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SP ENERGY NETWORKS

# SP Distribution Future Energy Scenarios Key Findings

April 2020

# 1 Foreword

Welcome to our Distribution Future Energy Scenarios (DFES). This document summarises the key findings from our DFES forecasts for how electricity generation and consumption may evolve in Central and Southern Scotland over the next 30 years. This is one of a suite of documents we have created to explain our forecasts. We look forward to engaging with you to hear your thoughts and feedback on these forecasts.


## A changing landscape

The energy landscape is changing fast as the way we generate, distribute and use energy evolves. To deliver Net Zero carbon targets, a significant proportion of transport and building heating will need to be electrified. We are also going to see a further leap in renewable generation capacity as fossil fuel power stations close. This new demand and generation will push the distribution network beyond what it is designed for, meaning that our network will need to evolve to enable our customers' Net Zero transition.

But while the overall direction of travel towards Net Zero is clear, there are some areas where policy decisions and action plans are still under development. How will Local Authorities turn their Climate Emergency status into action? How will UK and Scottish governments respond to the challenge of decarbonising domestic heating? Which communities will move faster than others?

Given these uncertainties and the ever changing energy landscape, creating a single forecast risks being misleading. Instead we set out four forecast scenarios which, between them, cover a range of credible pathways to describe the potential decarbonisation routes which our customers may follow.

## Working together

We do not endorse any particular scenario – our main role is to ensure that we provide the safe, economical and reliable network capacity that is needed to deliver the decarbonisation route that our customers and communities choose. It is therefore important that we make sure we have correctly understood your requirements – feedback on these forecasts from customers and stakeholders is vital to ensure that they reflect the plans and ambitions of the communities we serve.

We look forward to engaging with you and hearing your thoughts over the coming weeks. Please do not hesitate to share your feedback and insights with us, so we can ensure our network continues to meet your needs.

A final note: regardless of the decarbonisation pathway that our customers end up treading, we recognise that the distribution networks are a key enabler. We are already evolving the way we design, build and operate our networks, implementing innovative solutions, and embracing new technologies. We are doing this so that we can continue to provide our customers with a safe, reliable and good value electricity supply, whatever the future holds.

**Scott Mathieson**
*Network Planning & Regulation Director*

# 2
# Impact of Covid-19

Covid-19 has impacted every part of our society and the UK economy. It is too early to be able to accurately assess the impact of Covid-19 on our DFES forecasts, as it will depend on a complex range of societal and economic factors.




Our ways of working, socialising and living have all changed. These changes have affected UK electricity consumption, with electricity demand materially lower compared to this time last year. Looking forward to this summer, the ESO forecasts that UK demand could be up to 20% lower compared to the "pre Covid-19" forecasts[1]. It is important to highlight that, during this challenging time, SPEN is focussed on continuing to provide a safe, secure and reliable supply for all our customers.

It is too early to be able to accurately assess the impact of Covid-19 on our DFES forecasts, as it will depend on a complex range of societal and economic factors. Whilst Covid-19 is having an impact on our network operations and plans, we also believe that, at some point, government and industry effort must revert to ensuring society is tackling the climate change crisis whilst protecting the vulnerable and fuel poor. If anything, our Covid-19 experience has underlined this; it has challenged how we think about resilience and how we enact our response to this imperative.

In this context, electricity networks will endure as vehicles for driving forward government plans for achieving Net Zero. However, in the post Covid-19 period, they are also likely to have increased importance in acting as an economic catalyst in recovery. This is especially important to SPEN as we consider both the national and devolved governments that we serve.

To realise this ambition, it will be important that Ofgem continue to regulate objectively; the need to invest in our networks has never been more important than it is now.

We will keep the impact of Covid-19 under review, and as our understanding of its impacts on our industry and the energy system develops, we will incorporate this into future updates. In considering the impact of Covid-19, we would note that our present DFES forecasts are long-term, looking out to 2050. We assume the Net Zero legislated targets will remain, and so the need for decarbonisation is unchanged.

We welcome stakeholder views on the impact of COVID-19 on our DFES forecasts.

[1] Source: https://www.nationalgrideso.com/document/167541/download

# 3 Introduction

We are SP Energy Networks. We own and operate the electricity distribution network in the SP Distribution licence area covering Central and Southern Scotland. It is through this network of underground cables, overhead lines and substations that 2 million homes, businesses and public services are provided with a safe, economical and reliable supply of electricity.


A safe and reliable electricity supply is key to most people's lives – we depend on it to light our homes, keep our food fresh, power our businesses, and enable our connected lifestyle. In the future, we will also increasingly rely on it to heat our homes and power our transport as we decarbonise our society.

## External context

In response to the global climate change challenge, the Scottish Government has introduced a legally binding target for Scotland to achieve Net Zero (greenhouse gas emissions) by 2045. The Scottish Climate Change Act sets interim targets for emission reductions of 56% by 2020, 75% by 2030, and 90% by 2040. The Scottish Government also has the ambition to phase out the sale of new petrol and diesel cars and vans by 2032. At a more local level, a number of Scottish Local Authorities have declared climate emergencies.

Given that these targets often depend on switching from fossil fuel use to electricity, these targets require a significant change to Scotland's electricity distribution network.

## The DFES forecasts

In order to ensure our network has sufficient capacity to meet our customers' changing electricity needs, we need to forecast what our customers' usage is going to be into the future (we forecast out to 2050). These forecasts need to cover how much electricity existing and new customers might consume (demand) and how much they might produce (generation). We call these forecasts Distribution Future Energy Scenarios (DFES).

We use this understanding of future customer needs to plan and design our network – the DFES forecasts help us understand where we might need to create more network capacity, and how our operational and maintenance activities should be undertaken. This in turn helps us calculate what financial investment is required, and to seek approval for this expenditure from Ofgem, the network regulator. In short, the DFES forecasts are the foundation on which we plan our business to meet our customers' needs.

## Sharing your views

Given the importance of DFES forecasts, we are keen to engage with a wide representation of our customers and stakeholders. Your feedback is vital to ensure that our forecasts reflect the plans and ambitions of the communities we serve, so we can facilitate decarbonisation targets.

Different stakeholders will be interested in different levels of detail, so we have created a range of documents to explain our DFES[2].

Over the coming weeks we will be refining these DFES forecasts with your input. Your feedback is welcomed by the **29th May 2020** and can be emailed to **RIIO_ED2@spenergynetworks.co.uk**. We will also be hosting a range of stakeholder sessions. Further details will be published in our website.

[2] www.spenergynetworks.co.uk/dfes

# 4

# Our DFES forecasts

This section sets out the key findings from our DFES forecasts.

All the forecast values in our DFES are for the SP Distribution network covering Central and Southern Scotland; they are not forecasts for the whole of Scotland or the UK, or the transmission network[3].


## 4.1 How we create the forecasts

The SP Distribution (SPD) DFES forecasts use the National Grid Electricity System Operator (ESO) 2019 Future Energy Scenarios (FES)[4] as a starting point. These are four GB-wide holistic energy scenarios out to 2050, considering gas and electricity supply and consumption. In order to create DFES forecasts which can more accurately predict our customers' needs, we significantly augment these to provide a much more regionally reflective and geographically granular view. This is achieved by using a combination of extensive top-down and bottom-up assessments, spatial disaggregation, and additional input data from a range of sources.

Due to the evolving energy landscape, and the uncertainties surrounding communities' routes to Net Zero, a single forecast scenario would not provide a comprehensive view. We therefore consider it appropriate to retain the ESO's approach of creating four forecast scenarios, ensuring that a range of credible pathways to describe the potential decarbonisation routes are covered. These four scenarios represent differing levels of consumer ambition, government/policy support, economic growth and technology development. They are described in Section 4.2.

Our approach means we can produce forecasts for all key metrics for each scenario, at a sufficiently geographically granular level, for each year out to 2050. This level of detail gives us a greater understanding of the potential timing, magnitude and location of our customers' requirements, meaning that we can make more timely, targeted and efficient interventions in the network.

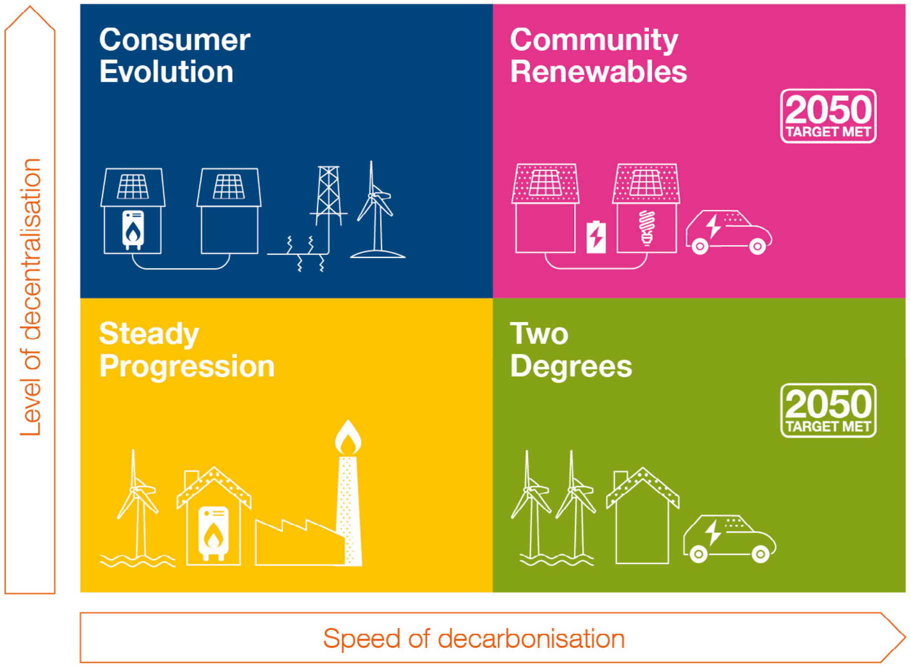
## 4.2 Scenarios overview

To illustrate their different representations, Figure 1 maps the four scenarios against two metrics: level of decentralisation (the extent to which energy generation is smaller-scale and sited closer to consumers) and speed of decarbonisation (how fast low carbon technologies are adopted).

[3] Only large-scale offshore and onshore generation, and very large individual demand customers, are likely to be directly connected to the transmission network. This means that these DFES forecasts.will capture nearly all demand and medium-scale, smaller-scale and domestic-scale generation in Central and Southern Scotland.

[4] http://fes.nationalgrid.com/fes-document/

**Figure 1** | Overview of the ESO's 2019 Future Energy Scenarios






**In SPD Steady Progression (SP)**[5]: the pace of the low carbon transition continues at a similar rate to today but then slows towards 2050. Consumers are slower to adopt electric vehicles and take up of low carbon alternatives for heating is limited by costs, lack of information and access to suitable alternatives. Although hydrogen blending into existing gas networks begins, limited policy support means that new technologies such as carbon capture, usage and storage and battery storage develop slowly.

**In SPD Consumer Evolution (CE):** there is a shift towards local generation and increased consumer engagement, largely from 2040 onwards. In the interim, alternative heating solutions are taken up mostly where it is practical and affordable, e.g. due to local availability. Consumers choose electric vehicles and energy efficiency measures. Cost-effective local schemes are supported but a lack of strong policy direction means technology is slow to develop, e.g. for improved battery storage.

**In SPD Community Renewables (CR):** local energy schemes flourish, consumers are engaged and improving energy efficiency is a priority. UK homes and businesses transition to mostly electric heating. Consumers opt for electric transport early and simple digital solutions help them easily manage their energy demand. Policy supports onshore generation and storage technology development, bringing new schemes which provide a platform for further green energy innovation to meet local needs. The key adjustments we made to accommodate the 2045 Net Zero target are a significantly higher uptake of heat pumps, higher uptake of distributed generation and electric vehicle uptake aligned with the Scottish Government's targets.

**In SPD Two Degrees (TD):** large-scale solutions are delivered and consumers are supported to choose alternative heating and transport options to meet the 2045 Net Zero target. UK homes and businesses transition to hydrogen and electric technologies for heating. Consumers choose electric vehicles and hydrogen is widely used for commercial transport. Increasing renewable generation capacity, improving energy efficiency and accelerating new technologies such as carbon capture, usage and storage are policy priorities. The key adjustments for the 2045 Net Zero target include a slightly higher uptake of heat pumps (hydrogen is still assumed to play a key role for heating under Net Zero compared to the SPD Community Renewables scenario), higher uptake of distributed generation and electric vehicle uptake aligned with the Scottish Government's targets.

[5] Source: Scenario descriptions based on the ESO's 2019 FES (http://fes.nationalgrid.com/media/1409/fes-2019.pdf)

# 4.3 Electricity demand

**Understanding how electricity demand could evolve on SP Distribution's network is the first fundamental factor informing the need for network intervention to increase or manage network capacity. The main drivers of changing electricity demand are the electrification of heat and transport, i.e. increased electric vehicles and heat pumps.**

### Key findings 1 and 2 – Demand increases in all scenarios and flexibility will be critical

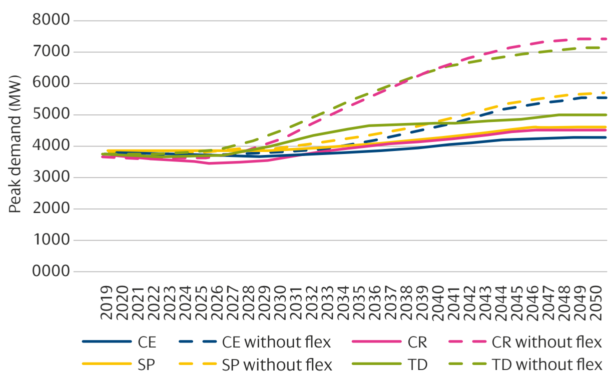
**Figure 2** shows how SP Distribution's total peak demand will vary for the four scenarios. It shows this for two states:

- The dashed line assumes that none of the demand is flexible (i.e. it can't be shifted away from the peak demand period to less busy periods).
- The solid line assumes a degree of demand flexibility. Flexibility is relevant as it means electricity consumption can be moved from peak demand times to less busy times of the day, or to periods of high generation output. This reduces the network impact and the requirement for network interventions.

**Key finding 1:** All scenarios show materially increasing demand. This means that the distribution network will need intervention to provide more capacity to facilitate decarbonisation.

**Key finding 2:** Demand flexibility can materially reduce peak demand and deliver real benefits to consumers. This means that we should all be working to enable flexibility.

**Figure 2** | Electricity peak demand with and without flexibility





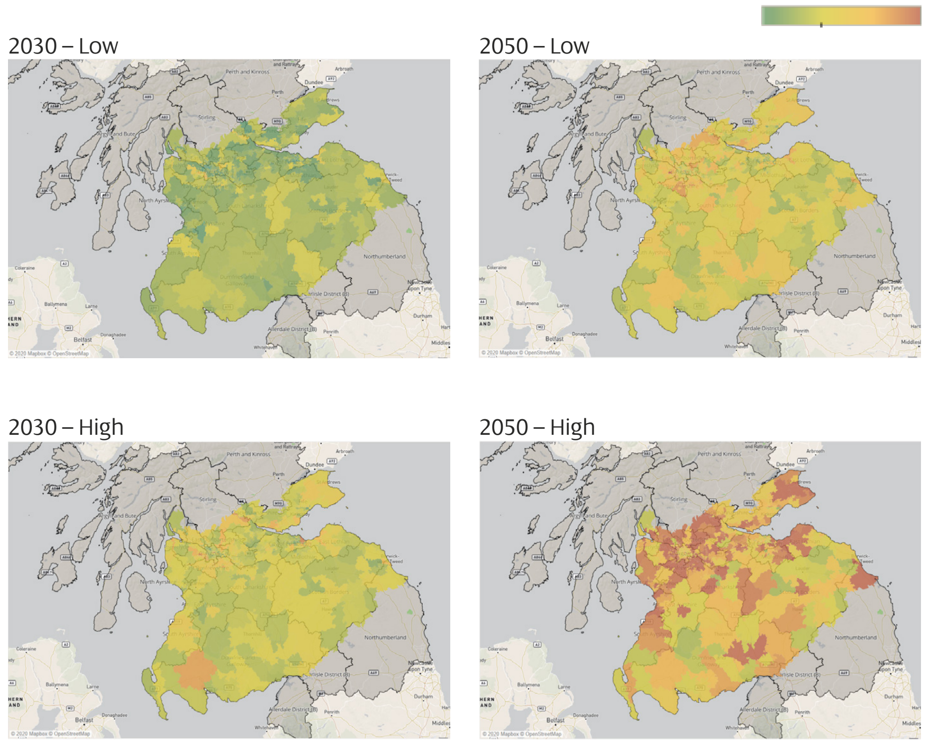

### Key finding 3 – Demand increases in different regions at different speeds

**Figure 3** shows a geographically granular view on how the demand could change from current levels for the high and low scenarios.

**Key finding 3:** There is clear variance in the demand changes seen between regions. This is because regions will decarbonise at different speeds and have different population densities.

**Figure 3** | Electricity peak demand changes from 2019 by primary substation area

*Scale range: -3MW to >5MW*

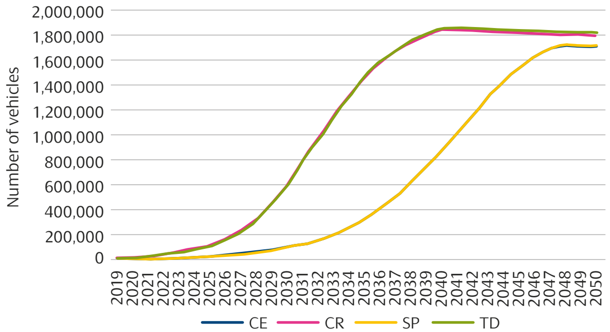


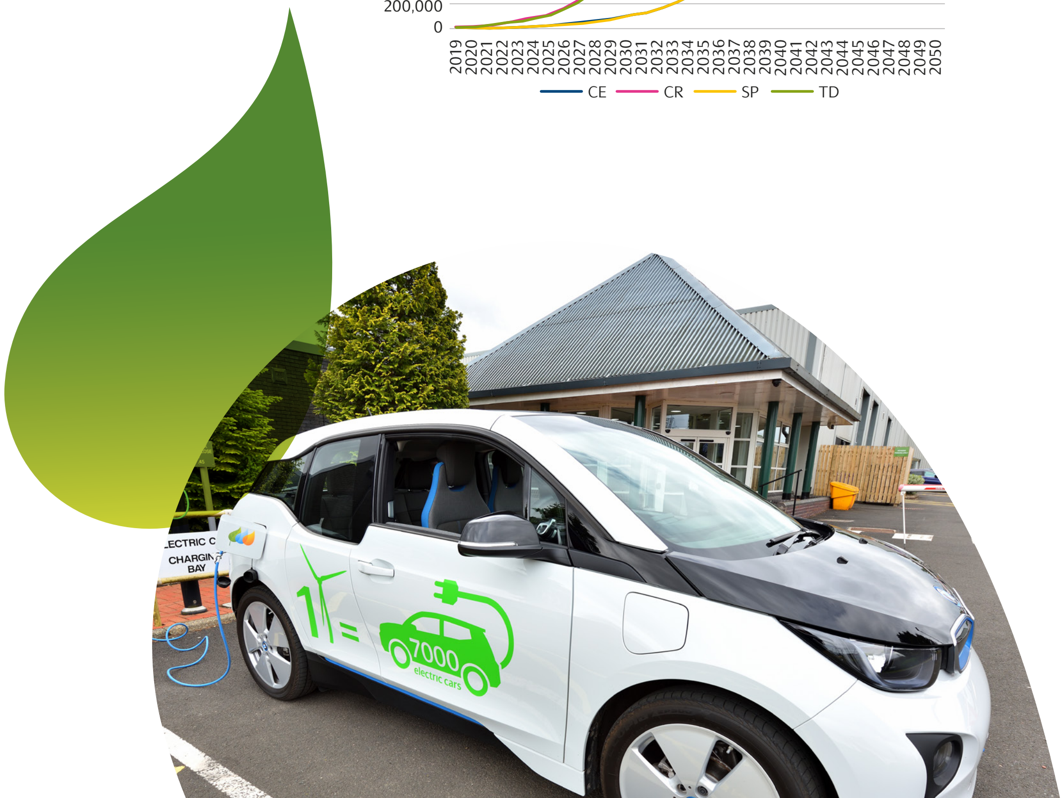
## Key finding 4 – Electric vehicle growth is significant in all scenarios, but the growth occurs at different times

Figure 4 shows the forecast numbers of residential battery electric vehicles in Central and Southern Scotland.

Key finding 4: There is a high degree of variance in the number of electric vehicles by 2030. This variance depends on whether Scotland's ambition for no new fossil fuel vehicles by 2032 is achieved. However, the total number of electric vehicles by 2050 is similar across all scenarios.

Figure 4 | Residential battery electric vehicle uptake



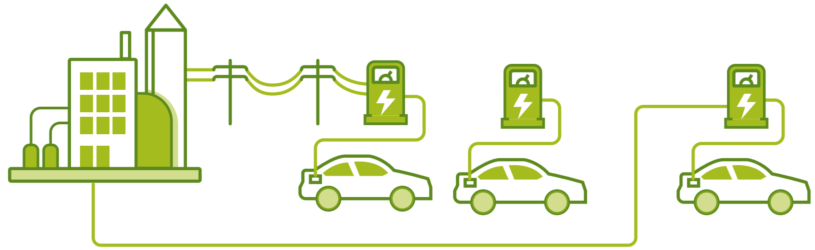



## Key finding 5 – Electric vehicle smart charging must be enabled

Electric vehicle charging could have a significant impact on SP Distribution's peak demand if left unmanaged. Smart charging and vehicle to grid (V2G) are two ways to add flexibility to electric vehicle charging; they help reduce this peak demand impact by shifting electric vehicle charging to a different time of day, and enabling electric vehicles to release electricity back to the network to help alleviate constraints.

Key finding 5: Enabling smart charging and other measures, which allow electric vehicles to charge in a more flexible way, will significantly reduce their impact on the network. This will enable a faster electric vehicle roll-out and deliver lower electricity bills for customers.

**By 2030**

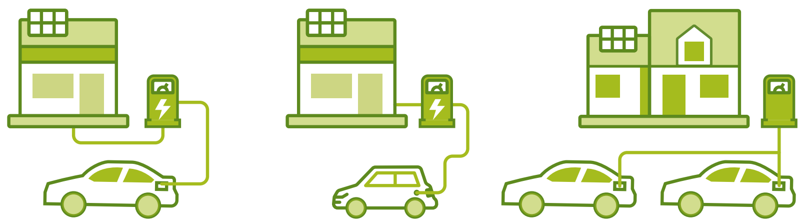


EV charging could add to SPD's peak demand between **67-245 MW**

Smart charging could reduce this contribution by **10-47%**

V2G could help decrease this by a further **7-11%**

**By 2050**



EV charging could add to SPD's peak demand between **605-845 MW**

Smart charging could reduce this contribution by **33-50%**

V2G could help decrease this by a further **42-46%**

### Key finding 6 – How society decarbonises heat could have a big impact on electricity consumption

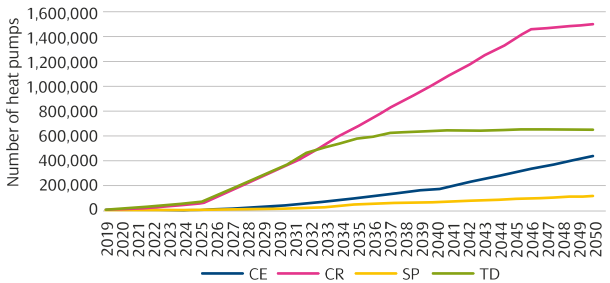
At the moment, a significant proportion of building heating is provided by natural gas or oil. This needs to change to achieve decarbonisation. There are three broad ways that domestic heating can be decarbonised: replacing natural gas with hydrogen in the gas network, district heating schemes, and heat pumps. Of these three options, heat pumps will have the greatest impact on the network given that they will increase the electricity consumption of every building.

**Figure 5** shows the forecast uptake of heat pumps for the four scenarios.

**Key finding 6:** There is a high and enduring variance in the number of heat pumps across the scenarios. As the impact on electricity consumption is proportional to the number of heat pumps, this means that how society decarbonises heat will have a significant impact on peak demand and electricity networks.

To put this potential impact into perspective, the additional demand from electric vehicles in the high scenario (taking account of flexibility) is approximately 64MW.By comparison, the additional demand from heat pumps in the high scenario (taking account of flexibility) is around 700MW.

**Figure 5** | Electric heat pump uptake






## 4.4 Electricity generation and storage

**Understanding how electricity generation could evolve on SP Distribution's network is the second fundamental factor informing the need for network intervention to increase or manage network capacity. The main drivers are increased wind generation, solar PV generation, and storage.**

### Key finding 7 – Distributed generation increases in all scenarios

The volume of generation connected to the SP Distribution network out to 2050 will be affected by the overall requirement for more generation (to meet increased demand), and the decentralisation effect – how much of that generation will be smaller-scale (and so connected to the distribution network) versus larger-scale (and so connected to the transmission network).

**Figure 6** shows how the total generation and storage capacity connected to the SP Distribution network will vary for the four scenarios.

To better illustrate what is driving the changes in generation, **Figure 7** shows a breakdown of the generation and storage forecasts from **Figure 6** by technology type, for 2030 and 2050.

**Key finding 7:** In the next ten years, generation capacity on our network is likely to triple, reaching 7.4GW. By 2050, our scenarios indicate there could be as much as 3-6 times more generation than today.

This generation growth is due to renewable generation and storage:

– Increases in solar PV capacity are significant across all scenarios – a potential fivefold increase this decade, and a 12 times increase by 2050. Our forecasts show that the great majority of this growth is due to ground mounted solar PV, rather than rooftop solar PV.

– There is significant variance in the levels of wind generation across the four scenarios. Wind generation is a cost-effective, proven technology, so the extent of new wind generation will likely depend on the onshore planning regime, government/policy support, and local support for individual schemes.

**Figure 6** | Total installed generation and storage capacity

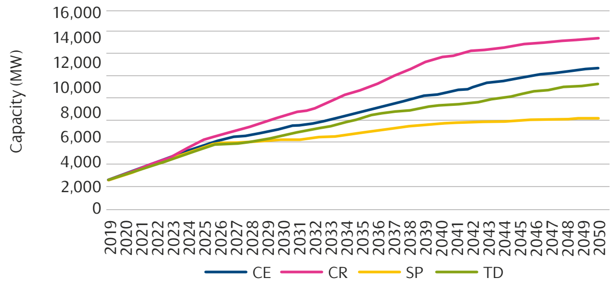
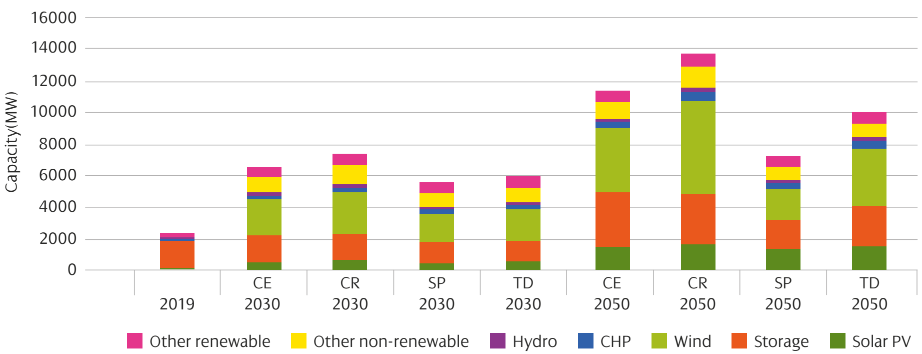



**Figure 7** | Breakdown of installed generation and storage capacity by technology type



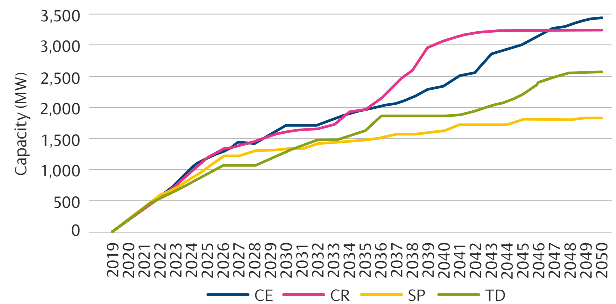

## Key finding 8 – The future of storage looks strong

Electricity storage can range from large-scale pumped hydro schemes down to domestic-scale battery units. Electricity storage can help manage peak demand (by exporting to reduce local demand) and provide valuable system services (such as frequency response).

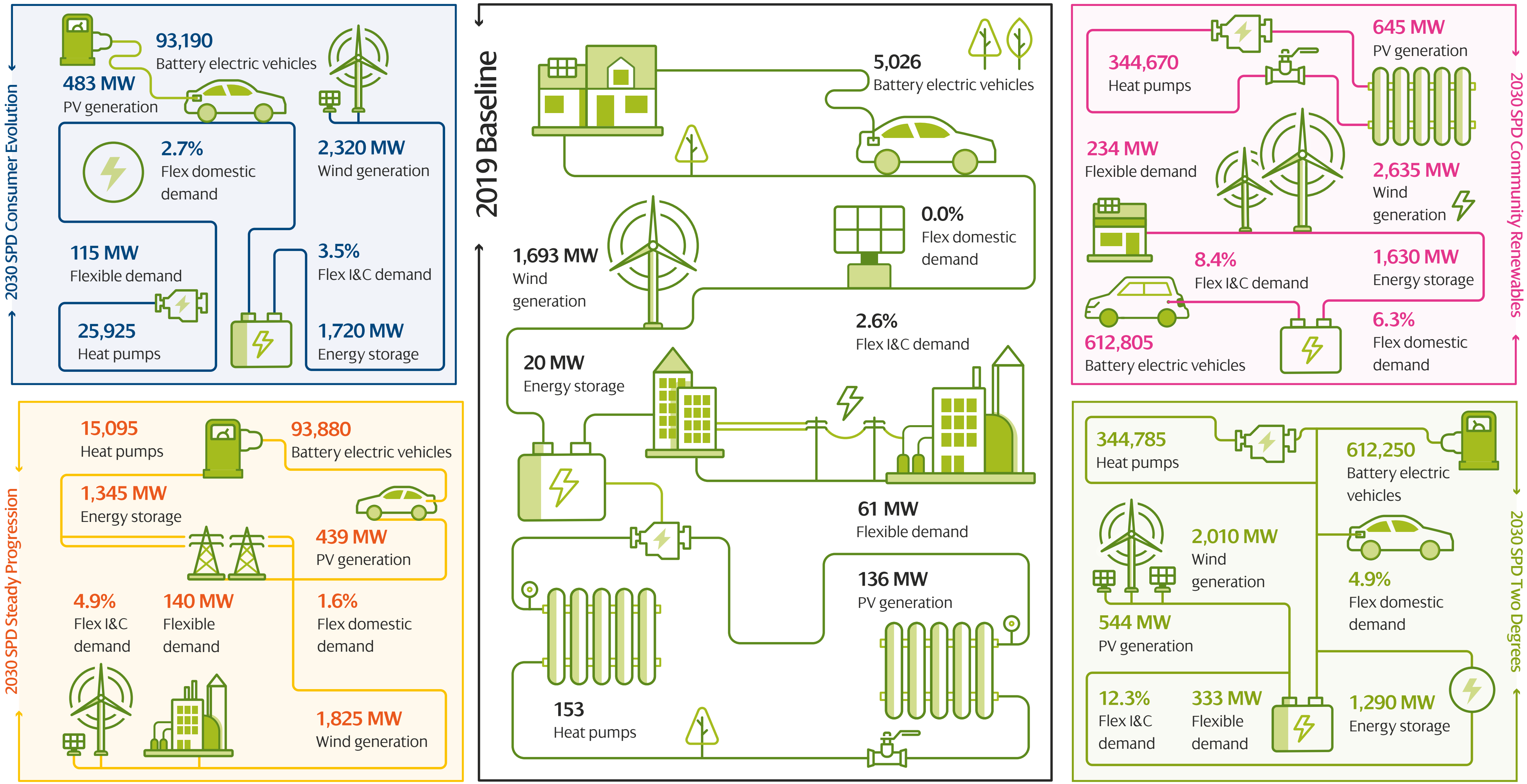
**Figure 8** shows the forecast uptake of electricity storage for the four scenarios.

**Key finding 8:** Future increases in storage are significant across all scenarios – in the next five years there is likely to be more storage growth than all other generation technologies combined. Our forecasts show that the majority of this growth is due to larger-scale standalone storage, rather than domestic-scale storage at individual properties.

**Figure 8** | Installed storage capacity




# 4.5 Key Figures – Changes from 2019 to 2030



## Notes



## Notes

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