 MW)'
Steady Progression	Slower pace of decarbonisation.
System Transformation	Transition to net zero results in strong growth in small solar. Supports production of hydrogen by electrolysis.
Consumer Transformation	Very high growth in small solar as it supports the transition to net zero and is highly aligned to the high societal change.
Leading the Way	Transition to net zero results in strong growth in small solar. Supports production of hydrogen by electrolysis. Growth limited by overall lower annual demands than Consumer Transformation.

References:

WPD connection offer data, Feed-In-Tariff data, Climate Emergency declaration data, Regen consultation with local stakeholders and discussion with local authorities and businesses.

Hydropower in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Hydropower - including comparison to FES 2020 small scale (< 1 MW) and large scale (≥ 1 MW) data.

Data summary for hydropower in the West Midlands licence area:

Installed capacity (MW)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	0.8	0.8	0.8	0.8	0.8	0.8	0.8
System Transformation	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Consumer Transformation	0.8	0.8	0.8	1.0	1.1	1.1	1.1
Leading the Way	0.8	0.8	0.8	1.0	1.1	1.1	1.1

Summary:

- The West Midlands has the lowest level of hydropower generation of the WPD licence areas, with just 0.76 MW currently installed.
- There are very low levels of deployment projected, with deployment focussed only on small scale sites, rising to a maximum of 1.22 MW.

Results and assumptions:

Baseline

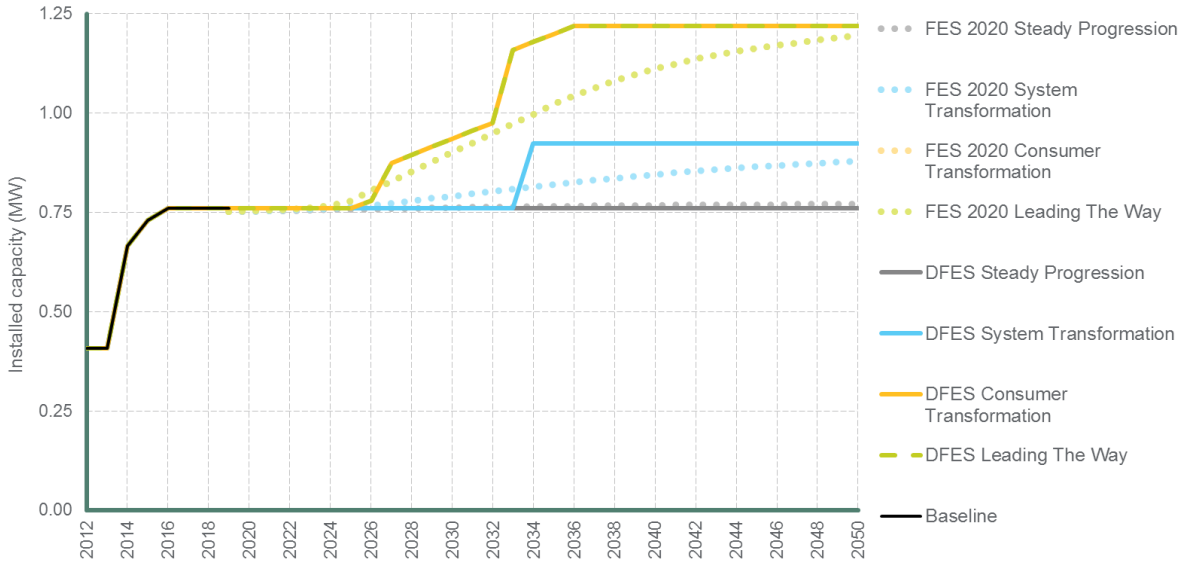
- The baseline capacity is composed entirely from small scale sites, the largest being a 236 kW project in Wychavon.

Projections

- There are two microgeneration schemes that have accepted a connection offer which may connect in the medium term at a combined capacity of 0.24 MW.
- Reflecting feedback from developers and the local topology, rain cover and lack of pipeline sites, the deployment of small sites is limited in the projections overall, and no large scale sites are connected.

Figure 18

Hydropower capacity by scenario
Comparison to FES 2020 GSP data for the West Midlands licence area



Reconciliation with National Grid FES 2020:

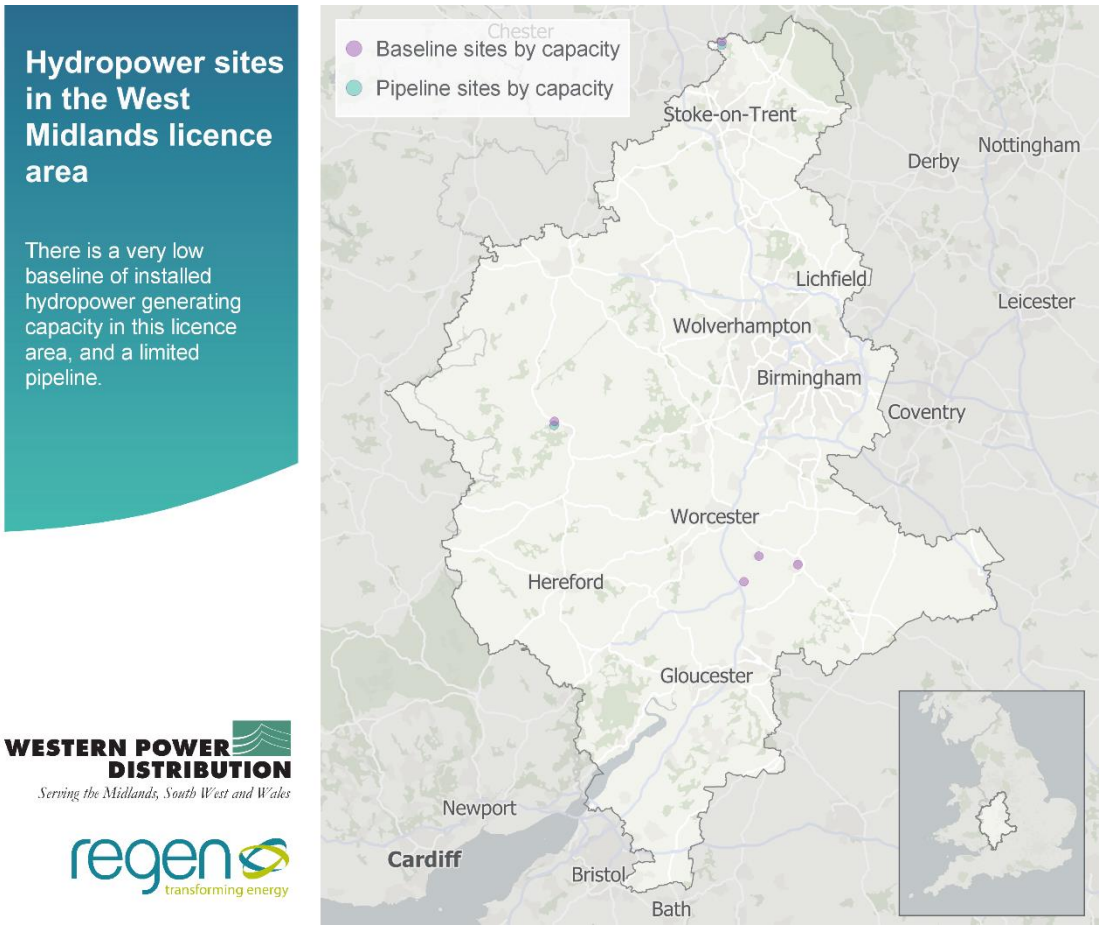
Results in this section relate to the FES 2020 data as reported for Building Block ID number Gen_BB018.

- The WPD DFES 2020 results are in line with the FES 2020 projections for hydropower in this licence area. Two microgeneration sites connect in the medium term under Consumer Transformation and Leading the Way, with some additional capacity connecting in the long term. A single pipeline site connects in a System Transformation scenario.

Factors that will affect deployment at a local level:

- The distribution of new hydropower sites is based on the location of water features and barriers which could potentially host a hydropower site, as well as the pipeline sites situated in Herefordshire and Congleton.

Figure 19



Relevant assumptions from National Grid FES 2020:

Assumption number	4.1.1
Steady Progression	High costs associated with large scale projects. Little ambition or support
System Transformation	High costs associated with large scale projects. Some support is forthcoming for large scale projects, limited societal change from large scale remote generation
Consumer Transformation	Potential for a lot of small scale projects that will have larger societal impact
Leading the Way	Potential for rapid deployment of large and small scale projects; society is more in favour of disruptive projects. Limited by the reduction in energy demand

References:

WPD connection offer data, System Wide Resource Registers (GB), the Renewable Energy Planning Database, the Environment Agency, Regen consultation with local stakeholders and discussion with developers.

Renewable engines (landfill, sewage, biogas) in the West Midlands licence area

Summary of modelling assumptions and results for anaerobic digestion.

Technology specification:

Anaerobic digestion (AD) installed capacity used for electricity generation only. This is the 'biogas' component of the building block technology "Renewable engines (landfill, sewage, biogas)".

Data summary for anaerobic digestion in the West Midlands licence area:

Installed capacity (MW)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	49	56	67	79	90	97	103
System Transformation	49	58	79	101	115	124	133
Consumer Transformation	49	61	89	123	142	152	163
Leading the Way	49	62	91	129	156	169	183

Summary:

- The West Midlands licence area has 49 MW of AD capacity. It has 7.2% of the GB installed capacity in 2019 according to FES 2020.
- Further deployment of AD plants in the West Midlands requires sufficient local feedstock either from agricultural or food waste. The licence area has one pipeline AD site which is expected to connect between 2021 and 2023, however with only 30% of local authorities collecting food waste, along with good agricultural resource, there is good potential for future growth in capacity.
- To note that additional AD capacity would also be expected in the licence area that produce biomethane for use in transport or injection into the gas network rather than burnt for electrical capacity. This additional capacity is not covered in this analysis.

Results and Assumptions:

Baseline

- There are 45 sites in the baseline with an average capacity of 1.1 MW. The West Midlands saw the majority of the electrical AD capacity connect between 2010 and 2015 where projects benefitted from government subsidies.
- Only 2 MW of capacity has connected in the last five years reflecting the difficulty of developing a business case for AD without subsidy.

Near term

- The pipeline site was accepted in 2019 and is expected to go ahead in all scenarios between 2021 and 2023.

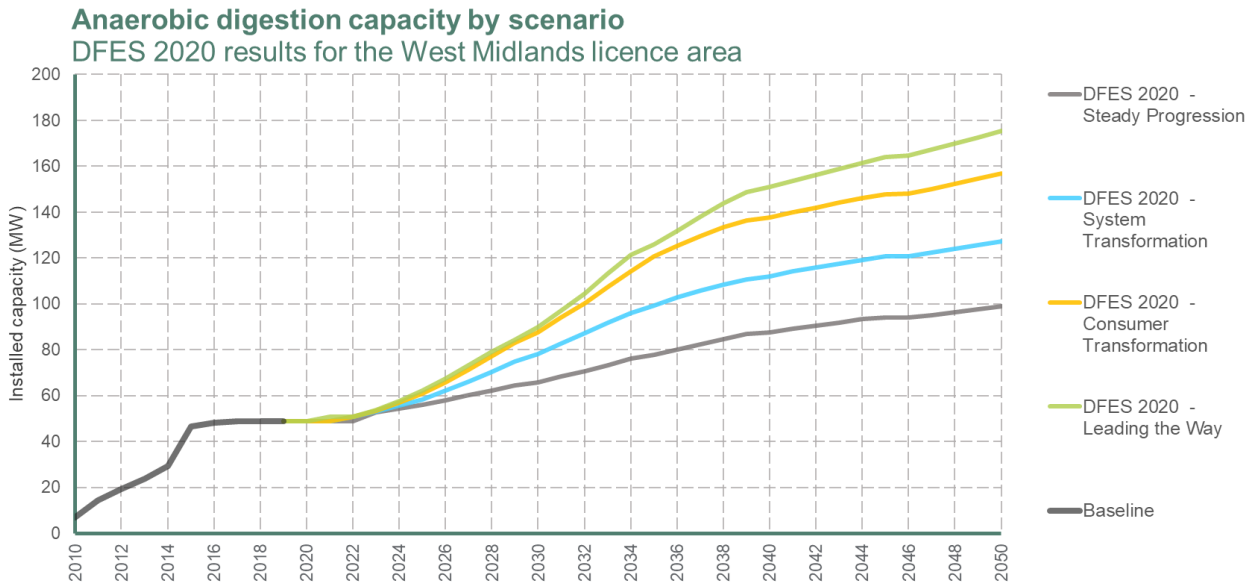
Medium term

- In the medium term, capacity growth in AD is expected to be driven by English local authorities requiring additional food waste processing facilities. It is anticipated that all local authorities start collecting food waste in the mid-2020s, as indicated in the latest Environment Bill.

Long term

- Further growth in AD capacity will be driven by cost reductions in the technology potentially through modularisation, and high revenues that could be captured from AD plants providing flexible electricity supply and balancing services to networks. This would include capturing high electricity prices expected in periods of low renewable generation or high demand.
- However, capacity growth is expected to be lower long term as burning biomethane for electricity generation is likely to be competing with higher demand for biomethane for zero carbon heat or transport. This could lead to a reduction in electrical capacity deployment as the government look to incentivise a switch to 'green gas'.
- In addition, it is assumed that the food waste produced per person will decrease towards 2050 meaning there may be less available for AD processing.

Figure 20



Factors that will affect deployment at a local level:

All deployment of sites out to 2023 is based on the existing pipeline sites with an accepted grid connection offer. Outside of the pipeline projects, local factors have been used to weight deployment from 2023 onwards, such as:

- Areas with high numbers of cattle (a key feedstock for farm based AD)
- Agricultural land grades 1 & 2 as a proportion of UK average
- Local Authority food waste collection potential

Summary of modelling assumptions and results for landfill gas.

Technology specification:

Landfill gas installed capacity used for electricity generation only.

Data summary for landfill gas in the West Midlands licence area:

Installed capacity (MW)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	81	81	81	81	81	81	81
System Transformation	81	81	81	81	80	78	70
Consumer Transformation	81	81	81	81	80	78	70
Leading the Way	81	81	81	80	78	70	25

Summary:

- Landfill gas capacity is expected to decline over time in all scenarios as residual waste is either burnt or gasified, as opposed to buried.
- This is brought about by the decommissioning of baseline sites with scenario specific assumptions made about the site lifetime.

Results and Assumptions:

Baseline

- There are 54 sites connected to the distribution network in West Midlands totalling 81 MW.
- 17 of the 54 sites are above 2 MW in size, with the largest being a 5.4 MW landfill site in Coleford, Gloucestershire.

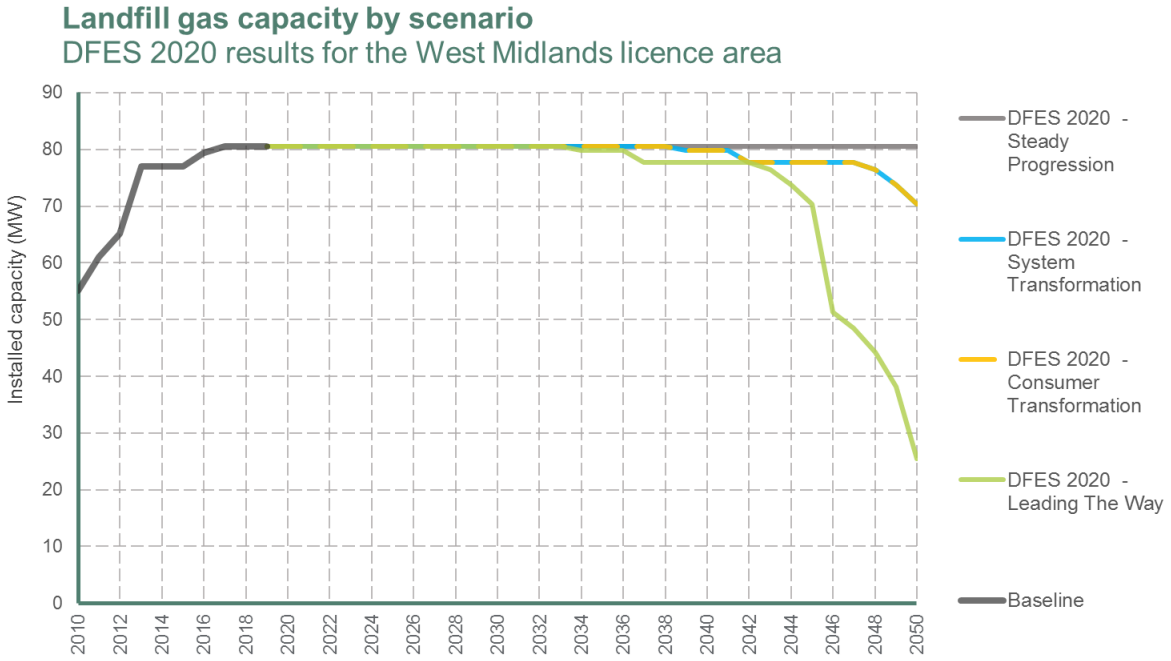
Near term

- There is no change projected in the output capacity or connections in the near term to 2030.

Medium and long term

- Older sites begin to decommission by 2040 as sites have no additional waste due to high landfill taxation. There is also declining waste availability per person and competition with other technologies such as ACT.
- To ensure DFES captures the near term worst case conditions on the distribution network within the scenarios, sites have been modelled as staying online, even if it is projected that under the net zero scenarios they may cease operation or see running hours may significantly reduce.
- After 2030 in Leading the Way there is a reduction in capacity reflecting the declining waste availability per person and competition with other waste processing technologies. Sites going offline in Consumer Transformation and System Transformation are assumed to face at least a 45 year delay on the connection agreement date. To ensure the worst case conditions on the distribution network are modelled, all existing sites with connection agreements stay online in Steady Progression out to 2050.
- Sites may also switch to biomethane injection into the gas network or exported for transport as the market for biomethane continues to expand.
- Sites that have connected more recently (in the last decade) have decommissioning rates matched to the declining export capacity assumed in FES 2020.
- While modelling credible pathways to net zero, the DFES must also capture the near term worst case conditions that the distribution network could see, which is important for strategic investment modelling. While National Grid ESO may discount generators without a supply contract, WPD DFES includes all generators with valid connection agreements regardless of absent supply contracts, this may lead to some discrepancies in the baseline totals.

Figure 21



Summary of modelling assumptions and results for sewage gas.

Technology specification:

Sewage gas installed capacity used for electricity generation only.

Data summary for sewage gas in the West Midlands licence area:

Installed capacity (MW)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	7	7	12	17	17	17	17
System Transformation	7	7	17	17	17	17	17
Consumer Transformation	7	7	17	17	17	17	17
Leading the Way	7	9	17	17	17	17	17

Summary:

- The scenario projections for sewage gas are relatively stable out to 2050 at a GB level in FES 2020.
- At a local level, there are currently no pipeline sites in the West Midlands, and low levels of deployment are projected in the near term.
- New deployment is projected in the medium term in all scenarios, however resource availability limits new deployment in the long term.

Results and Assumptions:

Baseline

- There are ten sites connected to the distribution network in the West Midlands totalling 7 MW.

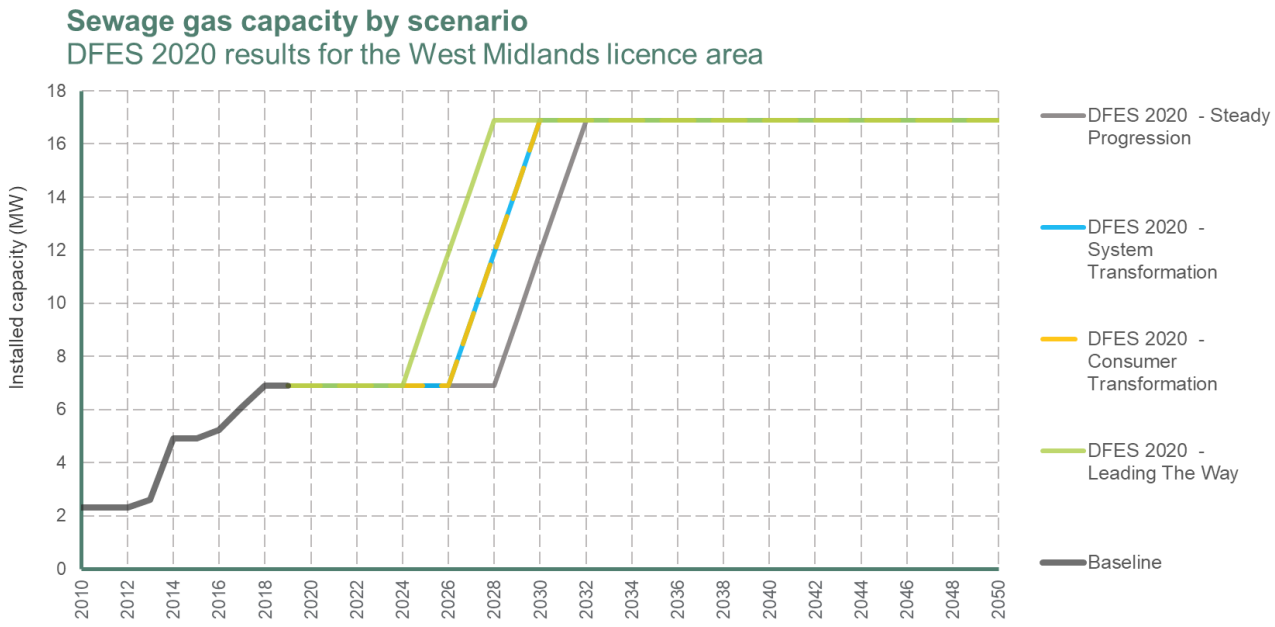
Near term (2020 – 2025)

- There is no change projected in the output capacity or connections out to 2030.

Medium to long term (2025 – 2050)

- Population calculations suggest that the maximum potential resource for sewage gas used for electricity generation in the West Midlands is c.30 MW.
- An additional four sites (10 MW in total) to process sewage gas and generate electricity have projected to connect in all scenarios between 2025 and 2032.
- In the long-term a key uncertainty is that existing and new sites may convert to biomethane injection to the gas network rather than generating electricity. Details on this assumption and uncertainty have not been included in FES 2020.

Figure 22



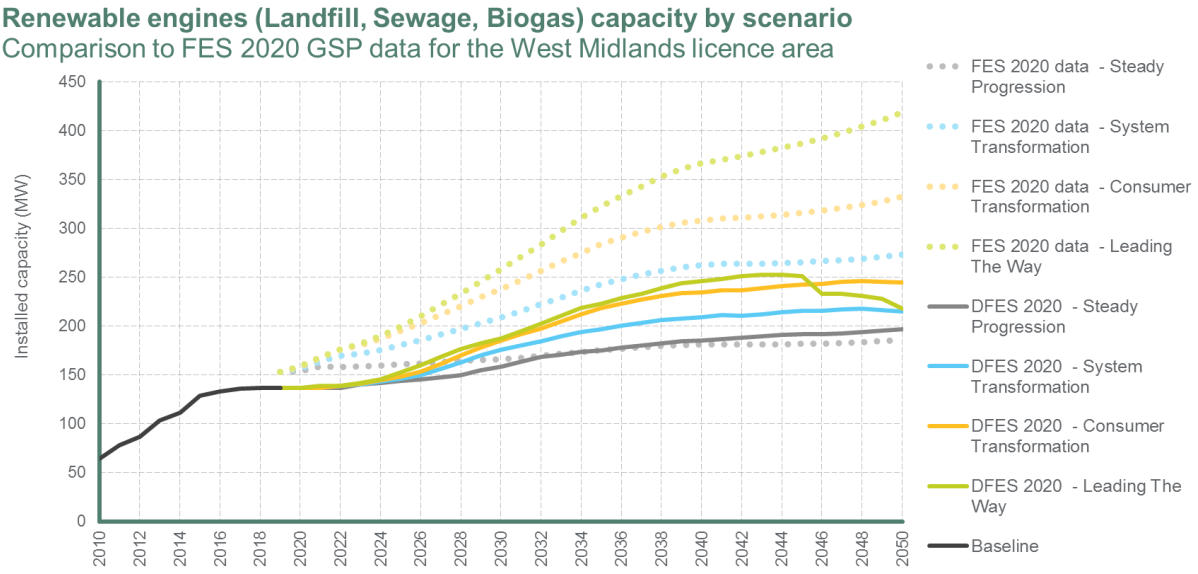
Summary of anaerobic digestion, landfill gas and sewage gas compared to the FES 2020 'Renewable engines (landfill, sewage, biogas)' building block technology

Reconciliation with National Grid FES 2020:

Results in this section relate to the FES 2020 data as reported for Building Block ID number Gen_BB004.

- The capacity growth in renewable engines comes primarily from anaerobic digestion as landfill gas capacity decreases over time and only 10 MW of sewage gas is added in all scenarios to 2050.
- The scenarios to 2050 are lower than FES 2020. Calculations of the estimated long term maximum capacity of renewable engines is based on 2050 population and assumptions about declining levels of waste production which impact the feedstocks available. Additional capacity is however expected in sites which focus on biomethane injection rather than electrical capacity, this additional capacity is assumed to be reflected in FES 2020 projections. However, the capacity is not included in this analysis.

Figure 23



Relevant assumptions from National Grid FES 2020:

Assumption number	1.1.5 Support: Incentive regime for biomethane (and other 'green gas') production.
Steady Progression	Support is focused on areas with greater potential volumes (UKCS/shale).
System Transformation	Bigger push for renewable gas as required to meet longer term decarbonisation targets.
Consumer Transformation	Bigger push for renewable gas as required to meet longer term decarbonisation targets.
Leading the Way	All sources of renewable fuels encouraged and biomethane used in niche areas in transport/industry.

References:

WPD connection offer data, Local Authority food waste collection status, UK cattle statistics, Land grade statistics, Climate Emergency declaration data, Regen consultation with local stakeholders and discussion with developers.

Biomass in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Biomass generation – including biomass for power generation and biomass CHP. Excludes biomass used solely for heat, and bioenergy with carbon capture and storage.

Data summary for biomass power (including CHP) in the West Midlands licence area:

Installed capacity (MW)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	17	18	18	18	18	18	18
System Transformation	17	18	18	18	18	24	25
Consumer Transformation	17	17	17	17	31	32	38
Leading the Way	17	17	17	17	30	32	34

Summary:

- New biomass power capacity is assumed to only connect in a Steady Progression scenario.
- In all scenarios there are significant capacity reductions as the existing sites come offline and are not replaced.
- In the net zero scenarios, sustainable biomass is assumed to be prioritised for use in sectors that are harder to decarbonise, or for use in power generation with carbon capture and storage.

Assumptions and results:

Baseline

- The West Midlands licence area has low levels of biomass power deployment when compared to the other WPD licence areas, made up from a higher number of smaller scale sites than the WPD average. There is 17 MW of biomass power capacity, made up from 18 sites.

Near term (2020 – 2025)

- There are no sites with a connection offer accepted in the West Midlands licence area, however there is a 1 MW site with planning permission which is projected to connected under Steady Progression only.

Medium term (2025 – 2035)

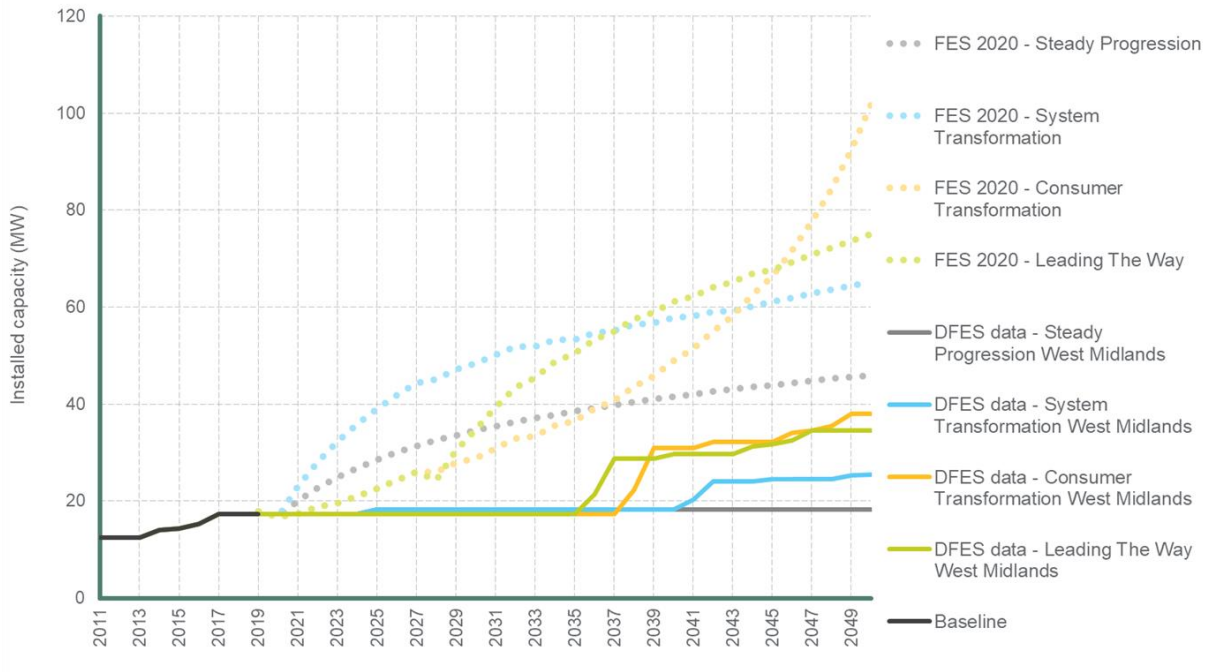
- The WPD DFES 2020 projections are based on an assessment of the age of biomass power generation sites, reflecting assumptions about the lifespan and competing uses for biomass feedstocks.
- Biomass with carbon capture and storage is deployed in the medium term onwards, however this is assumed to connect only at transmission level as the high costs of carbon capture at smaller scale have more impact on the viability of biomass power plants operating without subsidy.

Long term (2035 – 2050)

- Sustainable biomass feedstock is prioritised for non-energy uses and large scale biomass with carbon capture in the medium term onwards, leading to limited increase in generating capacity in the WPD DFES results.
- It is assumed that there is no biomass with carbon capture and storage used in power generation at the distribution level, instead these sites are installed at much larger capacities at the transmission level from the late 2020s and 2030s onwards.
- To ensure DFES captures the near term worst case conditions on the distribution network within the scenarios, sites have been modelled as staying online, even if it is projected that under the net zero scenarios they may cease operation or see running hours may significantly reduce.

Figure 24

Installed biomass power capacity in WPD DFES 2020
Comparison to FES GSP data for the West Midlands licence area



Reconciliation with National Grid FES 2020:

- As analysis suggests that there are no pipeline projects ready to deploy in the near term, the WPD DFES projections are much lower than the FES 2020 projections.
- In the medium and long term, the WPD DFES 2020 projections are well below the FES 2020 projections at distribution level, reflecting the assumption that as plants reach the end of their operational life they come offline, with a preference by scenario in the long term for larger scale biomass with carbon capture at transmission level.
- The limited number of sites in the baseline mean that there are larger 'step' changes in the WPD DFES projections as single sites connect or reach the end of their operational life, than compared to the FES 2020 projection.

Relevant assumptions from National Grid FES 2020:

Assumption number	4.1.13
Steady Progression	Limited support for biomass due to less of a drive to decarbonise and lack of CCUS. Some growth in decentralised biomass without CCUS.
System Transformation	Uptake in biomass generation linked to CCUS driven by the decarbonisation agenda.
Consumer Transformation	Uptake in biomass generation linked to CCUS driven by the decarbonisation agenda.
Leading the Way	High growth driven by the decarbonisation agenda. Linked to CCUS as this results in negative emissions.

References:

WPD connection offer data, Committee on Climate Change, the Renewable Energy Planning Database, Regen consultation with local stakeholders and discussion with developers.

Waste (incineration) in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Energy from Waste (EfW) technologies including incineration and Advanced Conversion Technologies (ACT).

Data summary for waste (incinceration) in the West Midlands licence area:

Installed capacity (MW)	2020	2025	2030	2035	2040	2045	2050
Steady Progression	279	404	404	404	404	404	404
System Transformation	279	379	344	303	303	267	194
Consumer Transformation	279	379	379	379	370	328	303
Leading the Way	279	379	344	303	303	267	194

Summary:

- The carbon emissions from unabated EfW incineration plants are not consistent with a net zero goal. As a result, it is assumed in the scenarios that EfW capacity reduces after 2030 as older EfW facilities reach the end of their lifetime and the capacity is not replaced.
- Advanced conversion technology (ACT) gasification plants are expected to have lower associated carbon emissions and are part of a net zero 2050 scenario assuming that residual emissions are abated. All ACT sites on WPD's network connected in the last decade and do not disconnect before 2050.

Results:

Baseline

- There are 18 EfW sites in the baseline totalling 279 MW, which is the highest baseline of WPD's four licence areas.
- There are three large sites between 30 - 40 MW capacity in Birmingham, Stafford and Oldbury.

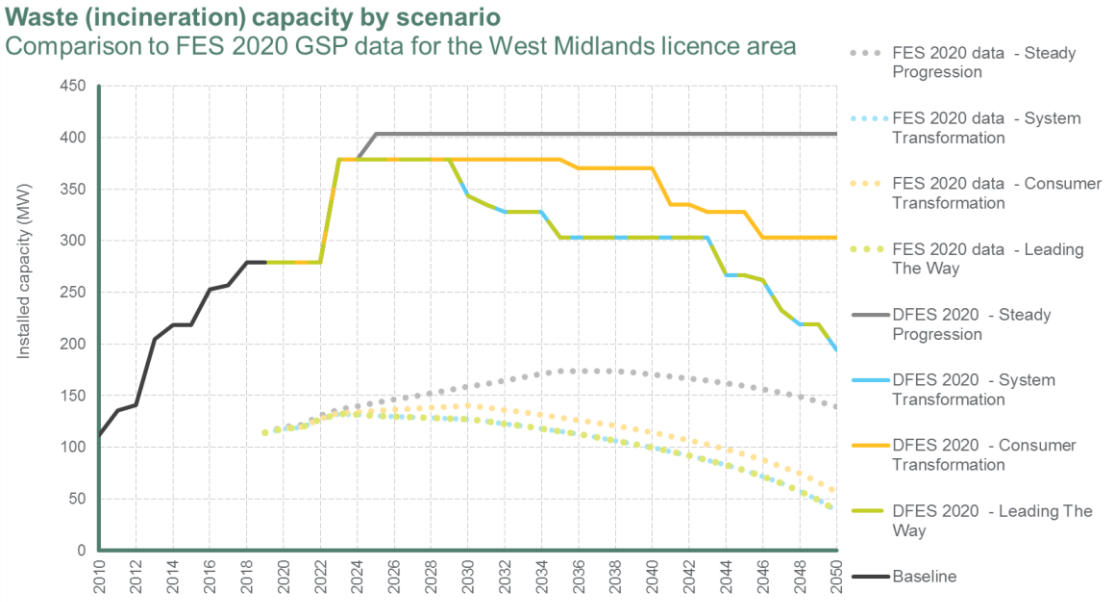
Near term

- There are five pipeline sites in the WPD connection database totalling 125 MW.
- Two pipeline sites totalling 100 MW connect in all scenarios by 2023, and a further 25 MW connects in Steady Progression. Only one site does not connect in all scenarios due to lack of recent progress.

Medium and long term

- No additional sites have been projected beyond the pipeline which is in accordance with FES 2020.
- The medium and long term projection is determined by the decommissioning of sites based on an assumed lifetime of the EfW facility of between 20 years and 30 years depending on the scenario. However as WPD would have no mechanism to reclaim the capacity held in existing connection agreements, there is no modelled capacity reduction from existing sites before 2030 to capture reasonable worst case conditions on the distribution network. No sites are projected to come offline in Steady Progression.

Figure 25



Reconciliation with National Grid FES 2020:

- The assumptions underpinning this work are in line with the FES 2020 results, however the results differ due to local spatial distribution.
- WPD connections data suggest a baseline capacity which is significantly higher than the FES 2020 baseline for the West Midlands licence area. While modelling credible pathways to net zero, the DFES must also capture the near term worst case conditions that the distribution network could see, which is important for strategic investment modelling. While National Grid ESO may discount generators without a supply contract, WPD DFES includes all generators with valid connection agreements regardless of absent supply contracts, this may lead to some discrepancies in the baseline totals.
- Near term deployment is significant due to the two large pipeline sites which are expected to connect by 2023 in all scenarios, and a further 25 MW in Steady Progression. The projected pipeline sites all have both a connection offer, and positive planning with either a planning application submitted, or granted.
- The decommissioning of sites in the medium and long term means that the decline in EfW capacity is staggered. All sites have decommissioned by 2043 in Leading the Way and 2048 in Consumer Transformation and System Transformation.

Relevant assumptions from National Grid FES 2020:

Assumption number	4.1.11 'Waste generation'
Steady Progression	No great change in waste management from society; leaving waste available as a fuel source.
System Transformation	Less waste to burn in general due to a highly conscious society adapting to low waste living.
Consumer Transformation	Limited societal change in waste management; less waste than current produced, limiting waste to burn generation.
Leading the Way	Less waste to burn in general due to a highly conscious society adapting to low waste living.

References:

WPD connection offer data, Renewable Energy Planning Database, Climate Emergency declaration data, Regen consultation with local stakeholders and discussion with developers.

Fossil gas power generation in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Fossil gas-fired power generation covering four technology types – OCGT, CCGT, reciprocating engines and CHP sites.

Data summary for fossil gas in the West Midlands licence area:

Installed capacity (MW)		2020	2025	2030	2035	2040	2045	2050
OCGT (non-CHP)	Steady Progression	100	100	100	100	100	100	100
	System Transformation	100	100	100	100	100	100	100
	Consumer Transformation	100	100	100	100	100	100	100
	Leading the Way	100	100	100	100	100	0	0
CCGT (non-CHP)	Steady Progression	0	299	299	299	299	299	299
	System Transformation	0	299	299	299	299	299	299
	Consumer Transformation	0	299	299	299	299	299	299
	Leading the Way	0	0	0	0	0	0	0
Reciprocating engines (non-CHP)	Steady Progression	150	337	465	524	551	582	594
	System Transformation	150	178	178	178	175	173	135
	Consumer Transformation	150	178	178	178	175	173	135
	Leading the Way	150	178	148	115	99	28	28
Gas CHP	Steady Progression	123	163	163	163	163	163	163
	System Transformation	123	139	135	135	135	132	67
	Consumer Transformation	123	139	135	135	135	132	67
	Leading the Way	123	139	135	125	41	17	17

Summary:

- Near term capacity growth is dominated by a single very large CCGT fossil gas plant in Meaford, which has planning permission and has accepted a network connection offer.
- Other than the proposed Meaford CCGT site, fossil gas-fired power generation decreases in all net zero scenarios, whereas for some generator types capacity increases significantly under a Steady Progression scenario.
- In all scenarios, the primary role of fossil gas is to provide flexibility and back-up services. Therefore, although the installed capacity may remain stable over some years, the annual running time, and energy output, decreases.
- At a national level, after 2030 hydrogen generation becomes a more economical source of supply-side flexibility in System Transformation, whereas Leading the Way and Consumer Transformation have higher levels of energy storage and residential thermal flexibility.

Results and assumptions:

Baseline

- The West Midlands licence area has the lowest installed capacity of fossil fuel generation of all the WPD licence areas, with a total of 397 MW connected. Just under half of the baseline capacity is made up from reciprocating engine installations, and the remaining capacity is made up from roughly equal components of OCGT and CHP sites.
- The largest site currently connected is Fort Dunlop power plant, at a capacity of 100 MW.

Near term (2020 – 2025)

- There are 29 pipeline sites which have accepted a network connection offer in the licence area.
- The pipeline is made up from one 299 MW CCGT site in Meaford, and the remainder of the pipeline is made up from CHP and reciprocating engine proposals.
- The pipeline sites show a wide variation in capacity, ranging from 40 MW to under 1 MW. Excluding the proposed Meaford power plant, the average capacity is around 9 MW. Four of these pipeline sites have had planning permission approval identified.
- 11 pipeline sites have either pre-qualified or secured a Capacity Market agreement in auctions since 2017, and two more sites were either rejected or did not pre-qualify.
- Evidence of planning applications, planning approval and activity in Capacity Market auctions are key factors for the year of connection in the near term by scenario.
- In the net zero scenarios, there is a small near term increase in capacity from the pipeline sites with planning permission.

Medium term (2025 – 2035)

- The Fort Dunlop power plant is not projected to reach the end of its operational life in the medium term, as such there is no change in OCGT capacity in the medium term.
- There is a reduction in operational hours projected for all net zero scenarios in the medium term. However, as WPD would currently have no mechanism to reclaim the capacity held in existing connection agreements, there is no modelled capacity reduction from existing sites before 2030 to capture reasonable worst case conditions on the distribution network.
- In Steady Progression there is a significant increase in capacity from reciprocating engines in the medium term, however the level of installed CHP capacity remains relatively constant across the medium term.

Long term (2035 – 2050)

- In the long term under all net zero scenarios, the annual running hours of all unabated fossil gas plant are expected to fall to almost zero, as other providers of flexibility are more economical, and baseload demand is met by other sources. This leads to a reduction of total installed capacity down to near zero by 2050 under all net zero scenarios.

Figure 27

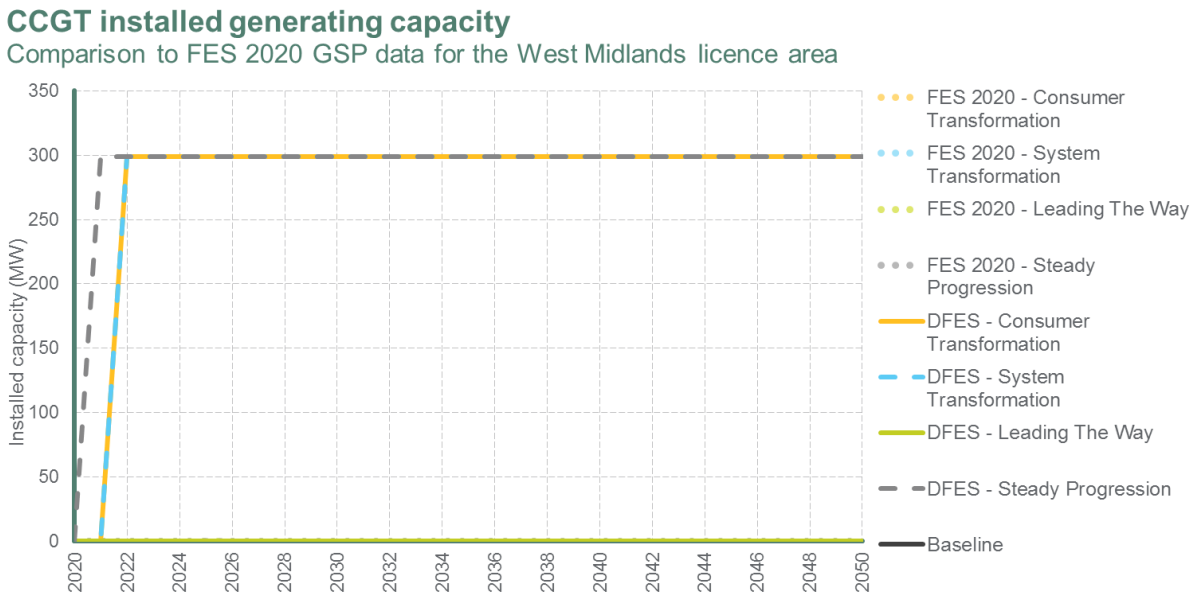


Figure 26

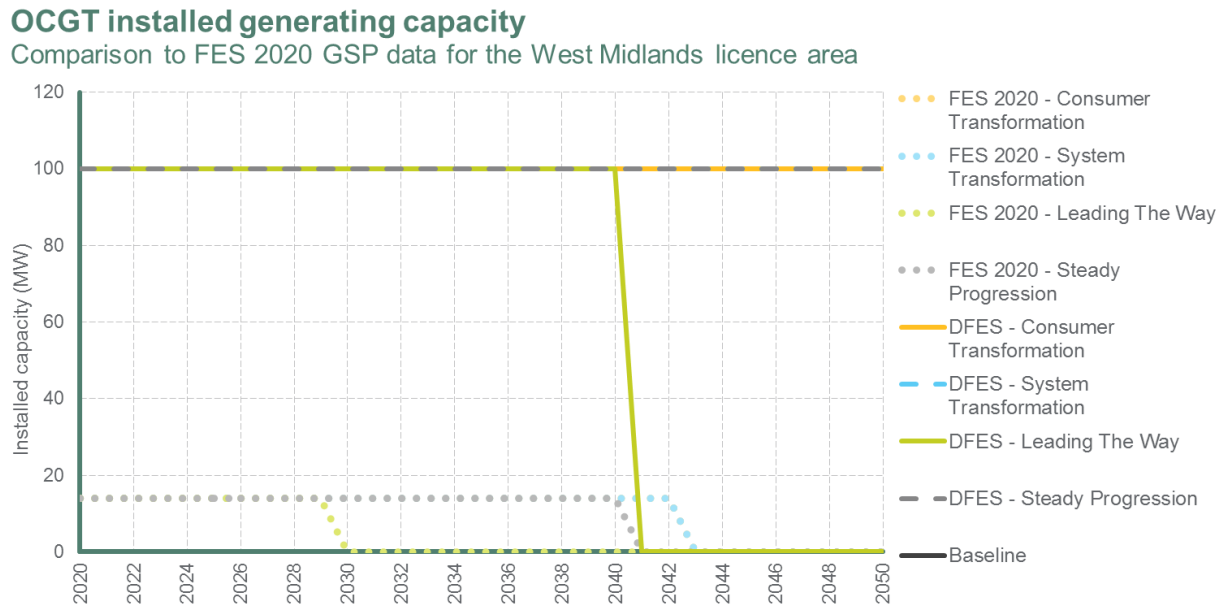
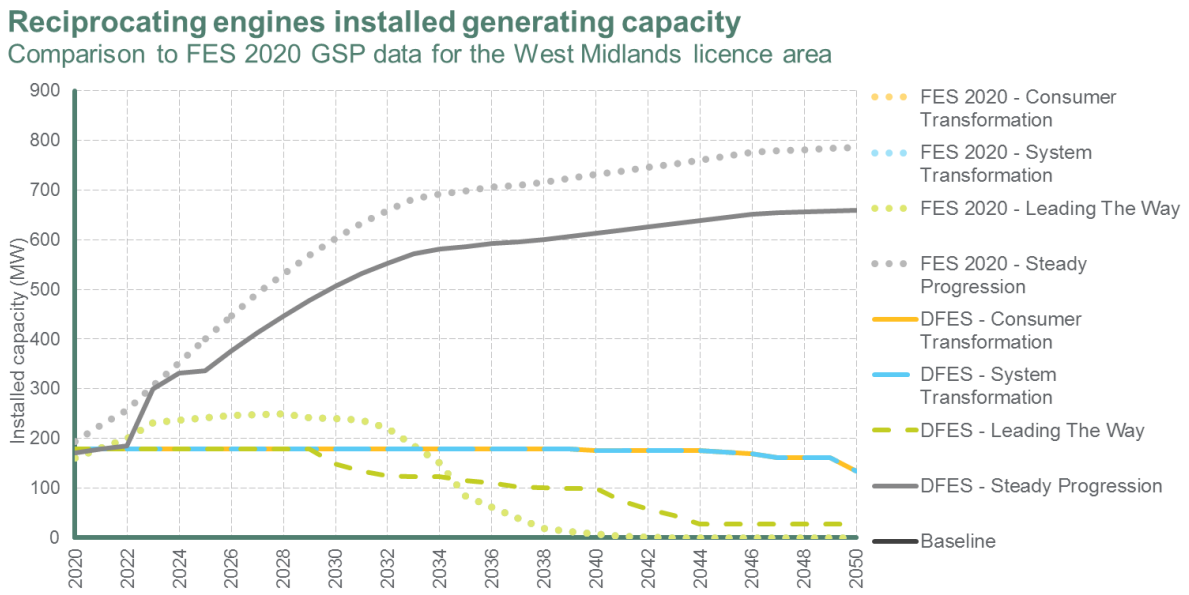
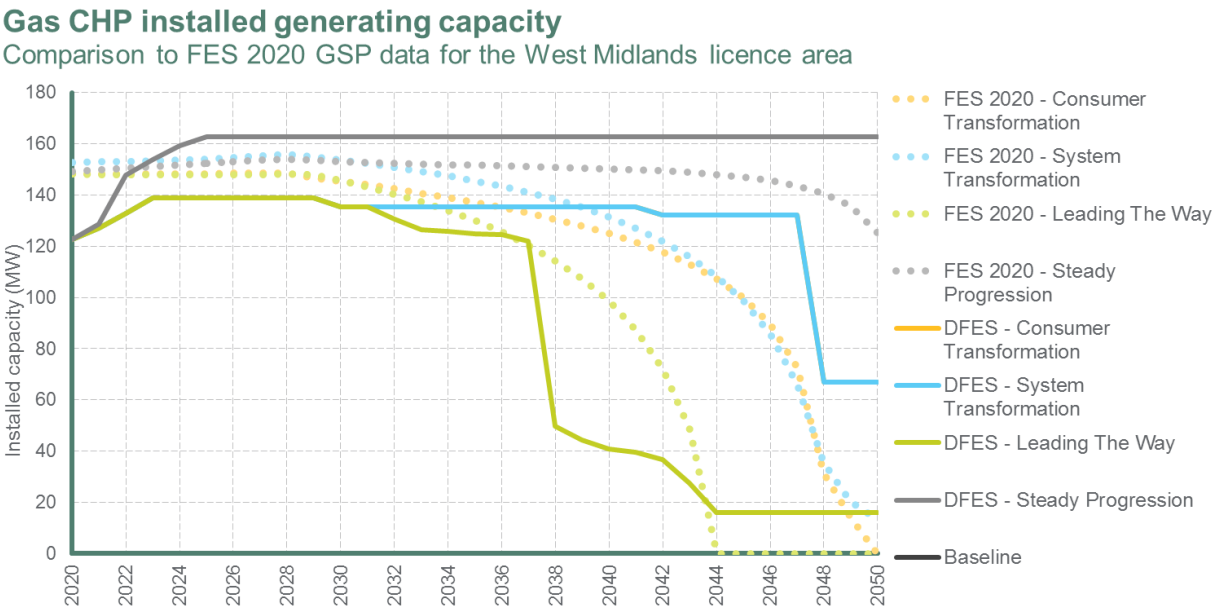


Figure 28


Reciprocating engines installed generating capacity
Comparison to FES 2020 GSP data for the West Midlands licence area
Installed capacity (MW)
0
100
200
300
400
500
600
700
800
900
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038
2040
2042
2044
2046
2048
2050
FES 2020 - Consumer Transformation
FES 2020 - System Transformation
FES 2020 - Leading The Way
FES 2020 - Steady Progression
DFES - Consumer Transformation
DFES - System Transformation
DFES - Leading The Way
DFES - Steady Progression
Baseline


Gas CHP installed generating capacity
Comparison to FES 2020 GSP data for the West Midlands licence area
Installed capacity (MW)
0
20
40
60
80
100
120
140
160
180
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038
2040
2042
2044
2046
2048
2050
FES 2020 - Consumer Transformation
FES 2020 - System Transformation
FES 2020 - Leading The Way
FES 2020 - Steady Progression
DFES - Consumer Transformation
DFES - System Transformation
DFES - Leading The Way
DFES - Steady Progression
Baseline

Reconciliation with National Grid FES 2020:

Results in this section relate to the FES 2020 data as reported for Building Block ID numbers Gen_BB001, Gen_BB002, Gen_BB006, Gen_BB008, Gen_BB009.

- The WPD DFES 2020 projections are below those in FES 2020 for reciprocating engines due to a slightly lower baseline and due to the treatment of the sites in the pipeline. In the medium and long term, deployment is in line with the FES, but remains lower due to the lower near term deployment of pipeline sites.
- For fossil gas CCGT, the WPD DFES 2020 projections are much higher than in the FES 2020, due to the assumed connection of the Meaford power plant in the 2020s.
- There is a baseline capacity discrepancy between DFES and FES for all sub-technologies, though most pronounced for OCGT, where there is an 86 MW difference. There is a smaller difference in the baselines for reciprocating engine and CHP sites, with around 25 MW capacity difference in both. The assumptions have been applied uniformly although compared to the FES 2020 data, the WPD DFES 2020 projections show large 'step' changes as specific large sites come offline, reflecting the limited number of sites for some technology types.
- While modelling credible pathways to net zero, the DFES must also capture the near term worst case conditions that the distribution network could see, which is important for strategic investment modelling. While National Grid ESO may discount generators without a supply contract, WPD DFES includes all generators with valid connection agreements regardless of absent supply contracts, this may lead to some discrepancies in the baseline totals.

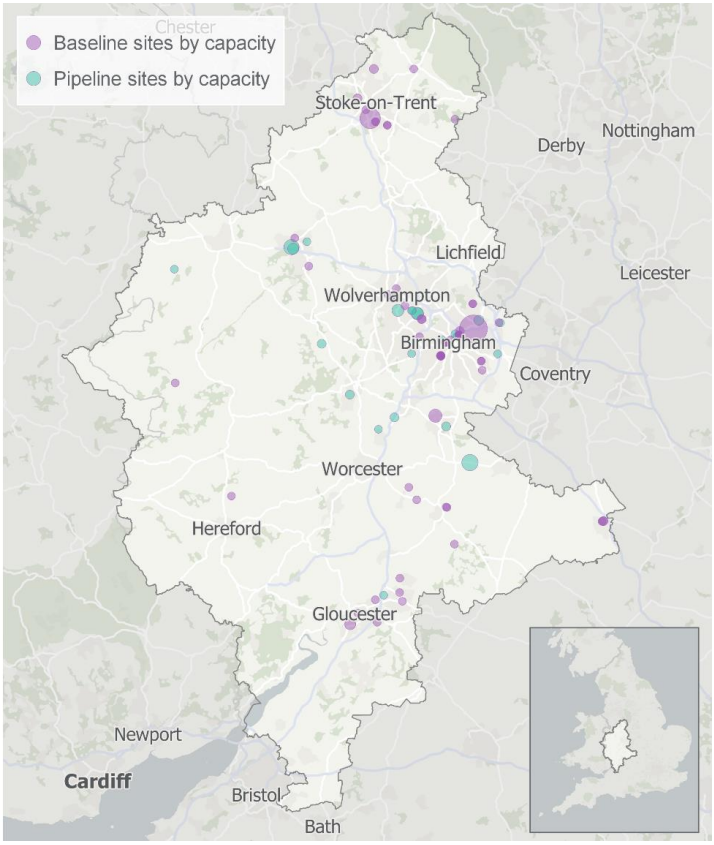
Factors that will affect deployment at a local level:

- The spatial distribution of new gas sites is based on proximity to the electricity network and reflects activity in the pipeline and Capacity Markets.

Figure 29

Fossil gas power sites in the West Midlands licence area

There is a concentration of sites around urban areas such as Birmingham, Wolverhampton, and Gloucestershire in both the baseline and pipeline sites.



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Relevant assumptions from National Grid FES 2020:

Assumption	Assumption number
Unabated large scale gas generation	**4.1.6**
Steady Progression	Low gas price and lower focus on decarbonisation promotes gas as the source of flexible generation.
System Transformation	High levels of decarbonisation, plus other sources of flexibility reduce the need for unabated gas.
Consumer Transformation	High levels of decarbonisation, plus other sources of flexibility reduce the need for unabated gas.
Leading the Way	Highest level of decarbonisation significantly reduces the amount of unabated gas.
CHP gas generation	**4.1.14**
Steady Progression	Low gas price supports growth however there is less emphasis on small scale generation that could be considered societal disruptive.
System Transformation	Renewable technologies are preferred due to the ambition to decarbonise.
Consumer Transformation	Renewable technologies are preferred due to the ambition to decarbonise.
Leading the Way	Gas generation not favoured in an accelerated net zero world; renewable technologies are favoured earlier.

References:

WPD connection offer data, Capacity Market auction results and data, System Wide Resource Registers (GB), the TEC register, the Renewable Energy Planning Database, Climate Emergency declaration data, Regen consultation with local stakeholders and the results from the WPD DFES 2020 consultation events.

Diesel generation in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Distributed diesel generation.

Data summary for diesel generation in the West Midlands licence area:

Installed capacity (MW)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	123	123	123	123	118	118	117
System Transformation	123	123	110	2	0	0	0
Consumer Transformation	123	123	110	2	0	0	0
Leading the Way	123	123	110	2	0	0	0

Summary:

- Increasingly stringent air quality limits mean there is no increase in diesel generation capacity in the net zero scenarios for West Midlands. The EU's Medium Combustion Plant Directive (MCPD) adoption into UK law enforces air quality limits in 2025 that impact the viability of diesel generators in the WPD licence areas (except those used solely for back-up).
- All existing plants not used solely for back-up are therefore decommissioned by 2025 in the net zero scenarios. In Steady Progression it is assumed that there is a delay and capacity reduces to zero by 2033.

Results and Assumptions:

Baseline

- There are 27 sites in the baseline totalling 123 MW. Four of these are back-up generators.
- There are four 20 MW diesel plants in the West Midlands licence area, three of which connected in recently in 2017/18.

Near term (2020 – 2025)

- With stringent air quality standards under the MCPD, diesel plants will no longer be able to operate from 2025 without abatement technologies which are unlikely to be financially viable in the near term. However, as WPD currently would have no mechanism to reclaim the capacity held in existing connection agreements, there is no modelled capacity reduction from existing sites before 2030, to capture reasonable worst case conditions on the distribution network.
- The 23 standalone diesel sites in the baseline have been modelled to reduce operational hours to zero 10 years after their connection year, or by 2025, whichever comes first, but stay online until at least 2030 to capture reasonable worst case conditions on the distribution network
- Back-up generators are assumed to have a lifetime of 15 years and are unaffected by the MCPD.
- There are no diesel sites with an accepted network connection offer in the West Midlands licence area.

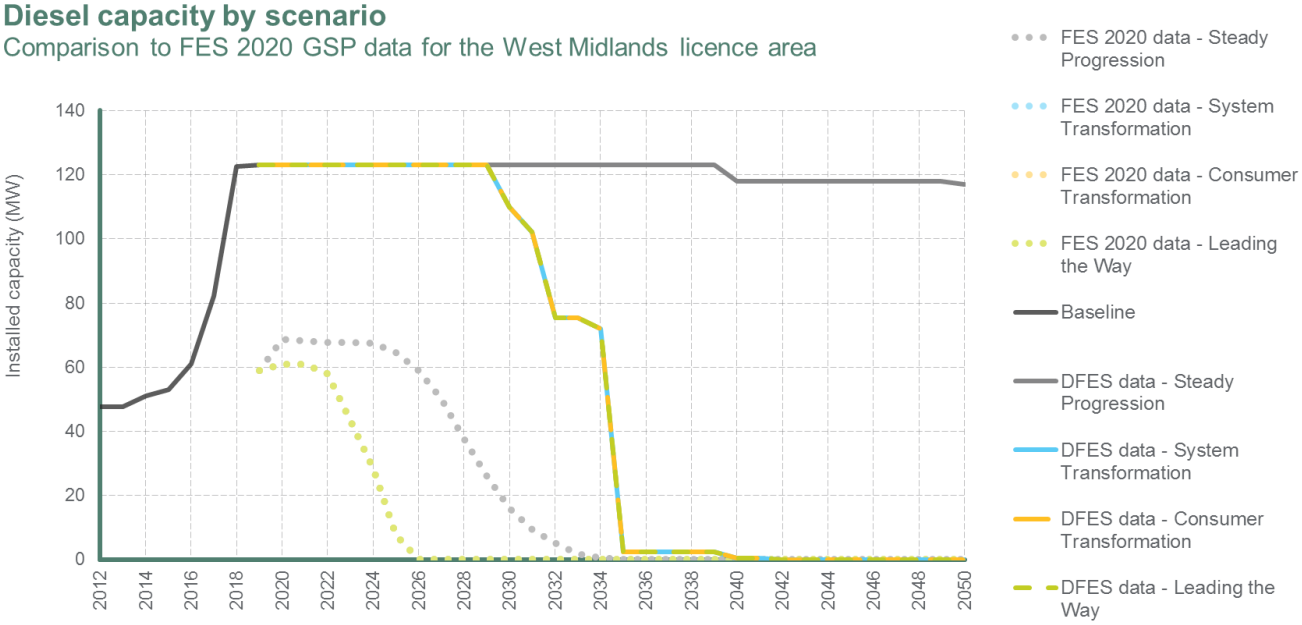
Medium to long term (2025 – 2050)

- No further deployment of distributed diesel has been modelled beyond 2025.
- It should be noted that non-synchronous diesel generation (e.g. only operating as back-up when mains failure occurs) is not subject to the MCPD and therefore remain connected until the end of their lifetime when they are assumed to be replaced with a different technology.

Figure 30

Diesel capacity by scenario

Comparison to FES 2020 GSP data for the West Midlands licence area



Reconciliation with National Grid FES 2020:

Results in this section relate to the FES 2020 data as reported for the Building Block ID number Gen_BB005.

- The assumptions underpinning this work are in line with the FES 2020 results, however there is a discrepancy in the total capacity currently installed. WPD connections data suggest a baseline capacity which is significantly higher than the FES 2020 baseline for the West Midlands licence area.
- In the three net zero scenarios, diesel sites decommission at the same rate by 2025, and by 2033 in Steady Progression, which is in line with FES 2020.

Relevant assumptions from National Grid FES 2020:

Assumption number	4.1.31 'Unabated small scale thermal generation'
Steady Progression	Less focus on decarbonisation compared to other scenarios. Diesel plant retired later than other scenarios.
System Transformation	Initial growth in gas peaking plant as renewables grow (instead of high growth in storage technologies), later switching to Hydrogen.
Consumer Transformation	Initial growth in gas peaking plant as renewables grow (instead of high growth in storage technologies), later switching to alternate sources of flexibility such as storage and V2G.
Leading the Way	Low use as scenario sees greater use of other technologies (e.g. storage). Earliest closure of diesel reciprocating engines.

References:

WPD connection offer data, Regen consultation with local stakeholders.

Other generation in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

All generation connection agreements and accepted offers that are either unidentified as one of the basic technology types.

Data summary for other generation in the West Midlands licence area:

Installed capacity (MW)	Baseline	2025	2030	2035	2040	2045	2050
Steady Progression	50	68	68	68	68	68	68
System Transformation	50	68	68	68	68	68	68
Consumer Transformation	50	68	68	68	68	68	68
Leading the Way	50	68	68	68	68	68	68

Summary:

- There is 50 MW of connected 'other generation' sites that have no identified technology type. In some cases this is because of a lack of available data means that connected site cannot be found, in other cases it is because the fuel source of likely backup generators cannot be confidently identified. Other than three sites between 5 – 8 MW, all baseline 'other generation' sites are under 2 MW.
- There is 17 MW of sites that have accepted a network connection offer in the West Midlands licence area, for which the technology type could not be confidently identified. The year of connection projected for these sites is the same across all scenarios and they are projected to connect 3 years after accepting a connection offer.
- All pipeline sites are projected to connect before 2024.

Reconciliation with National Grid FES 2020:

There is no equivalent technology type in National Grid FES 2020 to compare to.

References:

WPD connection agreement and offer data.

Results and assumptions

Energy storage technologies

Battery storage in the West Midlands licence area

Summary of modelling assumptions and results.

Technology specification:

Battery storage, comprising four business models:

- **Standalone network services** – typically multiple MW scale projects that provide balancing, flexibility, and support services to the electricity system.
- **Generation co-location** – typically multiple MW scale projects, sited alongside renewable energy (or occasionally fossil fuel) generation projects.
- **Behind-the-meter high energy user** – single MW or 'hundreds of kW' scale projects, sited at large energy user operational sites to support onsite energy management or to avoid high electricity cost periods.
- **Domestic batteries** – typically 10-20kW scale batteries that households buy to operate alongside rooftop PV or to provide back-up services to the home.

Data summary for battery storage in the West Midlands licence area:

Installed power capacity (MW)		Baseline	2025	2030	2035	2040	2045	2050
Standalone network services	Steady Progression	87	215	219	264	316	332	348
	System Transformation	87	215	216	255	301	317	332
	Consumer Transformation	87	226	236	285	356	374	392
	Leading the Way	87	215	225	296	384	403	423
Generation co-location	Steady Progression	5	5	8	8	16	28	29
	System Transformation	5	5	6	7	9	9	10
	Consumer Transformation	5	91	95	97	120	148	158
	Leading the Way	5	5	20	69	100	120	134
Behind-the-meter high energy user	Steady Progression	2	6	28	61	116	129	141
	System Transformation	2	4	25	58	67	75	83
	Consumer Transformation	2	19	40	104	149	198	217
	Leading the Way	2	33	147	155	251	274	297
Domestic batteries	Steady Progression	0	0	7	8	19	50	121
	System Transformation	0	0	2	2	3	9	10
	Consumer Transformation	0	1	39	73	150	262	563
	Leading the Way	0	10	85	286	394	496	590

Summary:

- The West Midlands licence area has the highest baseline of existing operational battery storage projects in the four WPD licence areas, with 17 sites totalling just over 93 MW.
- The West Midlands licence area also has a significant pipeline of battery storage projects with accepted connection offers, including a 100 MW project in Birmingham.
- The licence area has low overall potential for renewable energy co-location, with relatively low levels of ground mounted solar PV capacity and only a small amount of onshore wind capacity projected to connect, even in the most ambitious scenarios, by 2050.
- The licence area has a high number of non-domestic properties with the potential for battery storage. This has resulted in the West Midlands seeing the highest potential uptake of behind-the-meter storage assets deployed out to 2050 of any of WPD's licence areas.
- The West Midlands licence area has relatively low rooftop PV capacity projections, despite having a large total number of homes. This has resulted in a moderate uptake of domestic batteries – some 5% of all homes – in the Leading the Way scenario.
- Overall battery storage capacity in 2050 ranges from c.0.5 GW in System Transformation to 1.6 GW in Leading the Way.

Results and assumptions:

Baseline

- There are 17 battery storage projects totalling 93 MW currently connected in the West Midlands licence area – the highest connected baseline across WPD's network – all of which have come online since 2016.
- Most of the current capacity comes from standalone battery projects. The average installed capacity of the baseline is 5.5 MW.

Near term (2020 – 2025)

- The West Midlands has a relatively large pipeline of battery storage connection offers, with 23 projects totalling 392 MW.
- There is an even mix of standalone, generation co-location and behind-the-meter high energy user battery storage projects in the pipeline.
- The average capacity of the pipeline projects in the West Midlands licence area is 17 MW and includes a number of 40-50 MW projects and the only 100 MW project in WPD's network, located in Birmingham, which received planning approval in 2020.
- Of these pipeline projects, 278 MW (8 sites) have planning approval and 92 MW (2 sites) have contracted or pre-qualified for a number of Capacity Market T-4 and T-1 auctions.
- It is assumed that sites with successful Capacity Market activity or planning permission are more likely to be commissioned in the near term.
- By 2025, connected battery storage capacity in the West Midlands licence area is highest (301 MW) in the Consumer Transformation scenario and lowest (229 MW) in the System Transformation scenario.

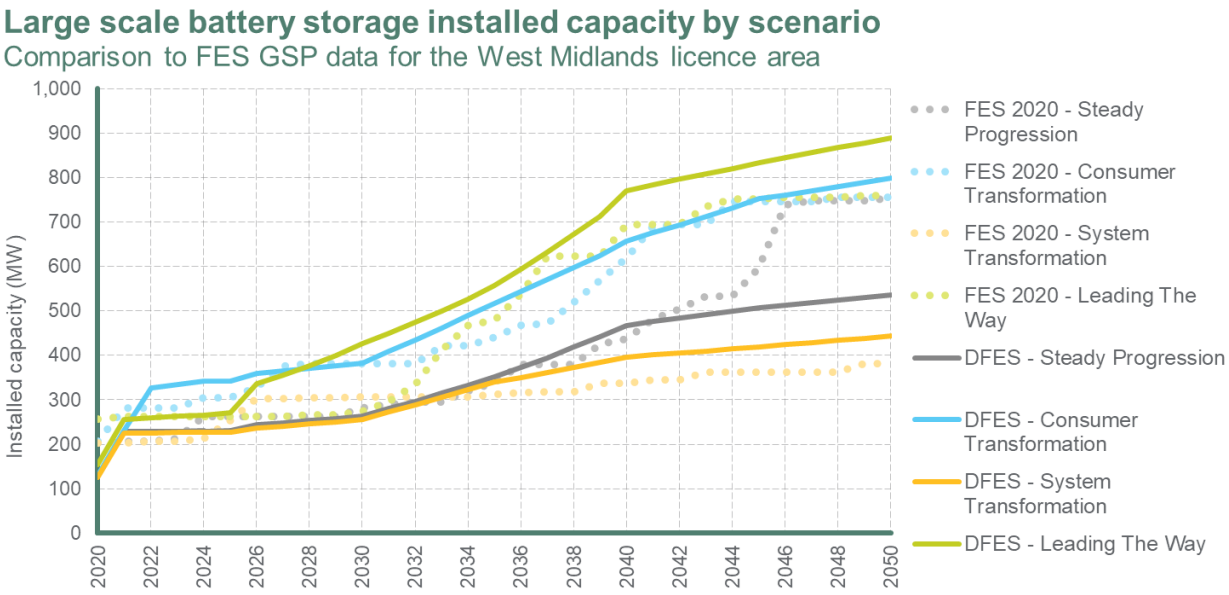
Medium term (2025 – 2035)

- The four business models for battery storage are modelled separately and are driven by different factors.
- Standalone storage accounts for most of existing storage market activity and this business model sees high levels of deployment across most scenarios by 2035.
- Generation co-location capacity sees a lower overall uptake in the West Midlands licence area, due to having relatively low combined ground mounted solar PV and onshore wind development by 2035.
- The West Midlands is the WPD licence area that has the highest number of non-domestic properties classified as having higher energy use. Engagement with stakeholders suggested that batteries co-located with high energy users could be a business model that sees high levels of deployment. This has resulted in the West Midlands seeing a significant uptake of behind-the-meter storage assets deployed out to 2050, highest in Consumer Transformation, and the highest of any of WPD's licence areas.
- Whilst the West Midlands licence area has the second highest number of homes across WPD's network, the uptake of domestic rooftop PV is more limited, reflecting the lower solar irradiance in the area. Therefore, only a moderate uptake of domestic batteries has been projected in the medium term.

Long term (2035 – 2050)

- In the long term, the biggest increase in projected battery storage capacity occurs in a Leading the Way scenario, supported by significant potential for co-location with the increase in deployment of solar PV and onshore wind, high levels of consumer engagement leading to uptake of behind-the-meter batteries, and significant deployment of standalone projects.
- The System Transformation scenario sees the lowest overall storage deployment in the West Midlands licence area, reflecting a lesser need for electricity system flexibility. This has been reflected in the longer term out to 2050, across all storage business models.
- Overall, installed battery storage capacity in the West Midlands licence area is highest (c.1.6 GW) in Leading the Way and lowest (c.0.5 GW) in System Transformation by 2050.

Figure 31



Reconciliation with National Grid FES 2020:

Results in this section relate to the FES 2020 data as reported for Building Block ID number Srg_BB001 and Srg_BB002.

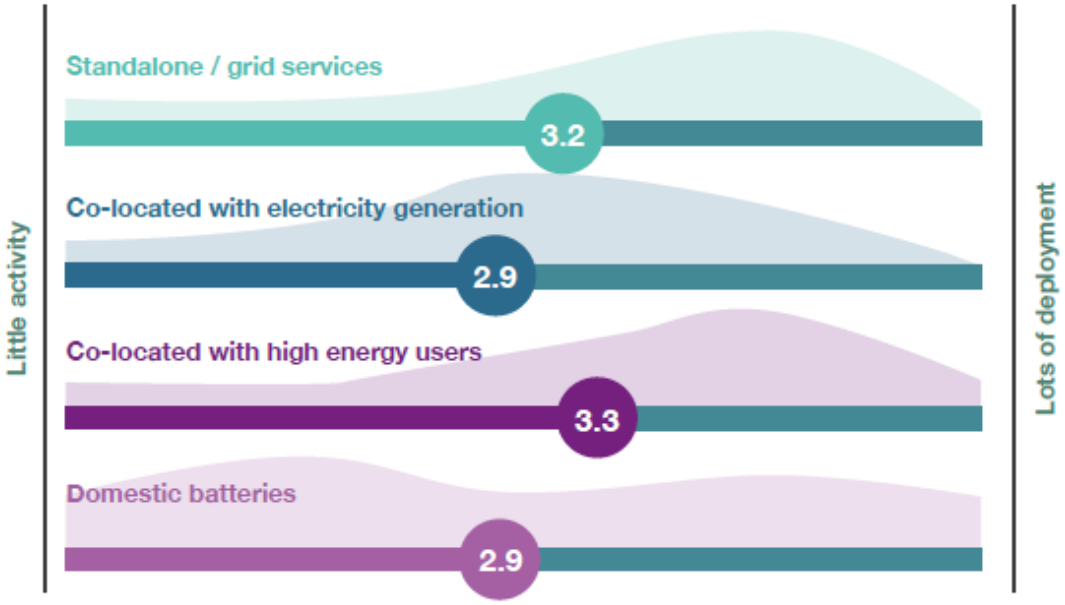
- Reflecting a significant baseline and pipeline, the WPD DFES 2020 projections across the early to mid-2020s are higher than the FES 2020 projections.
- The WPD DFES 2020 System Transformation scenario has a slightly higher installation of domestic batteries in FES 2020. This is based similar assumptions to the FES, but reflects the higher uptake of rooftop solar PV in the WPD DFES 2020.

Factors that will affect deployment at a local level:

- The spatial distribution of new battery storage projects in the near term is based on the location of the pipeline sites.
- In the longer term, spatial distribution varies according to the four battery storage business models used in the modelling.
- These local factors are:
    - **Standalone:** Proximity to 33kV and 132kV electricity network.
    - **Generation co-location:** Proximity to ground mount solar PV and onshore wind projects within the licence area.
    - **Behind-the-meter high energy user:** Proximity to industrial estates and commercial buildings.
    - **Domestic batteries:** Domestic dwellings with rooftop PV.

Stakeholder feedback from the consultation events:

Your comments to us	Our response
Theme: energy storage	
There was support from stakeholders for all energy storage business models presented. However, domestic batteries were rated the least likely to have high deployment in the near term.	We will continue to analyse energy storage deployment through the four business models, and we will update our projections for domestic batteries to reflect this feedback.
You told us that co-located energy storage facilities would be likely be at least 50% of the power capacity of the solar farm, with around a quarter of respondents suggesting the storage sites would be 100% of the renewable energy asset capacity or larger.	This is higher than the current national baseline average, according to data from the Department for Business, Energy, and Industrial Strategy. We will increase our projected proportional power size for co-located energy storage sites.
You told us that energy storage technologies other than lithium-ion and solid state batteries could be deployed in the future. This included liquid or compressed air storage, power-to-gas sites, and small-scale pumped hydro.	We will review this for the next round of DFES and incorporate stakeholder feedback for which technologies we could include.



References:

WPD connection offer data, the Renewable Energy Planning Database, various local authority online planning portals, EMR Delivery Body Capacity Market registers, Regen consultation with local stakeholders and discussion with developers.

Distribution Future Energy Scenarios 2020

Results and assumptions reports have been published for all four WPD licence areas and are available at the WPD DFES website, along with interactive maps and data download options.

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