

Pearson BTEC Levels 4 and 5 Higher Nationals in Engineering (RQF)

Unit 53: Utilisation of Electrical Power

Unit Workbook 2

in a series of 2 for this unit

DUKES 2020

Chapter 5

Electricity

Key points

- **In 2019, electricity consumption accounted for 17 per cent of the UK's final consumption.** This proportion has been relatively stable in recent years. (Table 1.1)
- **UK generation was 325 TWh in 2019, a decrease of 2.4 per cent compared to 2018** and the lowest value in more than twenty years. As well as lower demand, this was linked to higher net imports of electricity, up 11 per cent compared to 2018. (Table 5.1)
- **Total electricity demand was 346 TWh in 2019, 2.0 per cent lower than in 2018.** There were year on year decreases in electricity consumption for all sectors with consumption down 2.4 per cent for the industrial sector, down 1.2 per cent for the domestic sector and down 1.7 per cent for other final users (including commercial and transport use). (Table 5.1)
- **Fuel used for electricity generation totalled 59.9 Million tonnes of oil equivalent (Mtoe) in 2019. This was a decrease of 2.6 per cent compared to 2018** and the lowest value in more than twenty years. This partly reflects the lower electricity generation in 2019 as well as the shift in the generation mix to renewable alternatives. (Table 5.3)
- **The share of generation from fossil fuels fell to 43.1 per cent in 2019, with a record low share for coal of just 2.1 per cent of generation.** Gas's share of generation was slightly higher in 2019 at 40.6 per cent. The total generation from fossil fuels was 140 TWh, just over half the 276 TWh that was generated from fossil fuels in 2009. (Table 5.6)
- **Renewables' share of generation reached another record high in 2019 at 37.1 per cent. This is the first time they have accounted for more than one third of total generation.** This was driven by increased capacity, up 6.7 per cent in 2019 (de-rated to account for intermittency). Renewable generation in 2019 totalled 121 TWh, just 19 TWh lower than the total generation from fossil fuels. (Table 5.6)
- **Low carbon generation reached a record high share of 54.4 per cent in 2019, which was 1.8 pp higher than 2018.** The increase in low carbon share was not as large as the increase in renewable generation share because the nuclear share of generation fell, down to 17.3 per cent in 2019 as a result of outages and maintenance. (Table 5.6)

Introduction

5.1 This chapter presents statistics on electricity from generation through to sales, and includes generating capacity, fuel used for generation, load factors and efficiencies. It also includes a map showing the electricity network in the United Kingdom and the location of the main power stations as at the end of May 2020. A **full list** of tables is available at the end of the chapter.

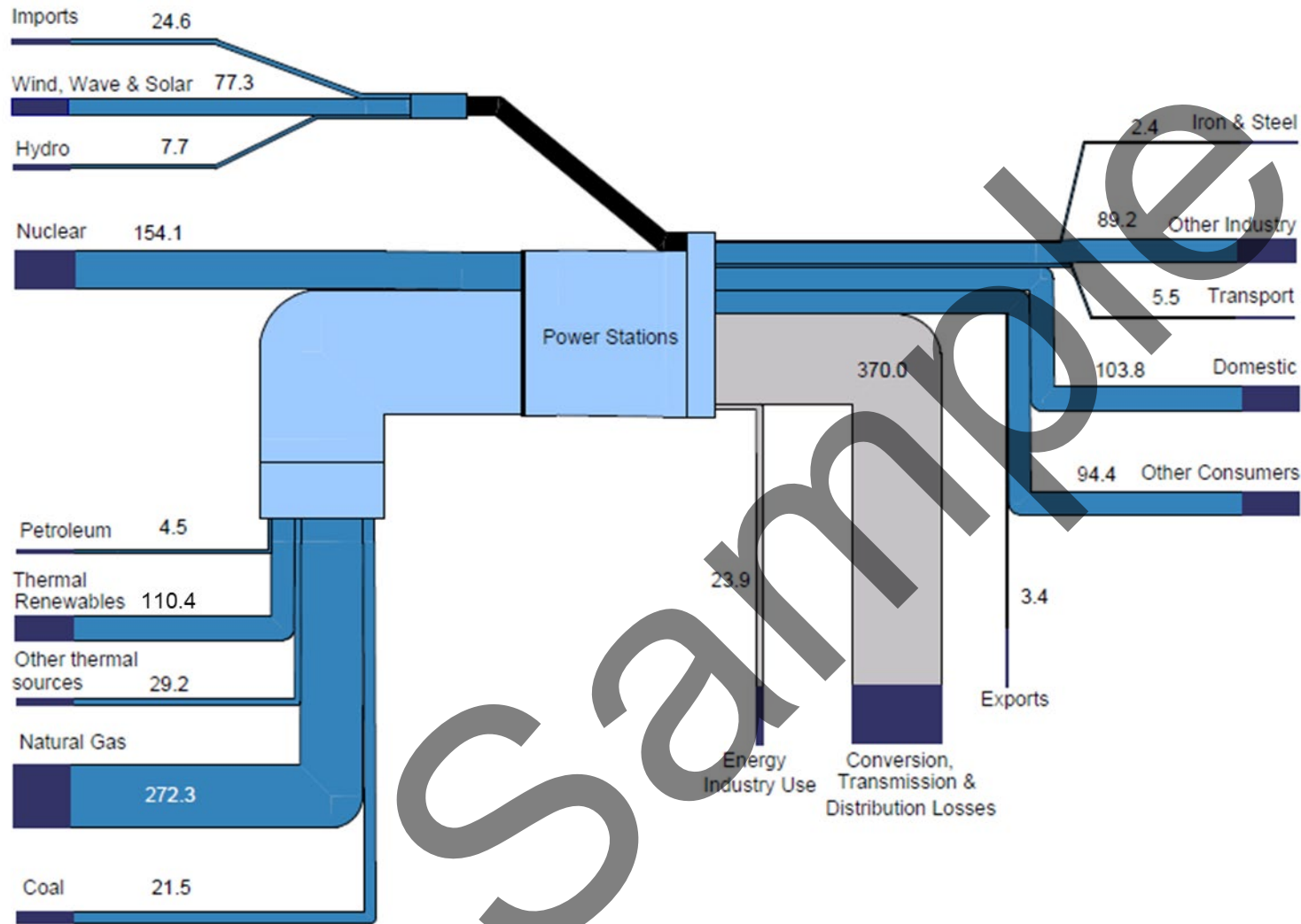
5.2 **In 2019, electricity consumption accounted for 17 per cent of the UK's final energy consumption¹.** This proportion has been relatively stable in recent years.

5.3 Below is an energy flow chart for 2019, showing the flows of electricity from fuel inputs through to consumption. It illustrates the flow of primary fuels used to produce electricity through to the final use of the electricity produced or imported as well as the energy lost in conversion, transmission and distribution. The widths of the bands are proportional to the size of the flows they represent.

¹ See section 1.16 for details.

Electricity flow chart 2019 (TWh)

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This flow chart is based on the data in Tables 5.1 (for imports, exports, use, losses and consumption) and 5.6 (fuel used).

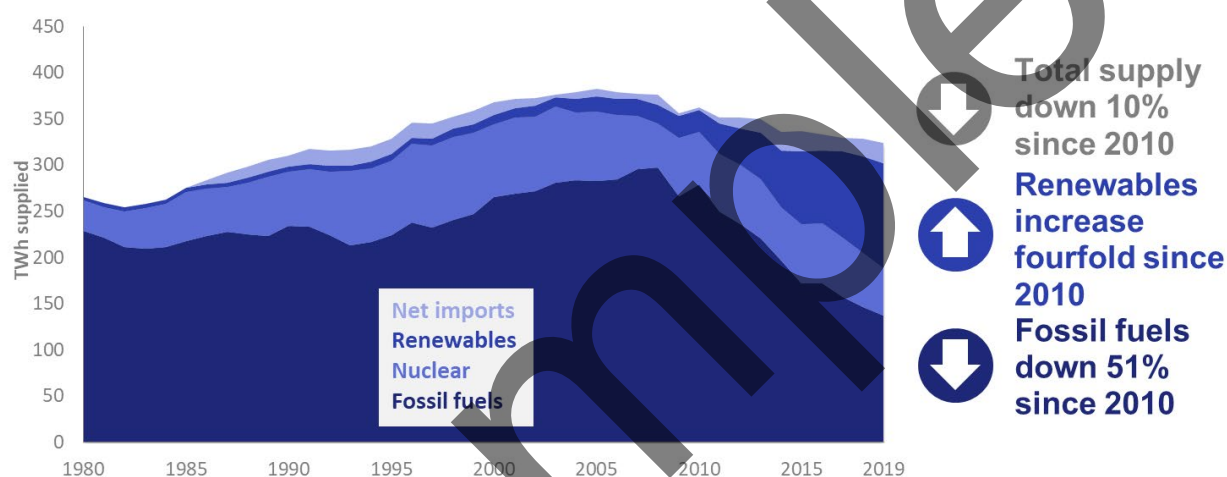
1. Hydro includes generation from pumped storage while electricity used in pumping is included under Energy Industry Use.
2. Conversion, Transmission and Distribution Losses are calculated as fuel used (Table 5.6) minus generation (Table 5.6) plus losses (Table 5.1).

Electricity supply (Table 5.1)

5.4 Total UK electricity supply in 2019 was 346 TWh, down slightly from 352 TWh in 2018. UK generation (including pumped storage) accounted for 93.9 per cent of total supply, which was slightly lower than the proportion in 2018 (down 0.7 percentage points (pp)). UK generation was 325 TWh in 2019, a decrease of 2.4 per cent compared to 2018 and the lowest value in more than twenty years. Net imports (imports minus exports) were 21.2 TWh in 2019, accounting for 6.1 per cent of total supply.

5.5 Electricity supply is driven by demand, as it is generated or imported as needed². In recent years, demand for electricity has decreased as energy efficiency measures have improved and increased in number. The total electricity demand comprises energy industry use, losses in transmission or distribution and final consumption by end users. Total electricity demand was 346 TWh in 2019, a decrease of 2.0 per cent compared to 2018. Final consumption is a substantial proportion of total demand and in 2019 accounted for 85.4 per cent. A summary of UK supply is provided in Chart 5.1.

Chart 5.1: Electricity supply, 1980 - 2019



5.6 The UK is a net importer of electricity and total net imports continued to increase in 2019, up 11 per cent compared to 2018. In 2019 imports increased to 24.6 TWh (+15 per cent) and exports increased to 3.4 TWh (up 52 per cent). This included the first year of operation for the GB-Belgium interconnector which began operating on 31st January 2019. Table 5A below summarises interconnector capacity, net imports and utilisation while chart 2 shows the interconnectors' trade flows.

² In the statistics there is a small difference between electricity supply and electricity demand due to different data collection methods. This is called the statistical difference. Further explanations of the statistical difference can be found in paragraphs 5.112 and in paragraph A.19 of DUKES Annex A.

Table 5A: Net Imports via interconnectors 2017 to 2019

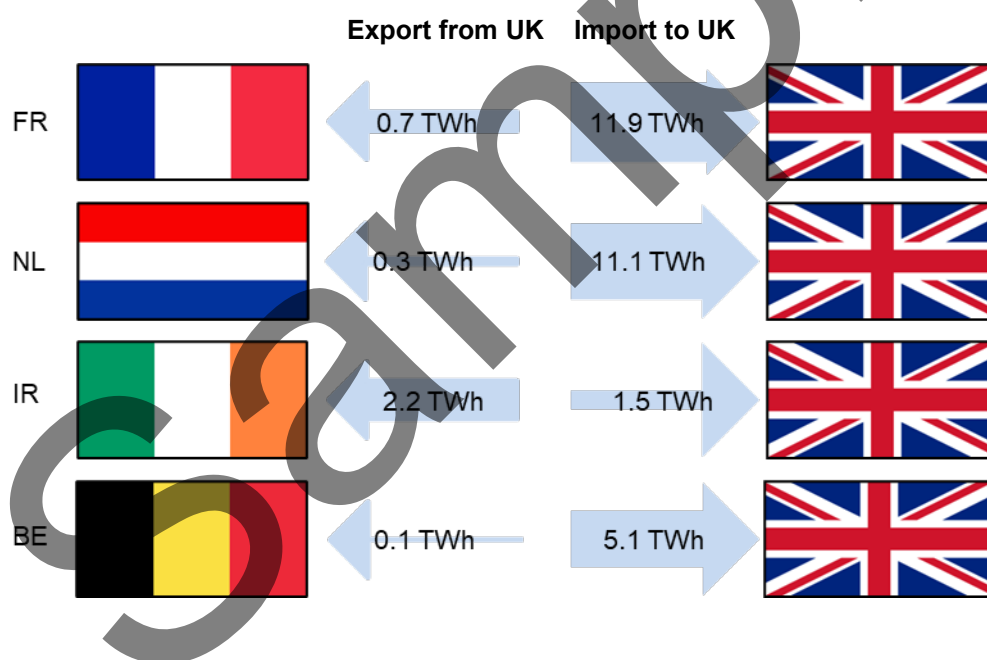
	France – GB ^a	Ireland – N. Ireland ^b	Netherlands – GB ^a	Ireland – Wales ^a	Belgium - GB	Total
Capacity (MW)	2,000	540	1,000	500	1,000	5,040
Net Imports (GWh)						
2017	7,181	-110	6,858	831	0	14,760
2018	12,890	-471	6,185	504	0	19,108
2019	11,147	-825	5,695	180	4,973	21,170
Utilisation (%)^c						
2017	67%	14%	83%	46%	0%	49%
2018	78%	26%	75%	47%	0%	53%
2019	72%	30%	73%	52%	59%	63%

a. Figures taken from the demand data available on the National Grid website at https://demandforecast.nationalgrid.com/efs_demand_forecast/faces/DataExplorer

b. Figures supplied by EirGrid

c. Utilisation is total imports and exports across the interconnector in the year divided by the total possible imports and exports.

Chart 5.2: Electricity imports and exports in 2019



5.7 For the French interconnector, net imports decreased 14 per cent in 2019 compared to 2018 to a total of 11.9 TWh. This was due to a 11 per cent decrease in imports and an 84 per cent increase in exports. The French interconnector had a utilisation of 72 per cent in 2019, which was 6 pp lower than in 2018.

5.8 For the interconnector with the Netherlands, the UK had net imports of 5.7 TWh in 2019, 7.9 per cent lower than in 2018. This was driven by a 5.4 per cent reduction in imports but a 71 per cent increase in exports, with utilisation down to 73 per cent.

5.9 For the Ireland-Wales interconnector, the UK remained a net importer in 2019, but net imports reduced by 64 per cent to 0.2 TWh. Imports decreased by 3.1 per cent compared to 2018 but exports increased 37 per cent. The interconnector's utilisation was slightly higher than in 2018 at 52 per cent.

5.10 The new interconnector with Belgium had net imports of 5.0 TWh, with a 59 per cent utilisation rate.

5.11 In contrast to the other interconnectors, the UK is a net exporter on the Ireland-Northern Ireland interconnector with net exports of 0.8 TWh. Imports decreased by 20 per cent while exports increased by 33 per cent, with the interconnector utilisation up 4 pp to 30 per cent.

Electricity demand and consumption (Table 5.1)

5.12 Total electricity demand in 2019 was lower than in 2018, down 2.0 per cent to 346 TWh. Most of this demand (295 TWh, 85.4 per cent) was from final consumption. The remaining demand was split between energy industry use (24 TWh, 6.9 per cent of demand) and losses (26 TWh, 7.6 per cent of demand).

5.13 Energy industry use decreased in 2019 to 24 TWh. Most of this demand was for electricity generation, which accounted for 62 per cent of energy industry use in 2019, a slightly higher share (up 2.0 pp) than in 2018. The lower demand for electricity generation included a substantial reduction in electricity demand for pumped storage, down 30 per cent compared to 2018. Pumped storage uses cheaper electricity to pump water to a higher reservoir. It can then be released later to generate electricity. Generation at pumped storage plants was substantially lower in 2019, reducing the amount of electricity used for pumping. There were also decreases in electricity demand for coke manufacture and for use in other fuel industries, in line with the changes in the fuel mix described in 5.32.

5.14 Losses decreased by 0.9 per cent in 2019 compared to 2018, to 26 TWh, in line with the lower generation. This was a 7.6 per cent share of the demand, similar (up 0.1 pp) to the share in 2018. Losses comprise three components³:

- Transmission losses (7.6 TWh) from the high voltage transmission system, which represented 29 per cent of the losses figure in 2019.
- Distribution losses (17.8 TWh), which occur between the gateways to the public supply system's network and the customers' meters accounted for 67 per cent of losses.
- Theft or meter fraud (just under 1.0 TWh) was 3.6 per cent of losses.

5.15 Final consumption by end users totalled 295 TWh in 2019, down 1.7 per cent compared to 2018. The breakdown across sector is shown in chart 5.3.

³ See paragraph 5.99 for further information on the calculation of losses.