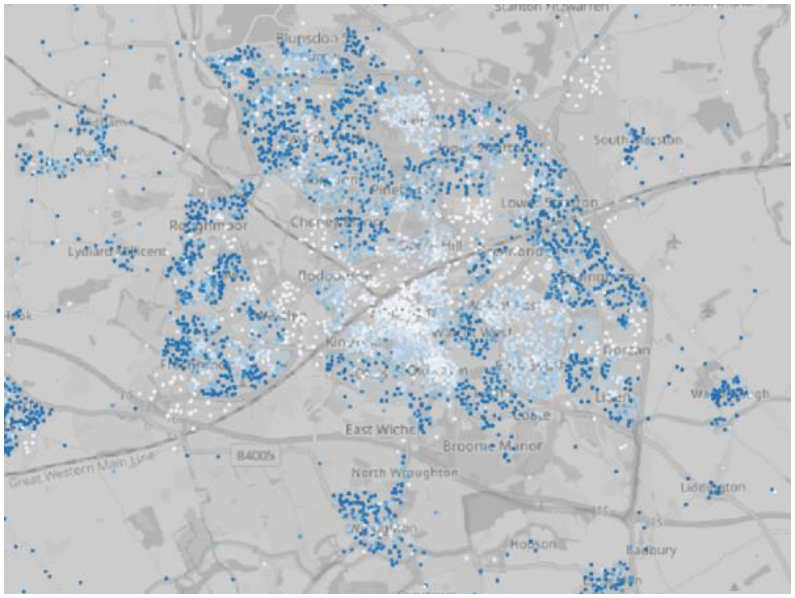
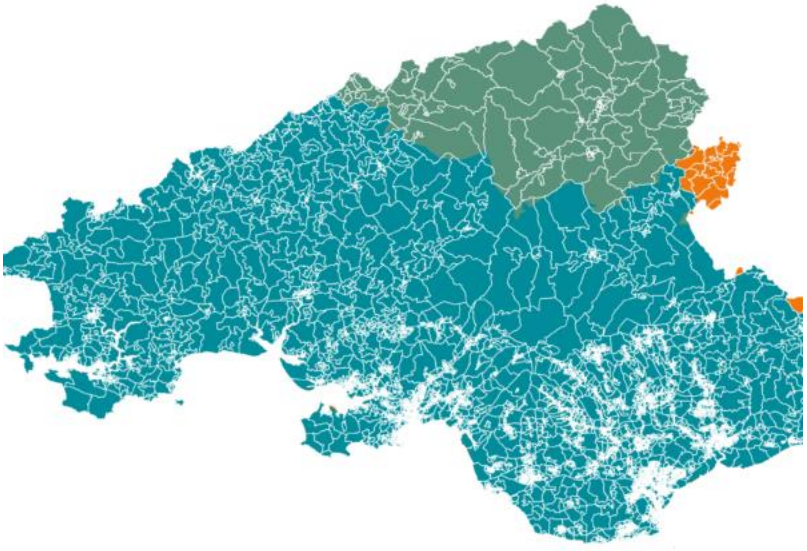
Distribution Future Energy Scenarios (DFES)
Frequently Asked Questions





September 2020

Distribution Future Energy Scenarios (DFES) Frequently Asked Questions

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Background

Regen is an independent, not for profit, centre of energy expertise and provider of energy insight services. Our mission is to accelerate the transformation of the UK's energy system for a zero carbon future. Regen works extensively with the energy industry, national and devolved governments, local authorities, communities and a range of organisations that share our mission.

Beginning with Western Power Distribution in 2015, Regen has worked with network operators to develop Distribution Future Energy Scenarios. Our involvement with DFES came about because we recognised that networks were struggling to forecast the growth of disruptive low carbon technologies such as solar, leading to network constraints which risked slowing down decarbonisation. We also felt that there was a need for an independent intermediary to facilitate a discussion and evidence gathering between the networks and energy system stakeholders.

Regen has since provided DFES analysis services to:

- Western Power Distribution – see here
- Scottish and Southern Electricity Networks – see here
- Wales and West Utilities (gas network) – see here
- Integrated gas and electricity DFES – see here

We also provide analysis services on regional and local pathways to net zero for local authorities, devolved government and other organisations. Regen has produced a number of thought leadership papers on the future of the energy networks and their role to promote a net zero and low costs energy system. See for example Energy Networks for the Future

The purpose of the FAQ sheet is to address some of the questions we are frequently asked about DFES. Our answers draw on our own experience working with our client Distribution Network Operators (DNOs), but it is hoped that they also broadly apply across other DNOs and organisations that are involved in the DFES process.

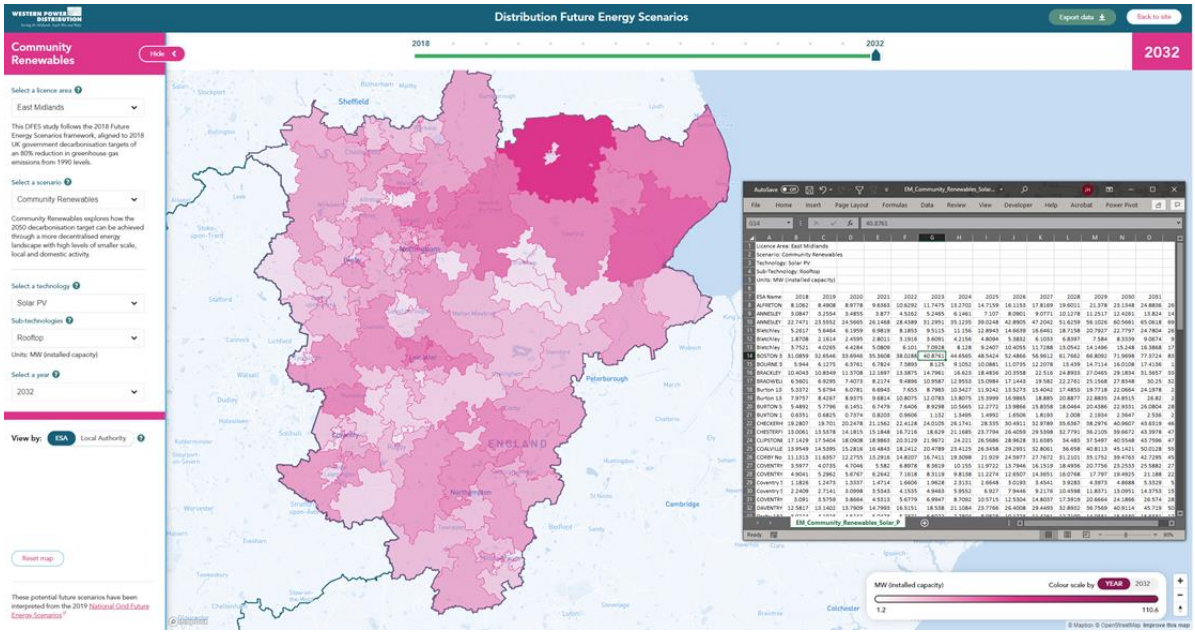


Figure 1 Example DFES output published by Western Power Distribution see https://www.westernpower.co.uk/distribution-future-energy-scenarios-application

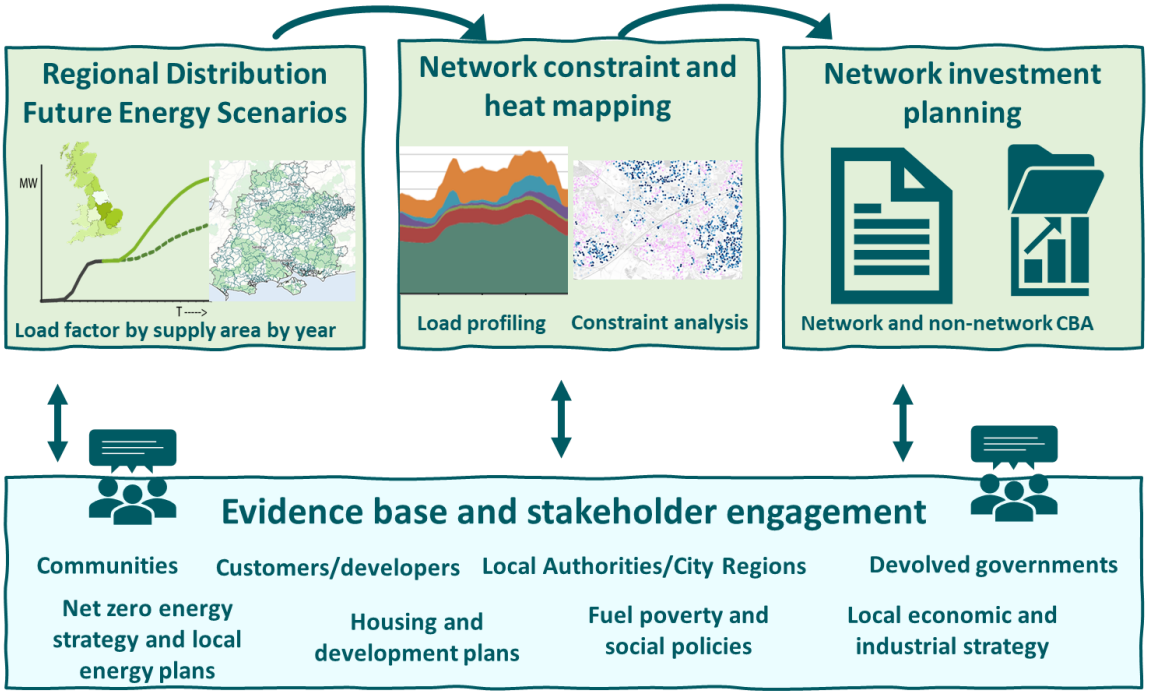
1) What is the DFES and how is it used?

Distribution Future Energy Scenarios (DFES) are high granularity scenario forecasts which provide a projection for the growth (or reduction) of energy generation (low carbon and conventional), demand and storage technologies which are expected to connect to the GB electricity distribution networks. DFES may also include projections for new housing growth and increase in commercial and industrial developments, energy efficiency and other network load elements.

For the DNOs, DFES forms part of an integrated network planning and investment appraisal process. DFES data sets, informed by stakeholder engagement, allow network planners to model and analyse different future load scenarios. They also provide a key data resource and evidence base to enable network strategy teams to appraise different investment options and develop the business case necessary to support future investment, including regulated business plans.

Producing future energy scenarios is now a statutory obligation for electricity networks as part of their requirement to produce forward looking Network Development Plans.

Ofgem has also asked networks to demonstrate the use of scenarios across a wide range of business functions under the banner of "DFES for a purpose"



Identify least regret investment options. By highlighting those parts of the network which have a high probability of requiring reinforcement under all scenarios compatible with our decarbonisation targets, DFES forecasts enable network planners to identify a base level of investment which forms part of submissions to the regulator, Ofgem, to determine future investment budget allowances.

Identify opportunities for non-network solutions and flexibility. Network planners are also able to identify likely future areas of constraint. These can then become part of flexibility or constraint managed zones.

Managing network uncertainty. Of course, forecasts and scenarios may change, and, by definition, can only represent a range of potential outcomes. However by completing annual reviews of the DFES, and through extensive stakeholder engagement, DNOs can build up a picture of how energy consumption and generation, and the uptake of new low carbon technologies such as heat pumps and electric vehicles, is changing over time. This enables network strategy team to manage investment risk and to establish business uncertainty mechanisms, such as business case "reopeners" and "volume drivers", which can be approved by the energy regulator to release additional network expenditure when it is needed.

Future proof investment. Where network planners have already identified the need for reinforcement, or the refurbishment of existing assets, scenario forecasts can provide important evidence to establish the business case for a more significant network upgrade. This may allow DNOs to make additional investments to future proof the network which, over the longer term, will reduce network costs, and the environmental impacts and disruption to customers and the general public, associated with repeated upgrades.

Supporting strategic Investment. Strategic investment, or anticipatory investment, for example to enable regional economic growth, unlock the potential of renewable generation or to accelerate decarbonisation, requires a high level of evidence and cost justification. DFES scenario forecast data on its own would not normally provide sufficient evidence to make such strategic investments, but it can allow network planners and key stakeholders to identify potential opportunity areas. This can then become the starting point for a more detailed analysis, and the development of local area energy plans (LAEPs) or other investment proposals for specific sites or development areas, which would undertaken in partnership with stakeholders, to build the case for strategic investment.

2) How can regional and local stakeholder influence the DFES?

Stakeholder engagement is a key part of the DFES process and has been a major development over the last 5 years. The annual DFES cycle has now become a major point of engagement between the networks and stakeholders and has enabled DNOs to take a more proactive approach to network planning. It has also opened up the possibility of bringing stakeholders into the network planning and engagement process. Regen sees this as an important stepping stone towards more devolved decision making and local governance for regional and local infrastructure.

It has also allowed stakeholders to become better engaged with the provision of network services and solutions (such as flexibility and grid investment collaboration) to address network constraints.

Engagement comes in different forms including:

a) **DFES workshops and engagement events.** We would generally expect to hold at least 2 engagement events for each licence area, the first to gather input and views on the growth scenarios and the second to present results and findings.

b) In the time of **Covid 19** these events have been run on-line but in fact, using webinars and engagement tools like Menti.com we have found it possible to outreach to a large number of stakeholders for example see

   - https://www.youtube.com/watch?v=wZvgcYL-XGw&feature=youtu.be
   - https://www.youtube.com/watch?v=h8yFFJwYLjA&feature=youtu.be

c) **Workshop and bilateral discussion** with project developers and using DNO led operator forums and Customer Engagement Groups. The views of developers, which may be more candid when approach by a 3rd party, helps to shape scenario projections and especially the firmness ascribed to the pipeline

d) **Data gathering and collation** for new housing developments and new commercial and industrial developments which draws heavily on local development plans and direct feedback from local authority planners. Much of this process has not been moved on-line using web enabled SharePoint to enable LA planners to view and directly edit the

In the next stage of DFES development we hope to see far more data sharing and exchange of knowledge between networks and network stakeholders. This will be greatly improved by the digitalisation of energy network data and forecasts.

3) Do all electricity networks now produce a DFES and are they all the same?

Yes, all DNOs now produce a DFES or an equivalent set of future energy scenarios. Scenario forecasting is also set to become a statutory licence condition for the production of Network Development Plans in line with the EU Electricity Directive 2019/944.

The DNOs started from different processes and systems but a more consistent and common approach is now emerging using, for example, the building block definitions (See Question 4). Most DNOs also now use the National Grid Future Energy Scenarios (FES) to provide a common scenario framework and reconcile back to the National Grid FES.

The output dataset and reports for the different DNO DFESs are very similar reflecting the combination of healthy competition and collaboration across the networks.

More work could be done to improve and share best practice and this is being championed by the ENA Open Networks project and the DNOs themselves. There is also scope to improve the feedback loop and data sharing between the DNO and the ESO and with gas networks.

This should be part of a continuous improvement process.

4) What technologies and demand loads are covered by DFES?

There is a very long list of technologies and other network load factors that are covered. The scope of the DFES has grown and extended over the years and follows a similar scope to the National Grid FES. The list has now become more standardised into a group of **"building blocks"** to ensure consistency across the networks and between the DFES and the National Grid FES scenarios. The building block definitions are maintained by the Electricity Networks Association, with new technology types being continually added, and can be found here

In broad terms the DFES will include

- All major renewable energy technologies (solar, wind, hydro, marine etc)
- Major waste driven technologies (AD, Biomass, sewage, EfW, ACT etc.)
- Fossil fuel generation – gas technologies, diesel
- Electricity storage by technology and by business model type
- Electric vehicles (by vehicle type) and EV chargers (by charger type)
- Electric heating and cooling technologies such as heat pumps including hybrid heating
- New disruptive technologies such as hydrogen

Many DFES studies will also include more conventional demand growth factors such as new housing developments and the growth of commercial and industrial new developments.

Some DFES studies are now also including the deployment of energy efficiency technologies.

An important point is that the scope and complexity of DFES will continue to change and develop as the energy system transformation proceeds. In 2020 for example the scenario forecast has also included autonomous vehicles for the first time as a new vehicle category.

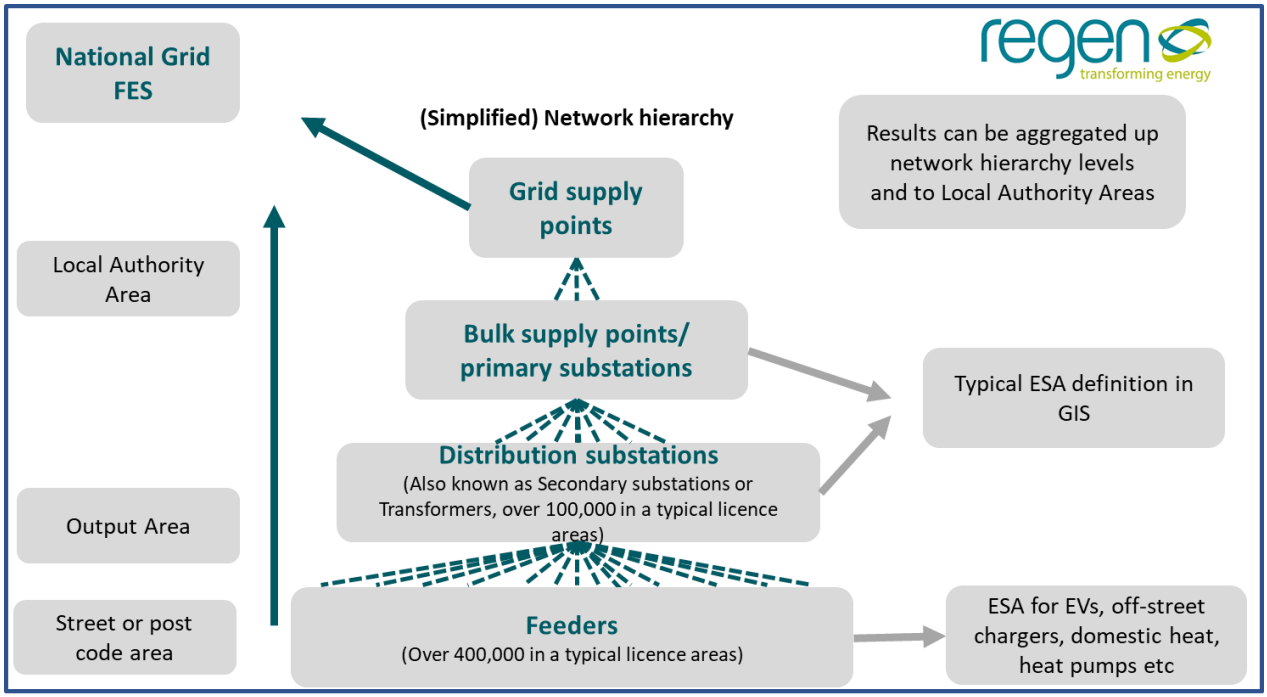
5) What level of detail does the DFES go to?

The geographic granularity of the DFES has increased significantly. Five years ago it was common to produce scenario forecasts down to a Bulk Supply Point (BSP) Level representing an area of a rural county, a large town or part of a city.

Now it is common for DFES forecasts to be made at Primary substation level (a few hundred homes) and for some technologies, such as EVs and Heat Pumps, there can be a requirement to produce scenario forecasts down to low voltage secondary substation and feeder level which is equivalent to a post code or street level. For an example of very high granularity scenario forecasts please see the recent SSEN High Granularity LCT Projections.

As low carbon technologies and energy efficiency grows it is increasingly important to understand the impacts on the low voltage network.

DFES file sizes have grown exponentially and may consist of hundreds of thousands or indeed millions of data points. This has led to a shift from using Excel file types to SQL files for data exchange.


National Grid FES
(Simplified) Network hierarchy
Results can be aggregated up network hierarchy levels and to Local Authority Areas
Grid supply points
Local Authority Area
Bulk supply points/ primary substations
Typical ESA definition in GIS
Distribution substations
(Also known as Secondary substations or Transformers, over 100,000 in a typical licence areas)
Output Area
Street or post code area
Feeders
(Over 400,000 in a typical licence areas)
ESA for EVs, off-street chargers, domestic heat, heat pumps etc

6) How is this data represented spatially? Can it be accessed along local authority boundaries?

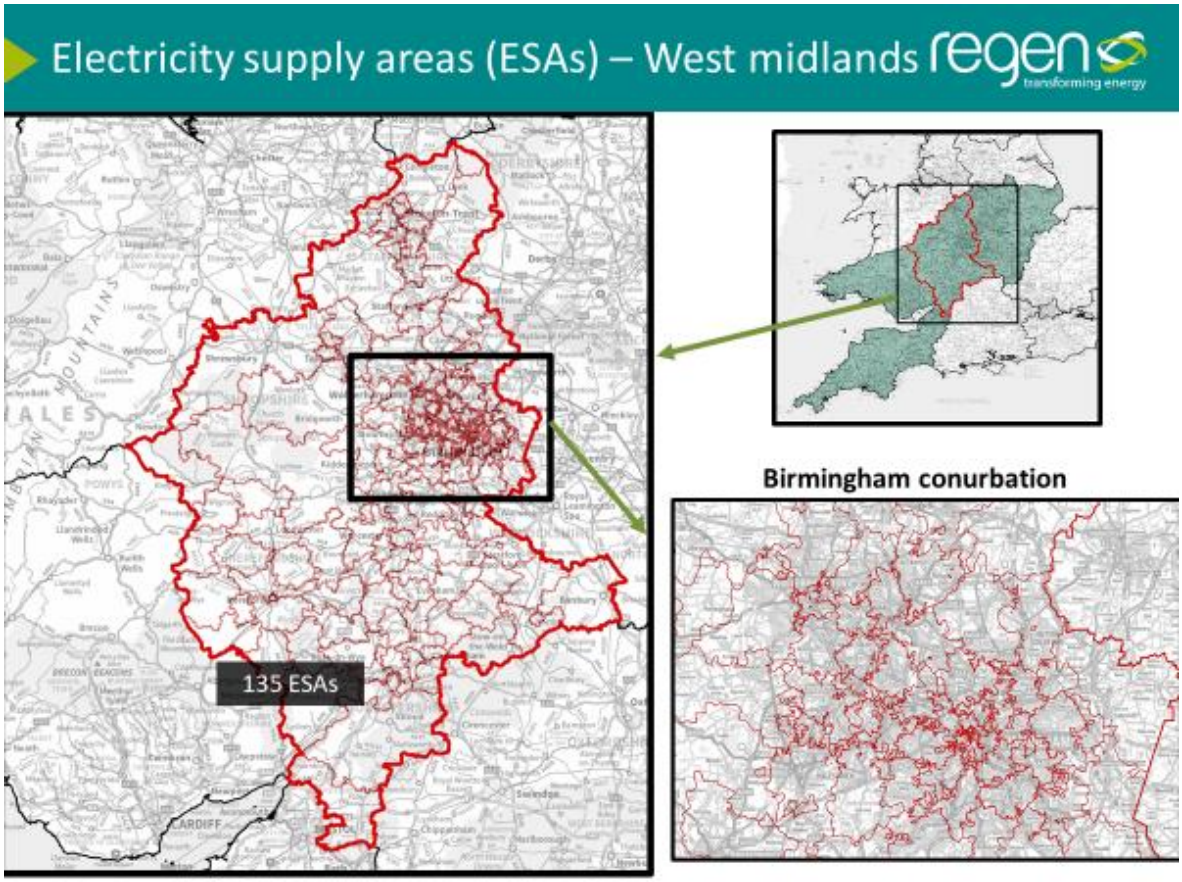
Representing network data against geographical boundaries has historically been a challenge.

However, all DNOs now make use of Graphical Information Systems (GIS) which enables data to be displayed, collated and overlaid across multiple geographical lines.

To facilitate this, DFES data is typically collated into a geographic unit know as an Electricity Supply Area or ESAs. An ESA represents the lowest geographical unit of analysis and can be defined at whatever level of granularity is required. ESAs can then be amalgamated up to create a geographical network hierarchy which approximates the real electricity network hierarchy.

ESAs can also be used to bring in other important spatial data such as socio economic data, solar irradiance, wind resources, number of households, vehicle registrations, affluence levels, EV charger locations or practically anything which is spatially mapped. This has opened up very rich and varied sources of data for energy analysis (see Question 15).

ESA's can also be combined to produce different data views by local authority area for example.



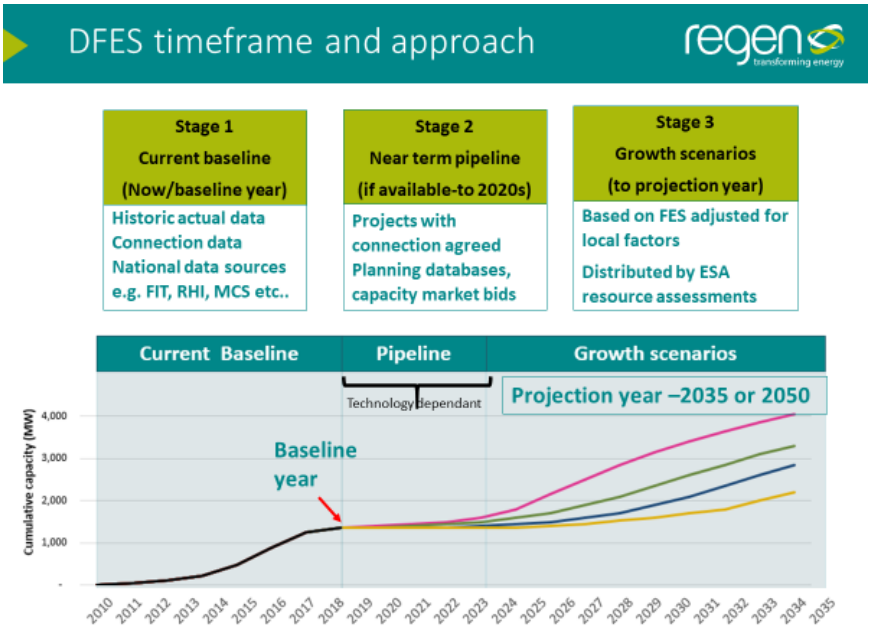
7) How is the DFES projection built up, and does it include projects and developments in the pipeline?

The DFES is usually described as a scenario forecast but actually it is a mixture of a scenario analysis and a pipeline forecast. When describing the DFES process we say it is made up of three key elements:

a) **A baseline analysis** to understand historic growth and what technologies and assets are currently connected to the network. Updating this from DNO connection data (Embedded Capacity Register)

b) **A pipeline analysis** of identified projects and developments, mainly those that have applied for, or accepted, a connection agreement, but also including projects that have been identified in planning datasets including the BEIS Renewable energy Planning database

c) **Scenario Analysis** – which brings into play the scenario assumptions and future growth projects will vary between scenarios and over time



In the near term the DFES does reflect more of a forecast view while in the longer term it reflects a scenario analysis. This does vary by technology, realistically the pipeline for onshore wind stretches out for 5 years or more, for large scale solar it is perhaps 2/3 years. The new housing development pipeline typically stetches to 5-7 years.

For network planners the long term scenarios are of course important but it is equally important that pipeline requirements, for which there may already be a connection agreement in place, are fully modelled in the network constraint analysis.

We don't assume that all pipeline projects will be commissioned within their expected timeframe in every scenario. This is particularly true when the pipeline may consist of a very large number of more speculative projects, for instance, as we have seen recently for energy storage and to an extent for solar energy. In many cases we will keep projects within the scenario projections, as these are useful data points, but spread their completion over a longer timeframe to be more aligned with national projections and with more candid stakeholder feedback. Even if delayed the pipeline of projects gives a spatial distribution of where future projects are likely to be located within the network.

8) If it includes the pipeline can I see my project within the DFES data?

The published DFES data does not contain specific project references, data is presented at the level of electricity supply area (ESA), so in broad terms the answer is "no". If however the project is large then it is possible to recognise a large wind farm or a gas fired power station or a significant housing development within the DFES ESA data.

It is important to note that the DFES is used for network modelling purposes but does not determine which individual projects get connected. The project network connection agreement is the key determinant of network access.

DNOs do now publish far more detail regarding their connected assets (Embedded Capacity Register) and those projects with a connection agreement. This is part of a shift towards open network data.

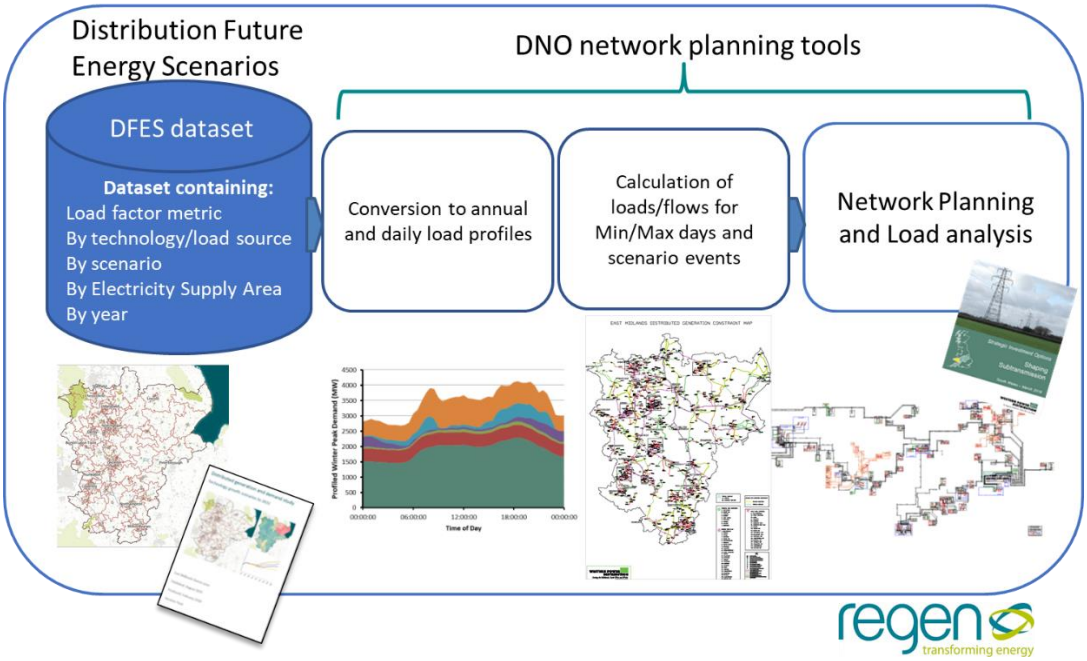
We are always happy to hear from project developers who want to discuss their project or check that it has been included in the underlying data.

9) Does the DFES include analysis of loads, peak loads and constraints?

This is a common question about the DFES. The DFES, in itself, does not produce analysis of network loads, load profiles or peak demand etc.

However, the DFES data feeds into a network planning process, generally run by the DNO network strategy and planning teams, that is used to profile demand loads and identify network constraints. WPD, for example, calls this process Shaping Sub-transmission

This is an important point. Many DNOs have outsourced the production of the DFES to third party providers such as Regen, Baringa, Element Energy and other energy consultancy firms. This has the advantage of providing additional resource and expertise, as well as a 3rd party that can produce scenario forecasts independently of the DNO. It is important, however, that DNOs maintain the capability to manage their networks and ultimately take responsibility for investment decisions and management of network risks.



10) Who produces DFES data forecasts, is it a competitive market?

Most DNOs have partnered with 3rd party organisations to produce their DFES. It should be emphasised however that this needs to be a collaborative process between networks and their service partners and cannot be fully outsourced.

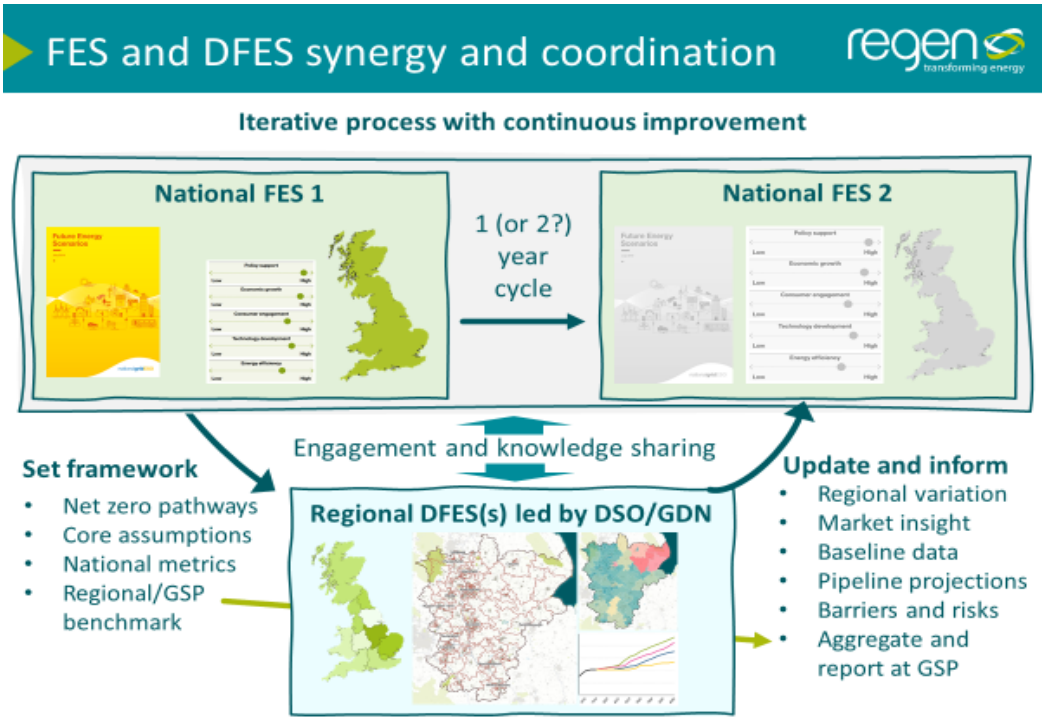
The collaboration between networks and the competition between service providers has helped to promote innovation and to reduce costs.

Consistency between DFES processes can be maintained by applying standards – such as the "building blocks" and other best practice being supported by the ENA Open Networks project.

11) How often is the DFES produced and how long does it take?

Owing to the level of change in the energy sector most DNOs update their DFES on a regular basis, with many adopting a 2 yearly cycle. Ofgem has now recommended that networks should update their DFES annually in line with the national ESO FES.

This will likely lead to a more regular yearly cycle with the National Grid ESO FES developed through the spring and launched in July time, while the DFES is developed over the summer and autumn period to be published in November and December. This regular cycle will allow for greater data sharing between DFES and ESO FES teams and continuous improvement of the data quality and process.

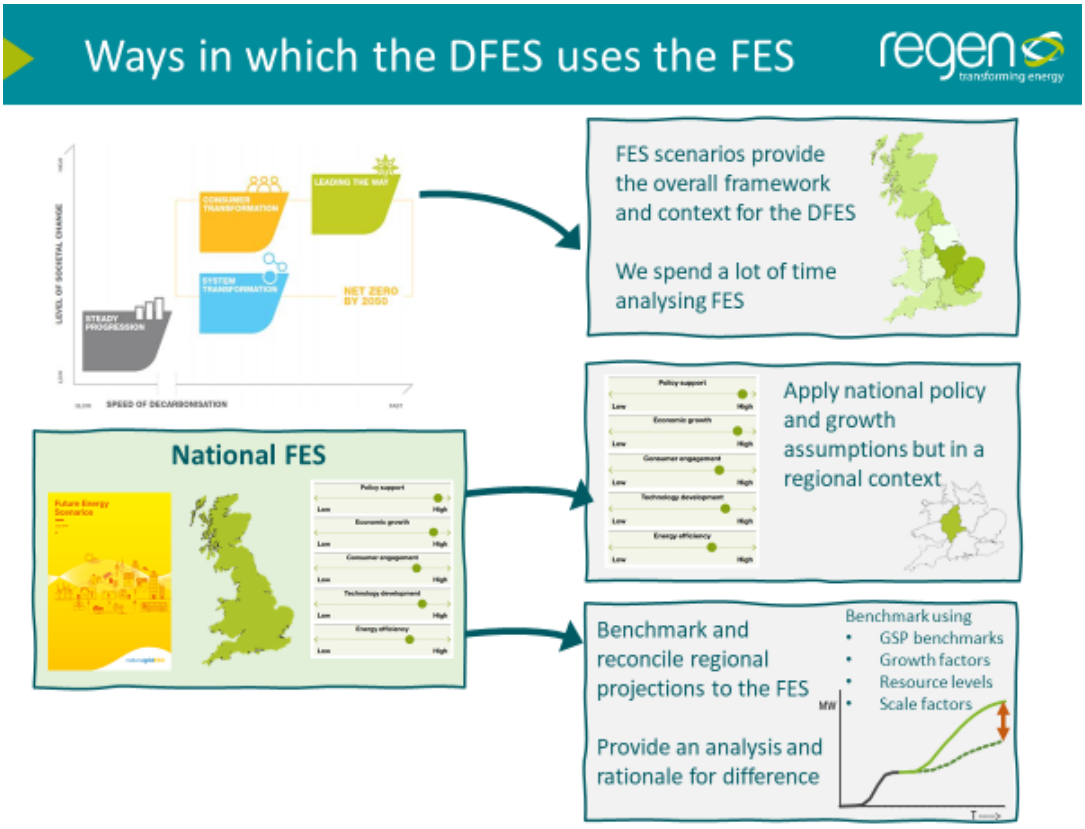


Production of the DFES has become a lot quicker and cost efficient now that the underlying data and mapping to the network has improved. Regen normally plans to turnaround a DFES analysis in a period of 3-4 months from the point of receiving a connection and asset data extract from the DNO. Whereas we used to process licence areas sequentially the process can now be run concurrently for multiple licence areas. Stakeholder engagement may continue before and after the main DFES production process.

12) What is the relationship between the DFES and the National Grid ESO FES?

Most DNOs now use the ESO FES scenarios to provide a common and consistent scenario framework and set of assumptions. The ESO FES has changed significantly over the years, with new scenario definitions coming in to reflect the changing GB energy landscape including net zero, and this has then been reflected in the DFES.

Although the DFES is intended to be a "bottom-up" process that reflects regional and local energy requirements, the DFES also uses the ESO FES analysis and outputs to provide a benchmark or guideline for the uptake and growth of new technologies, this is especially true where the ESO FES has provided an additional regional breakdown. Ofgem has asked the DNOs to ensure that there is reconciliation between the DFES and ESO FES and that regional variances are properly documented and explained in a transparent way. (See Technology Summary Sheets Question 17)



13) Why do regional DFES projections vary from the national ESO FES?

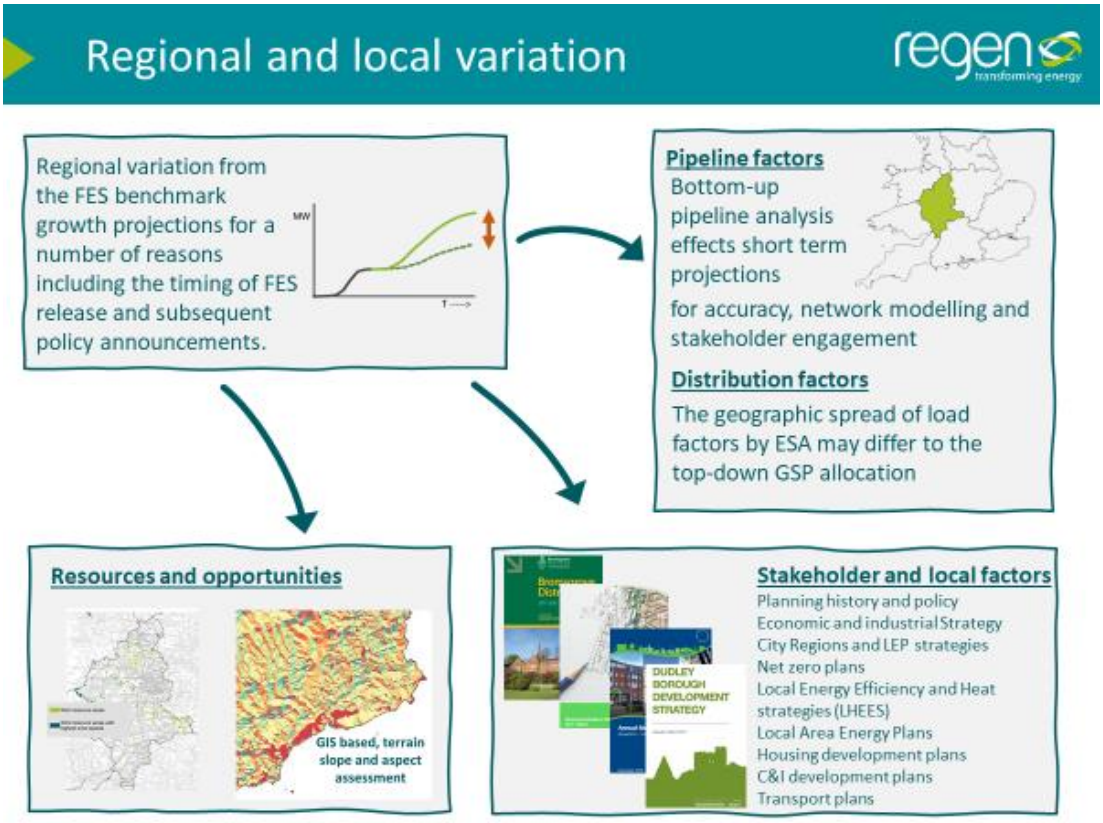
One approach would be to take a national projection for a particular technology and then mechanistically disaggregate it to each region or sub-region based on an algorithm. This would produce an internally consistent national and regional scenario forecast but would say very little about the individual region apart from what size it was or how many households/vehicles/land space etc it contained. Or whatever other factor was used to drive the algorithm.

This would disenfranchise stakeholders and also prevent network planners from modelling the actual projects and developments in their connection pipeline.

Instead the DFES is intended to be a bottom-up analysis of a changing energy system at a regional and sub-regional level using the national FES as a framework and benchmark but reflecting regional and local factors. It is, therefore, inevitable that there will be some variance between the DFES view and the national ESO FES view. Although this doesn't mean that the two views cannot be reconciled.

Regional and sub-regional variations tend to fall under a number of factors including:

- **Resource availability** – e.g. land space for solar or wind resource
- **Historic factors** related to the uptake of technologies which is some cases may be a good indicator of future growth and in some cases may be a false friend. E.g. high solar growth in the south west may not be a good indicator for the future since many of the best sites have been taken and this is reflected in a lower pipeline of projects compared to, for example, the East Midlands.
- **Political factors** such as the region's net zero ambitions, strategic plans and planning processes
- **Stakeholder input**, local area energy plans and strategies.
- **Baseline and pipeline factors** – the DFES will pay particular attention to the pipeline of projects which are actually being developed and especially those with network connection agreements. This means that, particularly in the shorter term, DFES analysis will tend to be influenced more by the pipeline than the long term scenario. Pipeline factors are perhaps the most significant source of variation in the short term.
- **Uptake rates** may differ. Even when the National ESO scenario is used as a benchmark and expect to see a consistent outcome across regions, for example for EV growth, we can already see variations in terms of uptake rates, especially in the short term. These variations may be expected to reduce over time.



As a rule of thumb

- those technologies that are heavily influenced by local factors such as resource availability and political/planning factors such as onshore wind will exhibit greater variance

- regional variation is most pronounced over the near terms due to pipeline factors, local policy and planning and differing uptake rates. Over the longer term regional DFES will trend towards the national growth projections

Whatever the cause of the variation it is important that variation is identified and understood. In fact, often the regional and local variation produces important learnings points for network planners, energy policy and the regulator.

Regen now produces a reconciliation between the DFES and ESO FES with a commentary as to why there is a variation. (See Technology Summary Sheets Question 17)

Critically this analysis can then be fed back into the National Grid ESO FES process to improve the national scenario forecast and its own regional analysis at Grid Supply Point level.

14) Is the DFES limited to the four National Grid ESO FES scenarios?

No, it's not, and on several occasions, we have added a 5th scenario, for example to reflect a net zero carbon outcome at a time when the National Grid ESO FES still reflected the previous 80% carbon reduction commitment.

It would also be possible to add additional scenario to better reflect local stakeholder energy strategies and local area energy plans as discussed further under question (21)

15) What input data sources does the DFES use?

The DFES uses a very wide variety of data sources almost all of which is publicly available.

The key input data is:

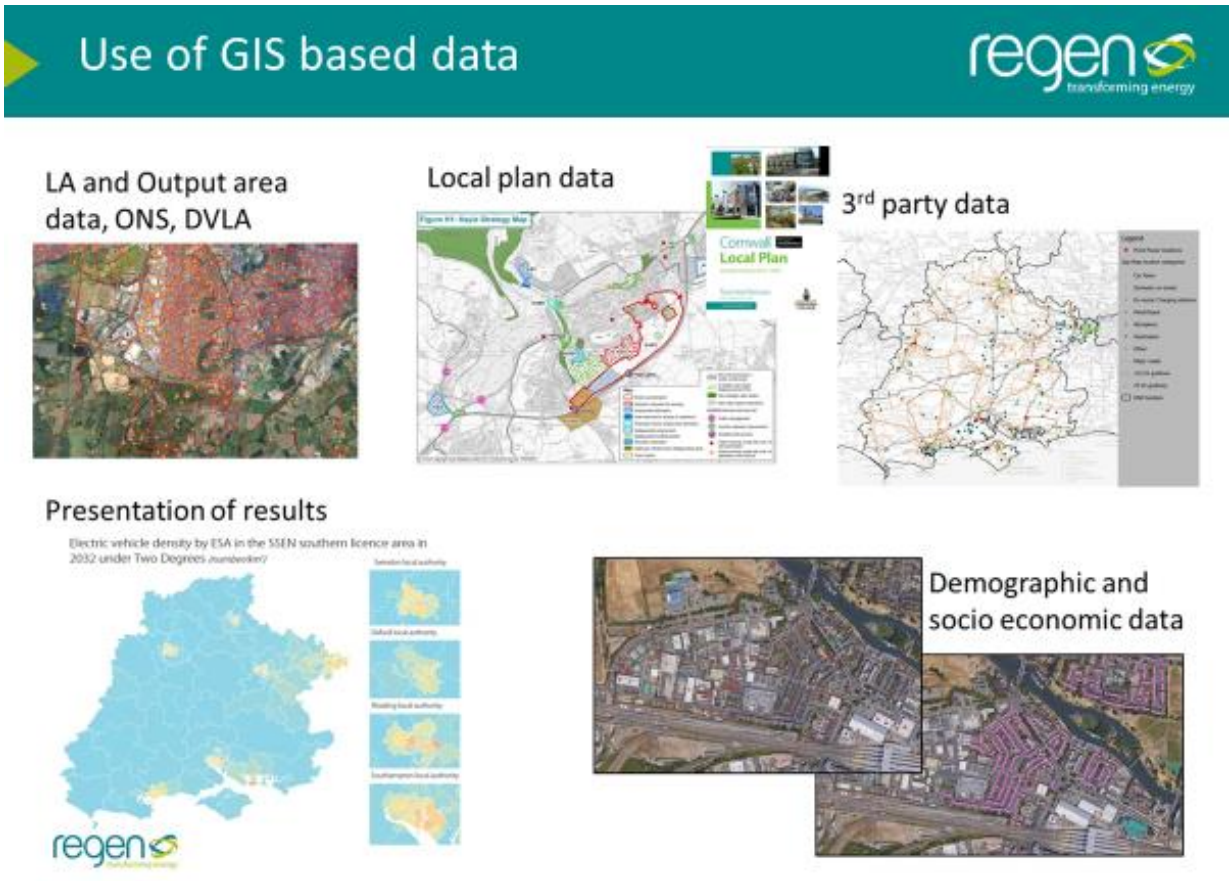
i. The National Grid ESO Future Energy Scenarios which are published annually
ii. DNO current asset registry data which has also now been published by the networks
iii. DNO connections data for new connections data that are under applications (not published) and accepted connections (published in part)

In addition, depending on the technology under analysis, the DFES uses:

- Planning data including the BEIS renewable energy planning database
- FIT and MCS data
- CFD data
- Capacity Market data
- BEIS published energy data sets (DUKES)
- Regional datasets such as the Welsh Governments Energy Generation and Consumption Data
- BEIS published regional and local authority data energy use and consumption data

- ONS data for demographics, population, affluence and fuel poverty etc
- DfT data on vehicles, roads
- Geographic data for energy resource assessments and land use for technologies such as wind, biomass and solar
- Land use data and agriculture statistics
- Crown Estate data
- Some 3rd party data sets including ZapMaps, and AddressBase – especially for very high granularity analysis
- Local development plans – especially for housing and commercial and industrial property growth
- Regional and local energy strategies, net zero action and local area energy plans
- Some data gathered directly from developers of energy projects

The DFES makes extensive use of GIS to plot this data and overlay data onto the network electricity supply areas (ESAs).



16) Is the DFES output data available and can it be used by other stakeholders?

Absolutely. All the DNOs have committed to publish and/or make available their DFES data and many have now established data portals to allow stakeholders to explore and download DFES data.
For example, see:

- WPD DFES interactive map https://www.westernpower.co.uk/distribution-future-energy-scenarios-application
- SSEN's DFES downloads https://www.ssen.co.uk/lctuptake/
- UKPN DFES data https://innovation.ukpowernetworks.co.uk/2020/02/06/distribution-future-energy-scenarios/

Stakeholders can use the data to explore energy within their region and to provide baseline data for existing connections and low carbon energy uptake.

The more stakeholders that use the DFES the better the data quality will become over time. The annual cycle of the DFES also offers the opportunity for better data sharing and digital data exchange.

17) How visible and transparent is the DFES data, analysis and assumptions?

The level of DFES transparency has increased greatly. This has been helped by the separate publication by the networks of their connection and asset capacity data, two of the key DFES inputs that where previously under NDA.

Early versions of the DFES included very long (over 140 pages) reports that described the DFES methodology, results and technology chapters. This was hard to digest

This has now been simplified with a separate methodology report, shorter summary results and "in 5" type reports and, for Regen produced DFESs, individual **technology summary sheets.**

In terms of transparency:

a) For most DNOs, the DFES is based on the National Grid ESO FES scenarios which are published on an annual basis with supporting commentary and assumptions
b) DFES input data is based almost entirely from publicly available resources including the DNO connection and asset registry data. (Some of the FIT data has to be released under a freedom of information request). See Question
c) DFES stakeholder engagement events are documented and, since Covid, the webinars can be made available online. See for example
    - Report https://www.regen.co.uk/wp-content/uploads/WPD-DFES-Webinar-Summary-Report-SOUTH-WEST-24048-ARTWORK.pdf
    - Webinar https://www.youtube.com/watch?v=wZvgcYL-XGw&feature=youtu.be

d) For each technology building block the DFES include a 3-4 page **technology summary sheet**:
    - Summary results for that technology or load factor building block
    - Listing of projection assumptions including national and regional assumptions
    - Short, medium and long term analysis
    - Key uncertainties and sensitivity
    - References to input data
    - Reconciliation to national FES and commentary on regional differences
    - References to stakeholder input and how it has been used to impact projections
    - Overview of the distribution factors and regional distribution

There is a lot of data and content with the DFES, but if a third party wants to use the data or audit the results we have tried to make it as transparent as possible.

For an example of a technology summary sheet see here

18) How is data and output quality maintained and improved with the DFES process?

Energy data quality is one of the key issues that has been identified by the Energy Data Taskforce, as well as the ENA Open Networks project.

The DFES is subject to the same data issues as any other analysis that is using multiple sources of input data. For example, in the first rounds of the DFES a lot of work had to be done to improve the mapping of network asset data to ESAs and to tidy up connection databases. Typical issues included assets that where mislabelled to the wrong technology type or had the wrong locational data, including assets which were apparently in the sea.

An example of data error was a large CCGT Gas Power Station which for years had been identified in BEIS DUKES data as being in England, when it was actually in Wales.

With hundreds of thousands, and now millions of data points, there is no way to manually check the data quality of every DFES item. So rather than think of data perfection it is probably better to think of systematic checks and continuous data improvement.

There are a number of ways to improve data quality in the DFES process:

a) The DFES used the National Grid ESO FES. Annual reconciliation and cross checking back to the FES can highlight discrepancies in both data sets. The shift to an annual process should allow better knowledge exchange between the FES and DFES teams and allow for data validation and error spotting. This process does, however, need to be formalised.
b) The annual DFES process also allows comparison between years which can often be used to highlight data discrepancies
c) Within the Regen DFES team there is a process of peer review and cross checking of data between the data analysts and sector/technology leads.

d) Cross checking has been facilitated by the use of Technology Sheets which form the basis of a quality review
e) The DFES process also features continuous engagement between the DFES team and DNO network planners. Working together these teams can often identify and resolve data issues. Close communication is essential.
f) Stakeholder engagement provides an additional opportunity to present and validate results to a wide audience

By far the best way to validate and improve the DFES data is to use it. All networks have now completed at least one iteration of the DFES and many have now completed several "rounds". With each round data quality has improved, especially once network planners and district managers have begin using the data in earnest.

The annual DFES process therefore offers a unique opportunity to improve data quality across the networks.

19) If the DFES presents alternative scenarios how does it support network investment? Don't networks need a single forecast?

It is sometimes said that because DFES is still based on (4) scenarios is does not constitute a single defined forecast and therefore cannot determine future DNO investment.

This is only partly true and there are some important points to bear in mind:

- DFES is not intended to determine future investmentf, its primary purpose is to provide a set of input data that network planners can use to model and stress test the network. It is the network planning process, and options appraisal that follows, that drives investment planning. For a good example of this see WPD Shaping Sub-transmission.

- It is not true that investment planning requires only a single forecast. Under the RIIO process it is probably more useful to think in terms of a baseline investment allowance augmented by a number of **uncertainty mechanisms*** that allow investment budgets to be increased under certain conditions. It is therefore useful for DNOs to have a baseline forecast, which may be based on a best view or central scenario, but then to also have a range of scenario outcomes to model the sensitivity, scope and scale of potential uncertainty mechanisms.

- DFES based modelling has helped the networks to better understand the sensitivity of the networks to different load growth outcomes at a regional and local level. This in turn has enabled them to better determine what would be a reasonable "best view" or central scenario that manages network risk against cost while achieving certain investment outcomes.

* Under RIIO ED2 uncertainty mechanisms can be defined in terms of "volume drivers" or growth trigger points, Capacity Volume Drivers, Price Control Deliverable (PCD) or a more general budget re-opener. It is understood that uncertainty mechanism will be used much more under ED2 compared to ED1. see Ofgem RIIO ED2 Sector Specific Methodology Consultation

Networks can use the DFES combined with their network constraint analysis to determine a central or baseline scenario to underpin their investment planning process. This can be done in a number of ways depending on the level of uncertainty and risk associated with network investment. It also depends to some extent whether network investment will fall within the network allowance (e.g. to support most demand loads) or will be subject to connection charges as is the case with generation technologies. For example networks can adopt:

- **A "best view" forecast** which is heavily influenced by historic growth and the regional near term pipeline and projections for a given technology in the short and medium term. This works better for technologies that have a relatively long lead time and visible pipeline.

- **A "common or least regret" scenario**. By identifying load requirements which are common across DFES (net zero) scenarios networks can identify a low regret forecast for baseline planning. This could then be combined with an uncertainty mechanism to address a higher load outcome. This could be the best approach where there is uncertainty over the net zero pathway in the longer term, or forecast that are subject to optimism bias such as housing growth.

- **A national (central) scenario or guideline if one is in place**. This could be suitable for technologies that have a wide range of scenario outcomes combined with a low baseline or track record of regional deployment. Or where regional factors are likely to be overridden by national policy decisions. Electric Vehicles could be a technology that would benefit from a more clearly defined central scenario

20) How does a DFES differ from a Local Area Energy Plan (LAEP)?

A DFES analysis and a LAEP will use much of the same input data and methods to analyse the energy system.

A LAEP analysis may go deeper in terms of a geographic focus and granularity, although high granularity DFES for some technologies does go to low voltage substation and feeder level (street level).

The main difference however is the starting point and the overall objective being met.

A DFES provides a set of regional and sub-regional energy scenarios for the primary purpose of network planning, which are based on the National Grid ESO FES, other national or potentially devolved government scenarios.

The DFES allows for a high degree of regional or devolved nation variation based on stakeholder input and supported by "bottom-up" evidence analysis, but is still bounded within a national scenario framework and can be reconciled back to the national scenario.

So, while the DFES should be strongly influenced and informed by stakeholder input, and regional evidence gathering, it does not claim to represent the full extent of local energy ambition and local objectives.

A Local Area Energy Plan starts from the basis of local energy objectives, not a national scenario. The methodology outlines by the Energy Systems Catapult and CSE begins with a definition of the energy vision and definition of local energy objectives. LEAPs therefore represent a much more local stakeholder view of the energy system, albeit with strong input from energy networks.

Local energy objectives may be wide ranging. For example:

- An accelerated local net zero target
- Maximising the use of regional energy resources or achieving more energy self sufficiency
- Addressing fuel poverty and just transition objectives
- Increasing local and community ownership of energy assets
- Clean air, health and welfare benefits
- Protecting future generations (e.g. Wales)
- Creating local jobs and economic value retention esp. Green Recovery
- Reflecting stakeholder preferences for certain technologies e.g. pro tidal energy, or heat networks but not nuclear or EfW
- Political and democratic factors

LAEP projections and forecasts could therefore be quite different to DFES and national scenarios and would serve a different purpose; to create momentum and impetus behind a locally defined energy future, a net zero action plan and economic growth.

21) Could the outputs from a LAEP be incorporated back into a DFES?

Yes, DFES and LAEPs could easily work together and this would be a very positive development for both DNO's and regional stakeholders.

Incorporating LAEP results back into the DFES process would allow the DNOs to analyse the LAEP results within its network planning processes and to compare and present the results against the national scenarios. This would probably be necessary in order to support and evidence any proposals for additional regional investment.

Likewise DFES analysis, and the spatial definition of the ESAs, would be a useful input to the LAEP.

Incorporating the LAEP outputs within the DFES analysis would require some practical steps, all of which are surmountable:

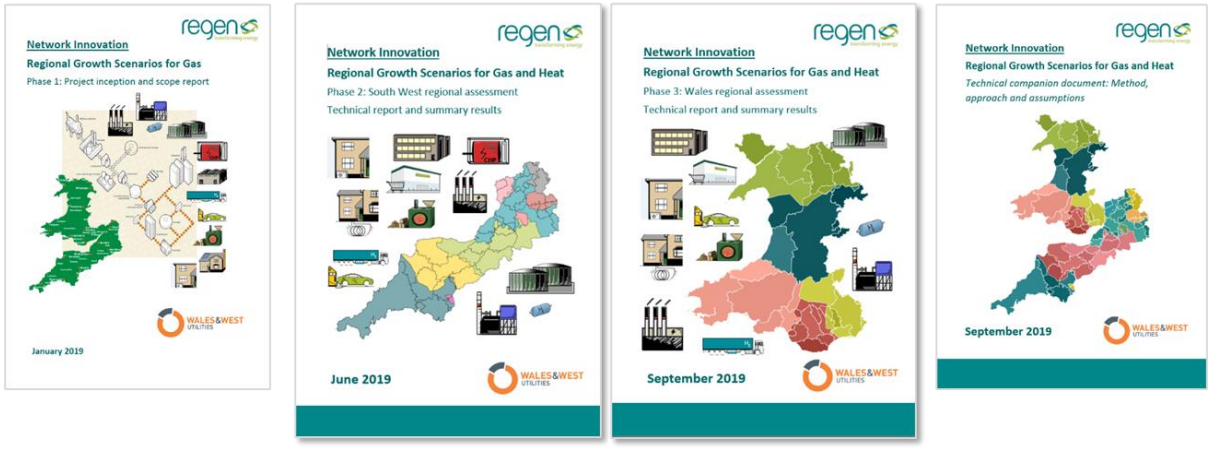
a) It would probably require the definition of a new (5th) DFES scenario as it would be difficult, and probably confusing, to reconcile a LAEP into one of the existing national scenarios.
b) It would be beneficial if the LAEP methodology also used the same building block definitions of technology types (this should probably be done anyway)

c) DFESs are updated annually whereas a LAEP is likely to be completed on a less regular basis. So some means of updating or maintaining the LAEP would be required if the process was to be repeated annually.
d) It is unlikely that at any given time LAEPs would cover an entire DNO licence area, a methodology would therefore be needed to extend the LAEP to the remaining licence area, or the approach could be to use the LAEP inputs for a part of the licence area only.

22) Can a DFES approach be used by gas networks as well?

This FAQ sheet has focused on electricity networks but Gas Networks (GDNs) can also adopt a DFES type process.

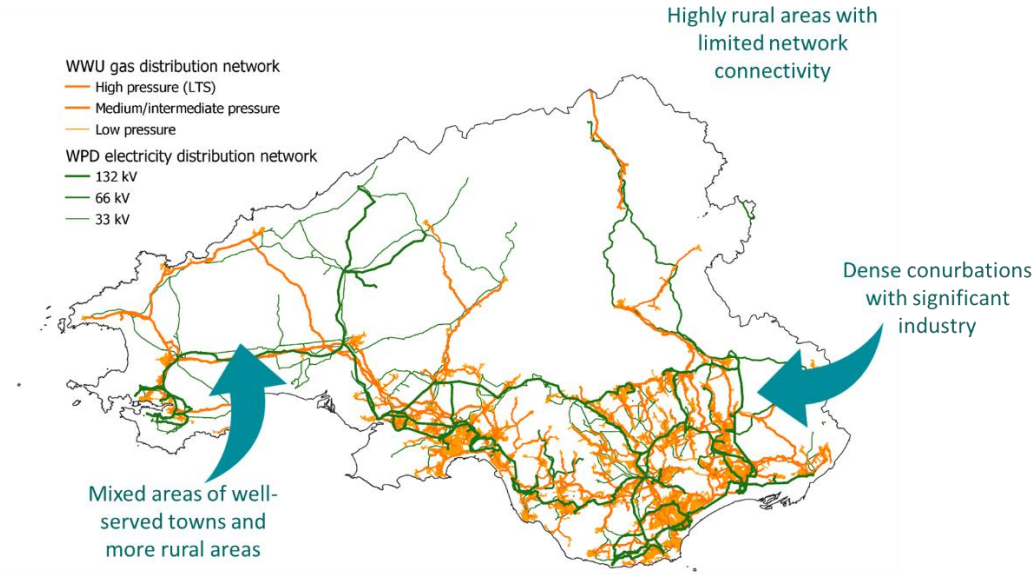
Wales and West Utilities has been the first to do this in a formal process and the results of their first DFES analysis for South West England and Wales networks can be found https://www.regen.co.uk/project/wales-and-west-utilities-regional-growth-scenarios-for-gas/



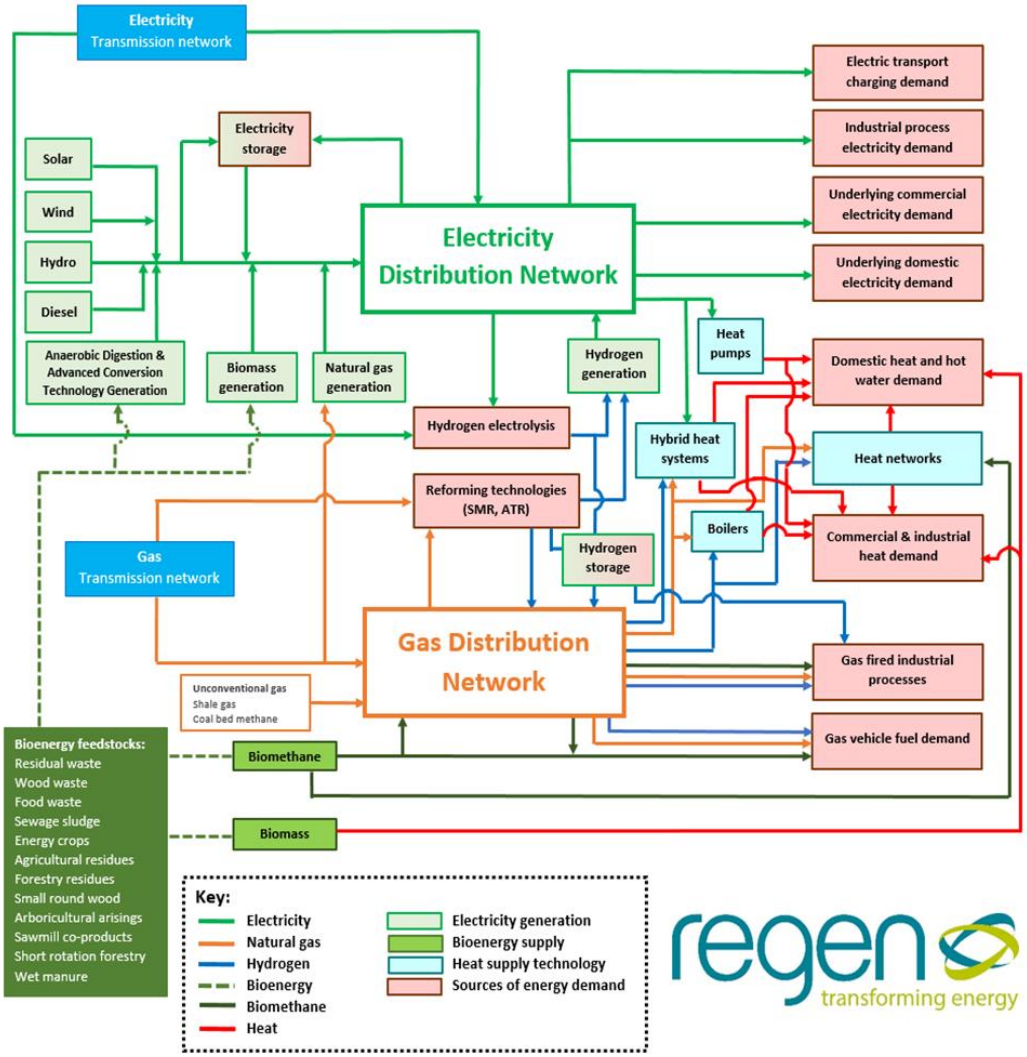
23) Is there an opportunity for gas and electricity networks to complete an integrated DFES?

Yes, there is but it can be complicated by different timescales and objectives.

Working with WPD and Wales and West Utilities, Regen has completed an integrated DFES analysis for the South Wales Region see Net Zero South Wales



The Net Zero South Wales study identified lots of areas of overlap and cross-vector integration between the networks which are summarised in the diagram below.



The Net Zero South Wales study produced very useful analysis of the interaction between the networks and could provide a basis for future integrated and whole system DFES approaches.

One issue identified in the Learning Report that accompanies the study was the additional complexity and difference in timing between electricity and gas network companies which is mirrored by differences in the RIIO periodic review process. There is therefore a trade-off between having integrated DFESs on a regular basis versus the time and cost impacts of trying to work together. There is, however, definitely a case for greater joint working and data sharing between the networks and this could be facilitated by adopting a similar DFES process and building blocks.

24) Where can I get further information about the DFES

All the distribution networks have published information about their DFES process on their websites and will be running regular stakeholder engagement events both to collect data and to disseminate their forecasting results.

Regen is also happy to field more general questions about the DFES process, please email us at Admin@Regen.co.uk or have a look on our website