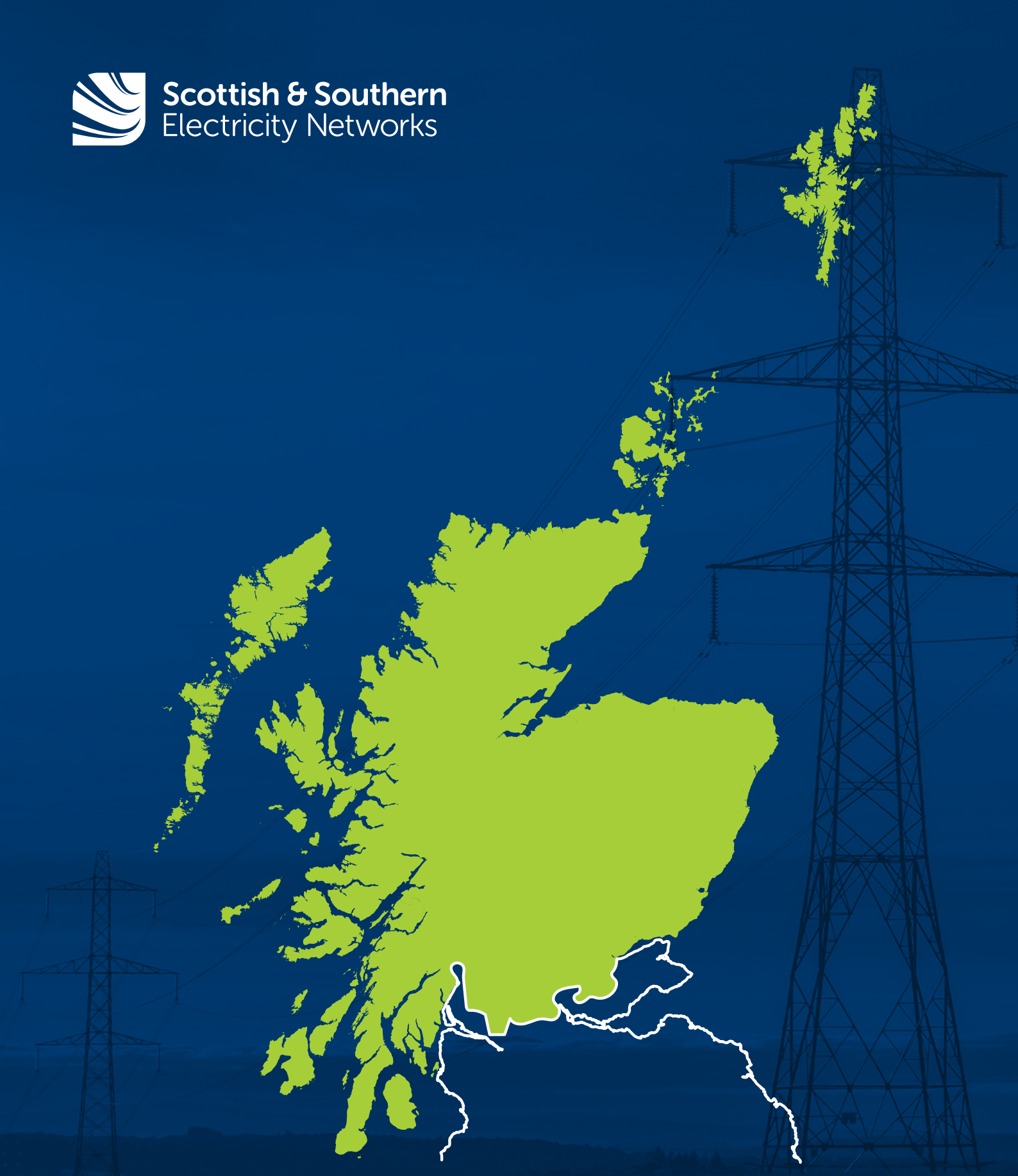
Scottish & Southern Electricity Networks



North of Scotland Future Energy Scenarios

August 2018

ssen-transmission.co.uk

This publication

The Great Britain (GB) energy landscape has undergone significant change in the past decade as decarbonisation and renewable energy targets have driven a rapid growth in renewable energy generation and overall reductions in electricity and gas demand.

To be able to meet customers' future needs over the next decade and beyond, we must understand which technologies are likely to impact generation and demand profiles. This publication sets out SHE Transmission's view of the range of potential generation scenarios in the north of Scotland for the period 2021-2030. It summarises the scenario analysis undertaken at a national and localised level to determine network development options and the scale of investment required to meet the future demands on the network.

The analysis will help shape the business plan submitted to Ofgem ahead of the next price control, RIIO-T2, as well as SHE Transmission's long-term investment strategy.

About us

We are Scottish Hydro Electric Transmission (SHE Transmission), part of the SSE Group, responsible for the electricity transmission network in the north of Scotland. We operate under the name of Scottish and Southern Electricity Networks, together with our sister companies, Scottish Hydro Electric Power Distribution (SHEPD) and Southern Electric Power Distribution (SEPD), who operate the lower voltage distribution networks in the north of Scotland and central southern England.

As the Transmission Owner (TO) we maintain and invest in the high voltage 132kV, 275kV and 400kV electricity transmission network in the north of Scotland. Our network consists of underground cables, overhead lines on wooden poles and steel towers, and electricity substations, extending over a quarter of the UK's land mass crossing some of its most challenging terrain.

We power our communities by providing a safe and reliable supply of electricity.

We do this by taking the electricity from generators and transporting it at high voltages over long distances through our transmission network for distribution to homes and businesses in villages, towns and cities.

A network plan

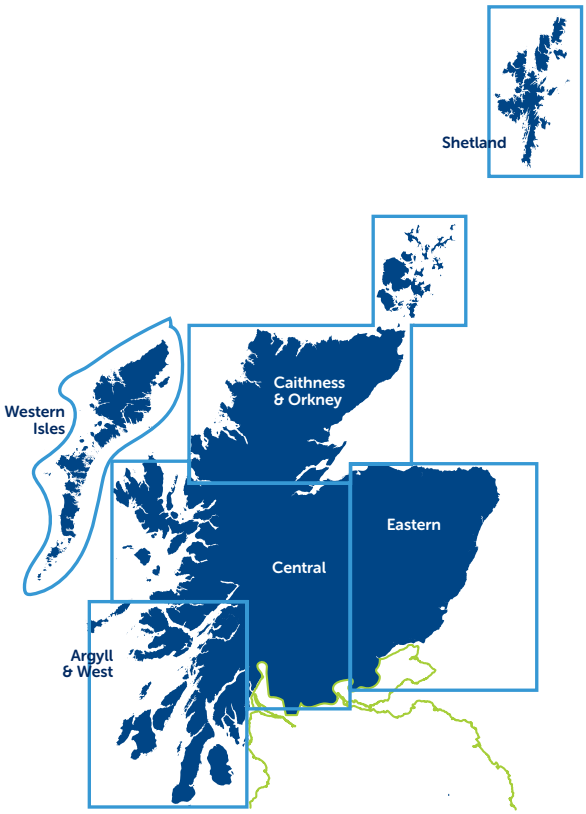
for the north of Scotland customer

Why regional scenarios?

Every year the GB Network System Operator, National Grid, produces their Future Energy Scenarios (FES) which identify a range of credible energy solutions for the next 30 years and beyond. These consider how much energy GB might need and where it could come from.

At a macro level, the FES is a powerful tool as they capture a range of potential national political, economic, social and technological possibilities. However, the application of the FES assumptions on a regional level is limited. In the north of Scotland, SHE Transmission have seen developments that have not always matched the prevailing GB trends and therefore believe that additional granularity, provided through localised future energy scenarios for the north of Scotland, would best meet energy users' needs. This view was shared by stakeholders who agreed there is significant uncertainty in energy system developments.

Scenario analysis was therefore deemed an effective method of building an understanding of potential outcomes and allowing associated network requirements to be modelled for SHE Transmission's north of Scotland network area to ensure we can meet our customers future needs.



Previously, SHE Transmission would have limited its network modelling to changes on the electricity transmission network however as we move towards whole-system planning, consideration must also be given to developments in other areas of the energy system such as electricity distribution, heat and transport.

As the map above shows, within our north of Scotland network area there are six distinct regions. Due to their unique geographical and topological attributes, each region has different network and user characteristics.

How we developed our scenarios?

The process to develop Future Energy Scenarios for the north of Scotland began over 18 months ago. An initial internal workshop was held to identify areas of uncertainty.

We published our North of Scotland Energy Trends paper in August 2017, which highlighted that developments in the north of Scotland did not always follow the GB trend, confirming the need for localised analysis. A series of external engagement was proposed as the best method for gathering further insight in order to develop our scenarios.

Stakeholder engagement

There were four stages in our Scenarios engagement approach in 2017/18

1

Targeted interviews to confirm the need for localised scenarios, identify issues affecting customers and stakeholders and agree best methods for future engagement.

2

Broad, public consultations on identified areas of uncertainty with a regional element.

SHE Transmission consulted on five papers:

- North of Scotland Energy Trends
- North of Scotland Onshore Wind Repowering
- North of Scotland Electric Vehicles
- North of Scotland Energy Efficiency and Heat
- North of Scotland Generation and Storage.

3

Reviewing consultation findings (including a range of potential outcomes) and proposed scenario development methodology with targeted customers and stakeholders.

4

Publication of a 'North of Scotland Future Energy Scenarios Report' summary paper in summer 2018.

This paper will include a summary of the feedback received through the consultations and stakeholder engagement, and how this feedback has influenced the scenario development, and the results of this - the scenarios themselves.

PRINCIPAL CUSTOMERS AND STAKEHOLDERS

GOVERNMENT AND LOCAL AUTHORITIES

COMMUNITY ENERGY GROUPS

DEVELOPERS

NETWORK OPERATORS

FUTURE CUSTOMERS

Throughout the consultation period customers and stakeholders were encouraged to respond via an online feedback form or directly via telephone or email. These findings were used to develop the scenario ranges in the North of Scotland Future Energy Scenarios that we will use as the basis for our Load Related Expenditure plans and uncertainty mechanisms for the RIIO-T2 price control.

This will also inform our view on what outputs and incentives will be required in RIIO-T2 to promote the needs of customers and stakeholders. Throughout the process customers and stakeholders were invited to agree or challenge the treatment of the feedback and the resulting scenario proposals. These confirmations and challenges were used in the refinement of the methodology and scenarios assumptions.

We engaged with

Circa 150 customers and stakeholders

How did we engage with them?

Working papers and blog articles published on website

Via local press articles and energy industry insight reports

Direct mail

Face-to-face and telephone interviews

Workshops in Glasgow and Inverness

> I have very much appreciated the opportunity to take part in the Future Energy Scenarios workshop.
>
> Argyll and Bute Council

> Good to see SSEN consulting on this vital segment of the future energy system (The future of Energy Efficiency and Heat and Preparing our network for Electric Vehicles).
>
> Energy UK

OUR SCENARIOS

PROACTIVE DECARBONISATION

LOCAL OPTIMISATION

COST LIMITATION

Our scenarios

Scenario	Main driver	Description
PROACTIVE DECARBONISATION	Decarbonisation	Scottish consumers are supportive of decarbonisation, increasing their use of renewables and engage in the benefits of decarbonisation and decentralisation at local levels. The focus is on capital investment in large scale projects and policy is in place to stimulate the development of less established, low carbon energy technologies.
LOCAL OPTIMISATION	Decentralisation	Scottish consumers and businesses are driven by cost reduction as well as decarbonisation, investing in decentralised, domestic microgeneration to reduce their spend on energy. The focus is on delivering decentralisation and decarbonisation through democratisation of energy supply to deliver improved affordability for consumers and businesses.
COST LIMITATION	Affordability	Scottish consumers are less inclined to invest in microgeneration and renewable heating technologies, but energy efficiency continues to be a focus of national and local government. The focus is on delivering cost reduction in energy bills. Decarbonisation is a secondary consideration, as a result there is low uptake in domestic microgeneration and little focus on decentralisation.

Government targets

The Scottish Government has significant policy levers through which to deliver its renewable energy targets. This includes; planning policy, innovation and development funding, and Local Authority plans.

Scotland's Climate Change Plan outlines the following policy proposals for electricity;

- A new renewable, all energy consumption target of 50% by 2030, covering electricity, heat and transport
- Renewed efforts to secure routes to market for a range of renewable technologies
- Continued support for offshore wind development and innovation
- Renewed focus on developing local energy systems and models
- The development of a whole-system bioenergy action plan.

Scottish Government analysis underpinning the new 2030 target shows that renewable electricity could rise to over 140% of Scottish electricity consumption by 2030.

This assumes a considerably higher market penetration of renewable electricity than today – requiring in the region of 17GW of installed capacity in 2030 (compared to 9.5 GW in June 2017).

Proactive decarbonisation

Themes

CLIMATE CHANGE

LARGE SCALE GENERATION

AFFORDABILITY

Scottish consumers are supportive of decarbonisation, increasing their use of renewables and engage in the benefits of decarbonisation and decentralisation at local levels. Targets set by both the Scottish and UK governments are surpassed and are in line with a decarbonisation pathway in which the UK is actively pursuing efforts to limit the temperature increase to 1.5 degrees Celsius, as set out in the Paris Agreement.

Intent on delivering the challenging decarbonisation and renewable energy targets, government looks to support localised and centralised energy supply to maximise use of renewable energy resources and balance local and national demand. Affordability is addressed through changes in the socialisation of energy costs.

The economy is performing well, and investment in the sector remains high. Targeted support schemes lead to high capital investment in large scale projects across the north of Scotland.

Policy is in place to stimulate development of low carbon energy technologies. Less established technologies such as offshore wind, wave and tidal, which are well suited to Scottish topography, continue to be supported by government and cost reductions increase their competitiveness.

Established technologies such as onshore wind and solar benefit from favourable Scottish planning policy, technology development and economies of scale, allowing projects to be developed without government subsidy.

Interconnection plays a role in the generation mix, which will allow for the export of large scale renewable generation from the North and balancing through imports.

Scottish consumers invest in microgeneration & low carbon heating technologies to bring down the cost of their energy bills.

Consumers use a mix of technologies with regards to heat - in rural areas where there is excess renewable generation, consumers utilise electric storage heaters and heat pumps; in more urban areas, natural gas boilers continue to be used with an increase in the uptake of hybrid systems.

Consumers invest in a range of insulation products, from loft and cavity insulation through to solid wall insulation, as well as shifting from halogen bulbs to LED bulbs to reduce the cost of their energy bills.

Many consumers and businesses switch from fossil fuel cars to electric cars as they look to mitigate their impact on the environment and make best use of their additional behind the meter generation.

Local authority led infrastructure development makes charging away from home easier with fast chargers in towns and cities and on key tourist routes in the north of Scotland.

Local optimisation

Scottish consumers and businesses are driven by cost reduction as well as decarbonisation, investing in decentralised, domestic microgeneration to reduce their spend on energy.

The focus is on delivering decentralisation and decarbonisation through democratisation of energy supply to deliver improved affordability for consumers and businesses.

The economy is growing, with high investment in small scale, renewable technologies. Government policy favours small scale, community based distributed energy resources, instead of large scale renewable projects.

Successful implementation of the Distribution System Operator (DSO) model in the north of Scotland leads to effective and efficient decentralisation of energy generation. Some renewable technologies have reduced in cost to such an extent that some large onshore and offshore wind projects are developed without the need for subsidy support.

Small scale distributed energy resources such as local and community wind, wave, solar and storage projects are supported through favourable Scottish planning policy, beneficial connection and charging arrangements, and priority in the provision of grid services.

Interconnectors provide flexibility for bulk flows, but with more decentralised generation on the distribution network, additional flexibility is provided at a local level by distributed energy resources.

Scottish consumers and businesses are driven more by cost reduction than decarbonisation and invest in microgeneration and low carbon heating technologies to reduce their spend on energy. In communities where there are large amounts of excess local generation such as the Scottish Islands and more remote rural areas, consumers utilise electric heating in the form of storage heaters and heat pumps.

Where access to excess generation is limited, a range of biomass combined heat and power (CHP) and district heat networks are used. In more urban areas, the use natural gas boilers continue alongside an increase in the uptake of hybrid systems.

Consumers focus on some simple things to help improve energy efficiency in their households such as replacing halogen bulbs with LED bulbs and fitting cavity and loft insulation to decrease the cost of their energy bills.

Scottish consumers invest in electric cars, not for the environmental benefit, but as a means of benefiting from local generation. Consumers prefer to charge their electric vehicles at home, benefitting from vehicle to grid services, with some fast chargers in cities and on the motorways in the north of Scotland.

Themes

MICRO GENERATION

CLIMATE CHANGE

AFFORDABILITY

Cost limitation

Themes

AFFORDABILITY

ENERGY EFFICIENCY

CLIMATE CHANGE

Scottish consumers are less inclined to invest in microgeneration and renewable heating technologies, but energy efficiency continues to be a focus of national and local Government.

The focus is on delivering cost reduction in energy bills. Decarbonisation is a secondary consideration, as a result there is low uptake in domestic microgeneration and little focus on decentralisation.

Economic growth flattens, and the lack of government support leads to reduced investment levels.

Government policy is for subsidy free development of energy generation (excluding the development of less established technologies such as wave and tidal energy and floating offshore wind).

Large scale onshore wind and solar projects are developed in the limited locations where subsidy free development is viable in the north of Scotland.

A lack of surplus generation for export reduces the case and need for interconnection in the north of Scotland, resulting in no new interconnector projects being connected in the period up to 2030.

The removal of subsidy costs from energy bills keeps costs down, so fewer consumers and businesses invest in microgeneration and renewable heating technologies.

There is no government intervention to encourage consumers to move towards greener sources of energy, but energy efficiency continues to be a focus of national and local Government.

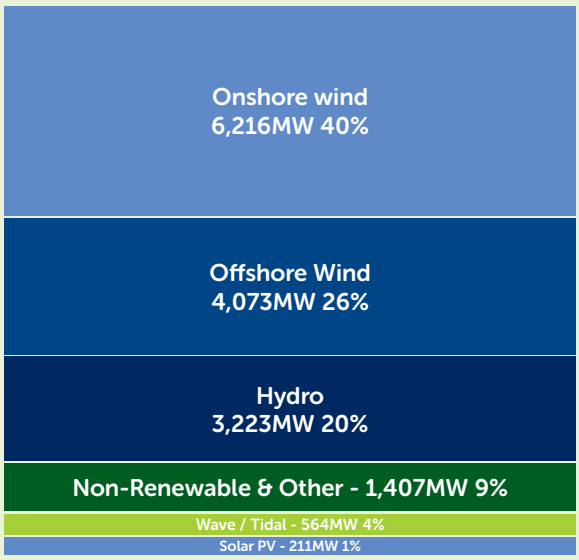
New Scottish planning policy, leasing and selling requirements encourages the improvement of efficiency in building energy use through efficient natural gas boilers, appliances and lighting, and insulation.

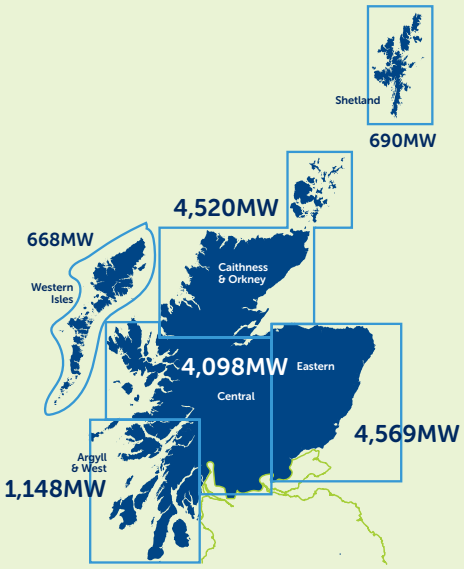
Driven primarily by concerns on air quality and establishment of zero-emission zones, uptake of electric vehicles is limited and restricted to urban areas and some progressive rural communities.

Charging electric vehicles away from the home is made easier through investment in transport hubs primarily located in towns and cities.

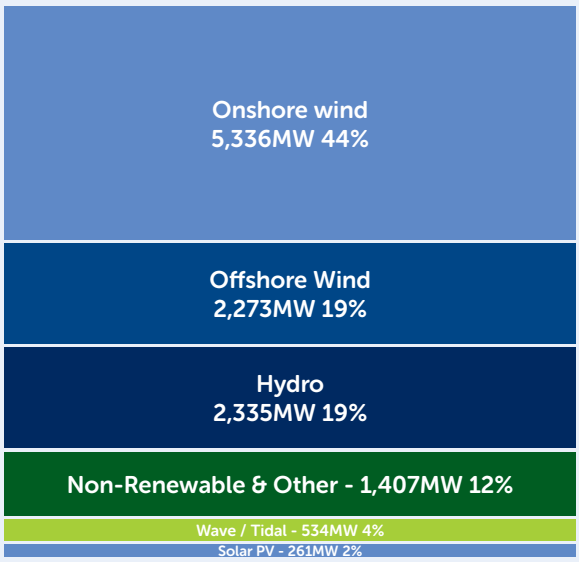
Installed generation capacity in our scenarios by 2025/26

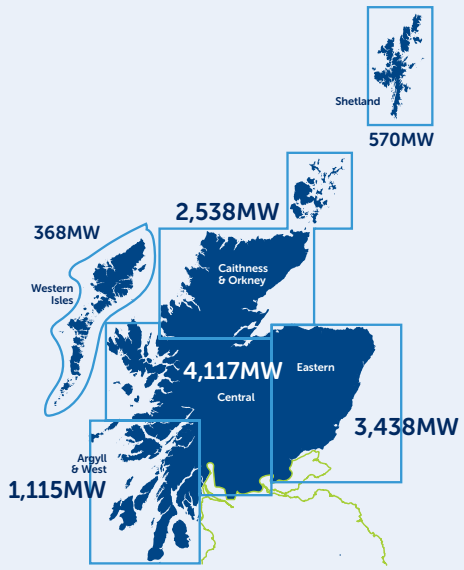
PROACTIVE DECARBONISATION



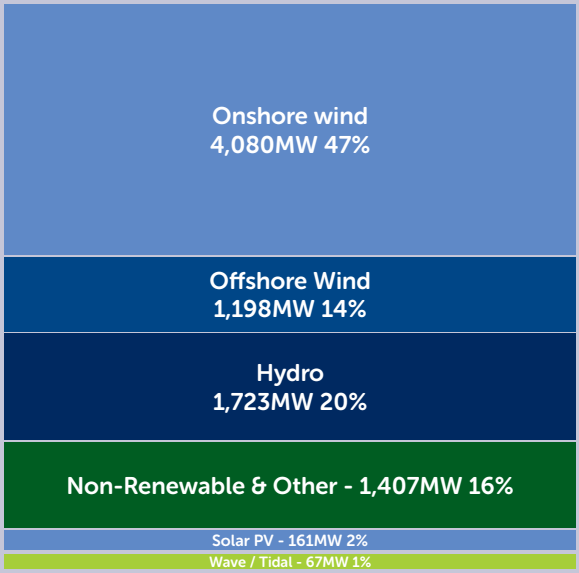


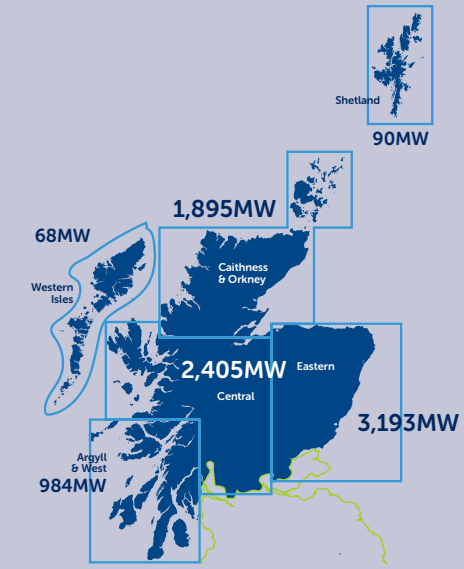
LOCAL OPTIMISATION





COST LIMITATION





Summary of generation capacity in our scenarios by 2029/30

	PROACTIVE DECARBONISATION	LOCAL OPTIMISATION	COST LIMITATION
Current connected capacity 2017/18	5,760MW	5,760MW	5,760MW
Estimated connecting capacity 2018/19-2020/21	2,444MW	2,444MW	2,444MW
Connected capacity by 2020/21	8,204MW	8,204MW	8,204MW
Connected capacity by 2025/26	15,693MW	12,146MW	8,635MW
Of which is renewable	*14,287MW*	*10,739MW*	*7,229MW*
Estimated connecting capacity 2026/27-2029/30	6,804MW	1,620MW	94MW
Estimated total capacity on the network by 2029/30	22,498MW	13,766MW	8,729MW

In Proactive decarbonisation, 15,693MW will be on the system by 2025/26. This increases by 6,804MW post RIIO-T2, totalling 22,498MW by 2029/30.

Local optimisation will have 12,146MW on the network by 2025/26. Post 2025/26, Local optimisation sees a modest increase in generation capacity with 1,620MW connecting between 2026/27-2029/30. By 2029/30, there will be 13,766MW of generation capacity on the network.

By 2025/26 in Cost limitation, there will be 8,635MW of generation capacity on the network. 94MW will be connected between 2026/27-2029/30. By 2029/30, there will be 8,729MW of generation capacity on the network.

Summary of domestic electricity demand in our scenarios

	PROACTIVE DECARBONISATION	LOCAL OPTIMISATION	COST LIMITATION
Electricity demand from electric vehicles by 2030	440 GWh	418 GWh	113 GWh
Domestic electricity demand from existing homes by 2030	3,425 GWh	2,887 GWh	3,231 GWh
Domestic electricity demand from new homes by 2030	342 GWh	347 GWh	77 GWh
Total domestic electricity demand in the north of Scotland by 2030	4,206 GWh	3,652 GWh	3,421 GWh

Proactive decarbonisation has the highest level of domestic electricity demand by 2030 across all three of the scenarios. This is due to the large number of homes fitting electric, low carbon heating technologies, the increase in electric vehicles and additional demand from new homes.

Local optimisation has the second highest level of domestic electricity demand by 2030. This is due to the large number of homes fitting electric, low carbon heating technologies, the increase in electric vehicles and additional demand from new homes, which outweighs the reduction in domestic demand due to the number of homes fitting microgeneration (solar PV).

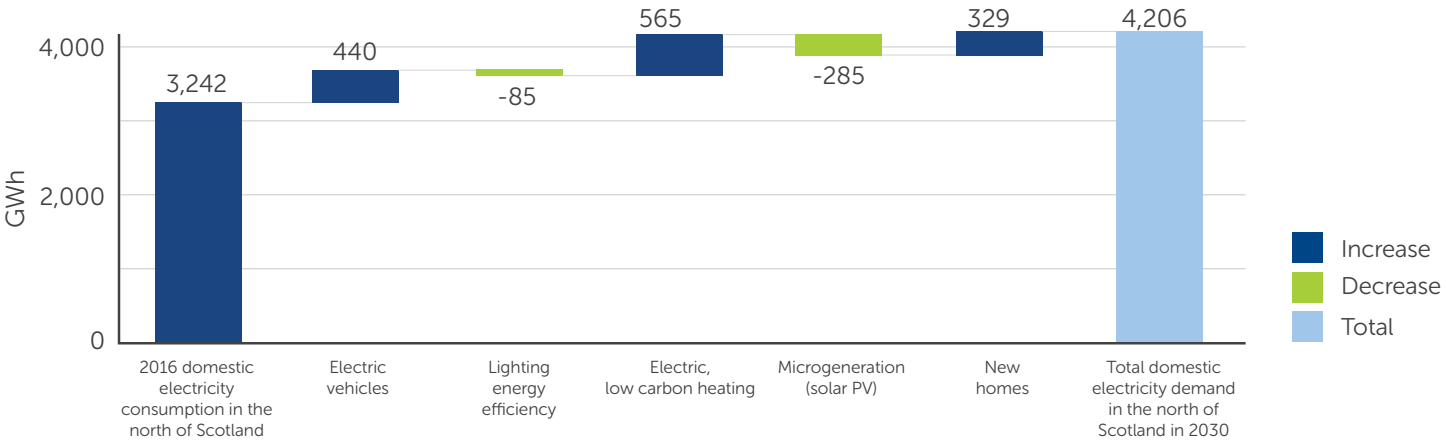
Cost limitation has the lowest level of domestic electricity demand by 2030 as result of the increase in electric vehicles and additional demand from new homes. Investment in lighting energy efficiency improvements and microgeneration (solar PV) have minimal impact on reducing domestic electricity demand.

Factors affecting demand in our scenarios

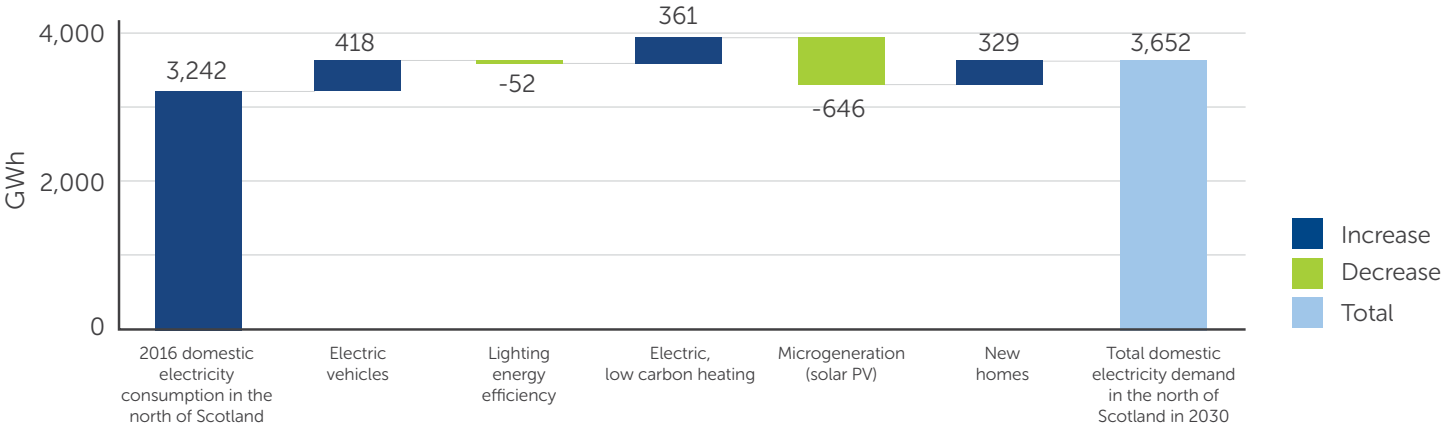
	PROACTIVE DECARBONISATION	LOCAL OPTIMISATION	COST LIMITATION
Electric vehicles on the road in 2030 (000's)	211	200	54
Homes that carry out lighting energy efficiency improvements by 2030 (000's)	368	228	65
Homes that install electric, low carbon heating technologies by 2030 (000's)	120	107	0.8
Homes that install microgeneration (solar PV) by 2030 (000's)	84	190	1.5
New homes built by 2030 (000's)	62	62	15

Annual domestic electricity demand in 2030 and variances from today

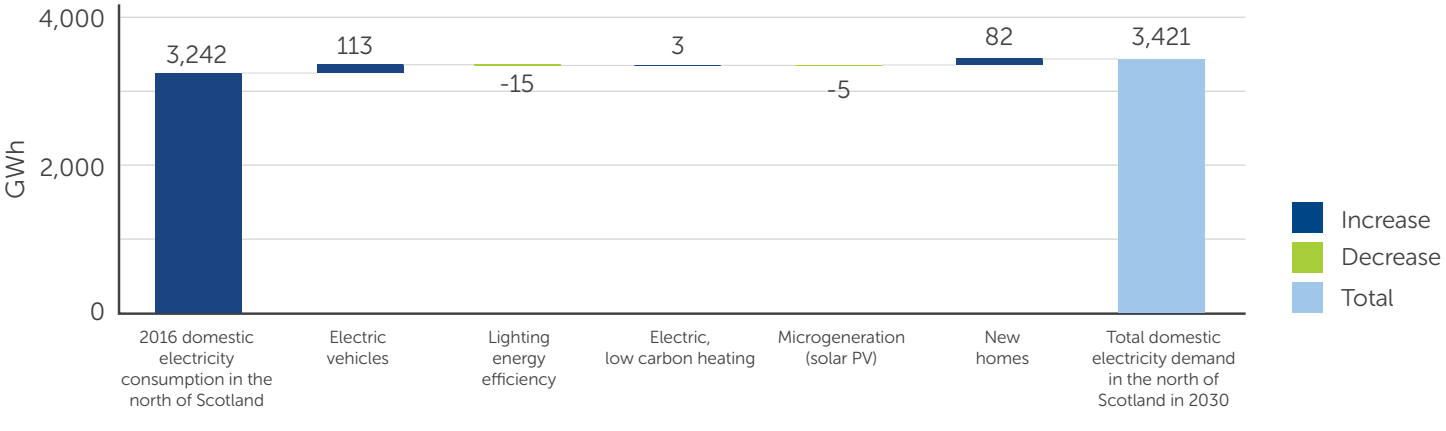
Proactive decarbonisation



Local optimisation



Cost limitation



Scottish & Southern Electricity Networks

North of Scotland Future Energy Scenarios Report

We will be publishing a document which outlines how our North of Scotland Energy Scenarios were created.

The document will include the process we used to engage with stakeholders, highlighting the outcomes for each scenario in more detail and outline the methodologies used to generate the outcomes for each scenario and topic area.

We want to hear from you

We welcome any comments and feedback on this document and our more detailed report when published.

This document and future North of Scotland Energy Scenario documents will be hosted on **www.ssen-transmission.co.uk/information-centre/industry-and-regulation/future-energy-scenarios.**

If you would like to get in touch with the team to ask questions, and provide feedback and comments then please use the following contact methods:

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