An introductory guide to the
GB energy industry
2018

CHAPTER 02
ELECTRICITY MARKET STRUCTURE AND STATISTICS

ENERGY INNOVATION CENTRE

CATAPULT Energy Systems

CORNWALL INSIGHT CREATING CLARITY
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Electricity market structure and statistics

2.1 Electricity market map

The electricity market is made up of sources of generation and networks to transport electricity from where it is produced to where it is consumed by final users. There are a range of bodies that act to maintain and regulate this system.

**Electricity generation** involves the creation of electricity onto the public network for onwards transport to customers. Large scale generators must have a generation licence from Ofgem.

**Networks** are responsible for the transportation of electricity from generators through to consumers. The national high voltage transmission network provides bulk transport of power up and down the country with the lower voltage regional distribution networks stepping down voltage levels to safe levels for consumers. Network companies must either sign a transmission or distribution licences.

**Suppliers** purchase electricity from generators in the wholesale markets and supply onto customers. Suppliers also charge through network and policy costs onto consumers. To handle consumer contracts a supplier licence is needed from Ofgem.

**The system operator** is responsible for balancing the market in a real time basis and accounting for any supply that is not met by the market. This activity is currently undertaken by National Grid.

Figure 2 provides a graphical representation of these players.
2.2 Electricity generation

2.2.1 Electricity generation capacity
In Great Britain (GB) the majority of electricity generation capacity remains powered by fossil fuels. In 2017, there was approximately 70GW of generation capacity connected to the national transmission network, of which gas generation accounted for approximately 41%, while coal accounted for nearly 20%. Nuclear made up nearly 15% while a small share (2.5%) also comes from Combined Heat and Power (CHP). The remaining capacity comes from renewables and can be split as 7% offshore wind, 6.5% onshore wind, 3.9% pumped storage, 2.9% biomass and 1.5% hydro (as shown in Figure 3).

The GB power system also benefits from having interconnectors with other countries. Interconnectors are essentially large cables that link separate markets by allowing electricity to be traded between markets. Currently GB has a 2GW interconnector with France, a 1GW interconnector with the Netherlands, a 0.5GW interconnector with Northern Ireland, and a 0.5GW interconnector with the Republic of Ireland. While there are currently four operational interconnectors, a number of others are currently being constructed.

FIGURE 3: TRANSMISSION CONNECTED CAPACITY AGAINST OUTPUT

Source: National Grid, TEC register, April 2017
Source: BEIS, DUKES - April 2017
2.2.2 Electricity generation output

It is important to note though that just because a fuel has a large installed capacity, this does not necessarily mean that it will provide an equally large share of the total electricity produced.

For example, while coal represents almost 20% of GB’s total installed capacity, it has recently been providing less than 10% of the total electricity produced. This is due to market dynamics where recent higher carbon and coal prices are making it more economic to run gas generation rather than coal. The other major change that can be seen in Figure 3 is that nuclear accounts for a much greater share of electricity output than its share of capacity as nuclear operates as “baseload” generation, operating continuously at high output, except for maintenance.

2.2.3 Embedded generation

There has been a major change in recent years with the increase of embedded generation (also known as decentralised energy or distributed generation). This is generation that is connected – or embedded – in local distribution rather than at national transmission level.

In GB significant volumes of onshore wind and solar PV are connected at this level. Overall, the amount of embedded generation in the UK has risen from below 15GW in 2012 to over 40GW in 2017, or around 40% of overall capacity. The market rules mean that embedded generation can have a cost advantage to large power stations connected to the transmission system due to the way that parties are charged for flowing power around the networks. However, such benefits have been reduced by recent reforms pursued by Ofgem.

2.3 Electricity consumption

Total GB electricity consumption can be roughly split as a third for industrial and commercial, a third for small and medium enterprises (businesses) and a third for households.

Industrial and Commercial (I&C) customers include facilities like factories and manufacturing units. They tend to be more sophisticated purchasers of electricity and gas and tend to have energy managers or teams to procure their energy and track their usage. Some even have onsite generation to guarantee energy security or secure lower prices. Small and Medium Enterprises (SMEs) are businesses such as shops and offices.
They also tend to purchase their fuels separately, although there is a higher proportion of SMEs who only take required electricity, with a higher prevalence of electric heating.

Domestic refers to household usage, which encompasses heating, lighting, running appliances and cooking. Generally, households have a more predictable usage pattern across the country compared to the vast array of business uses. Ofgem calculates Typical Domestic Consumption Values (TDCVs) for households regularly, with the latest update showing an average for a medium user of 3,100kWh a year (where the household also has access to gas). This has reduced significantly in the last 10 years with an average of 4,000kWh pre-2010.

This trend, also seen for businesses, can be attributed to a number of factors, such as improved energy efficiency of buildings, more efficient technologies (such as more advanced boilers) changes in consumer behaviour, and price response.

Figure 4 details recent trends for annual electricity consumption.

**FIGURE 4: CHANGES OVER TIME IN ANNUAL ELECTRICITY DEMAND**

Source: Cornwall Insight from BEIS data
2.4 The electricity system operator (SO)

The electricity system operator (SO) for GB is National Grid. This entity is a separate function to the National Grid electricity and gas network businesses. The purpose of National Grid as SO is to ensure security and safety of the GB transmission system. They do this through real-time management of the transmission grid to ensure supply and demand are kept within engineering tolerances. The main measurement tool being the frequency on this system, for this process is maintained by the SO at 50Hz per second with a +/- 0.2%.Hz limit.

The SO can call upon parties (such as generators) to provide it with services required to maintain the balance between supply and demand. It does this through contracts (known as balancing services) or via the Balancing Mechanism, which is where parties choose to (or must, depending on the type of party) offer balancing services to the SO for a price. The costs of balancing the system are passed back to generators and suppliers.

Market trading for electricity ends one hour before delivery (more on this in section 5), so final responsibility for flows on and off the transmission system is solely down to the SO.

2.4.1 Elexon

Elexon is the Balancing and Settlement Code Company (BSCCo) and is responsible for implementing and managing the balancing and settlement arrangements for GB. It does this using the Balancing Settlement Code (BSC), which outlines the rules and governance for the balancing mechanism and the associated imbalance settlement charges that arise. All licensed electricity companies who operate in the market place must adhere to this code.

Elexon is a wholly owned subsidiary of National Grid, but it is independently financed and has its own independent Board of Directors.
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