

UK RENEWABLE ELECTRICITY POLICY 2002–2018

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GWPF

For the Regulatory Policy Institute
2 May 2017

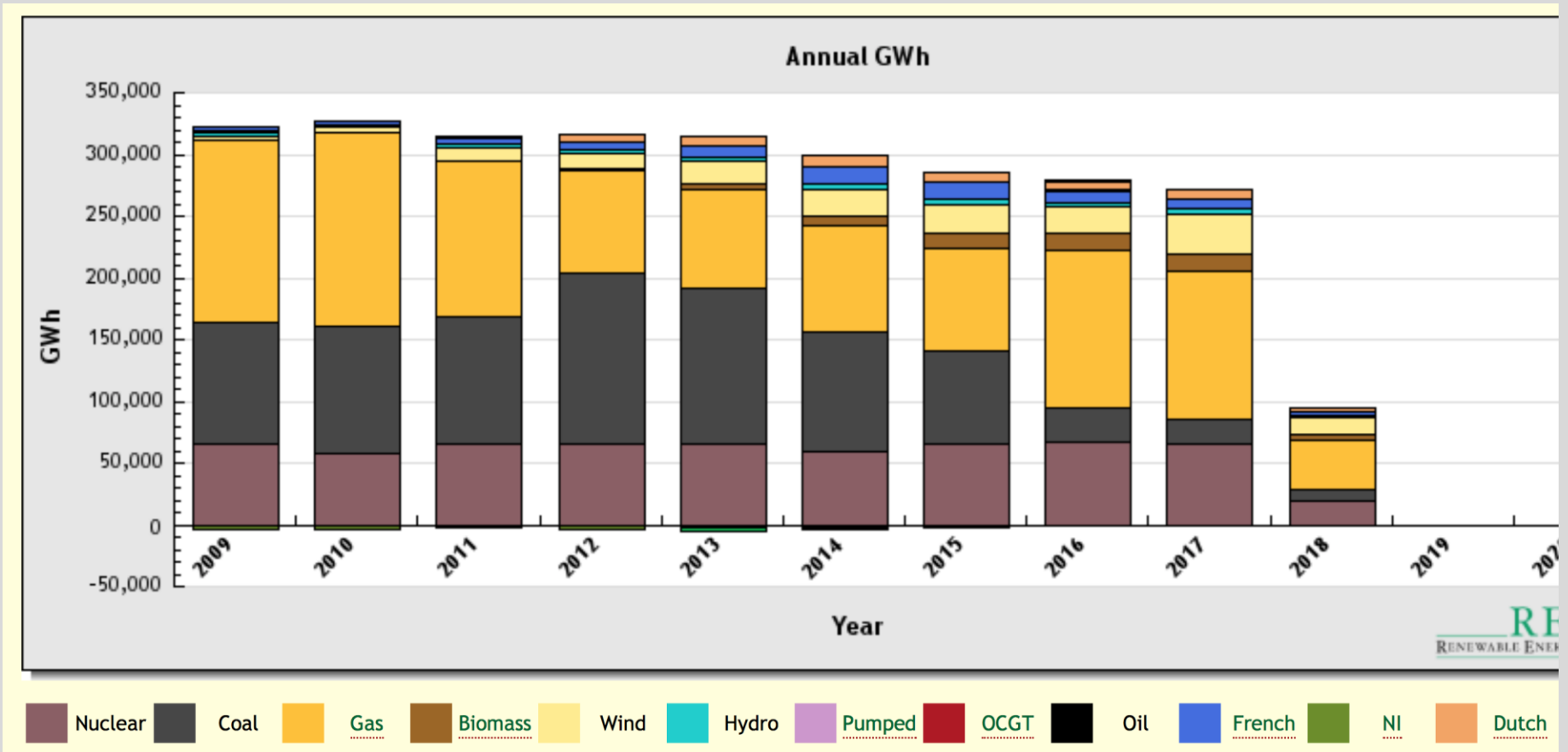
UK Electricity Market History 1945–2018

- 1945–1990: Nationalised industry
- 1990–2001: Privatisation/liberalisation phase
 - Central Electricity Generating Board broken up
 - Major growth in Combined Cycle Gas Turbines (CCGT)
- 2001: Privatisation peak: Electricity Trading Arrangements (NETA) introduced *bilateral trading* in electrical energy (MWh).
- 2000: Royal Commission on Environmental Pollution (RCEP) report *The Changing Climate* (2000), and EU policies, caused emissions reduction imperatives to drive a return of state management and even *administrative pricing*.
 - 2001: EU Large Combustion Plant Directive
 - 2002: Renewables Obligation (RO);
 - 2009: EU Renewables Directive
 - 2010: Feed-in Tariff (FiT)
 - 2015: FiTs with Contracts for Difference (FiTs CfDs)
- Autumn Budget 2017: Low Carbon Levies Frozen...

The EU Renewables Directive and the UK

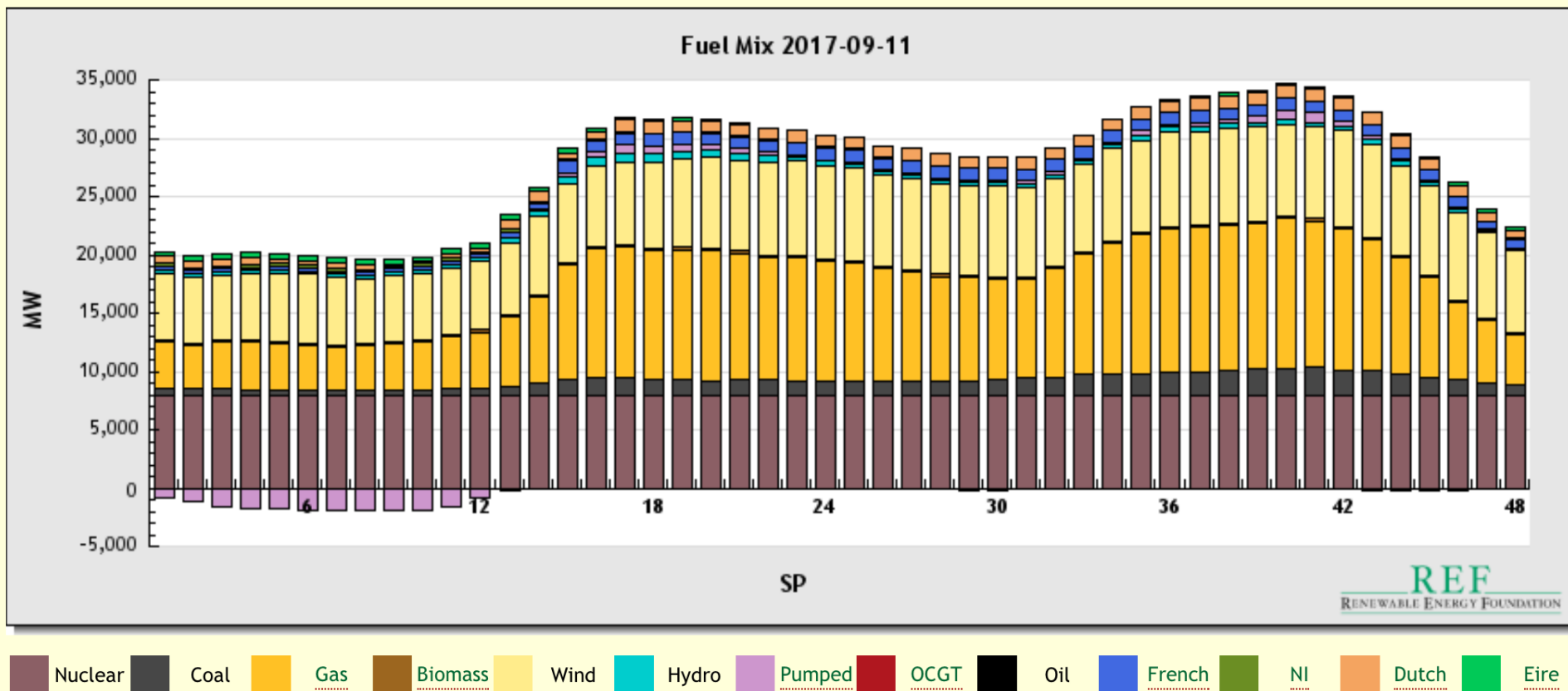
- EU Renewables Directive (2009): 20% of EU Final Energy Consumption (FEC) to be renewable by 2020
- UK burden share: 15% of FEC (up from 1.5% in 2009)
 - Target is a % of an unknown quantity
 - Approximately 230 – 270 TWh must be generated from renewable sources in 2020
 - Main policy instrument is subsidy...
- Approximate composition:
 - Transport fuel: 45 TWh (10% of UK transport fuel)
 - Electricity: 110 TWh (30% of UK electricity)
 - Heating and cooling: 70 TWh (12% of UK H&C)

Electricity Fuel Mix 2009–2018 (GWh)



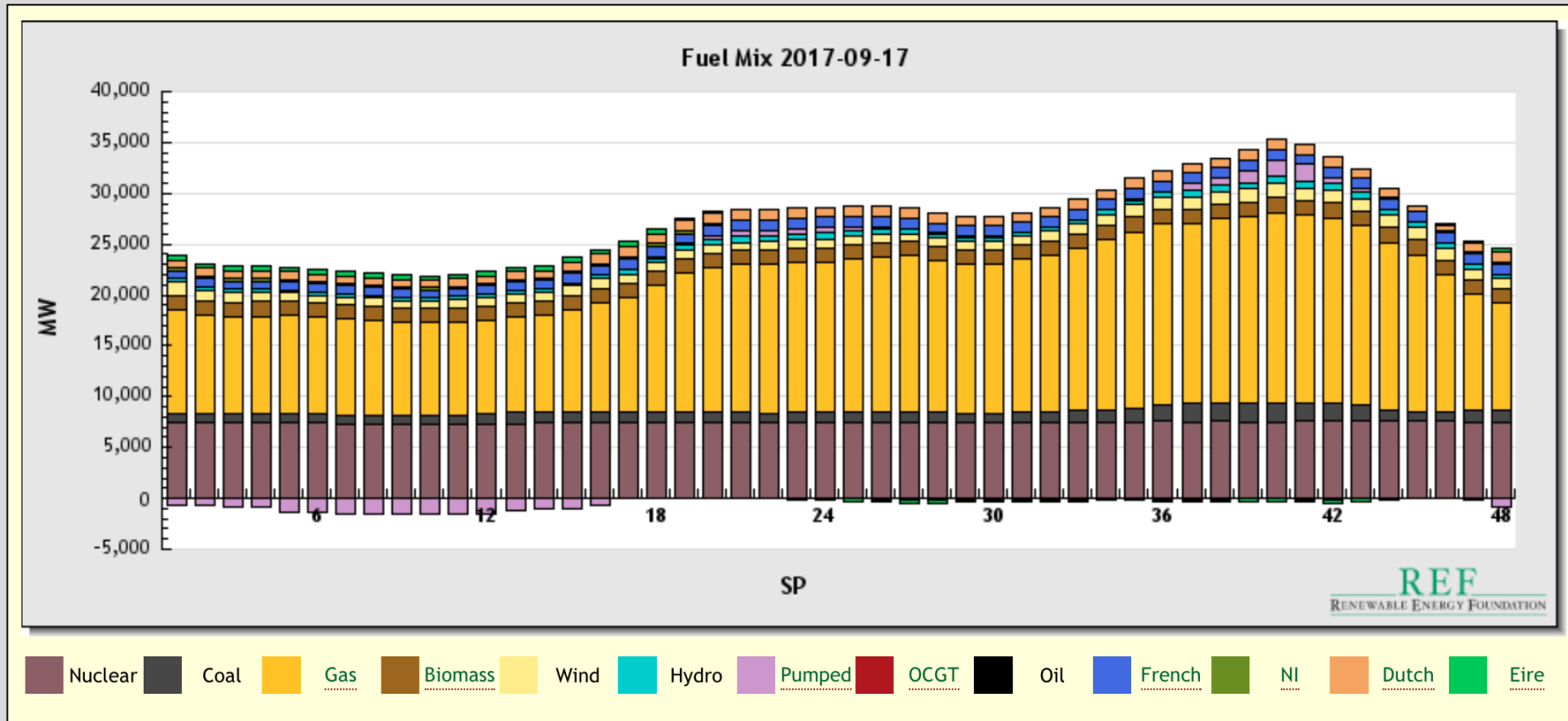
Source: BM Reports. Chart by REF: see www.ref.org.uk.

Daily Electricity Fuel Mix: 11.09.17 (MW)



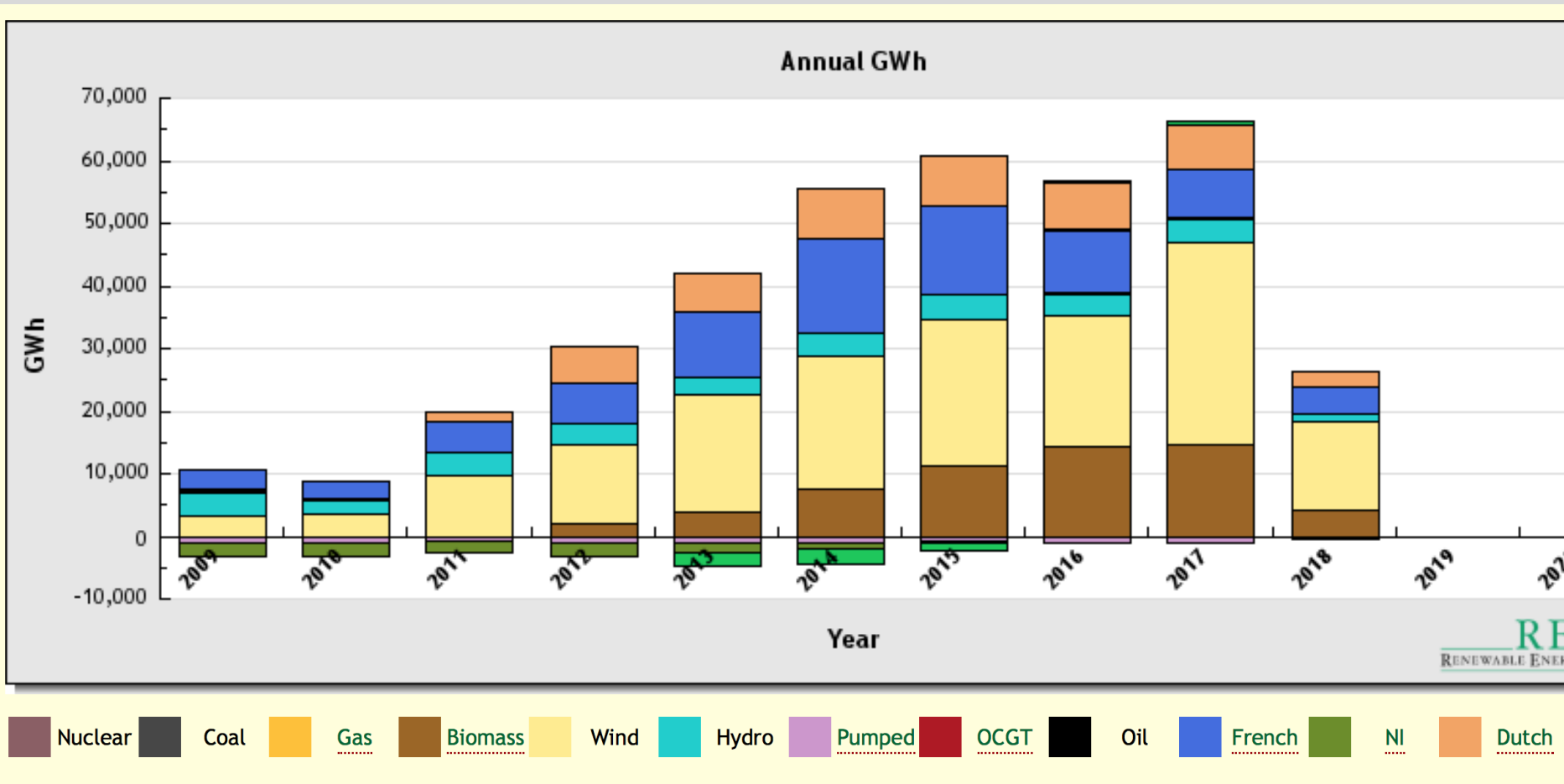
Source: BM Reports. Chart by REF: see www.ref.org.uk.

Daily Electricity Fuel Mix: 17.09.17 (MW)



Source: BM Reports. Chart by REF: See www.ref.org.uk.

Electricity Fuel Mix (2009–2018): Renewables and Interconnectors (GWh)

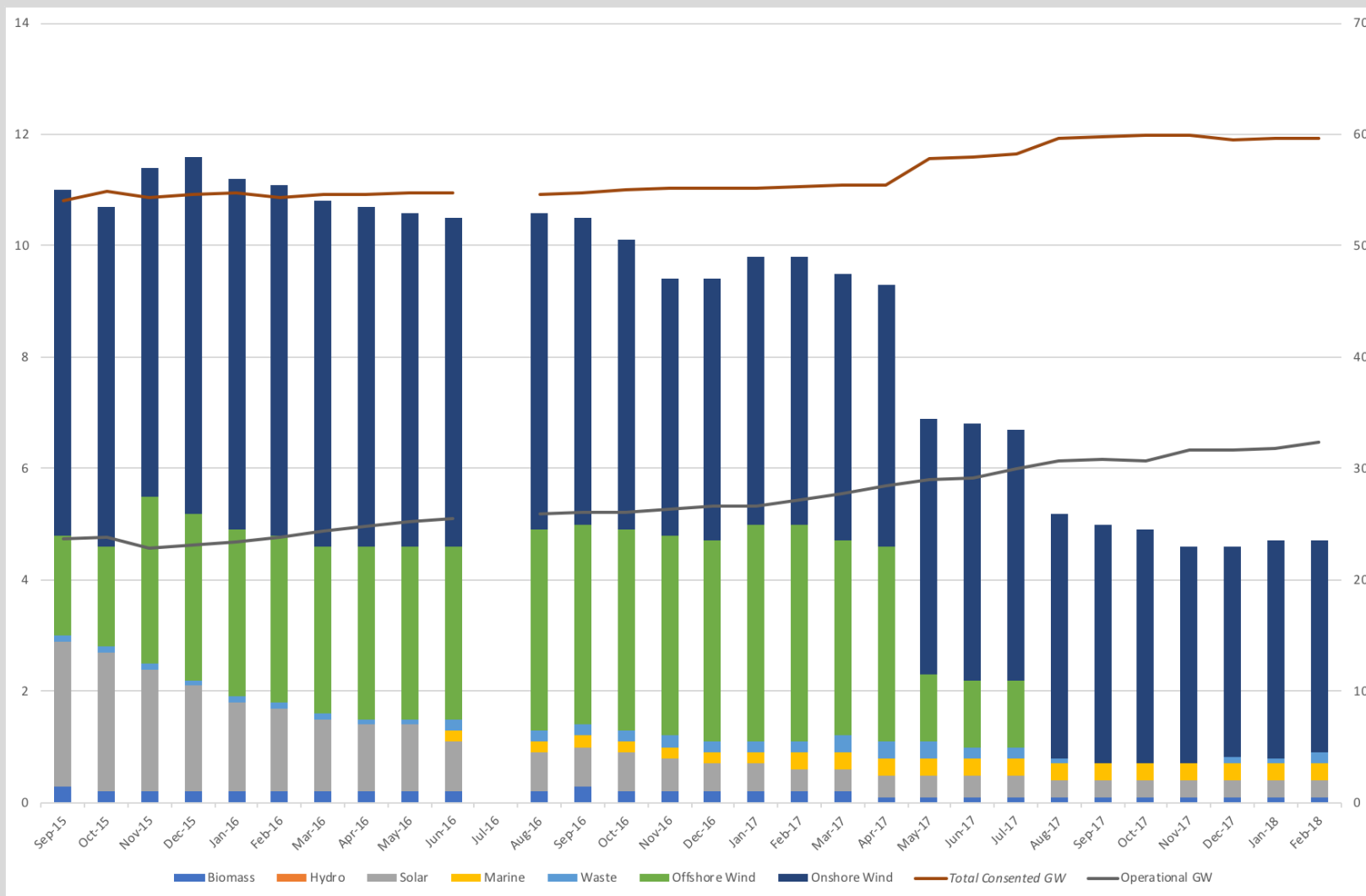


Source: BM Reports. Chart by REF: see www.ref.org.uk.

The Renewable Electricity Sector, Overheated but cooling off...

- **≈ 36 GW of operational capacity**
 - Biomass (4 GW); Solar (8.2 GW [+ 4 GW of capacity outside the permitting system]); Waste (1.1 GW); Offshore wind (6.4 GW); Onshore wind (12.2 GW)
 - **Generating approx. 80 TWh per year**
 - **Subsidies now > £6 billion per year (and rising)**
- **27 GW of capacity under or awaiting construction**
 - 15.6 GW offshore wind, 4.8 GW onshore wind
 - 2.2 GW solar, 3 GW biomass, 1 GW waste
- **Total Consented capacity 59.6 GW**
 - Output of consented capacity ≈ 160 TWh
 - **47% in excess of 110 TWh target for electricity in 2020**
- **Cooling off...** only 4.7 GW of capacity seeking consent:
 - Onshore wind (3.8 GW), almost all in Scotland...
 - Offshore wind (0 GW)
 - 300 MW solar, 300 MW marine...

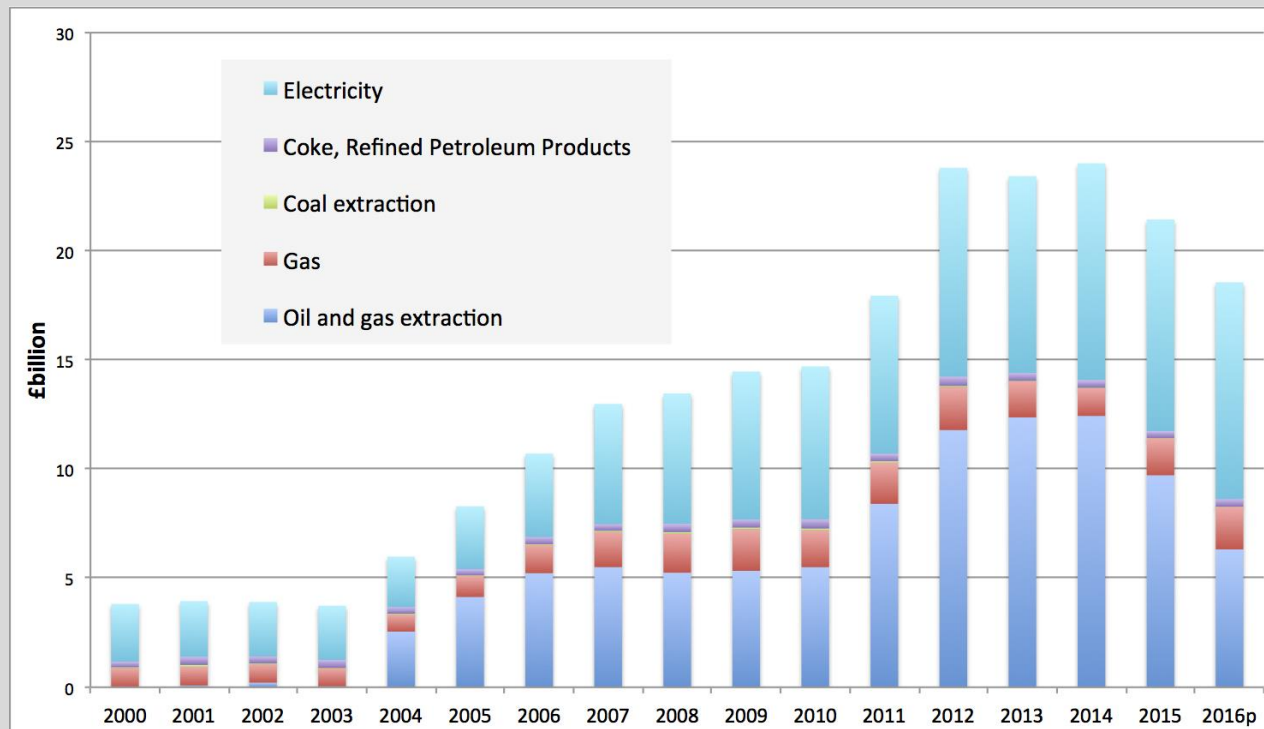
Renewables Sector Cooling: 2015–2018



Renewables capacity in planning, in monthly snapshots (GW, stacked bars, left axis), September 2015 to December 2017; and on the right axis, the total consented renewables capacity (GW, dark red line), and total operational capacity (GW, dark grey line). Source: BEIS, REPD.

Renewables Capital Investment

- Investment in renewables since 2010: £52 billion.
- 36% of *total energy sector* capital formation
- 83% of electricity sector investment

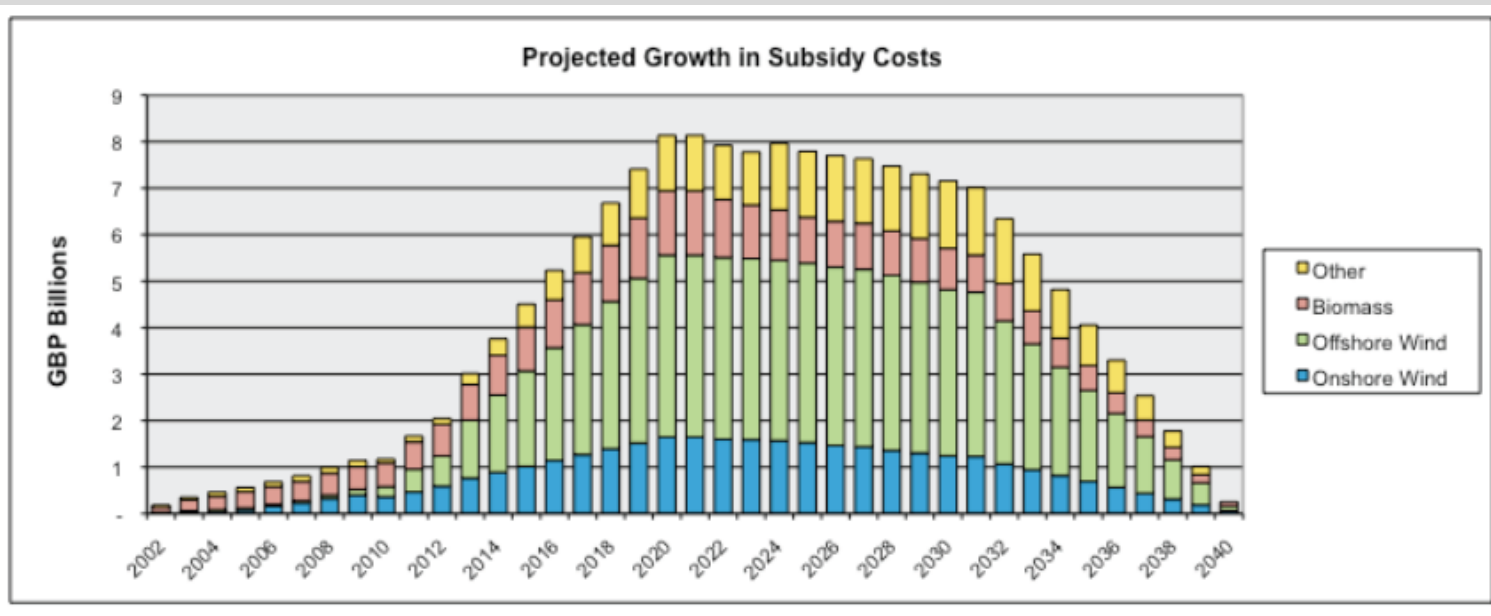


Source: Department of Business, Energy and Industrial Strategy (2017). Chart by author.

Renewable Electricity

Cumulative Subsidy 2002–2040

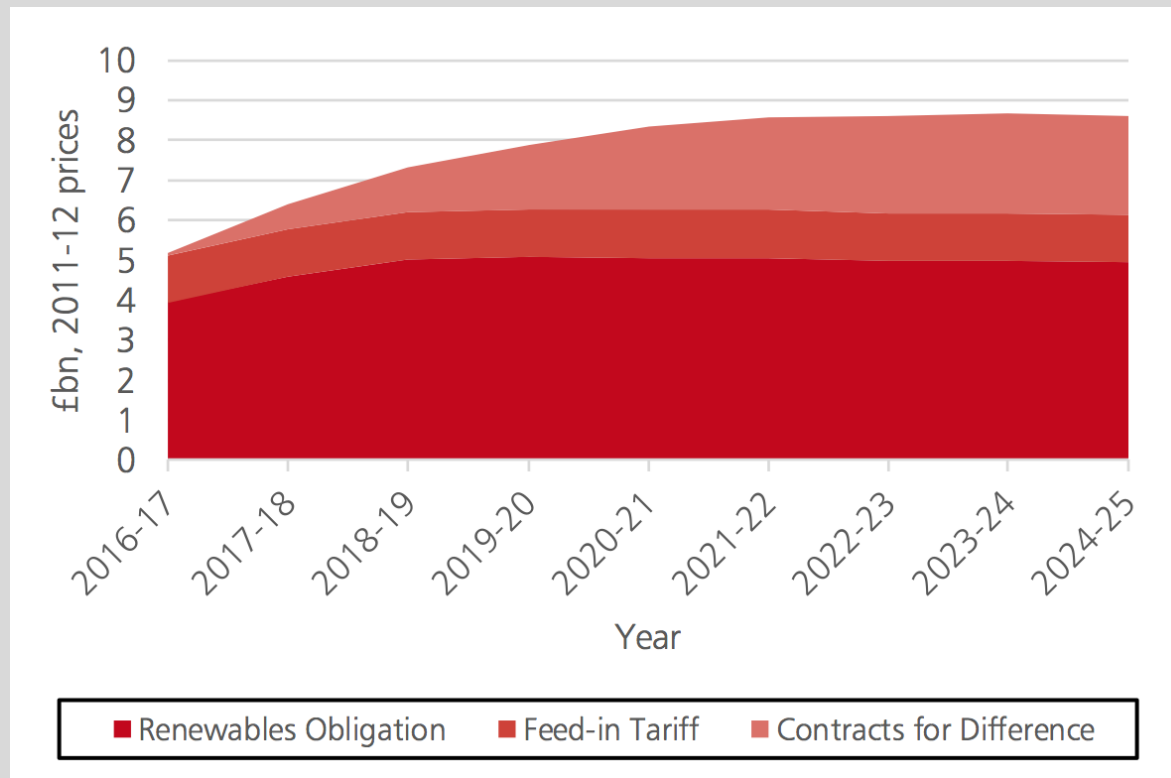
- Assumptions: Current subsidy levels; no new capacity after 2020; DECC technology pipeline projections
- Cumulative subsidy Cost 2002–2040: ca £162bn
 - With system integration costs: ca. £250 bn?



Source: REF. Based on DECC's pipeline projections in *Renewable Energy Roadmap* 2013.

Autumn Budget 2017

- No new levies (subsidies) for low carbon technologies until total annual cost burden starts to fall...
- When? Mid 2020s? But if gas prices stay low... much later.



Low Carbon Levies Forecast 2016–2025: Source: HMT, *Control for Low Carbon Levies* (2017).

DECC's 2020 Electricity Price Policy Impacts

- Domestic Households
 - Low fossil price scenario: + £55/MWh (+ 42%)
- Medium Sized Businesses
 - Low fossil price scenario: + £53/MWh (+77%)
- Even in DECC's High Fossil Price scenario prices rise by 30% to 45% due to climate and other policies

Source: DECC, *Estimated Impacts of Energy & Climate Policies on Prices and Bills* (2014)

- Government has published no new estimates since 2014

CO₂ Abatement Cost & Social Cost of Carbon

Marten (2011): SCC = \$0 – \$206/tCO₂:Stern Review: SCC = \$29/tCO₂

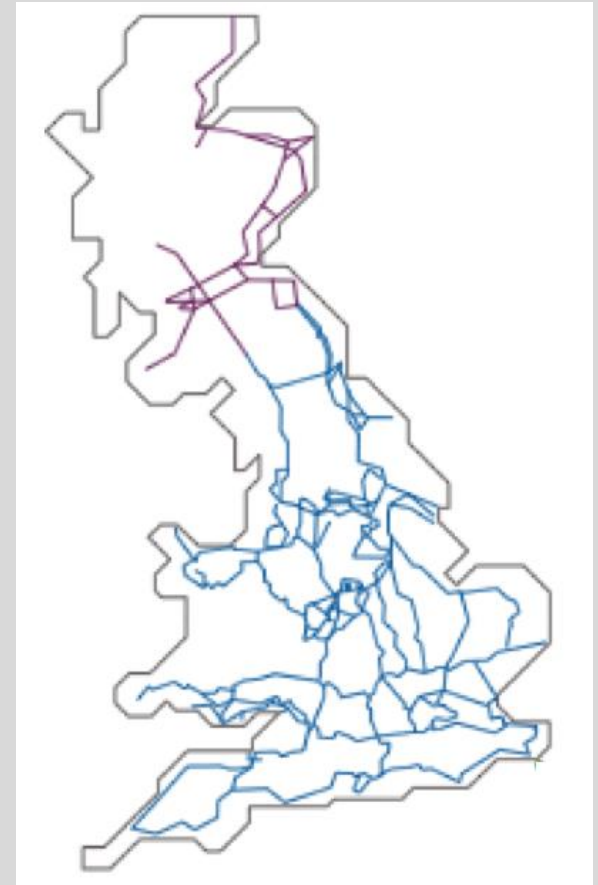
	Cost per tonne CO ₂
Roof mounted solar PV	\$380 – \$1,450
Free-standing solar PV	\$228
Small onshore wind (<500 kW)	\$608
Large onshore wind (> 1 MW)	\$137
Offshore wind	\$274
Dedicated biomass	\$198
Hydro	\$0 - \$137 – \$684
Anaerobic digestion	\$274 – \$380
Incinerated municipal biomass	\$0

Source: Ofgem, DECC. Calculations by the author.

Marten, Alex L. (2011). Transient Temperature Response Modeling in IAMs. Economics E-Journal 5: 2011–18.

System Integration Problems: *Constraint Payments to Wind Power*

- Total 2010 to 23 April 2018:
£404m
 - £108m in 2017
- **Almost all in Scotland**
 - **But offshore wind increasingly constrained off**
- Average price in 2017 to reduce generation: **£70/MWh**
- **But perhaps cheaper than expanding the network**



The UK HV Network
Source: National Grid

But is it all worthwhile?

- “Subsidy free solar comes to the UK”

Department of Business, Energy, and Industrial Strategy (BEIS), 26 September 2017

- Offshore Wind: “Costs Halve”!

All UK newspapers, 11 September 2017

Clayhill Solar Farm: Opened 26.09.17



Clayhill *Battery* System (+ Solar)

- 10 MW Solar PV + 5 BYD Batteries: 6 MW peak & 6 MWh storage
 - Shares grid connection with nearby 4.75 MW, subsidised solar farm
- Clayhill will be contracted on a retainer in the Capacity Market to provide balancing services
- Project is not a subsidy free solar system, but battery providing rapid response power, and using onsite solar as *one* of its charging options
- Clayhill is **not** an indicator of broader prospects for solar energy generation:
 - “Steve Shine, chairman of Anesco, which owns Clayhill, said that solar farms were still not economically viable but that the company was developing another five farms with batteries.”

The Times 26.09.17

Offshore Wind: “Costs Halve”

- Feed-in Tariffs with Contracts for Difference Auction
 - Round 1 (2015): £114–£150/MWh (2012 prices)
 - Round 2 (2017): £57.50–£74.75/MWh (2012 prices)
 - *Daily Telegraph*
 - ‘Offshore wind to power £17.5bn investment boom as costs halve’
 - BBC
 - ‘Offshore wind power cheaper than new nuclear’
 - *The Times*
 - ‘Winds of Change: The price of renewable energy is falling faster than anyone dared hope’
 - *Daily Telegraph*
 - ‘Wind could make Britain an energy superpower to rival Arabia’
 - Cornwall Energy:
 - ‘Paradigm Shift: Offshore wind blows hole in opposition to renewables’.

Are Offshore Wind Costs Really Falling?

- Published 25.09.17
- Statistical analysis of capex and other data for 86 offshore wind farms
- Available from:
<https://www.thegwpcf.org>



Offshore Wind Capital Cost and Water Depth

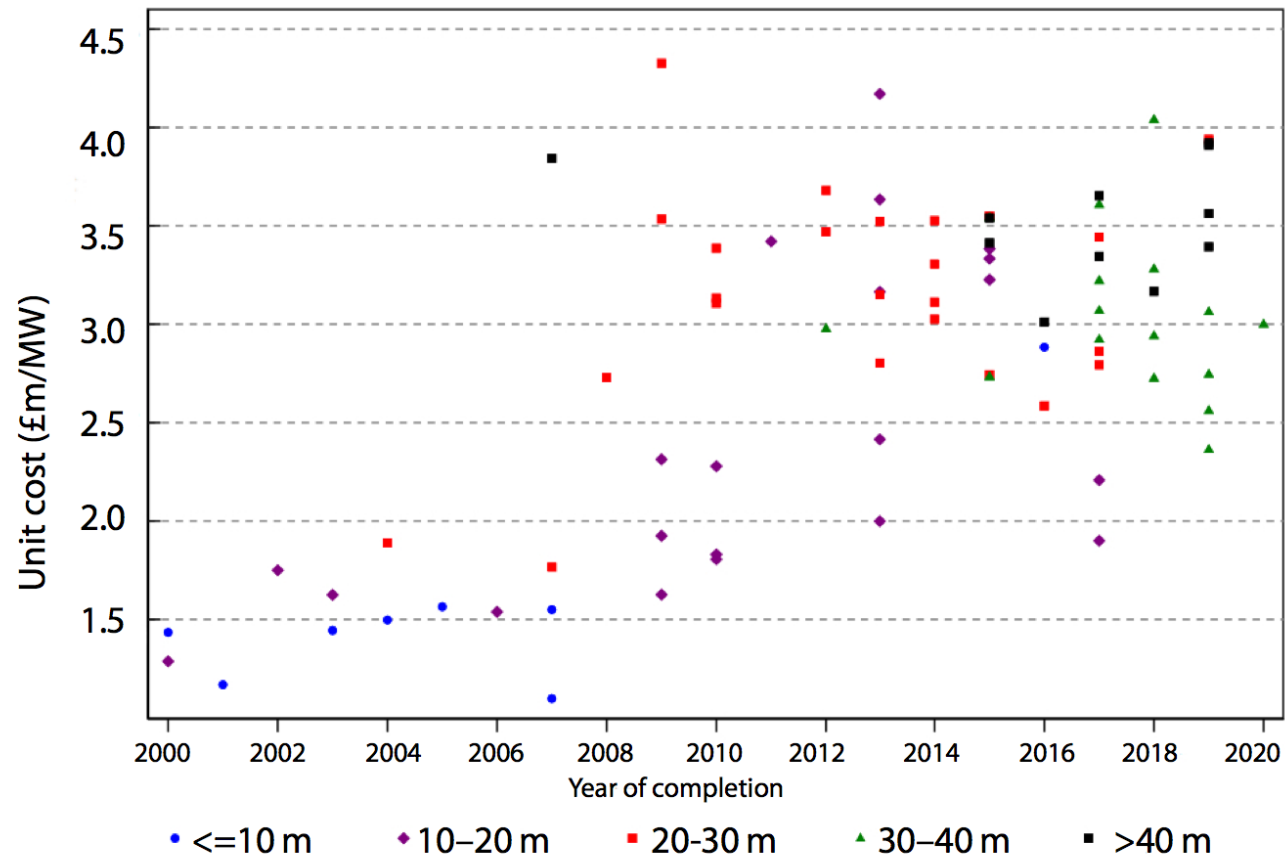


Figure 1: Wind farm capital cost and water depth, 2000–2020.
£/MW, 2012 prices.

Yes, some technological progress...

Costs falling at 4% per year since 2013

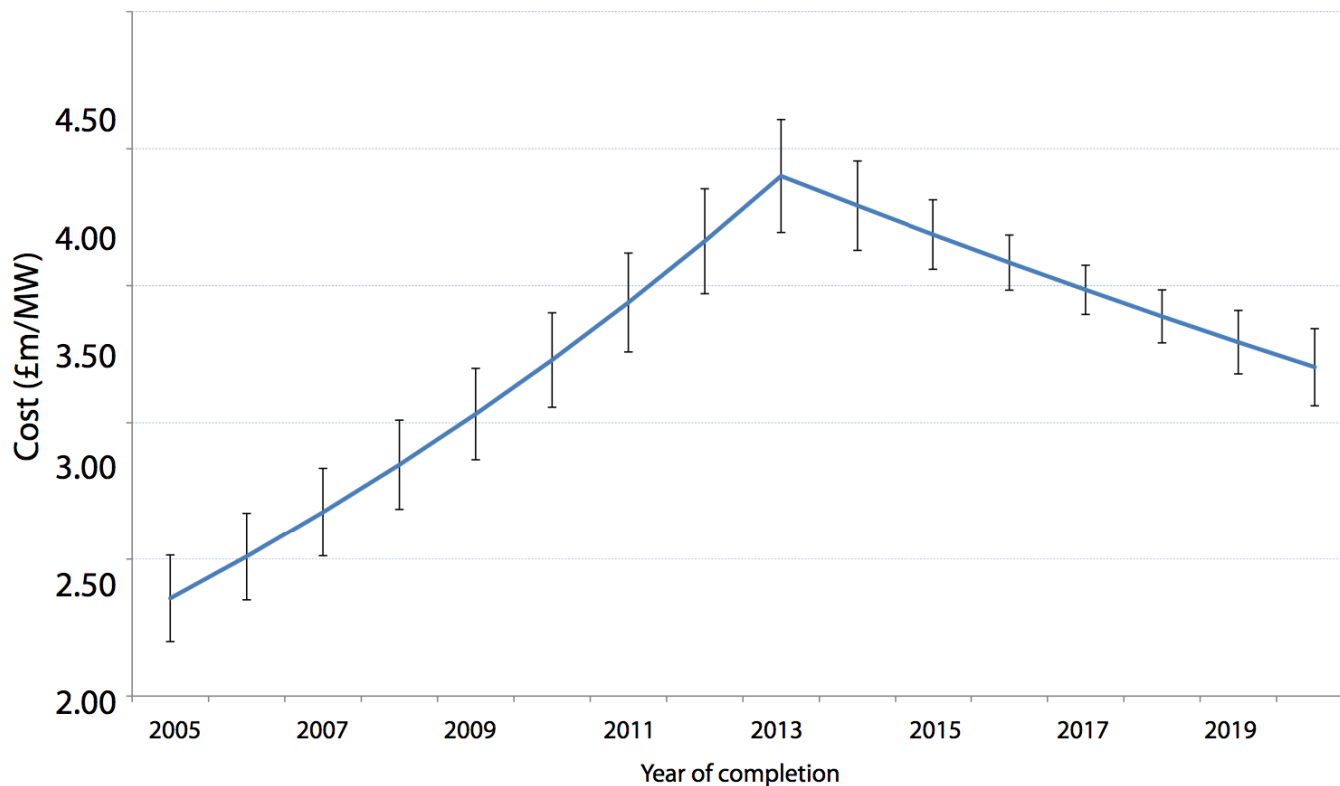


Figure 2: Evolution of standardised unit costs for wind farms over time.
Authors' dataset.⁷ Calculations by the authors.

...but offset by deeper water

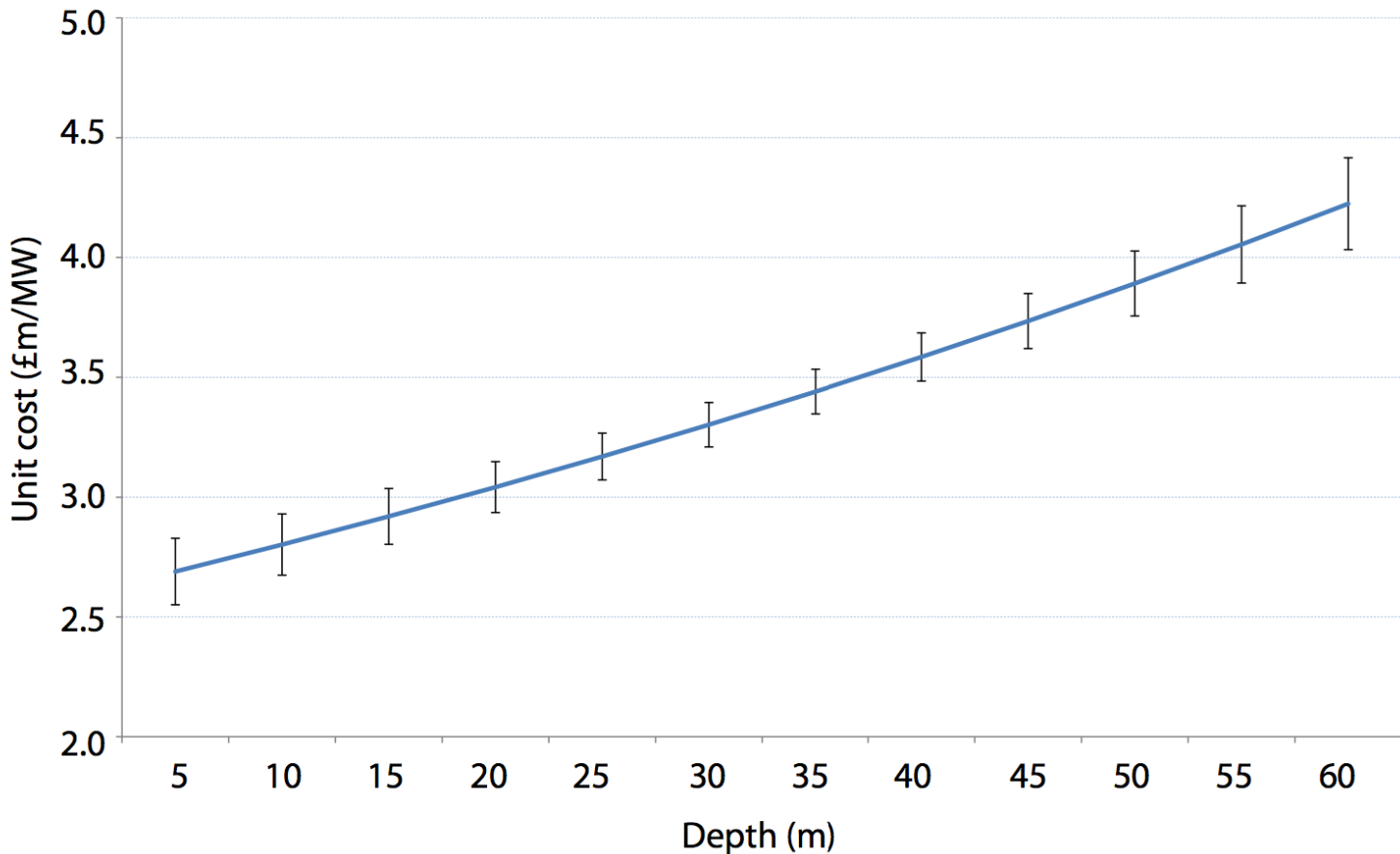


Figure 3: Standardised unit costs vs depth for wind farms in 2016.

Source: Authors' dataset.⁷ Calculations by the authors.

Industry Regards CfDs as *Options*...

- CfD bid prices of £57.50 per MWh are not economic...
 - Price of about £120/MWh probably required...
- Why did companies bid so low?
- The CfD is a gamble on future wholesale prices and policy
 - High gas prices
 - Carbon price
- If wholesale prices rise, or a carbon price is introduced, developers will build and then abrogate the CfD contract.
- If wholesale prices do not rise, they will not build.
- In the meantime, they generate good PR, secure a market position and inhibit competition.

UK Renewables 2002–2018: Summary

- UK electricity market an administrative construction delivering renewables.
- Renewable generation dominated electricity sector capex.
- Yet, renewables are still not self-supporting.
- High annual and ongoing subsidy costs.
- High system costs.
- **Falling productivity of the Electricity Supply Industry.**
- **Doubts about long term policy...**

Will the Subsidy Moratorium Be Sufficient?

- Current annual renewables subsidy cost ($> \pounds 6\text{bn}$, 2012 prices) is approx. 5% of global subsidies to renewables, with implications for competitiveness.
- High price impacts on businesses will feed through to households in costs of goods and services and downward pressure on wages, and employment rates.
- Emissions savings cost is unsustainably high. This is not a lasting climate policy.
- Destruction of price signals to indispensable conventional sector: both gas and nuclear require counter-subsidies.
- Is retrospective action needed to flush renewables out?
- **Better/cheaper/cleaner to buy them back into a Bad (Green) Bank and shut them down?**