Scottish & Southern Electricity Networks

North of Scotland Energy Trends

Introduction

This paper presents a summary of energy trends in the north of Scotland over the last decade. This is the first stage in the analysis of Future Energy Scenarios for the north of Scotland that we are undertaking as part of our planning for the next transmission price control (RIIO-T2).

Background

The GB energy landscape has undergone significant changes 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. As the electricity network owner in the north of Scotland, our main focus has been on delivering the additional capacity and connections required for this increased renewable energy generation in an economic and efficient way, while ensuring reliability of supplies for our network users and consumers. As we begin planning for our next price control period, RIIO-T2, which will begin in 2021, we are mindful of significant uncertainty on some aspects of the future of energy which will influence what network developments are required.

Uncertainty in areas such as the electrification of heat and transport, and which generation technologies are likely to be developed in our area, could significantly impact the generation and demand profile. To be able to meet customers' needs in a timely manner, we must understand the range of potential outcomes in these areas, and the effects that this would have on the transmission network, to determine the scale of investment required over the next decade. This will also indicate what type of network developments future investment will be focused on. The impact of many of the uncertainties are being felt first on the distribution network, such as the increasing proportion of embedded generation on the system, and increasing ownership of electric vehicles. These changes at the distribution network level have the potential to impact the transmission network at the grid supply points (GSPs)[1] and to influence overall flows on the network.

Why scenario planning?

Scenario analysis provides a credible approach to capturing these uncertainties and providing a view of the range of potential outcomes that could materialise over the period. The scenarios currently used by the System Operator (SO) and all Transmission Owners are the National Grid Future Energy Scenarios (FES)[2]. The FES have been developed at a Great Britain (GB) level using concepts of green ambition and economic prosperity as guides to create a broad, yet credible, scenario set capturing a range of potential political, economic, social and technological possibilities. While the FES are a powerful tool at a macro-geographic level, because the FES are developed at a GB level and then divided down to provide regional data, the assumptions themselves are limited in their regional variations. In the north of Scotland, we have seen developments that have not always matched the prevailing GB trends; we believe that additional granularity, provided through localised future energy scenarios for the north of Scotland, would best meet energy users' needs.

This paper represents the first stage in developing a view of the changes that have occurred in our network area and identifying points of difference that will need to be included in our localised scenario assumptions. The paper identifies regional trends and highlights how these align with or differ from prevailing trends at a GB level.

About us

We are part of Scottish and Southern Electricity Networks, operating as Scottish Hydro Electric Transmission plc under licence and are responsible for maintaining and investing in the electricity transmission network in the north of Scotland.

Scottish & Southern Electricity Networks

Scottish Hydro Electric Transmission plc

Scottish Hydro Electric Power Distribution plc

[1] A system of connection points at which the high voltage transmission network is connected to the low voltage distribution network that connects to customers and businesses.
[2] http://fes.nationalgrid.com/

Key findings and recommendations

Our analysis identified the key energy trends across electricity, heat and transport in the north of Scotland:

- Government policy and legislation has been the lead driver in the changes in GB energy generation and demand.
- Fossil fuel plays a relatively small role in the north of Scotland electricity mix, with gas representing only 9% of generation capacity on our network in 2015.
- Since 2005, the scale of generation connected in our area has more than doubled. Onshore wind has been the dominant generation technology, with 2,406MW added.
- Embedded generation has played a more prominent role in the network since 2005, representing more than 50% of the total generation capacity on the network in 2015.
- In line with the GB trend, average residential electricity and gas consumption in the north of Scotland has fallen, largely due to energy efficiency improvements and changes to building regulations.
- In contrast, average industrial and commercial electricity consumption in the north of Scotland increased by 13.5% from 2005 to 2015, opposite to the reduction trend seen in the GB average.
- The increase in industrial and commercial gas demand in the north of Scotland was 16%, significantly larger than the increase in the GB average.
- The total number of electric vehicles in the north of Scotland has increased year-on-year at a slower rate than the GB total, but Aberdeen City, Aberdeenshire, Dundee City, Perth and Kinross and Highland are the local authority areas with the highest number of licenced EVs, some of which are also areas with high electricity demand.

Our analysis has also identified a number of areas on which we are undertaking further analysis. These are summarised as follows:

- Considering views on scale and location of new generation that could seek access to the network post-2020.
- Increasing collaboration between the transmission owner (SHE Transmission plc) and the distribution network owner (Scottish Hydro Electric Power Distribution plc) to understand the current and forecast balance of generation and demand on the distribution network and the resultant energy flows at the GSPs.
- Considering reasons for increased industrial and commercial electricity and gas consumption and consider whether this is set to continue.
- Identifying the impact of variations in electricity demand on areas where relatively low or high demand exists.

Electricity generation

The transmission network in the north of Scotland has gone through a period of substantial growth in the last decade due to increasing renewable energy generation driven by UK and Scottish Government policy support.

In 2015, 4,623MW of generation capacity was present on our network, more than double the generation capacity on the network in 2005. Fossil fuel plays a relatively small role in the electricity mix, with the gas power station at Peterhead representing only 9% of generation capacity on the network in 2015.

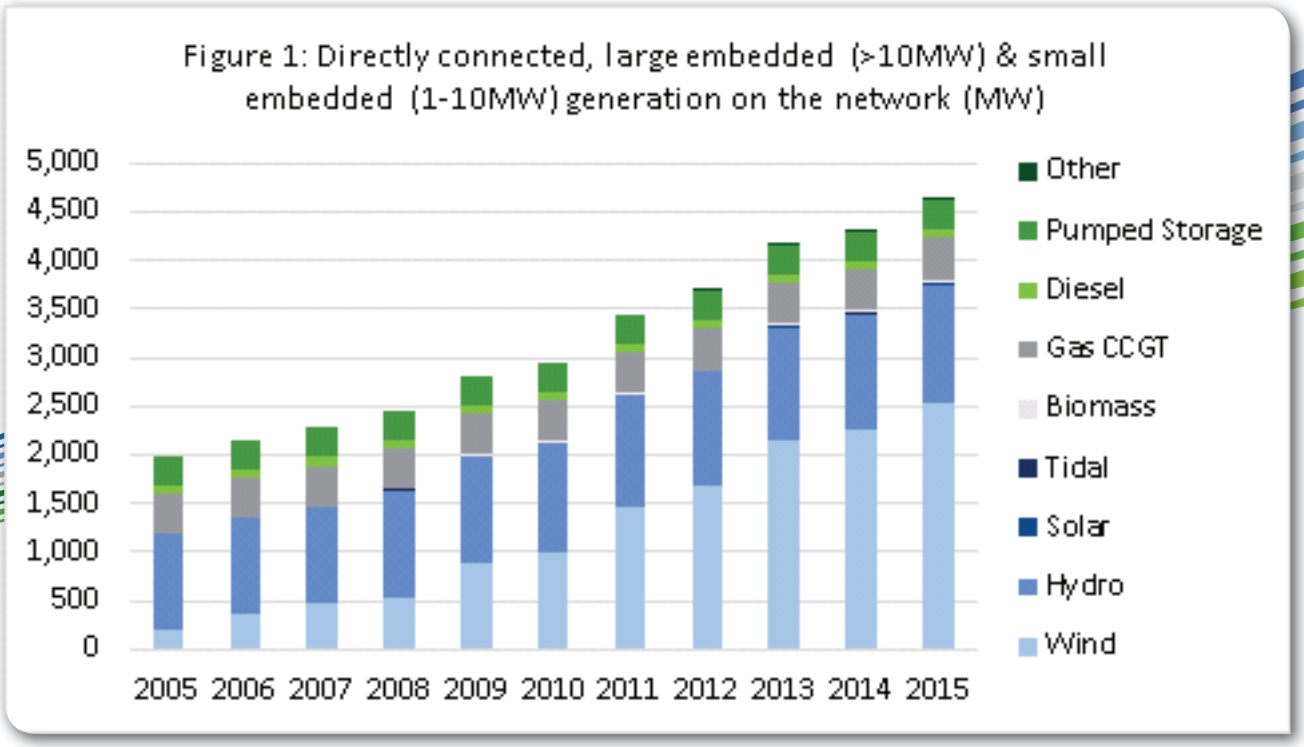
From 2005 to 2015, new generation from onshore wind (2,406MW), hydro (220MW) and solar (22MW) was added to the network. Additionally, other technologies, such as tidal, biogas and CHP, make up the remainder of generation additions, totalling 60MW from 2005 to 2015. In comparison to the rest of GB where solar capacity has increased significantly, the north of Scotland has only seen a small increase in solar generation capacity. 90% of new generation capacity added to the network came from low carbon, intermittent generation sources.

Understanding the scale and location of additional low carbon generation that is expected to request access to the network is fundamental in enabling us to minimise the impact of intermittent generation on the network.

Further to this, embedded generation (generation connected to the distribution network) also plays an important role, representing more than 50% of the total generation capacity on the network in 2015. This increase requires us, as the transmission owner, to work closely with the distribution network owner (Scottish Hydro Electric Power Distribution plc) to understand the potential impact on the network, and how this can be best managed from a whole system perspective.

The high volume of embedded generation on the local distribution network has changed the traditional approach of a grid supply point being either import or export. It is now common to have reverse power flows as generation and demand fluctuate at different times within the day.

Figure 1: Directly connected, large embedded (>10MW) & small embedded (1-10MW) generation on the network (MW)



Source: SHE Transmission plc

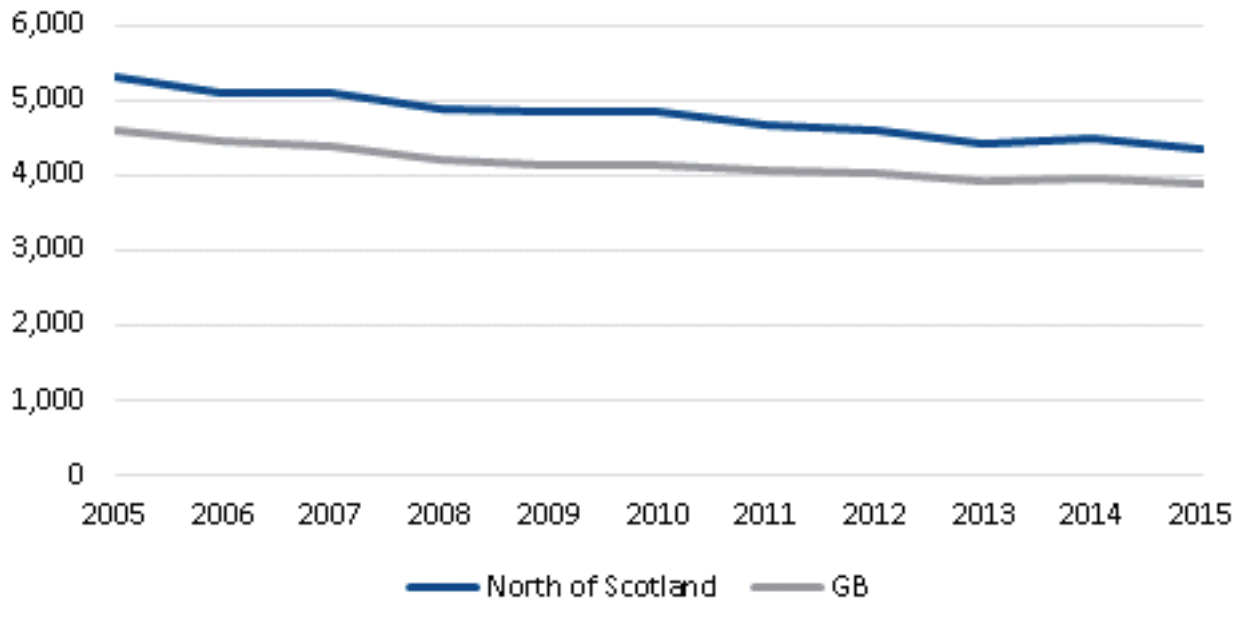
Electricity consumption

Residential

A reduction in electricity consumption for residential customers is evident in the north of Scotland which is largely in line with the 15.4% decline seen at GB level. Energy efficiency improvements brought about through the adoption of the EU's Eco-design Directive in 2005 will have contributed to part of the decrease in electricity consumption. In 2012, Defra estimated that the Directive and complementary regulations have provided £1bn p.a. of energy cost savings in the UK from the use of more energy efficient products[3].

The average residential electricity consumption in the north of Scotland fell from 5,311kWh to 4,356kWh, a reduction of 18% across the period. There are two local authorities that have higher electricity consumption when compared to the other local authorities in the north of Scotland; the Orkney Islands and the Shetland Islands which could be contributed to their location and dependency upon electric heating. Research by Defra, DECC, and the Energy Saving Trust[4] in 2010 found that households owned an average of 41 appliances, having grown from around 12 per household in the 1970s. Efficiency improvements have been offsetting this increase but penetration of efficient appliances is nearing 100% for some categories and a return to growth (seen pre-2005) is considered a possibility.

Figure 2: Non weather-adjusted average residential electricity consumption per point of supply in the north of Scotland (kWh)[5]



Source: BEIS Sub-national electricity publication 2005-2015

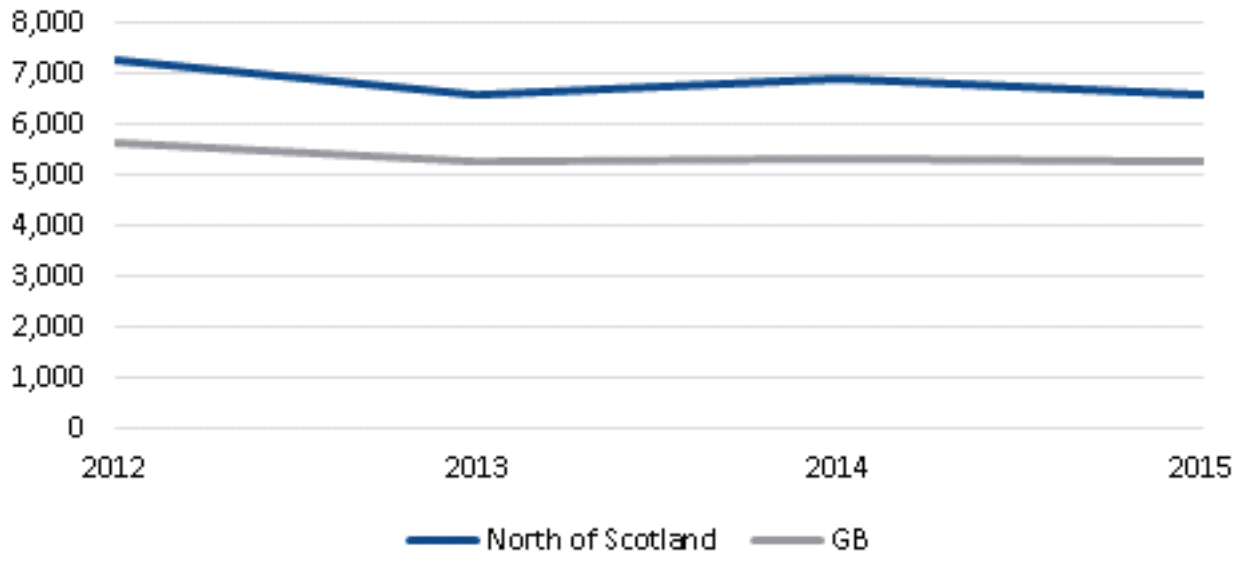
[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/406225/defra-regulationassessment-2015.pdf
[4] Research carried out in England
[5] Includes electricity consumption from standard and economy 7 meters

Electric heating

Our analysis highlighted that the use of economy 7 meters occurs across all local authorities in the north of Scotland and is not simply limited to the Islands. Electricity consumption from economy 7 meters follows a similar declining trend to that in Figure 2.

At a GB level, the average residential electricity consumption from economy 7 meters decreased by 6.1% from 2012 to 2015 whereas in the north of Scotland, consumption fell by 9.6%. Average consumption from standard meters in the north of Scotland for the same period, 2012 to 2015, only decreased by 1.8%.

Figure 3: Non weather-adjusted average residential electricity consumption from economy 7 meters per point of supply in the north of Scotland (kWh)



Source: BEIS Sub-national electricity publication 2005-2015

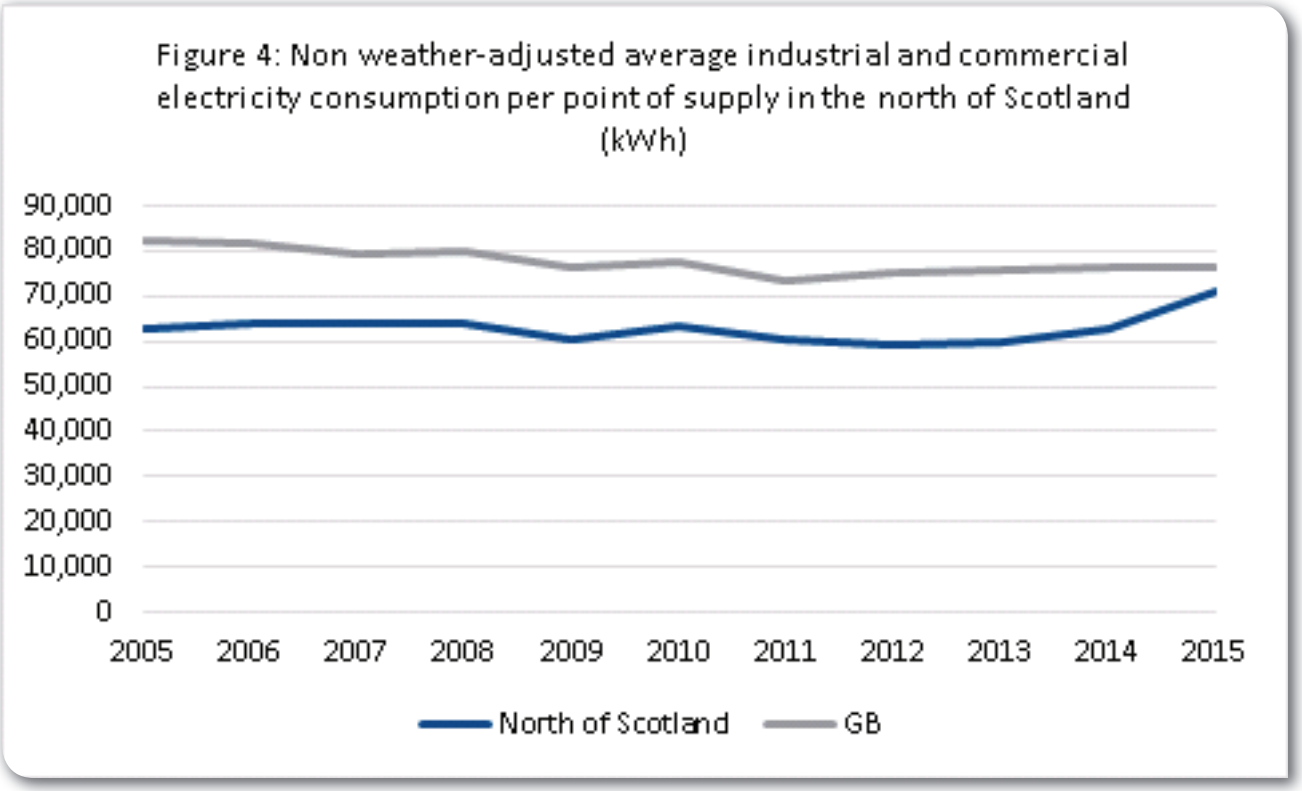
Industrial and commercial

In contrast to the 7% decrease seen in industrial and commercial electricity consumption across GB from 2005 to 2015, Figure 4 shows the increasing trend in industrial and commercial electricity consumption in the north of Scotland.

The average industrial and commercial electricity consumption in the north of Scotland increased from 62,530kWh to 70,969kWh, an increase of 13.5%. Only three out of the eleven local authorities saw a reduction in electricity consumption from 2005 to 2015; Aberdeen City, Angus and Dundee City. The remaining local authorities saw an increase in their electricity consumption with the highest occurences in Aberdeenshire (30.8%), the Highlands (30.5%) and the Orkney Islands (110.9%). Initial engagement suggests that much of this increase is due to growing production in the Scottish food and drink sector but further investigation is required to fully understand the reasons for these increases at a local level.

Industrial and commercial electricity and gas consumption has increased over the last decade which is largely in contrast to the decline seen across GB.

Figure 4: Non weather-adjusted average industrial and commercial electricity consumption per point of supply in the north of Scotland (kWh)



Source: BEIS Sub-national electricity publication 2005-2015

Gas consumption

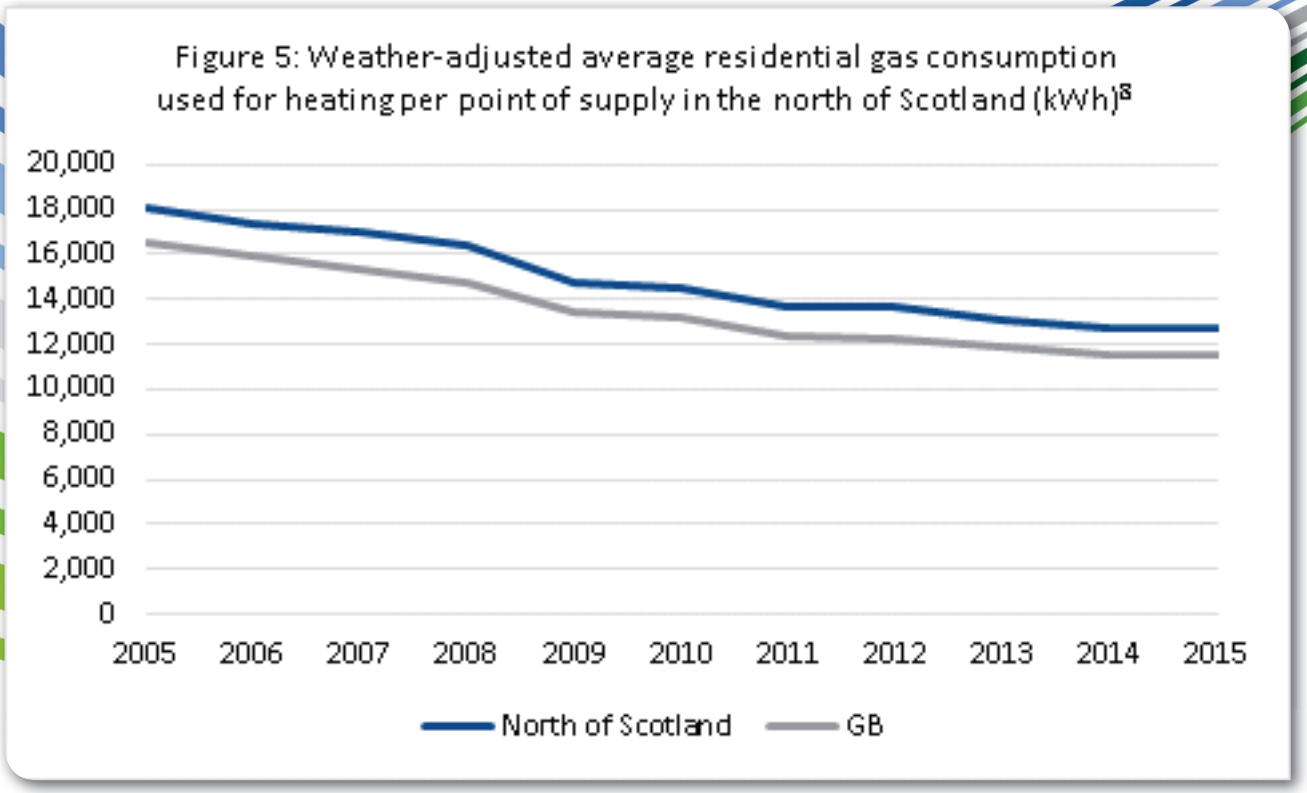
Over the past decade, we have seen the introduction of legislation and policies aimed at improving the efficiency of household boilers and building stock across GB. In order to meet challenging decarbonisation targets, the utilisation of other technologies such as heat pumps, combined heat and power plants, and district heating may be required.

Residential

At a GB level, average residential gas consumption declined by 30.6% from 2005 to 2015. The average residential gas consumption in the north of Scotland reduced by 29.4% across the period. In 2015, approximately 213,000 households in the north of Scotland did not have access to the grid which will have contributed to the high electricity consumption shown in Figure 3 as well as the use of other fuels to provide heating such as LPG, oil and solid fuels. The high number of households off the gas grid also increases the incidence of fuel poverty in these areas. A paper released by SPICe in 2015 stated that half of all people without access to the gas grid are fuel poor. Within our network area in 2013, high percentages of households in Eilean Siar (62%), Highland (50%) and the Orkney Islands (58%) local authorities were in fuel poverty[6].

According to the Scottish Government, increasing gas prices, energy efficiency improvements and economic conditions which have depressed household disposable incomes, have all contributed to the decline in gas consumption trend[7].

Figure 5: Weather-adjusted average residential gas consumption used for heating per point of supply in the north of Scotland (kWh)[8]



Source: BEIS Sub-national gas publication 2005-2015

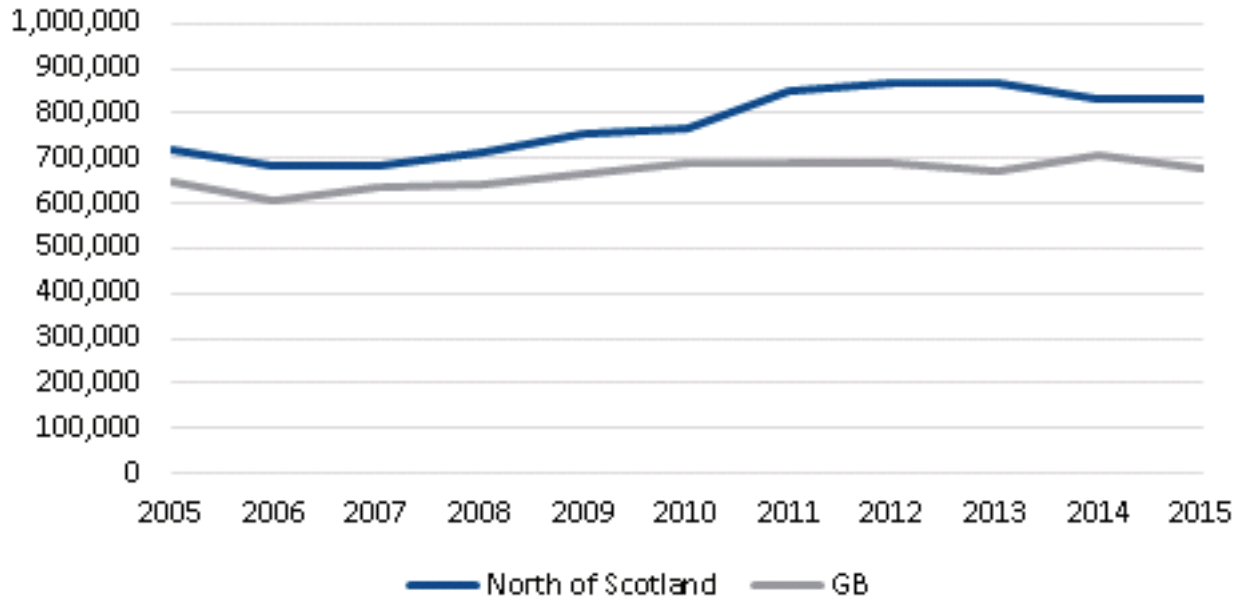
[6] http://www.parliament.scot/ResearchBriefingsAndFactsheets/S4/SB_15-13_Fuel_Poverty_in_Scotland.pdf
[7] http://www.gov.scot/Resource/0051/00513466.pdf
[8] Residential gas consumption figures calculated by applying 87% to original figures as space and water heating represents 87% of a household total gas consumption

Industrial and commercial

Industrial and commercial gas consumption in the north of Scotland has increased further than the increase seen at the GB level (4.7% increase) despite a reduction in recent years. Figure 6 illustrates that from 2005 to 2015, the average industrial and commercial gas consumption in the north of Scotland increased from 718,804kWh to 834,144kWh, an increase of 16%. It is important to note that Figure 6 will include gas consumption that is used to power industrial processes as well as gas consumed to provide space heating for industrial and commercial premises.

63% of local authorities in the north of Scotland saw an increase in gas consumption from 2005 to 2015. There are some specific local authorities where there have been significant increases in gas consumption; Moray (76.5%), Angus (51.1%) and the Highlands (43.7%). Due to the type of industry located in the north of Scotland, it may be less likely that we will see a shift from gas to electricity as the main heating fuel but other alternatives are a possibility. Further investigation will be carried out to determine the drivers for increased gas consumption in the north of Scotland and the suitability of alternative solutions.

Figure 6: Weather-adjusted average industrial and commercial gas consumption per point of supply in the north of Scotland (kWh)



Source: BEIS Sub-national gas publication 2005-2015

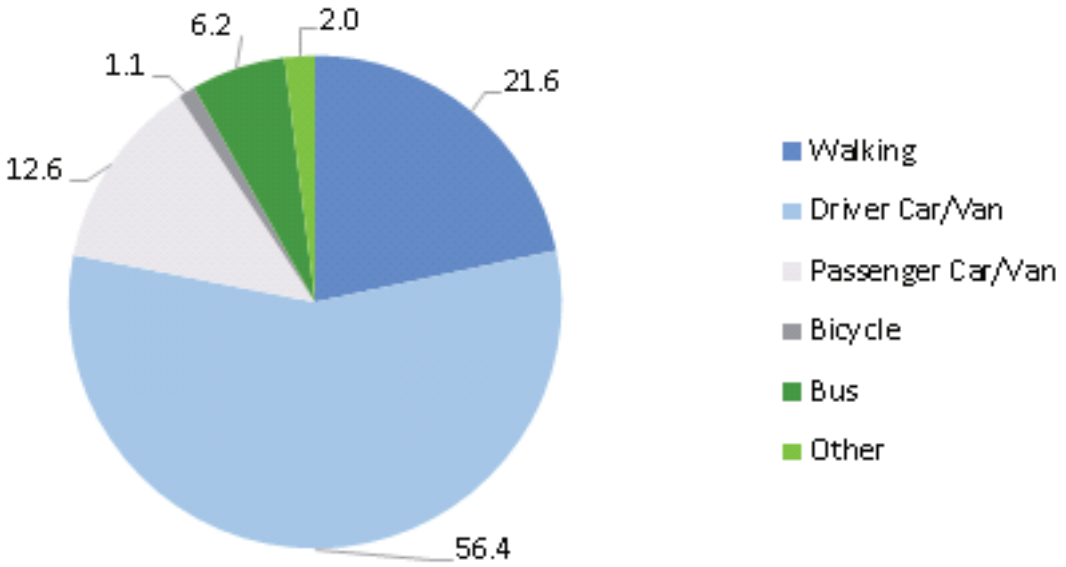
Transport

Transport has been recognised as an industry which will impact the electricity market through the electrification of transport.

There have been only minor changes in the main modes of transport used in the north of Scotland. Walking and cycling have increased in the north of Scotland by 2.1% and 0.3% respectively. The use of public transport such as buses has also increased by 0.9%. These small increases for other modes of transport do little to displace driving from being the most popular mode of transport, with the proportion of people driving being 56.4% in the north of Scotland.

The Scottish Government has set out ambitious plans for the future of the transport sector. In June 2017, the Scottish Government published the second phase of its 'Switched On Scotland Plug-In Vehicle Roadmap.' The document highlighted the Scottish Government's commitment to reducing the damage fossil fuel car emissions have on Scottish towns, cities and communities by 2050[9] and outlined plans to achieve this via the effective roll out of electric vehicles.

Figure 7: Primary mode of Transport by journey in the north of Scotland, 2015 (%)



Source: SHS Transport - Local Area Analysis 2015

Aberdeen City, Aberdeenshire, Dundee City, Perth and Kinross and the Highland local authority represent the local authorities with the highest total number of licenced EVs some of which are also areas with high electricity demand.

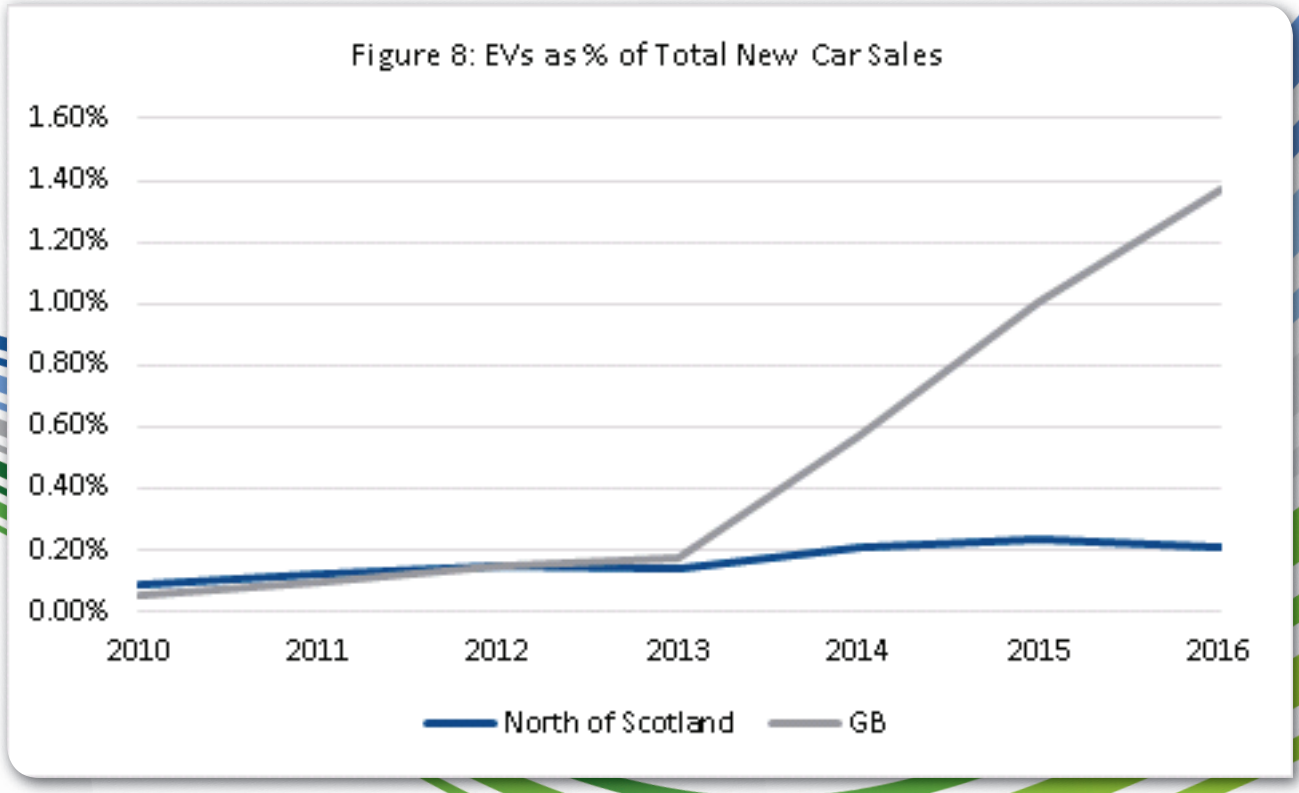
[9] http://www.e-cosse.net/

Electric vehicles (EVs)

Our analysis on electric vehicles has used both the number of registered vehicles and the number of licenced vehicles. Vehicle registration provides an indication of new car sales (presented in Figure 8) as the data is collected at the point of sale, whereas licenced vehicles provides us with an indication of the total number of vehicles on the road.

The UK and Scottish Government have both sought to promote EV adoption through preferable road tax, loans and grants towards purchase costs, as well as supporting deployment of public EV charging infrastructure.

Figure 8 illustrates the difference in EV uptake in the north of Scotland versus GB. It is evident that the rate of uptake of EVs in the north of Scotland is lower than that seen at a GB level. In 2016, EV sales at a GB level represented 1.4% of total new car sales whilst EV sales in the north of Scotland only represented 0.2% of all cars sold in the north of Scotland.



Source: Department for Transport

EV clustering

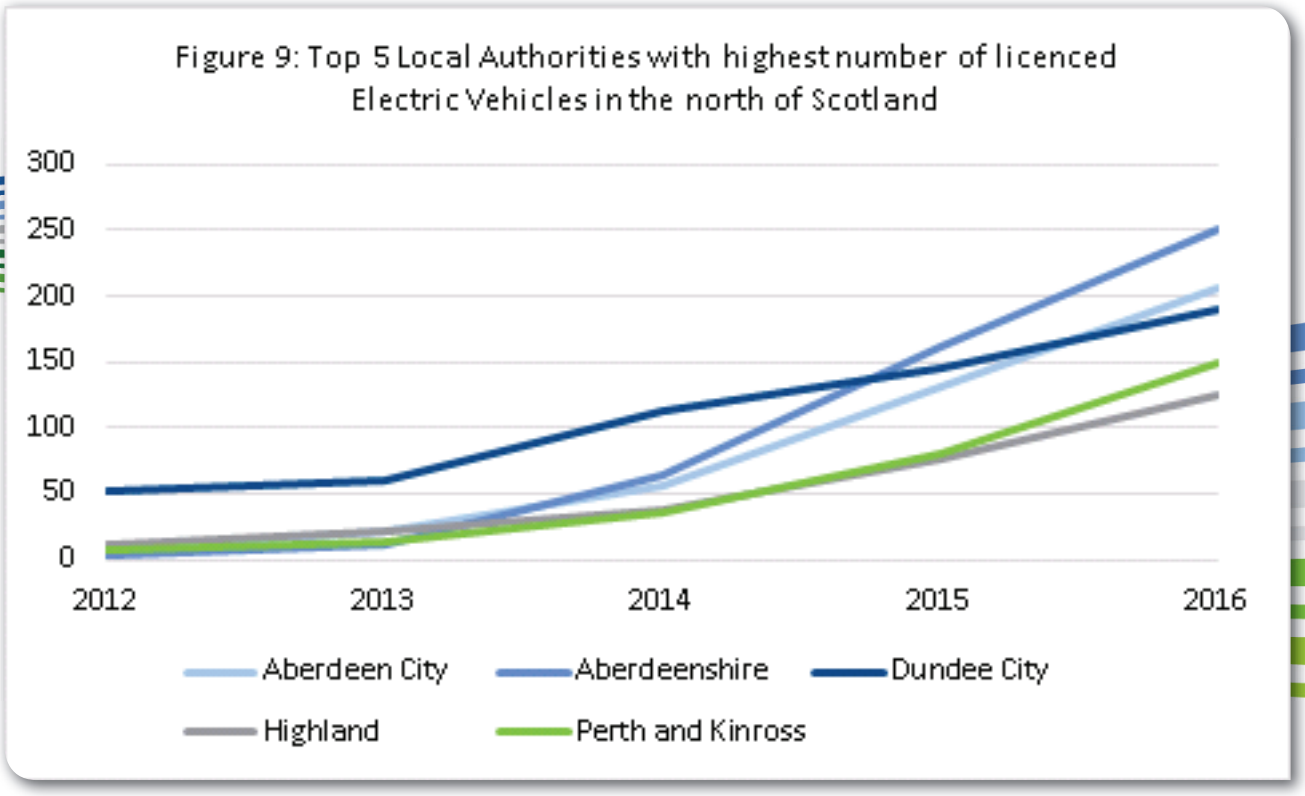
In the north of Scotland, the total number of EVs licenced increased from 96 in 2012 to 1,240 in 2016. In the same four years, the total number of EVs licenced in GB increased from 4,855 to 83,482 vehicles.

55% of local authorities in the north of Scotland had 100+ licenced EVs at the end of 2016. As shown in Figure 9, Aberdeen City, Aberdeenshire, Dundee City, Peth and Kinross and Highland are the local authorities with the highest total number of licenced EVs. Whilst the total number of EVs in the north of Scotland has increased at a slower rate than the GB total, the clustering of EVs in areas with existing high electricity demand may require further investigation to understand the impact of variations in demand on the network.

The increase seen in EVs could be partially attributed to support by Transport Scotland. Transport Scotland implemented a scheme to support the purchase of ultra low emission vehicles in Scotland through an interest free loan operated by the Energy Saving Trust. The interest free, low carbon loans have been offered to businesses since 2011 and to customers since 2015 with 248 loans being provided to businesses and consumers in 2016/17. The loan provision is set to continue untl at least March 2020.

Additionally, investment by local authorities in EV charging infrastructure and EV fleets has aided the uptake of EVs in the north of Scotland. Projects such as Orkney's Electric Future by Orkney Islands local authority led to an increase from 1 EV in 2012 to 105 EVs in 2016. Dundee City local authority has also invested in a fleet of 60+ EVs and has introduced a programme offering free parking in council managed car parks for owners of pure electric vehicles. Local authorities will play an increasingly important role in creating the EV infrastructure required to increase EV uptake.

Figure 9: Top 5 Local Authorities with highest number of licenced Electric Vehicles in the north of Scotland



Source: Department for Transport

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Table VEH0150: Vehicles registered for the first time by body type, monthly: Great Britain and United Kingdom, Department for Transport, 15 June 2017
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Table VEH0152: Motor vehicles registered for the first time by body type: Great Britain and United Kingdom, Department for Transport, 15 June 2017
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We are really interested in hearing your views as to how we can keep you informed and make this better. If you have any feedback, please contact us on the details below:

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