
Major Changes to the UK's Electricity System following the Electricity Market Reforms (EMR) of 2013: Impact on Encouraging Renewable Electricity Generation in the Energy Mix

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1 Introduction

Electricity is an essential commodity used by households to generate heat, cook and operate electrical equipment. This energy medium is generated using several technologies such as; hydropower plants, wind plants, fossil fuels, gas-fired plants, solar farms, and coal plants. There are many generation, transmission, and distribution complexities required to deliver electricity to households. The power sector in any country, required to meet the electricity demand of households, depends on the kind of electricity market guiding energy producers and consumers. In the UK, the electricity market has undergone significant changes since the 1990s. There has been government policy to liberalise the market and incorporate sustainability and environmental concerns. We will examine the history of the electricity market structure in the UK and, subsequently, the Electricity Market Reform of 2013.

2 History of the UK Electricity Market

Before 1990, the central government owned the electricity generation and transmission companies and supplied local retailers, who delivered to homes (Grubb & Newbery, 2018). A considerable proportion of the nation's electricity supply was generated using coal. With the introduction of the Electricity Act of 1989, electricity utility companies were privatised, following the economic restructuring effected by the Margaret Thatcher-led government. The government privatised all the major generating companies between 1990 and 1999 across England, Wales, and Scotland. Given the increased gas production from the North Sea, the new owners invested in gas-fired power plants for electricity generation.

Figure 1 below displays a fuel mix for UK's electricity generation. As demonstrated by Figure 1, there was a substantial decline in coal use and a consecutive increase in gas usage in the energy generation mix from 1990 onwards. This switch was the beginning of energy mix diversification in the UK, with a view towards lower costing, efficiency, and carbon

reduction. There was also an increase from wind energy technologies from 2010 onwards. By 2020, the nation did not generate electricity from coal plants. Gas, nuclear, wind and oil remain the major fuels for the economy. The National Grid was formed as a company owned by twelve regional electricity companies (National Grid, 2021) to administer the electricity market, while the Office of Gas and Electricity Markets (Ofgem) was created in 2000 to regulate energy markets across the UK.

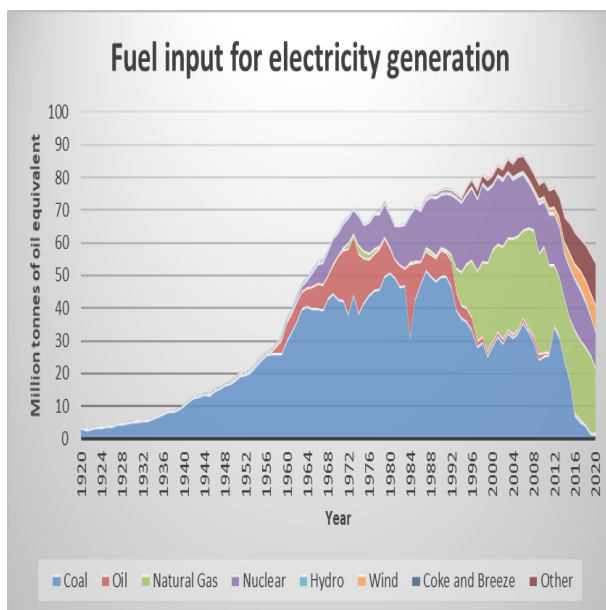


Figure 1: *Historical electricity generation mix trend: 1920 to 2020*

Source: (Department for Business, Energy and Industrial Strategy (BEIS), 2021a)

Before 2001, the electricity market was administered using a pooling mechanism. The National Grid asks each electricity producer to estimate the quantity of electricity they could supply, as well as their pricing. With this information, the National Grid calculates a pool price and balances supply and demand in real-time (Grubb & Newbery, 2018).

The New Electricity Trading Agreement (NETA) came into effect in March 2001 to replace this trading mechanism. Under this arrangement, the market adopted a bilateral trading mechanism where futures/ forwards were used to negotiate electricity pricing and quantity for future dates (National Audit Office, 2003). A forward is a contractual agreement between two parties to settle a trade at

a future date at a currently agreed price. A futures contract is a standardized form of a forward contract, tradeable in the financial markets. There was also a balancing mechanism in the market where bids and offers come in from electricity generators and suppliers to balance supply and demand on excess or under-supplied electricity in the national grid. This policy was introduced to increase competitiveness in the electricity market and reduce prices. With the inclusion of Scotland in 2005, this agreement was called the British Electricity Trading and Transmission Arrangements (BETTA).

This post-2000 era saw the emergence of the Big Six electricity suppliers who control a large proportion of the electricity generation in the United Kingdom. They are British Gas, EDF Energy, E.ON, RWE Npower, Scottish Power, and SSE. EON eventually acquired Npower in 2019 to consolidate the largest suppliers to the Big Five (E.ON Energy, 2021). These suppliers dominate the market, with over twenty other smaller suppliers competing.

3 The 2013 Electricity Market Reforms (EMR)

The UK electricity market liberalisation in the 1990s served as a framework for other reforms across the rest of the world. There was free competition, with some producers consolidating market share. Electricity generated from renewable sources was minimal as the technology was developing. There was also an impediment in the form of significant upfront capital costs for installing renewable energy technologies.

On 16th December 2010, the Secretary of State for Energy announced a consultation on Electricity Market Reform. The major aim of this reform was to “deliver secure, affordable, and low carbon energy.” There was an increasing focus of national policy on the energy trilemma trade-off of environmental equity, energy security, and equity (access and cost). The Department of Energy and Cli-

mate Change (2010) consultation paper highlighted the government's new priorities to decarbonise electricity supply in a world increasingly emphasising the debilitating effects of climate change.

3.1 Reasons for the Reform

The BETTA framework could not overcome the major challenges of pursuing the nation's newfound priority to decarbonise. Specifically, it did not encourage a large-scale investment that would be needed to replace the nation's ageing generation assets. It did not also facilitate the incorporation of renewable energy sources into the energy mix, given the low technical know-how and expensive deployment. Finally, the BETTA did not signal a need for spare capacity in the market (Department of Energy and Climate Change, 2010).

Also, the UK's security of electricity supply was threatened because most of the nation's existing plants were due to be retired in a couple of years. It was necessary to improve investment while achieving the European Union's (EU) 15% renewable energy target by 2020. There was a realization that demand for electricity prices was likely to rise, despite increased household efficiency useage. This could cause increased electricity prices, especially if emissions' carbon price continues to grow.

These reasons above necessitated a change in the modus operandum of the UK electricity energy market. The reform was developed to address emission concerns in electricity generation and pricing for energy generated from renewable sources. The reform was an investment signal for stakeholders that the UK was renewable-energy inclined. To give an example of the high costs associated with the deployment of renewable energy technologies, a 2009 study by Ofgem put onshore wind capital costs (£1,2m/MW) as twice that of Combined Cycle Gas Turbines (CCGT) (£0.6m/MW). Thus, it made sense for electricity generation investment decision-makers to continue deploying the cheaper alternative. According to a 2011 white paper

presented to the Parliament by the Department of Energy and Climate Change, the principal objective of the EMR was to guarantee investment in new low-carbon generation capacity and infrastructure in a cost-effective manner.

3.2 Changes Introduced by the Reform

The Energy Bill was introduced into Parliament in 2012 to implement key aspects of the EMR. The Climate Change Act (CCA) of 2008 can be viewed as a precursor for this policy. The CCA committed the UK to reduce its greenhouse gas emissions by 80 per cent by 2050, compared to 1990 levels (London School of Economics, 2020). Eventually, it was amended to be a net-zero target. The government's energy objective was to ensure the security of electricity supply, address climate change challenges, and minimise costs for consumers (Department of Energy and Climate Change, 2012).

Given the substantial investment needed to meet the nation's ambitious climate goals, the government believed the market arrangement would not work, hence the need for the EMR. This policy introduced a central planning mechanism in the market, away from the previous liberalised stance, a planning mechanism vehemently disputed by some authors. According to the Department of Energy policy overview document and Spataru and Arcuri (2017), the critical elements of the EMR include:

- A A mechanism to support investment in low-carbon electricity generation: the Feed-in Tariffs with Contracts for Difference (CfD);
- B A mechanism to support the security of supply, if needed: the Capacity Market;
- C A mechanism to discourage emission: A Carbon Price Support; and
- D A mechanism to deter investment in carbon-intensive technologies: An Emission Performance Standard.

Contracts for Difference (CfD): The EMR

supported the previous Feed-in Tariffs (FIT), which were introduced on 1st April 2010 (Ofgem, 2021). The Feed-in Tariffs was a government programme that promoted low-carbon electricity generation technologies. FIT payments were made quarterly to individuals who had installed such generation technologies based on their meter readings. The CfDs were long-term contracts given to low-carbon generators as an incentive for investment. The government would pay the difference between the electricity average wholesale price and the price established in the contract (Spataru and Arcuri, 2017). The wholesale market prices were usually smaller than the generation cost from the newer low-carbon technologies.

Capacity Market (CM): To protect the integrity of supply to the market, the EMR introduced a Capacity Market. This change involved payments to reliable capacity providers during peak demand times on the national grid. The availability and sustained electricity supply contracts were awarded through a competitive bidding process. An auction is held to determine who will supply or demand the excess capacity in the market four (T-4) years before the relevant date (T). Another auction is held a year (T-1) before the applicable date to determine if extra capacity is needed. All generators can compete in this auction despite the technology employed to generate electricity.

Carbon Price Support (CPS): The carbon price support change aimed to reduce investor uncertainty, put a fair price on carbon, and provide a stronger incentive to invest in low-carbon electricity generation. This meant a carbon price floor that would systematically increase to ensure that generators pay the minimum carbon price for their carbon emissions—a move to encourage a switch to low-carbon technologies systematically. As of March 2011, the target minimum carbon price was £16.00 /tCO₂. This price was to increase every year and reach £30 by 2020 and £70 by 2030. In the 2014 budget, the CPS was frozen at £18.00 between 2016-2017 and 2019-2020 to limit the competitive disad-

vantage suffered by UK generators (Clifford Chance LLP, 2016).

Emission Performance Standard (EPS): The government's policy on emissions performance standards was built into the EMR to drive investment away from carbon-intensive technologies. The policy change concerned all new fossil-fueled plants to be built. It was a decarbonization technique that prevented new carbon-intensive power plants from being built. The EPS was initially set at 450g CO₂ /kWh (at baseload) for all new fossil fuel plants, except Carbon Capture and Storage (CCS) demonstration plants (Department of Energy and Climate Change, 2011). CCS (also called Carbon Capture and Sequestration) is a process whereby carbon dioxide is captured before it enters the atmosphere, transported, and stored, usually in underground geological formations. The policy was not to be applied retrospectively for power plants already in operation before the EMR. The EPS objective was to ensure that while fossil fuels continue to make significant contributions to the security of supply in the electricity market, it does so in a manner consistent with UK's decarbonization policy

The CfD, Capacity Market, Carbon price support, and EPS were the major changes introduced by the EMR act to the UK electricity market. This policy document signaled the government's intention to intervene and direct the future of the electricity market, in line with its overall environmental sustainability objectives. A significant policy that effectively changed how the electricity market operated, especially for renewable technology investment decision-making. The objectives of the policy's changes are summarized in figure 2 below.

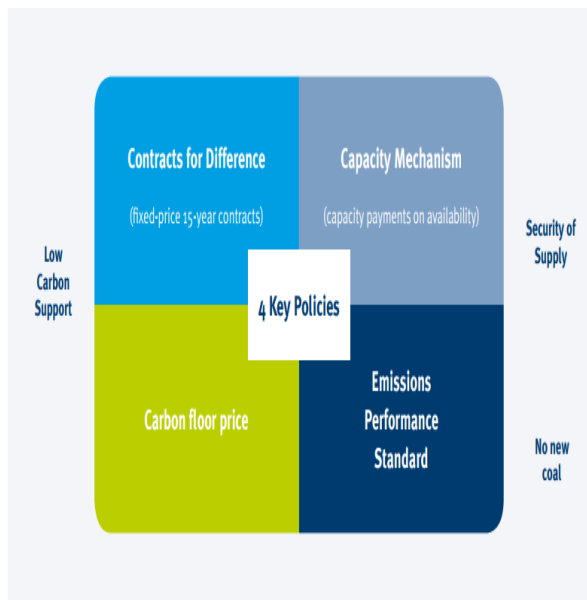


Figure 2: The Four Key Policies of the EMR
Source: (Rhodes et al., 2019)

4 Have the changes introduced through the EMR been effective in encouraging the development of more renewable electricity into the generation mix?

In 2016, the UK emitted 467 megatonnes of greenhouse gases, a 42% reduction since 1990. (Ofgem, 2017). There was a significant fall in the country's greenhouse gas emissions from electricity generation processes, especially following the implementation of the EMR. Figure 3 and Figure 4 below demonstrate the increased share of renewables in electricity generation after implementing the EMR. We can imagine the EMR reforms of 2013 as a breakeven point in a trend analysis. Clearly, in figure 3, from 2011 (when the consultation paper was released) onward, there is a higher adoption rate for renewable energy in the country's energy mix than in the past decades. From figure 4, between 2010 and 2020, the contribution of renewables to the UK's electricity generation increased from 40 TWh to about 130 TWh, a more than 300%

increase. By 2020, renewable electricity accounted for a record 43.1% of electricity generated in the UK less than a decade after implementing the EMR.

To a considerable extent, I agree that the Electricity Market Reform introduced changes that informed investment decisions and provided certainty as to future policy objectives of the national government in the electricity generation space. Thus, a signaling effect was created in the market, leading to widespread investment in these newer technologies.

Electricity capacity, 1996 to 2020

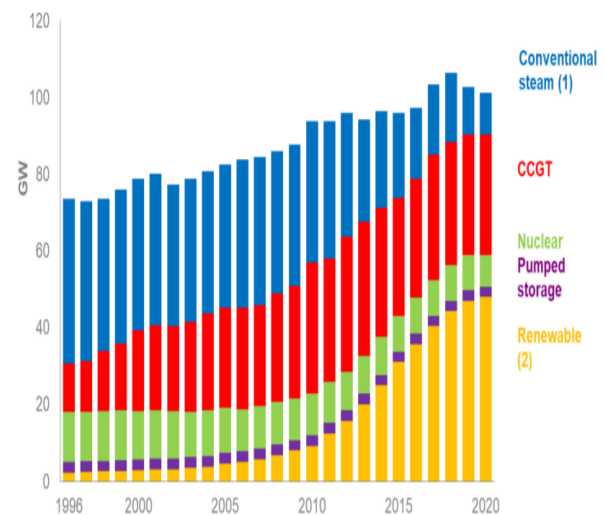


Figure 3: Electricity Capacity: 1996 to 2020
Source: (Department for Business, Energy and Industrial Strategy (BEIS), 2021b)

Electricity generation from renewable sources since 2000

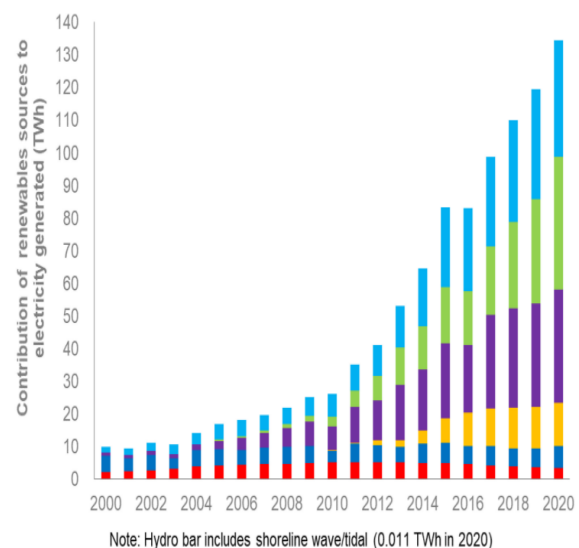


Figure 4: *Electricity generation from renewable sources since 2000.*

Key: Blue = Bioenergy; Red = Hydro pumps; Green = Solar PV, Solar Thermal and Geothermal; Purple = Wind; Yellow = Hydro.
Source: (Department for Business, Energy and Industrial Strategy (BEIS), 2021b)

Grubb and Newbery (2018) also agree that renewables share in UK's energy mix began to accelerate after 2010 with the advent of the feed-in-tariffs and CFDs. He also noted that the carbon price feature of the policy helped reduce the contribution of coal to the national electricity grid power generation. Similarly, Deloitte's (2015) report noted that the EMR introduced support mechanisms to increase the share of renewables in the energy mix by heightening investment certainty and increasing the competitiveness and attractiveness of low-carbon electricity with the carbon floor price.

The most significant criticism of this reform was an indication of central planning in the market by the government following its attempt to liberalise and privatise the electricity market in the 1990s. While some authors agree that the intervention created distortions in the market, others argue that the intervention was not an indicator of central planning

but an attempt to guide outcomes in the market towards environmental sustainability and energy security.

While authors criticize many components of the EMR, the emerging trend in renewables adoption following the implementation of the reform support the hypothesis that this policy played a significant role in attracting investment to renewable technologies. *"The CfD auctioning process has led to a sharp fall in the bid prices of wind, solar and other renewables, and the Capacity Market, while currently suspended, had guaranteed firm capacity for the winter periods through to 2020, also at unexpectedly low prices"* (Rhodes et al., 2019). This process has helped attract investment into renewable technologies. In Ross Fairley's (2018) review of how successful the EMR has been in encouraging decarbonization, he noted that the policy has been very successful, especially in the case of offshore wind generation technologies. The cost reductions seen with CFDs auctions have enabled widespread deployment. He believes that the reform had a spill-over effect that incentivised new nuclear technologies, also seen as a low-carbon generation process.

Word Count: 2502

REFERENCES

Clifford Chance LLP (2016) *Carbon Price Floor and Emissions Performance Standard: an EMR Primer*. Briefing Note.

Deloitte (2015) *European energy market reform - Country profile: UK*.

Department for Business, Energy and Industrial Strategy (BEIS) (2021a) *Historical electricity data*. Available at: <https://www.gov.uk/government/statistical-data-sets/historical-electricity-data> (Accessed: 27 November 2021).

Department for Business, Energy and Industrial Strategy (BEIS) (2021b) *UK Energy in Brief 2021*, p. 52. Available at: <https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics>.

Department of Energy and Climate Change (2010) *Electricity Market Reform: consultation document*. London: Stationery Office.

Department of Energy and Climate Change (ed.) (2011) *Planning our electric future: a white paper for secure, affordable and low-carbon electricity*. London: the Stationery office.

Department of Energy and Climate Change (2012) 'UK Energy in brief 2012', p. 48.

E.ON Energy (2021) *E.ON completes migration of two million former npower customers to E.ON Next in record speed, E.ON completes migration of two million former npower customers to E.ON Next in record speed*. Available at: <https://www.eonenergy.com/About-eon/media-centre/eon-migration-two-million-npower-customers-eon-next/> (Accessed: 1 December 2021).

Grubb, M. and Newbery, D. (2018) 'UK Electricity Market Reform and the Energy Transition: Emerging Lessons', *The Energy Journal*, 39(01). doi:[10.5547/01956574.39.6.mgru](https://doi.org/10.5547/01956574.39.6.mgru).

London School of Economics (2020) *What is the 2008 Climate Change Act?*, Grantham Research Institute on climate change and the environment. Available at: <https://www.lse.ac.uk/granthaminstitute/explainers/what-is-the-2008-climate-change-act/> (Accessed: 2 December 2021).

National Audit Office (2003) *The new electricity trading arrangements in England and Wales: report*. London: Stationery Office.

National Grid (2021) *History of electricity transmission in Britain* | National Grid Group. Available at: <https://www.nationalgrid.com/about-us/what-we-do/our-history/history-electricity-transmission-britain> (Accessed: 27 November 2021).

Newbery, D.M. (2016) 'Towards a green energy economy? The EU Energy Union's transition to a low-carbon zero subsidy electricity system – Lessons from the UK's Electricity Market Reform', *Applied Energy*, 179, pp. 1321–1330. doi:[10.1016/j.apenergy.2016.01.046](https://doi.org/10.1016/j.apenergy.2016.01.046).

Ofgem (2017) *State of the energy market: 2017 Report*.

Ofgem (2021) *Feed-in Tariffs (FIT)*, Ofgem. Available at: <https://www.ofgem.gov.uk/environmental-and-social-schemes/feed-tariffs-fit> (Accessed: 9 December 2021).

Rhodes, A., Gross, R., Donovan, C., & Hindle, J. (2019). *Electricity markets, incentives and zero subsidy renewables: Do Britain's power markets and policies need to change?* Electricity Markets, 48.

Ross Fairley (2018) *Has the Electricity Market Reform succeeded?* Available at: <https://www.burges-salmon.com/news-and-insight/legal-updates/has-the-uk-governments-policy-on-electricity-market-reform-succeeded> (Accessed: 13 December 2021).

Spataru, C. and Arcuri, B. (2017) 'Renewable energy market in UK', p. 14.