National Audit Office

Report
by the National Audit Office

Department of Energy & Climate Change

Low-carbon electricity supported by the Levy Control Framework

NOVEMBER 2016

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Contents

The National Audit Office study team consisted of:
Marc Adams, Peter Kitson, Katy Losse, Stephen Luckhurst, Alex Macnab and Michael Main, under the direction of Michael Kell and James Osborne.

This report can be found on the National Audit Office website at www.nao.org.uk

For further information about the National Audit Office please contact:

National Audit Office
Press Office
157–197 Buckingham Palace Road
Victoria
London
SW1W 9SP

Tel: 020 7798 7400

Enquiries: www.nao.org.uk/contact-us

Website: www.nao.org.uk

Twitter: @NAOorguk

Introduction

1 This report has been prepared in response to a Parliamentary request for information about the costs and achievements of schemes included within the low-carbon Levy Control Framework (the Framework). The Framework provides a formal budgetary control for three schemes funded through levies on energy suppliers: the Renewables Obligation, Feed-in Tariffs, and Contracts for Difference. Each of the three schemes supports low-carbon energy generation. A more detailed explanation of the Framework can be found in our recently published value for money report on it.[1]

2 Using data from the Department for Business, Energy & Industrial Strategy (the Department) and Ofgem, we have estimated the costs of the schemes, and the total volume of low-carbon electricity they support.[2] The estimates are broken down by scheme, technology and nation of the United Kingdom. Unless otherwise noted, costs are reported in 2015-16 prices.

3 The costs that have been estimated in this report are the schemes' direct costs of support. Support costs provide only a partial picture of the total costs associated with low-carbon generation.[3] Each of the schemes has an arrangement for distributing support costs across electricity suppliers, with larger suppliers obligated to make greater contributions. These suppliers recover their costs from businesses and households through their bills.

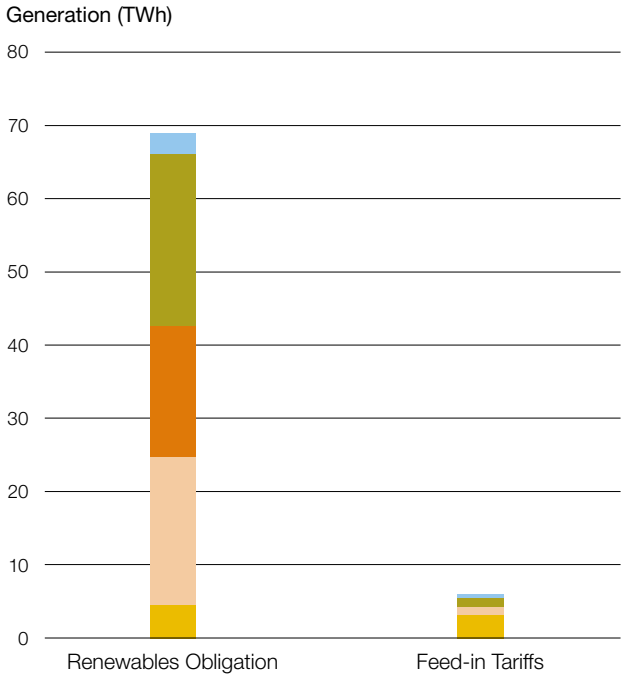
1 Comptroller and Auditor General, *Controlling the costs of consumer-funded energy policies: The Levy Control Framework*, Session 2016-17, HC 725, National Audit Office, October 2016.
2 The Department for Business, Energy & Industrial Strategy inherited responsibilities for energy markets and climate change from the Department for Energy & Climate Change, which closed in July 2016.
3 For more information on the limited picture given by support costs, see the value-for-money report in footnote 1.

Costs and electricity generation by scheme

4 In 2015-16 the Framework schemes supported the generation of approximately 75 terrawatt-hours (TWh) of electricity (**Figure 1**), more than one-fifth of total electricity generation. Around nine-tenths of this was provided through the Renewables Obligation, with Feed-in Tariffs supporting the remainder. No power plants with Contracts for Difference had begun generating electricity by 31 March 2016.

Figure 1

Generation in 2015-16 supported by Framework schemes



	Renewables Obligation	Feed-in Tariffs
Hydro	2.8	0.4
Energy from biomass and waste	23.5	1.1
Offshore wind	17.9	
Onshore wind	20.2	1.1
Solar	4.6	3.2

Notes

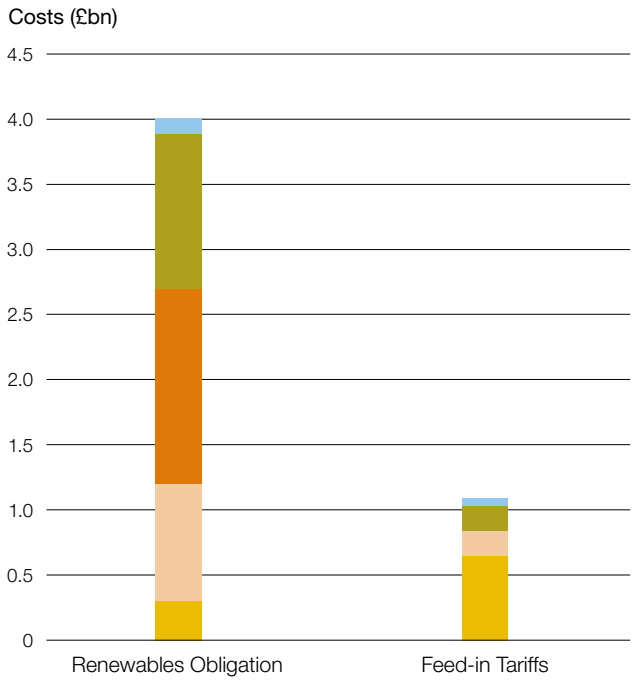
1 Generation supported by Feed-in Tariffs has been estimated by multiplying installed capacity by typical load factors.

2 For the Renewables Obligation, generation figures are based on Ofgem data on the number of certificates for renewable electricity that were issued during the year.

Source: National Audit Office analysis of: Department of Energy & Climate Change, Energy Trends, 2016; Ofgem, Central Feed-in Tariff Register, 2016; Load factors used for Renewables Obligation budget setting in 2015-16; and Department of Energy & Climate Change, Feed-in Tariffs annual load factors, 2015

5 We estimate that the Renewables Obligation and Feed-in Tariffs cost £5 billion in 2015-16 (**Figure 2**).[4] On average, the cost of Feed-in Tariffs per TWh of electricity supported is higher than the cost per TWh of the Renewables Obligation (**Figure 3**). When it introduced Feed-in Tariffs, the government set levels of support under the scheme higher than they were under the Renewables Obligation, in order to provide high enough incentives for households, businesses and communities to install smaller-scale and more expensive technologies.[5] Over time, levels of support for new small-scale installations have been reduced significantly, as their costs have also fallen.

Figure 2
Estimated costs of Framework schemes in 2015-16



	Renewables Obligation	Feed-in Tariffs
Hydro	0.1	0.1
Energy from biomass and waste	1.2	0.2
Offshore wind	1.5	
Onshore wind	0.9	0.2
Solar	0.3	0.6

Notes

1 Costs of the Renewables Obligation have been estimated by multiplying the total number of Renewables Obligation certificates by the 'buyout price' (the price per certificate suppliers would have to pay for failing to present enough certificates). This provides a reasonable estimate of total costs, rather than a direct measure; suppliers are not required to report the actual prices they have paid for certificates.

2 The total cost of Feed-in Tariffs shown here is the total cost in 2015-16 according to Ofgem. We have split this across technologies according to the split of costs forecast in the Department's model of the scheme.

Source: National Audit Office analysis of: Ofgem, Renewables Obligation Certificate Register, 2016; Ofgem, FIT levelisation reports, 2015-16; and Department of Energy & Climate Change, Feed-in Tariffs model, January 2016

4 The cost of the Renewables Obligation has to be estimated because energy suppliers are not required to report their levels of expenditure on the scheme.

5 In order to encourage widespread participation, Feed-in Tariffs were also designed to be a simpler and more predictable support mechanism than the Renewables Obligation. See Department of Energy & Climate Change, *Feed-in Tariffs: Government's response to the summer 2009 consultation*, February 2010.

Figure 3

Framework costs (£/MWh), by scheme and technology

	Renewables Obligation (2015-16)	Feed-in Tariffs	Contracts for Difference		
			Early awards (2025-26)	Auction round one 2025-26)	Hinkley Point C (2025-26)
Solar	67	200		22	
Onshore wind	44	168		29	
Offshore wind	84		93	67	
Energy from biomass and waste	50	165	51	34	
Hydro	44	215			
Nuclear					35
All technologies (weighted by generation)	58	188	77	50	35

Notes

1 We have estimated the support cost per MWh of Hinkley Point C by subtracting the expected wholesale price of electricity in 2025-26 (according to the Department's July 2016 projection) from the strike price (which is £92.50 in 2012 prices, and will rise in line with the Consumer Price Index until built). The projected support costs of all other Contracts for Difference are based on the Department's analysis as of July 2016.

2 Within the Feed-in Tariffs scheme, support levels for new projects will be reduced over time. These changes are expected to push the average cost per MWh of electricity down by roughly 5% to 10% for most technologies, and roughly 35% for hydro projects. Therefore in 2025-26, average support costs under Feed-in Tariffs will be lower than those shown in this table, but still substantially higher than average support costs under the other schemes.

3 Within the categories shown in this table, projects can vary significantly in terms of size or specific technology employed. 'Energy from biomass and waste', for example, is a set of disparate technologies which vary significantly in cost-effectiveness. Because the different schemes support different mixes of project types within each technology, it is not always possible to compare costs per MWh of a technology across schemes on a like-for-like basis.

4 There are one million megawatt-hours (MWh) in one terawatt-hour (TWh).

Source: National Audit Office analysis of: Department of Energy & Climate Change, Energy Trends, 2016; Ofgem, Central Feed-in Tariff Register, 2016; Load factors used for Renewables Obligation budget setting in 2015-16; Department of Energy & Climate Change, Feed-in Tariffs annual load factors, 2015; Ofgem, Renewables Obligation Certificate Register, 2016; Ofgem, FIT levelisation reports, 2015-16; and Department of Energy & Climate Change, Feed-in Tariffs model, January 2016

6 Contracts for Difference will eventually support a significant share of total low-carbon electricity generation. Peak generation activity under the Contracts which the government has already committed to will not occur until after the current timeframe of the Framework, that is, after 2020-21. Therefore in this report we include estimates of the Framework schemes several years after the Framework's budgetary cap ends, using 2025-26 as our example (**Figure 4**):

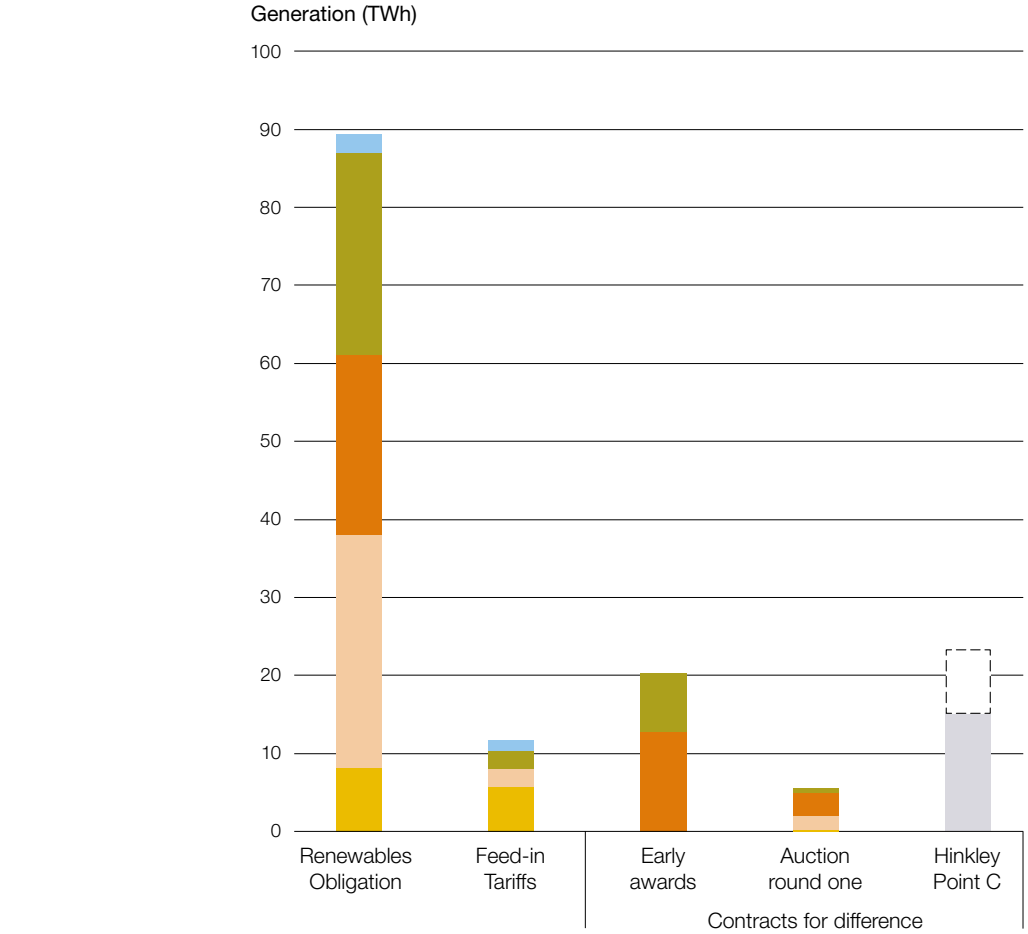
- Generation from Contracts for Difference awarded in 2014 and 2015 is expected to peak in the mid-2020s, at around 25 TWh per year, compared with around 100 TWh per year from the Renewables Obligation and Feed-in Tariffs.[6]
- Government has signed a Contract for Difference for a new nuclear power plant at Hinkley Point. It is expected to start generating electricity in 2025, and will be supported by a 35-year Contract for Difference.

6 The set of early awards made in 2014, and the round one auction in 2015.

Figure 4

Forecast generation in 2025-26 supported by Framework schemes

Contracts for Difference will support a significant amount of low carbon power in the 2020s



	Renewables Obligation	Feed-in Tariffs	Early awards	Auction round one	Hinkley Point C
Nuclear					15.2 (23.4)[1]
Hydro	2.4	1.2			
Energy from biomass and waste	25.8	2.4	7.4	0.5	
Offshore wind	23.0		12.9	3.0	
Onshore wind	29.9	2.4		2.1	
Solar	8.2	5.7		<0.1	

Notes

1 Hinkley Point C is expected to start generating part way through 2025-26 and generate around 15TWh by the end of the year. The first full year's generation (that is, generation in 2026-27) is expected to be around 50% higher, at around 23TWh.

2 The estimates in this figure are uncertain because future deployment and load factors under the schemes may vary from the Department's expectations.

3. For the purposes of this chart, we have assumed that annual generation from the Renewables Obligation and Feed in Tariffs from 2020-21 into the mid-2020s will remain constant, as no new projects will be allowed to enter the schemes, and existing support agreements under the scheme will not start to expire until the mid-2020s.

Source: National Audit Office analysis of Department of Energy & Climate Change Levy Control Framework models, July 2016.

7 Projections of generation and costs a decade away are highly uncertain. In July 2016, the Department forecast that the costs of the Framework in 2020-21 would be £7.5 – £9.9 billion. The Department had not produced a forecast ranges beyond that point, but they would likely demonstrate an even greater level of uncertainty. Despite this uncertainty, we believe it is important to report them in order to provide an indication of the magnitude of commitments government has made so far, and show that these commitments go well beyond the current timeframe of the Framework.

8 Projections from July 2016 indicated that the annual cost of top-up payments from non-nuclear Contracts for Difference would be around £2 billion in the mid-2020s (**Figure 5**). Hinkley Point C may cost around £0.5 billion in top-up payments in 2025-26.[7] As we have noted in our value-for-money report on the Framework, top-up payments are highly uncertain because they depend on wholesale energy prices, which in turn depend upon a large number of unknowns.

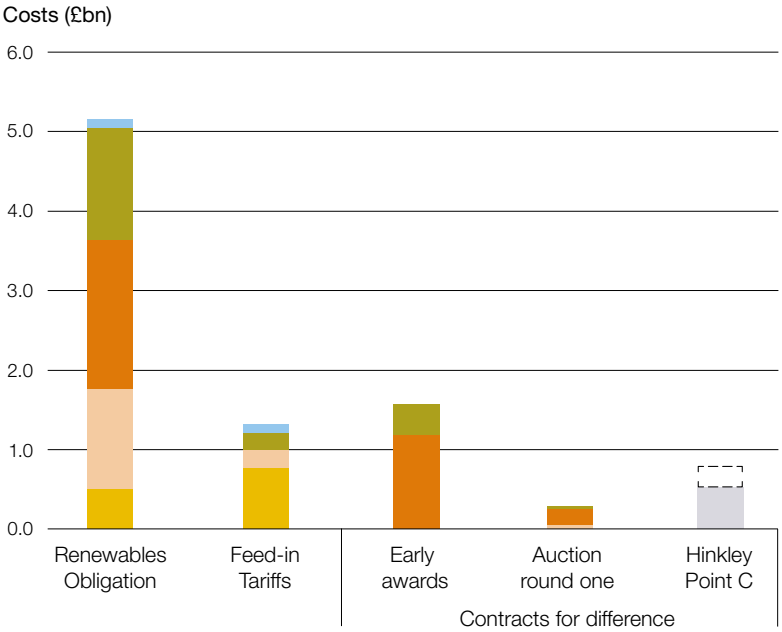
9 Revised forecasts of the total costs of the schemes are due to be published by the Office for Budget Responsibility on 23 November 2016 in the *Economic and Fiscal Outlook*. In previous years these forecasts have covered the period to 31 March 2021.

7 Over its lifetime, Hinkley Point C may cost £30 billion in top-up payments (in 2015-16 prices, with discounting) based on wholesale price projections as of 31 March 2016. See Comptroller and Auditor General, *Nuclear Power in the UK*, Session 2016-17, HC 511, National Audit Office, July 2016.

Figure 5

Forecast costs of Framework schemes in 2025-26

Top up payments from Contracts for Difference in the mid 2020s will be significant



	Renewables Obligation	Feed-in Tariffs	Early awards	Auction round one	Hinkley Point C
Nuclear					0.5 (0.8)[1]
Hydro	0.1	0.1			
Energy from biomass and waste	1.4	0.2	0.4	<0.1	
Offshore wind	1.9		1.2	0.2	
Onshore wind	1.3	0.2		0.1	
Solar	0.5	0.8		<0.1	

Notes

1 Hinkley Point C (which accounts for the costs of nuclear electricity shown here) is expected to start generating part way through 2025-26 and cost around £0.5 billion in top-up payments. Costs in subsequent years are expected to be higher. For example, in the first full year of generation, 2026-27, top-up payments would be around £0.8 billion. These are our estimates based on the Department's wholesale price projections as of July 2016.

2 The estimates in this figure are uncertain because future deployment and load factors under the schemes may vary from the Department's expectations. Furthermore, top-up payments due from Contracts for Difference are highly uncertain because they depend upon the future wholesale energy price, which itself depends upon a large number of unknowns.

3 For the purposes of this chart, we have assumed that the annual costs of the Renewables Obligation and Feed in Tariffs from 2020-21 into the mid-2020s will remain constant, as no new projects will be allowed to enter the schemes, and existing support agreements under the scheme will not start to expire until the mid-2020s.

Source: National Audit Office analysis of Department of Energy & Climate Change, Levy Control Framework models, July 2016

Costs and electricity generation by geographic area

10 All three of the schemes included in the Framework cover England, Scotland and Wales. The Renewables Obligation is the only one of the three schemes the Northern Irish government has participated in to date, although it is considering participating in Contracts for Difference.

11 The majority of the generation supported by Renewables Obligation and Feed-in Tariffs takes place in England. Scotland provides the next highest volume of electricity, followed by Wales, in turn followed by Northern Ireland. The same country order is observed for the costs of the schemes (**Figure 6**).[8]

12 Similarly, of the Contracts for Difference that have already been signed, the vast majority will support generation in England, followed by Scotland and then Wales. The costs of the scheme observe the same country order (**Figure 7**).

13 The electricity generation supported by each scheme can also be analysed at a national or sub-national level:

- Generation under the Renewables Obligation can be estimated for individual nations of the UK (**Figure 8**), although limitations to available data prevent us from producing detailed maps.
- Sub-national statistics on Feed-in Tariffs make it possible to estimate and map electricity generation supported by the scheme in different areas, both for solar projects (**Figure 9**) and projects using other technologies (**Figure 10**). We have mapped the amount of generation supported per 100,000 persons in each local authority.
- As there are relatively few Contracts for Difference, these can be shown on a map individually (**Figure 11**).

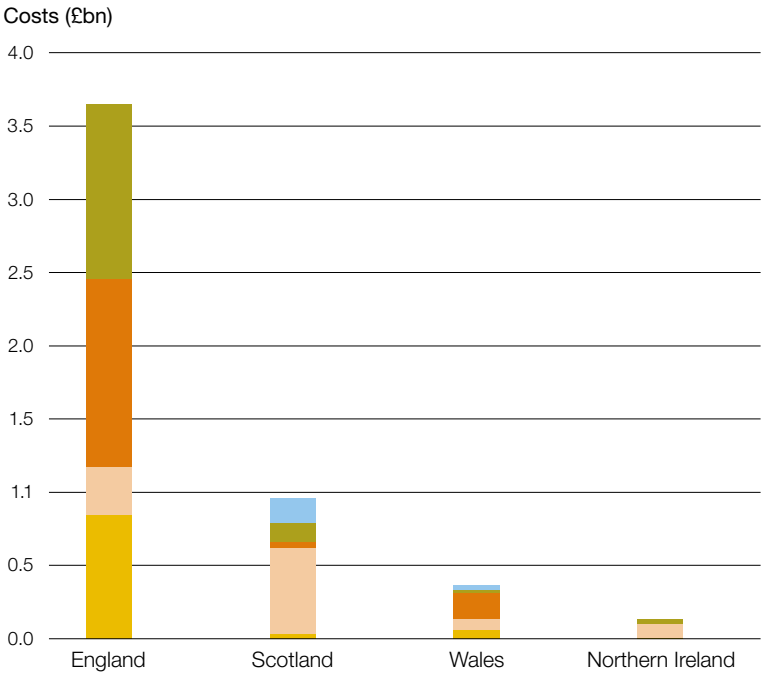
14 The geographic distribution of low carbon energy is driven by a number of causal factors. These include the local availability of energy sources. For example, solar energy is more abundant at lower latitudes, and so its deployment tends to be higher in more southerly regions. Hydroelectric power is cost-effective to deploy in existing quarries or reservoirs in mountainous parts of Wales and Scotland. Offshore wind farms can only be located on sites with supportive geology. In addition to local availability of energy sources, the geographic distribution of low carbon energy is driven by planning, population, and existing infrastructure.

15 Deployment of new low carbon energy infrastructure can benefit local areas by providing jobs, but the benefits are also felt nationally, as the electricity these projects generate is traded in national markets. Furthermore, central government's ambition for renewable energy deployment in 2020 is a national ambition (for 30% of national electricity demand to be met by renewable energy supply).

8 In Figures 6 to 8, we have allocated offshore wind farms to the nations within the United Kingdom according to the nearest land mass.

Figure 6

Estimated costs of Framework schemes in 2015-16, by country



	England	Scotland	Wales	Northern Ireland
Hydro	0.01	0.17	0.01	<0.01
Energy from biomass and waste	1.20	0.12	0.03	0.03
Offshore wind	1.28	0.04	0.17	
Onshore wind	0.32	0.59	0.08	0.09
Solar	0.85	0.03	0.06	0.01

Notes

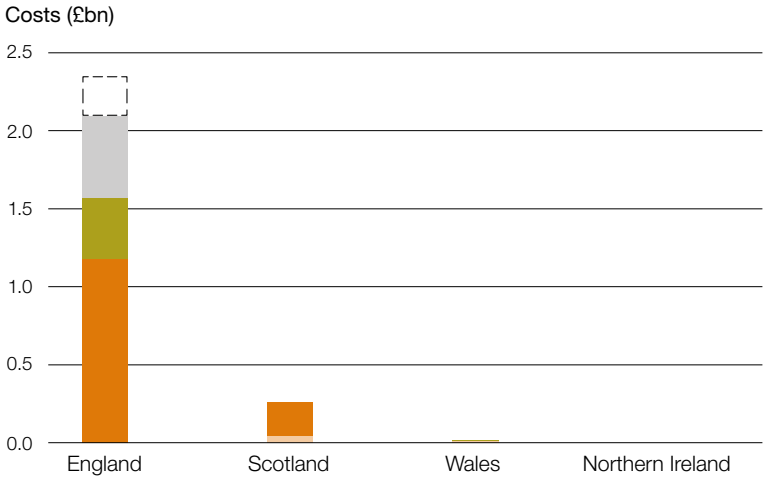
1 Costs of the Renewables Obligation have been estimated by multiplying the total number of Renewables Obligation certificates by the 'buyout price' (the price per certificate suppliers would have to pay for failing to present enough certificates). This provides a reasonable estimate of total costs, rather than a direct measure; the actual prices suppliers have paid for certificates are not made public.

2 The total cost of Feed-in Tariffs used here is the total cost in 2015-16 according to Ofgem. We have split this across technologies according to the split of costs forecast in the Department's model of the scheme.

Source: National Audit Office analysis of: Ofgem, Renewables Obligation Certificate Register, 2016; Ofgem, Feed-in Tariffs levelisation reports, 2015-16; Department of Energy & Climate Change, Feed-in Tariffs model, January 2016; and Department of Energy & Climate Change, Feed-in Tariffs sub-national statistics, 2016

Figure 7

Forecast costs of Contracts for Difference in 2025-26, by country



	England	Scotland	Wales	Northern Ireland
Nuclear	0.52 (0.77)[1]			
Energy from biomass and waste	0.39		<0.01	
Offshore wind	1.18	0.21		
Onshore wind	<0.01	0.05	0.01	
Solar	<0.01			

Notes

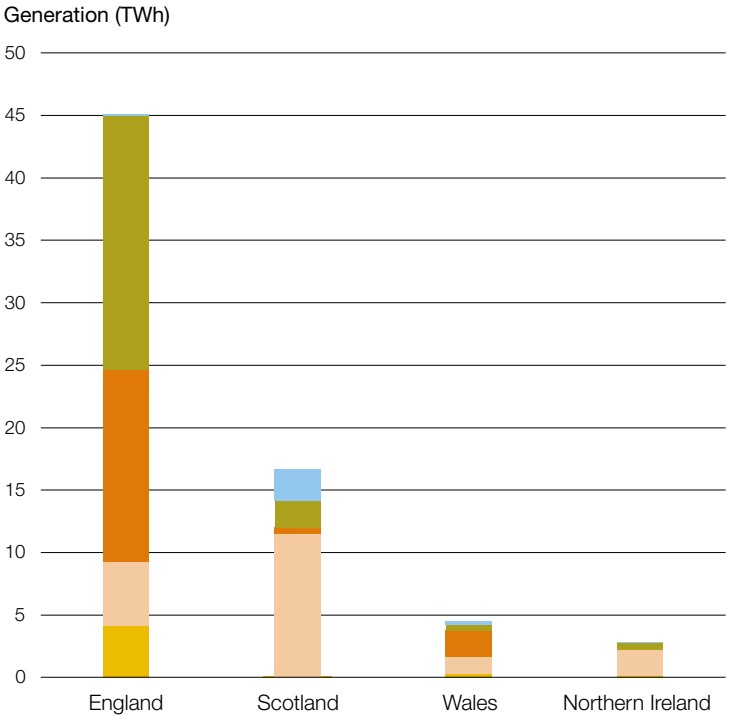
1 Hinkley Point C (which accounts for the costs of nuclear electricity shown here) is expected to start generating part way through 2025-26 and cost around £0.5 billion in top-up payments. Costs in subsequent years are expected to be higher. For example, in the first full year of generation, 2026-27, top-up payments would be around £0.8 billion. These are our estimates based on the Department's wholesale price projections as of July 2016.

2 The estimates in this figure are uncertain because future deployment and load factors under the schemes may vary from the Department's expectations. Furthermore, top up payments due from Contracts for Difference are highly uncertain because they depend upon the future wholesale energy prices, which in turn depend upon a large number of unknowns.

Source: National Audit Office analysis of Department of Energy & Climate Change, Levy Control Framework models, July 2016

Figure 8

Estimated generation under the Renewables Obligation, 2015-16



	England	Scotland	Wales	Northern Ireland
Hydro	0.1	2.5	0.2	<0.1
Energy from biomass and waste	20.3	2.2	0.5	0.6
Offshore wind	15.4	0.5	2.1	
Onshore wind	5.1	11.5	1.4	2.1
Solar	4.1	<0.1	0.3	0.1

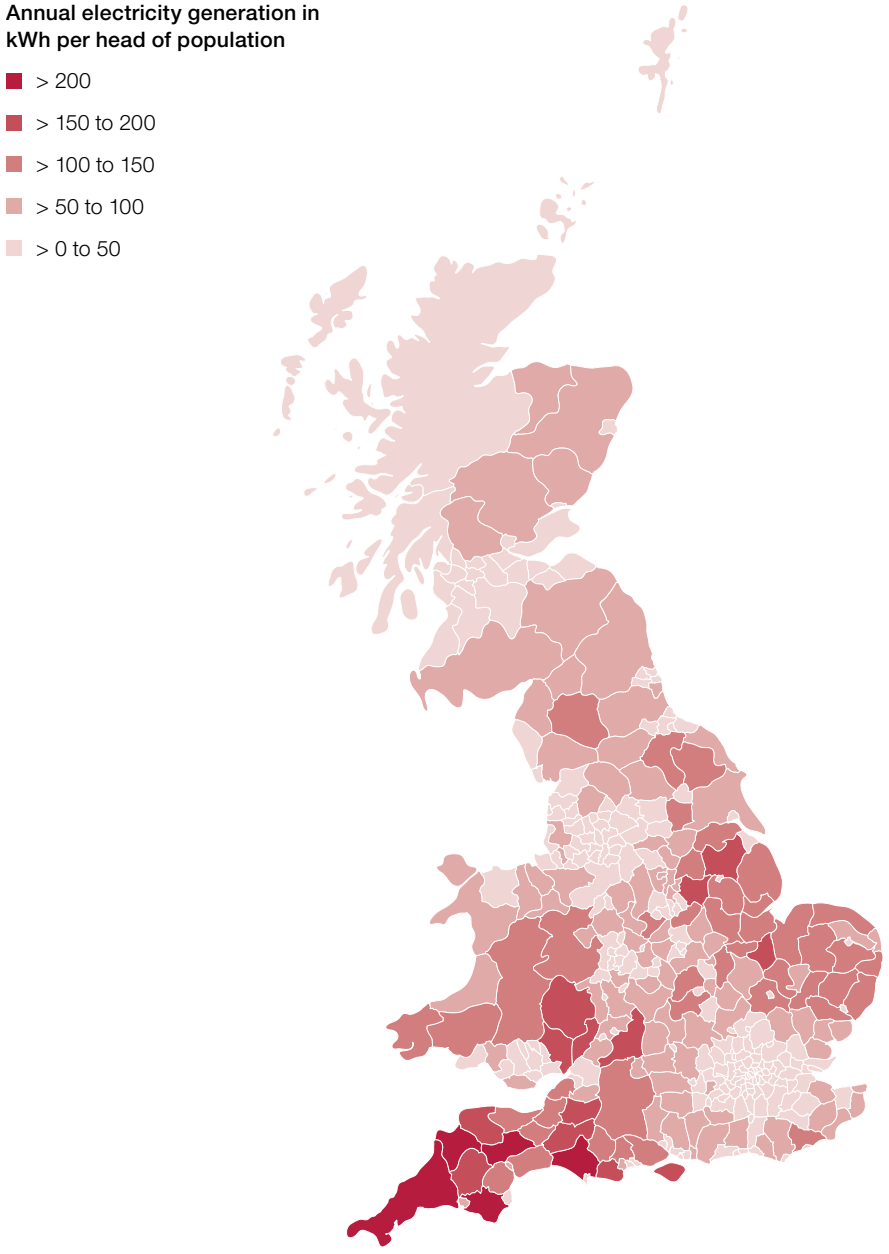
Note

1 These generation figures are estimates, formed by disaggregating UK-wide generation statistics according to the split of costs in each nation.

Source: National Audit Office analysis of Department of Energy & Climate Change Trends, 2016; and Ofgem Renewables Obligation Certificate Register, 2016

Figure 9

Estimated generation per person from Feed-in Tariffs for solar projects, 2015-16



Notes

1 Generation has been estimated by multiplying installed electricity generating capacity in each local authority by typical load factors. In the source data, around 3% of all known installed solar capacity could not be assigned to any local authority, and therefore was not included in the estimates of generation for this map.

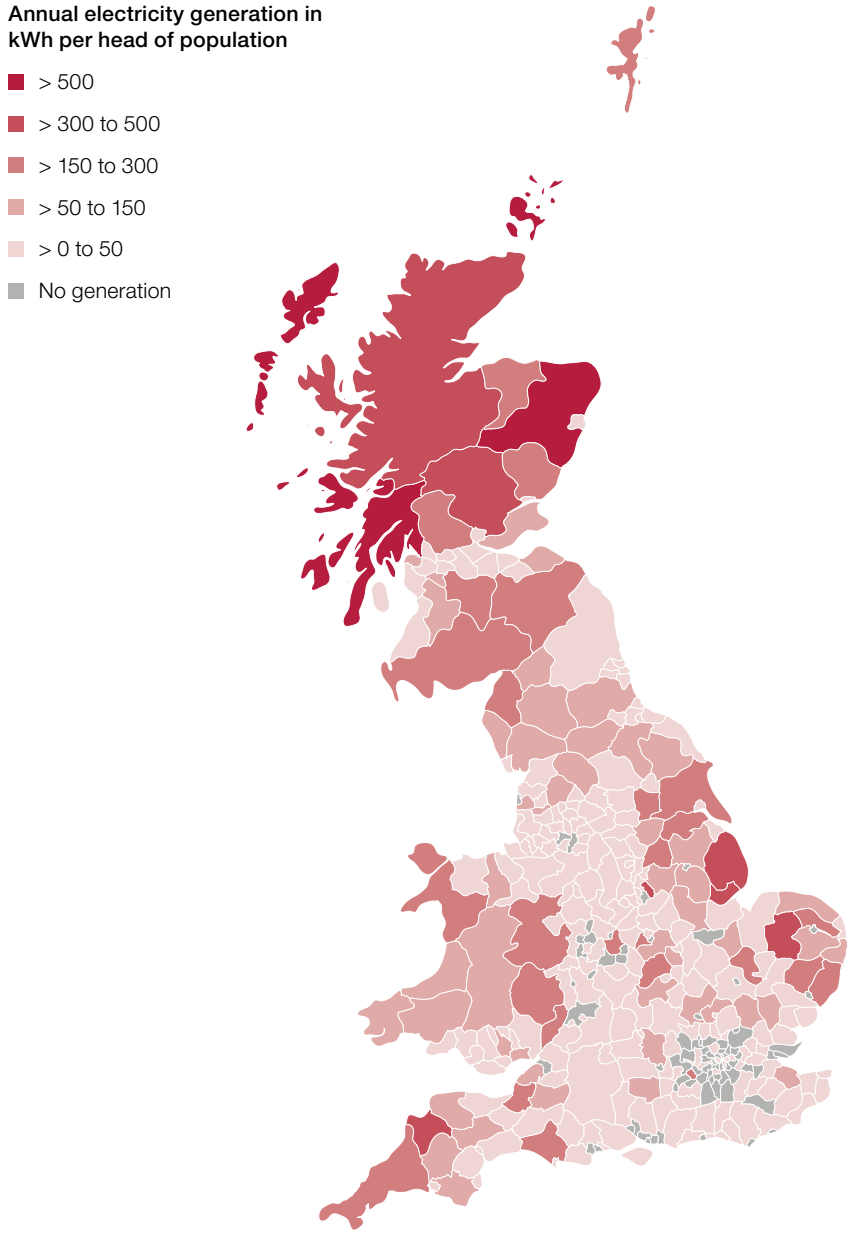
2 The Feed-in Tariffs scheme does not extend to Northern Ireland.

3 There are one billion kilowatt-hours (kWh) in one terawatt-hour (TWh).

Source: National Audit Office analysis of Ofgem Central Feed in Tariff Register, 2016; Department of Energy & Climate Change Feed in Tariffs annual load factors, 2015; and Office for National Statistics mid-year population estimates, 2015

Figure 10

Estimated generation per person from Feed-in Tariffs for wind, hydro, and anaerobic digestion projects, 2015-16



Notes

1 Generation has been estimated by multiplying installed electricity generating capacity in each local authority by typical load factors. In the source data, around 10% of all known installed capacity for hydro, wind and anaerobic digestion projects could not be assigned to any local authority, and therefore was not included in the estimates of generation for this map. A greater proportion of data is missing for hydro projects (20%) than for wind (8%) and anaerobic digestion (11%). Because hydro projects are predominantly located in Scotland, the missing data may disproportionately affect Scottish part of this map.

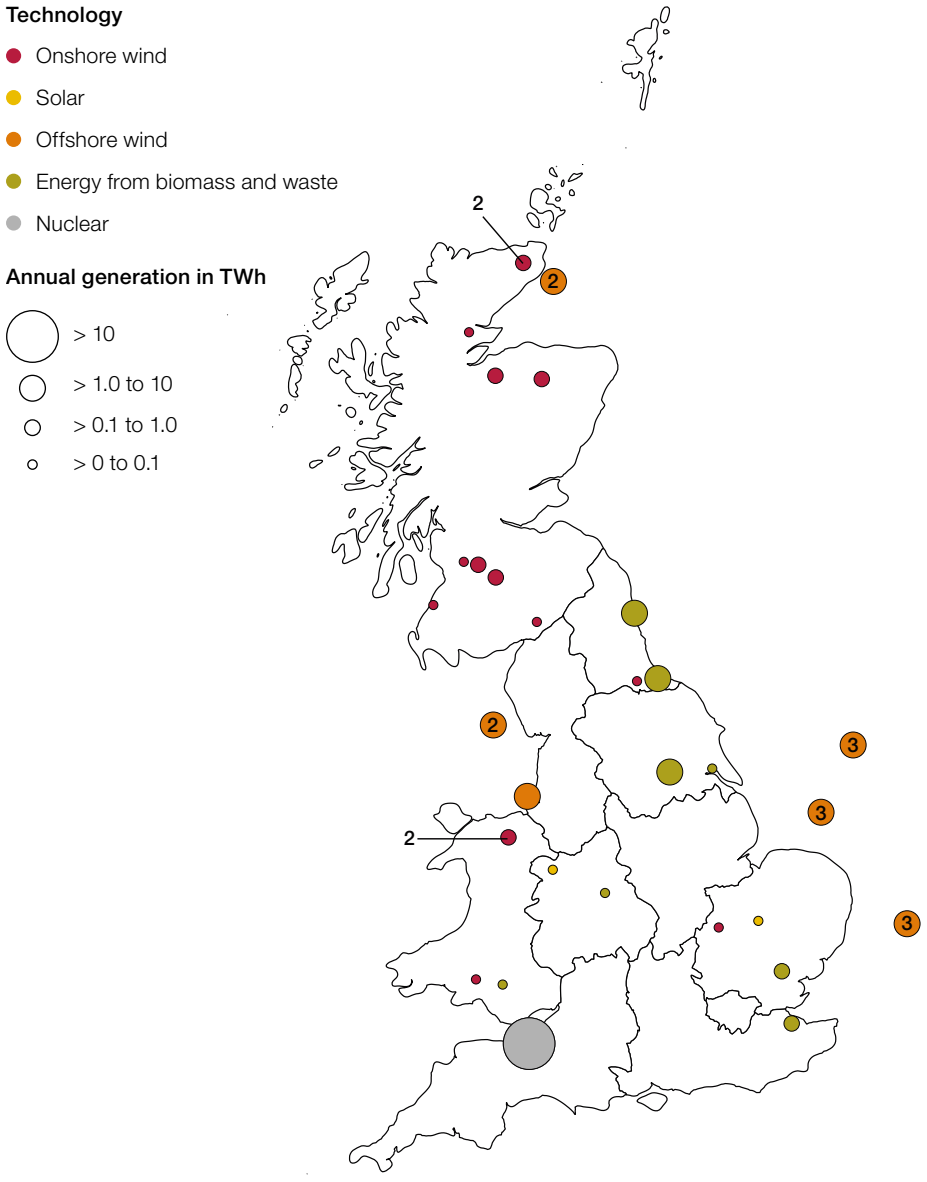
2 The Feed-in Tariffs scheme does not extend to Northern Ireland.

3 There are one billion kilowatt-hours (kWh) in one terawatt-hour (TWh).

Source: National Audit Office analysis of Ofgem Central Feed in Tariff Register, 2016; Department of Energy & Climate Change Feed in Tariffs annual load factors, 2015; and Office for National Statistics mid-year population estimates, 2015

Figure 11

Generation supported by Contracts for Difference in 2025-26



Note

1 Each circle on the map represents one Contract for Difference, apart from where a number label is used to indicate otherwise.

Source: National Audit Office analysis Low Carbon Contracts Company's Contracts for Difference register; and load factors used for Renewables Obligation budget setting in 2015-16

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