

**REF**  
RENEWABLE ENERGY FOUNDATION

# Renewable Energy in the United Kingdom

2002 to 2013

## Performance, Costs, Warnings

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October 2013

# REF

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## RENEWABLE ENERGY FOUNDATION

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- Energy policy think tank
- UK registered charity (since 2004)
- No political affiliation
- Supported by private donations and research contracts
- Publishes databases of all subsidised UK renewable installations

[www.ref.org.uk](http://www.ref.org.uk)

## 2002 Renewable Electricity Target for 2010

- 10% of electricity to be renewable
  - Instrument: *Renewables Obligation* (RO)
  - Subsidy = £50 / MWh
    - In addition to wholesale price (£25 / MWh)
- Subsidy level set by least economic technologies / sites
  - → Major over-support for lower cost technologies / sites
- Rising wholesale price (↑ £50 / MWh) created hyperprofits and overheated the renewables sector
  - → Poor site choice; Bad PR; Rent seeking...

# 2010 Target Was Missed

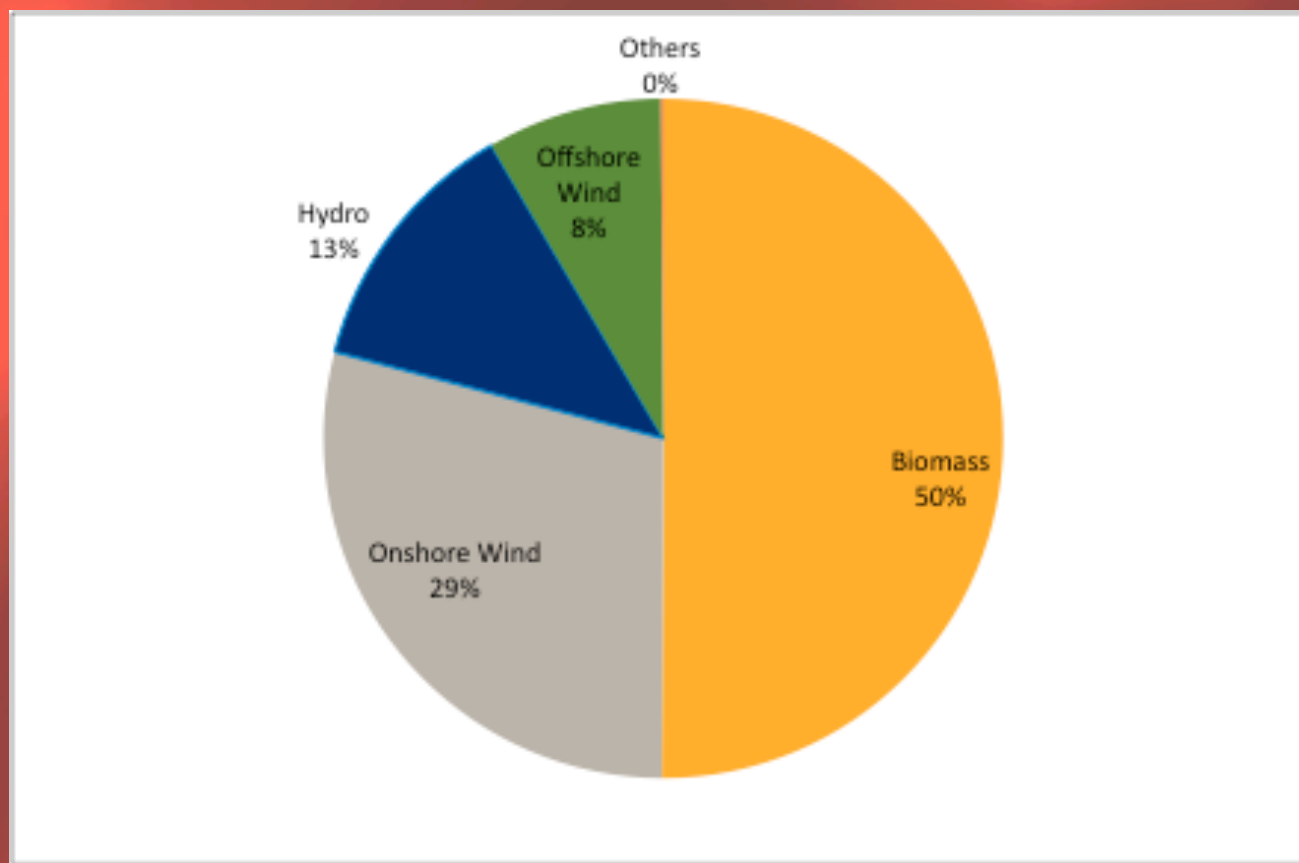
- 6.5% of UK electricity consumption was renewable in 2010
- Total subsidy cost: £5 billion (2002–2010)
- Annual cost: £1.1 billion (in 2010)



Source: DECC, Ofgem data, REF estimates. Chart by REF.

# RO Output (Apr. 2002–Mar. 2012): 149.3 TWhs

50% of all RO MWhs were from Biomass



Source: REF Calculations from Ofgem Data

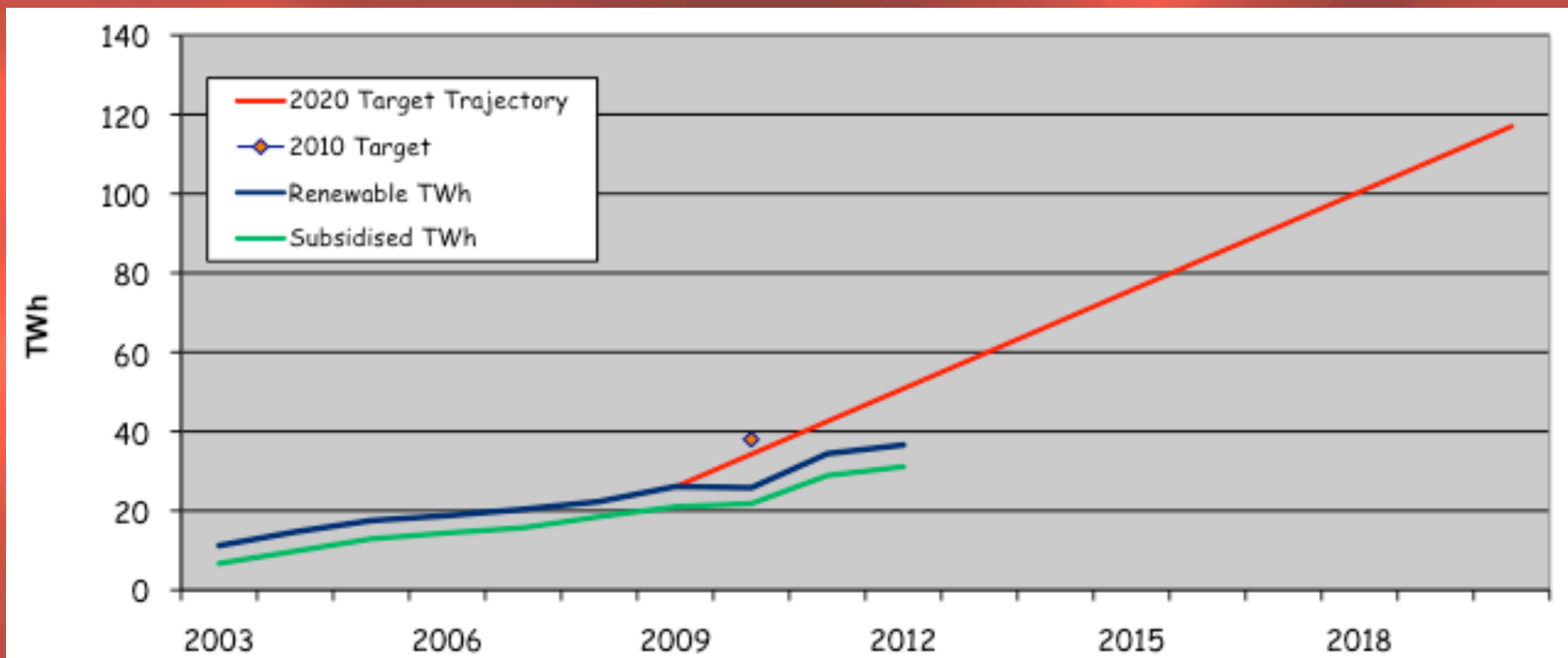
## European Union Renewables Directive (2009)

- 20% of EU 27 Final Energy Consumption (FEC) in 2020 to be from renewable sources
- UK burden share: 15% of FEC
  - Largest increase of any major state
  - > 25% of EU-wide costs fall on the UK
- UK FEC = 150 mtoe  $\times$  0.15 = 22.5 mtoe = 260 TWh
- Electricity target 120 TWh (30% of UK electricity)
- 140 TWh from transport fuel (10%) and heat (12%)

# Electricity Policy Instruments

1. Renewables Obligation (RO).
  - Closes to new registrants in 2017
2. Feed-in Tariff (FiTs)
  - For generators up to 5 MW
3. Feed-in Tariffs with Contracts for Difference (FiTs CfDs)
  - Replaces RO from 2017
4. Carbon Price Floor.
  - Tax on carbon fuels for electricity. Increases wholesale price (in effect an extra subsidy for renewables)

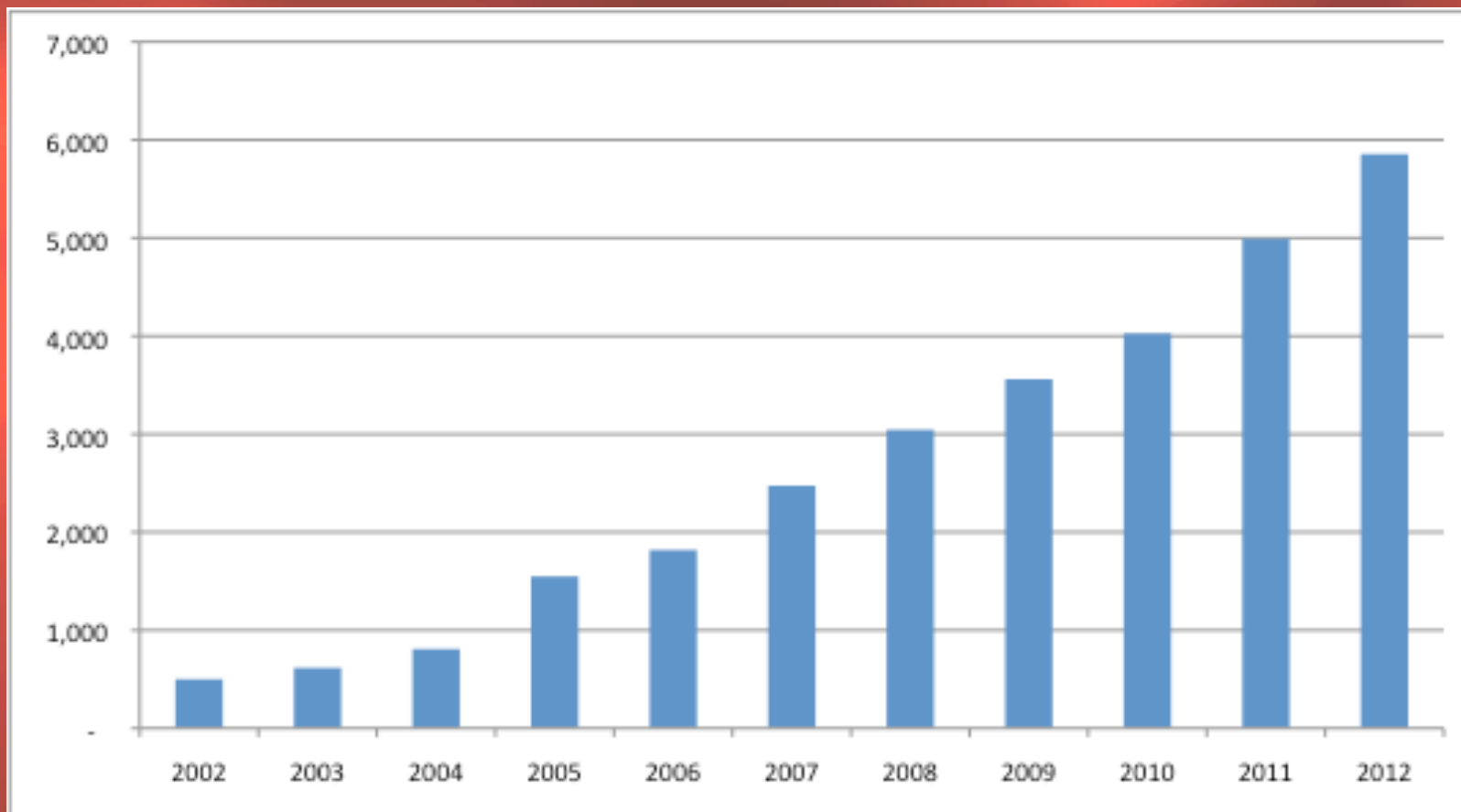
# Can the 2020 Electricity Target be Met?



Source: DECC, Ofgem data, REF estimates. Chart by REF.

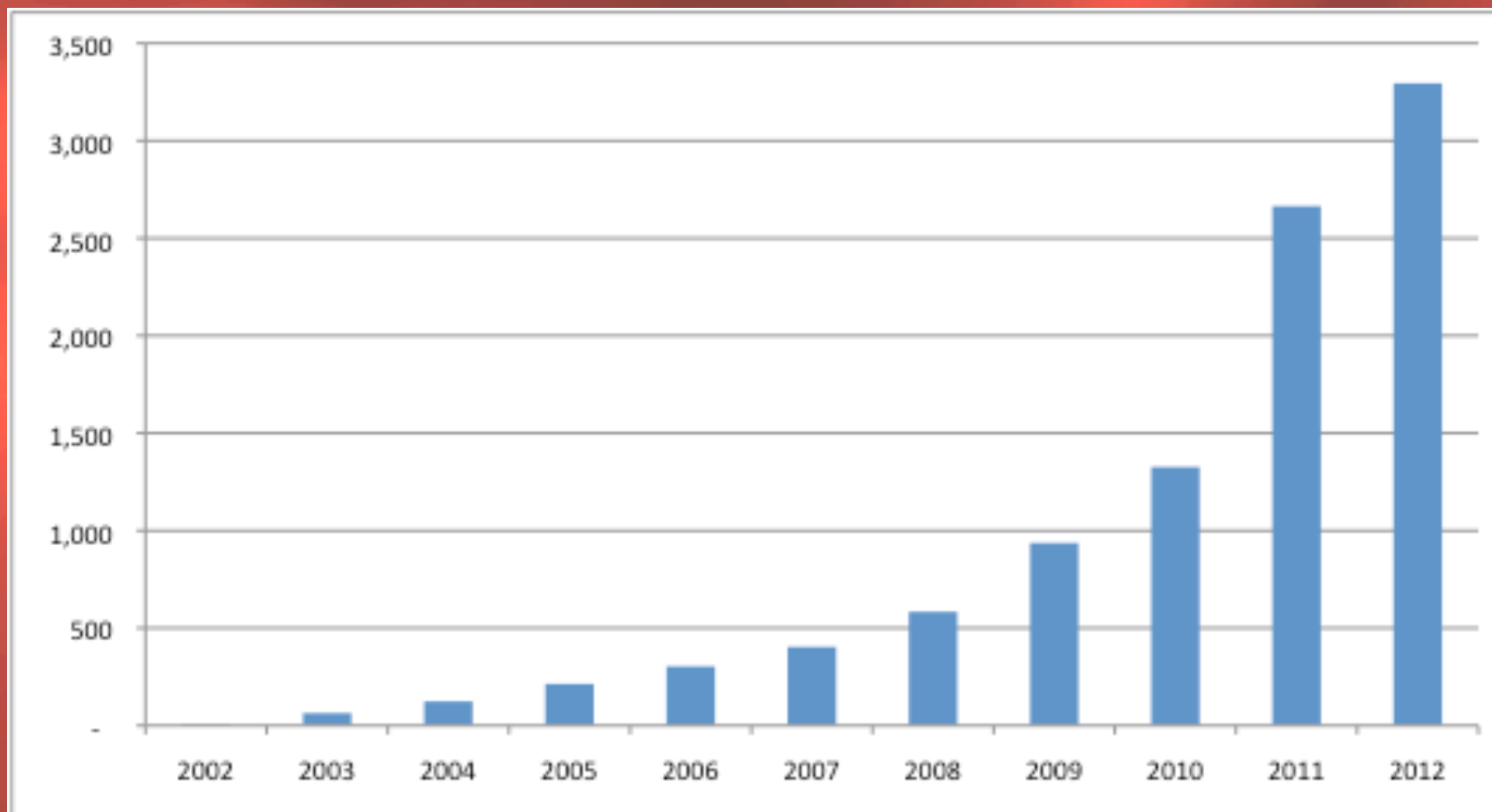


# Onshore Wind Capacity Build (Cumulative MW)



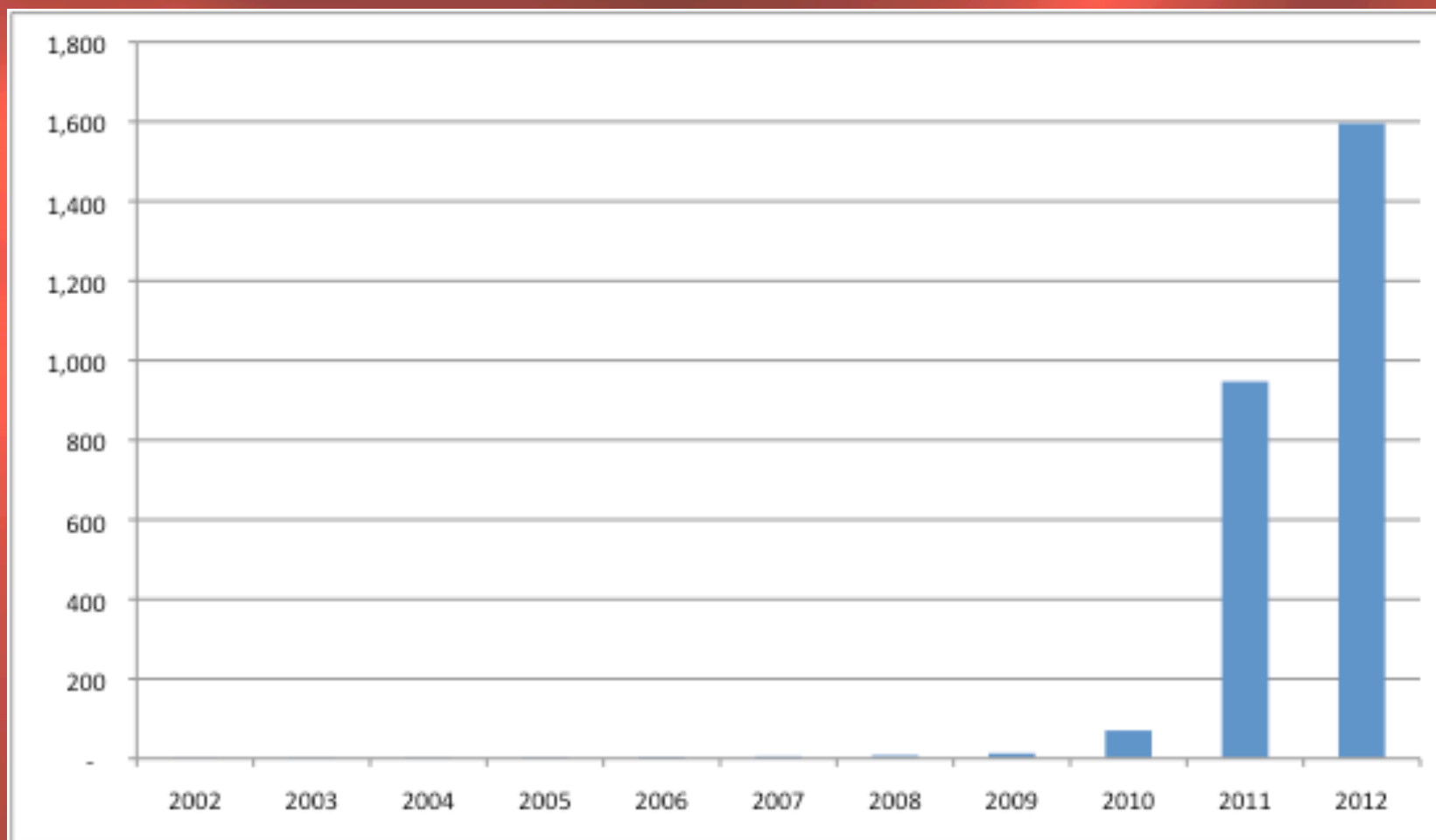
Source: DECC, Ofgem data. Chart by REF.

# Offshore Wind Capacity Build (Cumulative MW)



Source: DECC, Ofgem data. Chart by REF.

# Solar PV Capacity Build (Cumulative MW)



Source: DECC, Ofgem data. Chart by REF.

# Capacity & Performance in 2012

<i>Technology</i>	<i>Sites</i>	<i>Installed Capacity (GW)</i>	<i>2012 Generation (TWh)</i>	<i>2012 Load Factor</i>	<i>Share of UK Renewable Electricity</i>
<b>All</b>	<b>376,364</b>	<b>16.3</b>	<b>38.4</b>	<b>28.8%</b>	<b>100%</b>
<b>Wind</b>	<b>5,179</b>	<b>9.3</b>	<b>19.4</b>	<b>22.7%</b>	<b>51%</b>
<i>Onshore</i>	<b>5,157</b>	<b>5.9</b>	<b>11.9</b>	<b>22.5%</b>	<b>31%</b>
<i>Offshore</i>	<b>22</b>	<b>3.3</b>	<b>7.5</b>	<b>30.6%</b>	<b>20%</b>
<b>Biomass</b>	<b>716</b>	<b>2.8</b>	<b>12</b>	<b>48.9%</b>	<b>31%</b>
<b>Hydro</b>	<b>619</b>	<b>2.3</b>	<b>4.5</b>	<b>41.8%</b>	<b>12%</b>
<b>Solar</b>	<b>369,829</b>	<b>1.6</b>	<b>1.4</b>	<b>7.5%</b>	<b>4%</b>
<b>Waste</b>	<b>17</b>	<b>0.4</b>	<b>1</b>	<b>30.4%</b>	<b>3%</b>

Source: REF Calculations from Ofgem / DECC / Elexon Data.

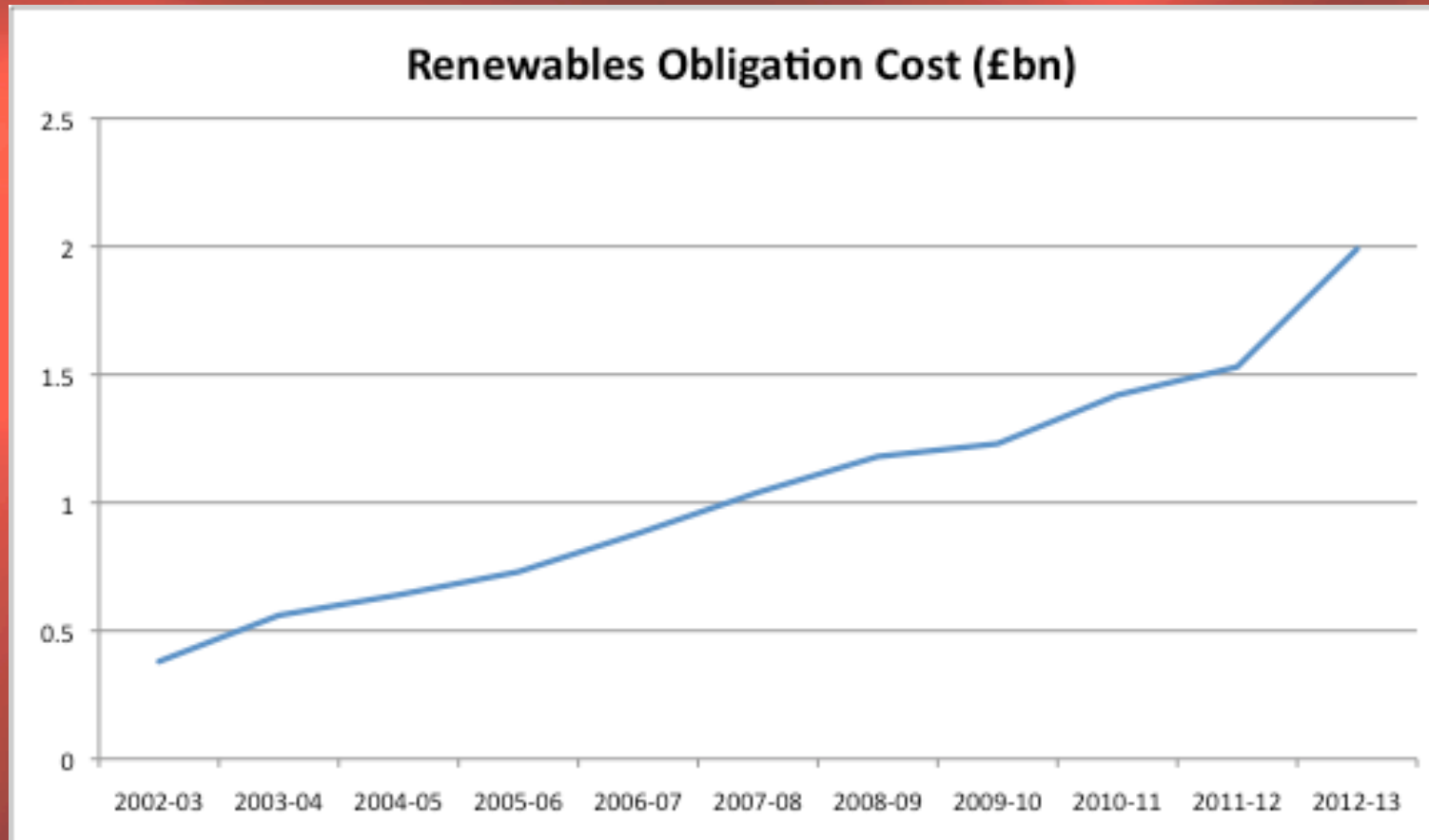
## RO, Unsubsidised, and FiT (2012)

<i>Support</i>	<i>Sites</i>	<i>Installed Capacity (GW)</i>	<i>2012 Generation (TWh)</i>	<i>2012 Load Factor</i>	<i>Share of UK Renewable Electricity (%)</i>
<b>RO</b>	1,664	12.6	33.3	32.2%	87%
<b>Unsubsidized</b>	36	1.9	3.1	29.9%	8%
<b>FiT</b>	374,664	1.8	1.9	21.9%	5%
<i>Photovoltaic</i>	369,518	1.6	1.4	8.8%	4%
<i>Onshore wind</i>	4,716	0.15	0.3	22.9%	0.7%
<i>Anaerobic Digestion</i>	46	0.05	0.2	52.6%	0.4%
<i>Hydro</i>	384	0.04	0.1	42.1%	0.3%

Source: REF Calculations from Ofgem / DECC / Elexon Data

# Total RO Costs to 2013: £11.6 billion

## Annual Cost in 2012: £2 billion

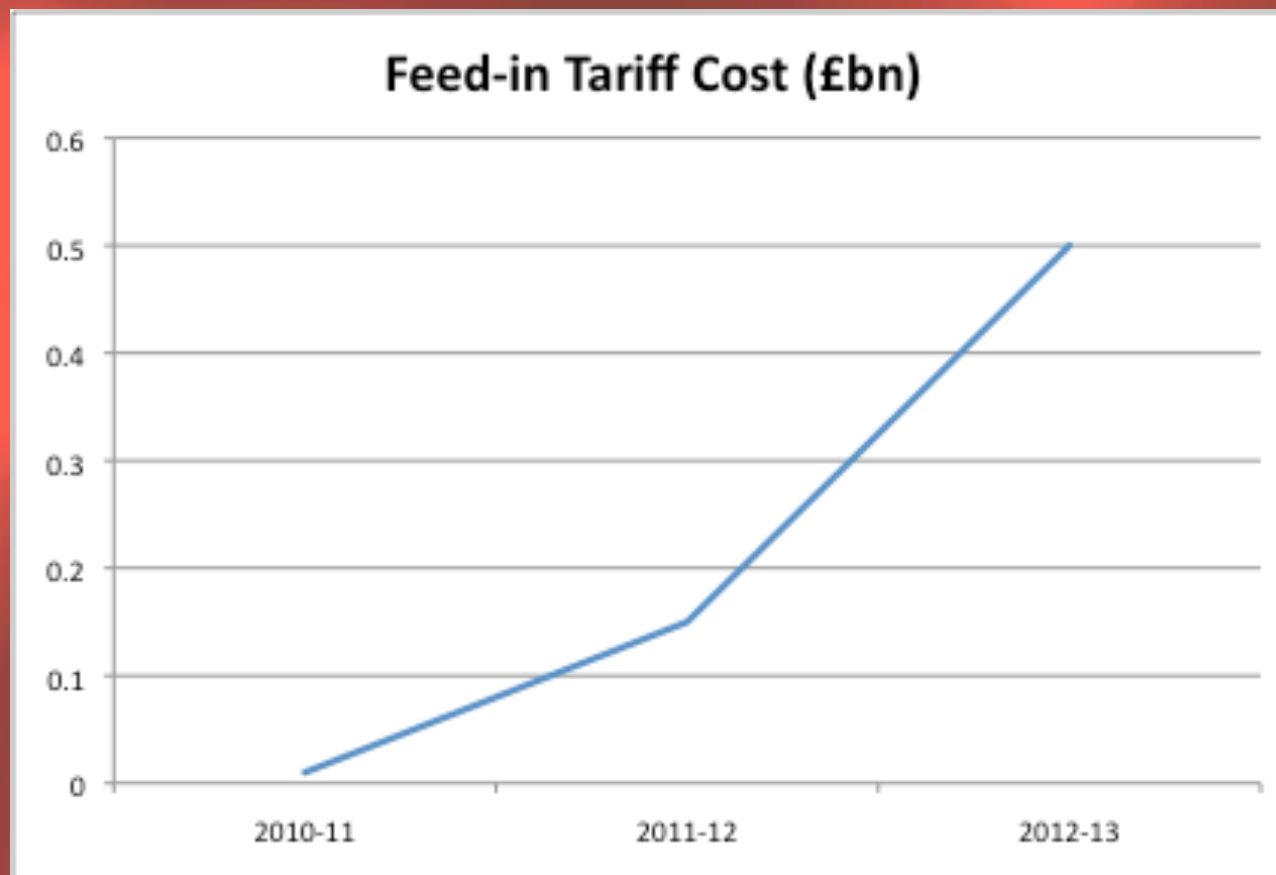


Real 2012 / 13 prices

RO years run from April to March. Source: DECC. Chart by REF.

# Total FiT Costs 2010–2013: £660m

## Annual Cost in 2012: £500m

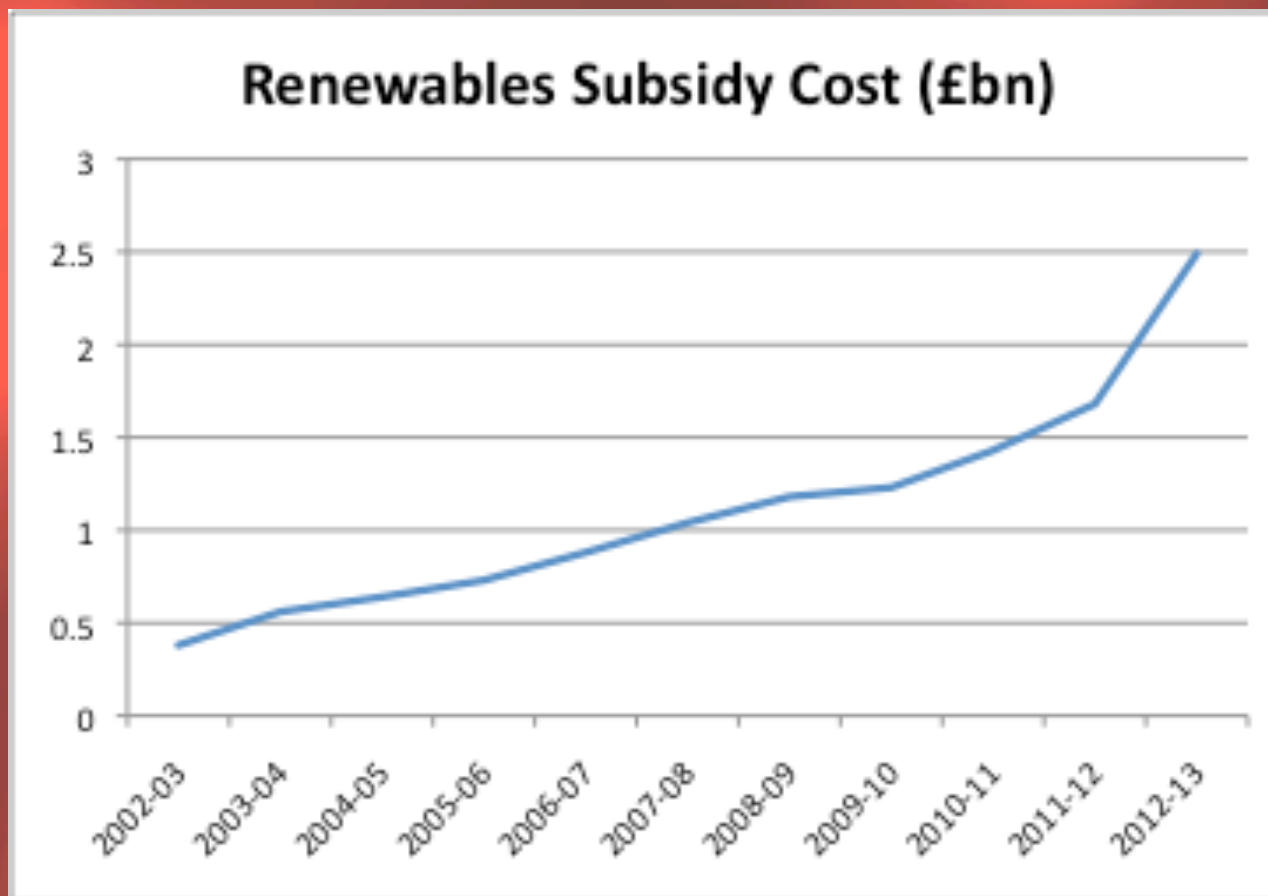


Real 2012/13 prices. Source: DECC. Chart by REF.

# RO + FiT Costs

Cumulative: 2002–2013: £12.2bn

Annual in 2012/13: £2.5bn and rising....



Source: DECC. Chart by REF. (Real 2012 / 13 prices.)



## RO and FiT Costs Compared

- FiT accounted for 5.4% of subsidised renewable electricity in 2012
  - 1.9 TWh / 35.3 TWh
- FiT accounted for 20% of renewables subsidy cost
  - £500m / £2.5bn
- Average subsidy costs:

FiT: £260 per MWh

RO: £58 per MWh

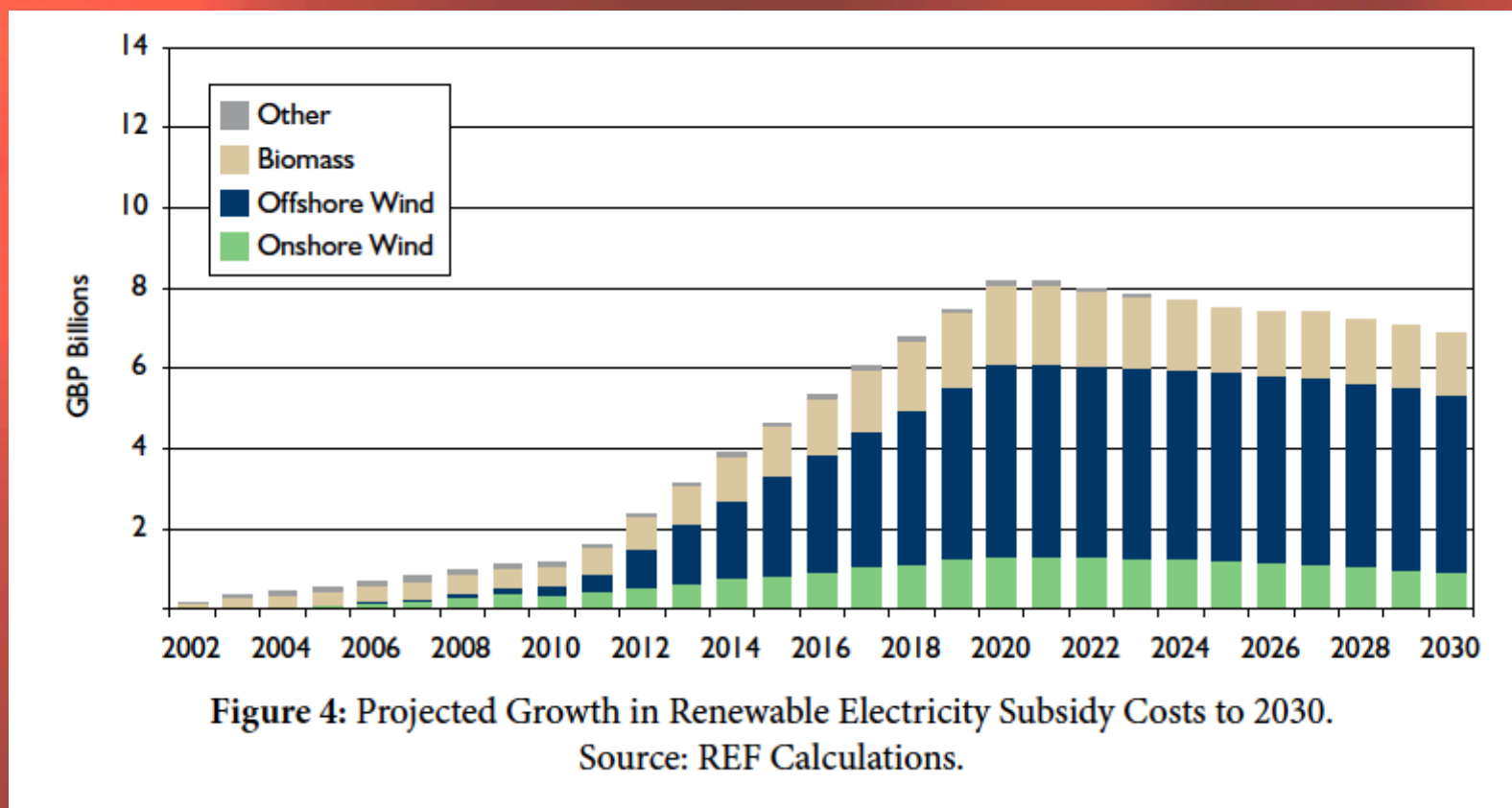
# Can the Consumer Afford the Targets?

## Three Areas of Doubt

1. Cumulative subsidy cost of EU 2020 renewables target is extremely high
  - ≈£130bn (2002–2030)
2. System costs of renewables (wind and solar) are very likely to be greater than government admits
  - Wind integration cost: £60 / MWh (Source: Gibson 2011)
3. Economic life of key plant (wind power) appears to be much shorter than expected
  - Levelised costs are higher than anticipated
  - Capital refreshment cycle is short, so cost of maintaining target levels of renewable energy is higher than predicted

# Renewable Electricity Subsidies

- Subsidy cost: £8bn per year in 2020
- Cumulative subsidy Cost 2002–2030: ca £130bn



Source: REF, *Energy Policy & Consumer Hardship* (London 2011)

# UK Govt. Relaxed about Policy Impacts

- “[...] taken together, the Government’s policies mean that household bills will be on average 11%, or £166, lower in 2020”
  - Optimistically assumes that energy efficiency will offset policy cost through conservation
- “For most businesses, direct energy costs are a relatively small proportion of total costs. [...] around 2.5% of total costs for UK manufacturing as a whole.”
  - Ignores embedded energy costs in labour and capital

Source: DECC, *Estimated Impacts* (2013)

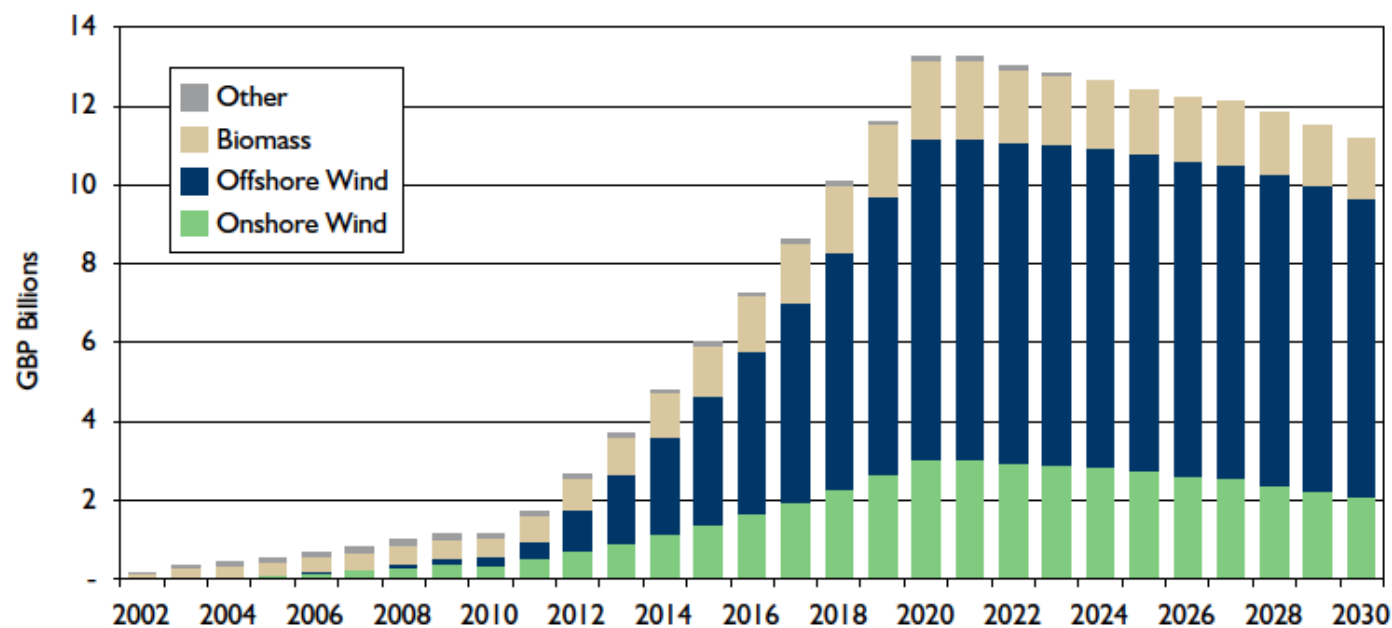
# Policy Impacts on Electricity Price in 2020

## DECC Models

- Domestic Households
  - Low fossil price scenario: + £54/MWh (+ 44%)
  - High fossil price scenario: + £45/MWh (+ 26%)
- Medium Sized Businesses
  - Low fossil price scenario: + £48/MWh (+74%)
  - High fossil price scenario: + £37/MWh (+33%)
- Even in DECC's High Fossil Price scenario prices rise by ca. 30% due to climate and other policies

## 2. Integration Costs (+ Subsidy)

- Total cost in 2020: £13bn per year in 2020
- Total Cost 2002–2030: ca. £175bn



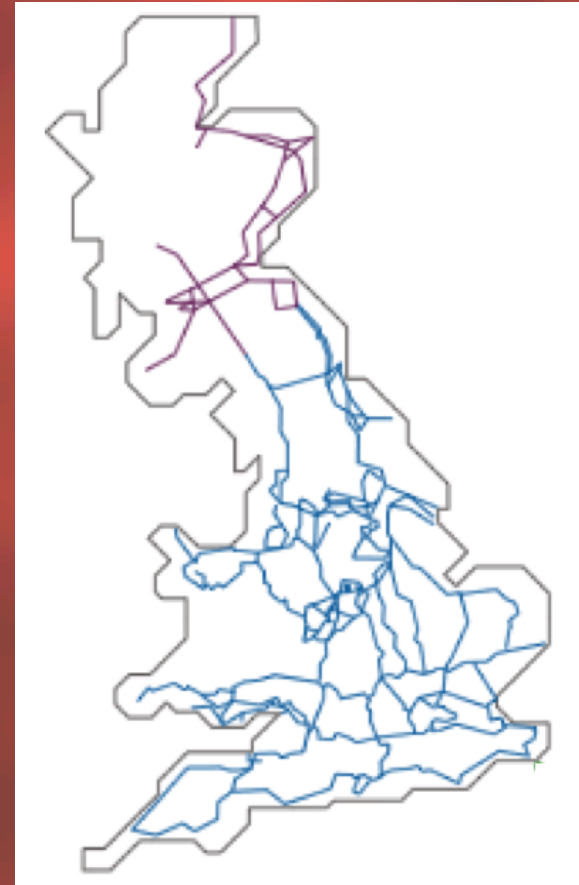
**Figure 6: Projected Growth in Total Cost of Renewable Electricity Programme (Subsidy + Ancillary Costs).**

Source: REF Calculations, Gibson 2011.

Source: REF, *Energy Policy & Consumer Hardship (London 2011)*

## 2. Integration Problems: Constraint Payments to Wind Power

- Total 2010 to present day:  
£41.6m
  - £22.7m in 2013 alone
- Average price to reduce generation: **£145/MWh**
  - Three times lost income
- But constraining wind off the system may be cheaper than building more network
  - Colin Gibson, Former National Grid Power Networks Director



The UK HV Network  
Source: National Grid

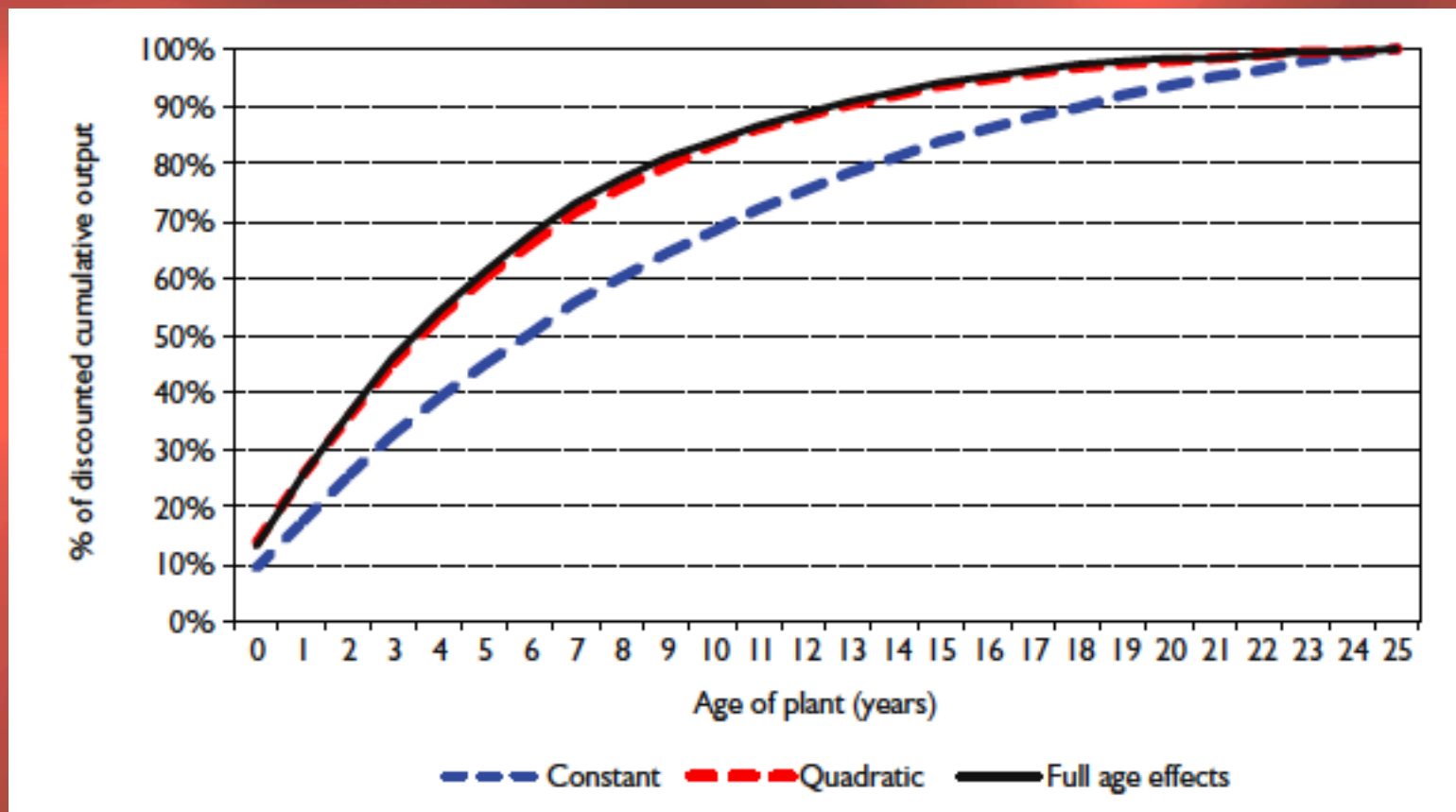
### 3. Economic Lifetime of Wind Turbines

- Gordon Hughes, *The Performance of Wind Farms in the United Kingdom and Denmark* (REF: London, 2012).
- The normalised load factor for UK onshore wind farms declines from a peak of about 24% at age 1 year to 15% at age 10 years and 11% at age 15 years.





# Load Factor Decline and Discounted Cumulative Output



Source: Hughes, *The Performance of Wind Farms in the UK and Denmark* (2012)

## Conclusion: Acute & Cumulative Costs

- Policy costs are:
  - *Acute and Chronic*: £14bn a year up 2040
  - *Cumulatively vast*: £175bn up to 2030
- Higher energy costs will be embedded in capital stocks and in cost of supporting labour
  - All “Non-energy” business input costs will rise
- UK now embarking on infrastructure renewal
  - Higher costs will be embedded in major capital stocks, increasing cost of use for decades to come

## But Acute Costs are Now a Political Issue...

- Ed Miliband, Labour party leader, has promised to freeze electricity prices for two years after the 2015 election
- Conventional and renewables investment now uncertain
- Reports suggest £4.5bn of cost (ca. 50% due to renewables) that cannot be passed through to consumers

