Renewables policy and prospects for energy costs

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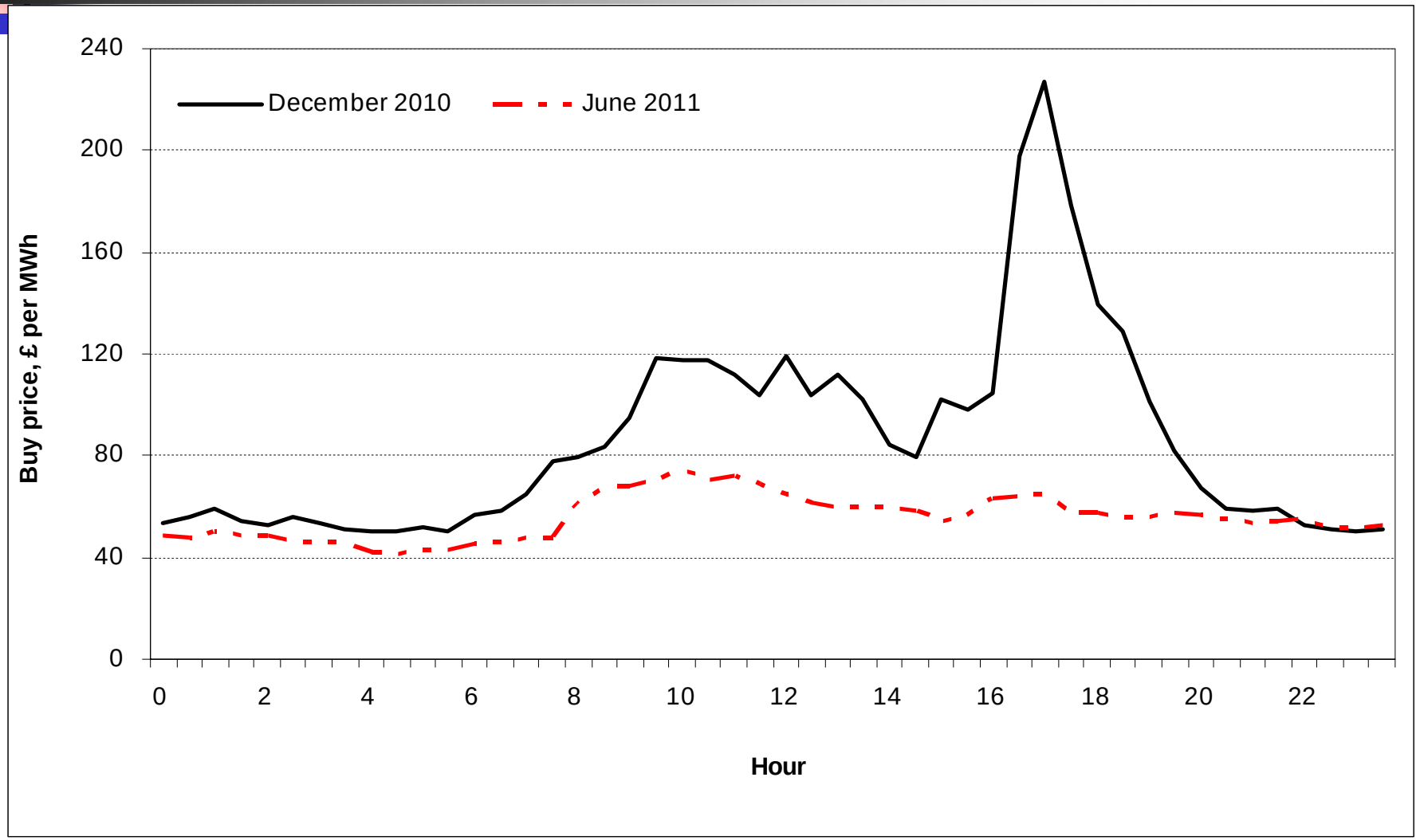
The economics of investing in power plants

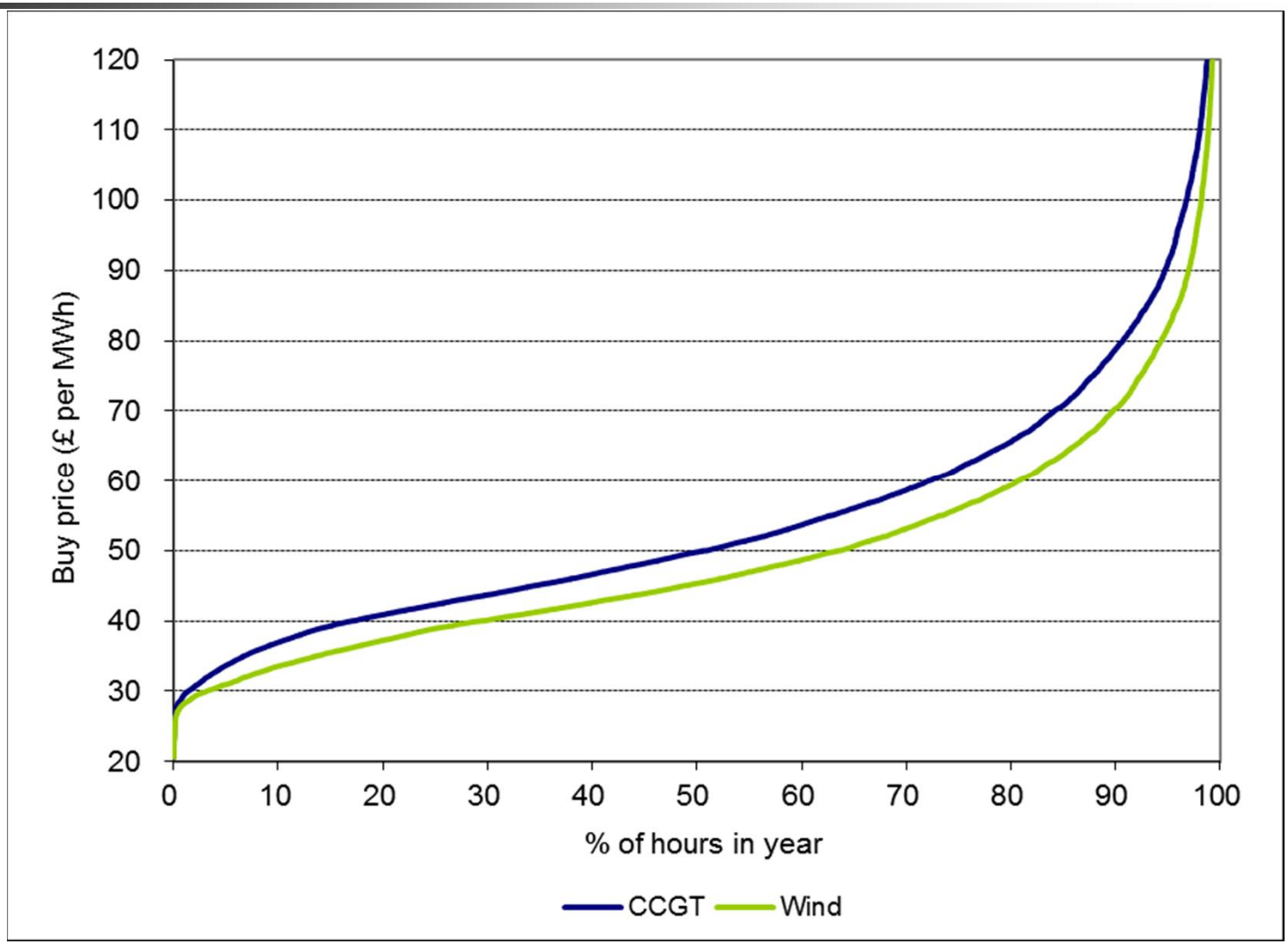
Projections of levelised costs of generation (£ per MWh 2018)

	Levelised costs in £ per MWh					
	Fuel + O&M	Total @ cost of capital of		CO2 levy	Total incl carbon levy	
Cost of capital		7.5%	10.0%		7.5%	10.0%
Nuclear	18.0	52.4	63.4	0.0	52.4	63.4
Coal - advanced (ASC)	33.2	80.1	86.3	24.0	104.1	110.3
Gas - combined cycle	46.4	63.2	65.1	9.7	72.9	74.8
Gas - turbine (single cycle)	71.6	99.9	103.5	14.3	114.2	117.8
Wind - onshore	11.8	70.3	83.6	0.0	70.3	83.6
Wind - offshore	16.5	141.2	169.7	0.0	141.2	169.7
Solar photovoltaic	18.4	320.6	380.3	0.0	320.6	380.3
Biomass	55.5	85.2	93.4	0.0	85.2	93.4
Reservoir hydro	8.1	49.7	62.6	0.0	49.7	62.6
Pumped storage hydro	10.8	130.9	167.9	0.0	130.9	167.9

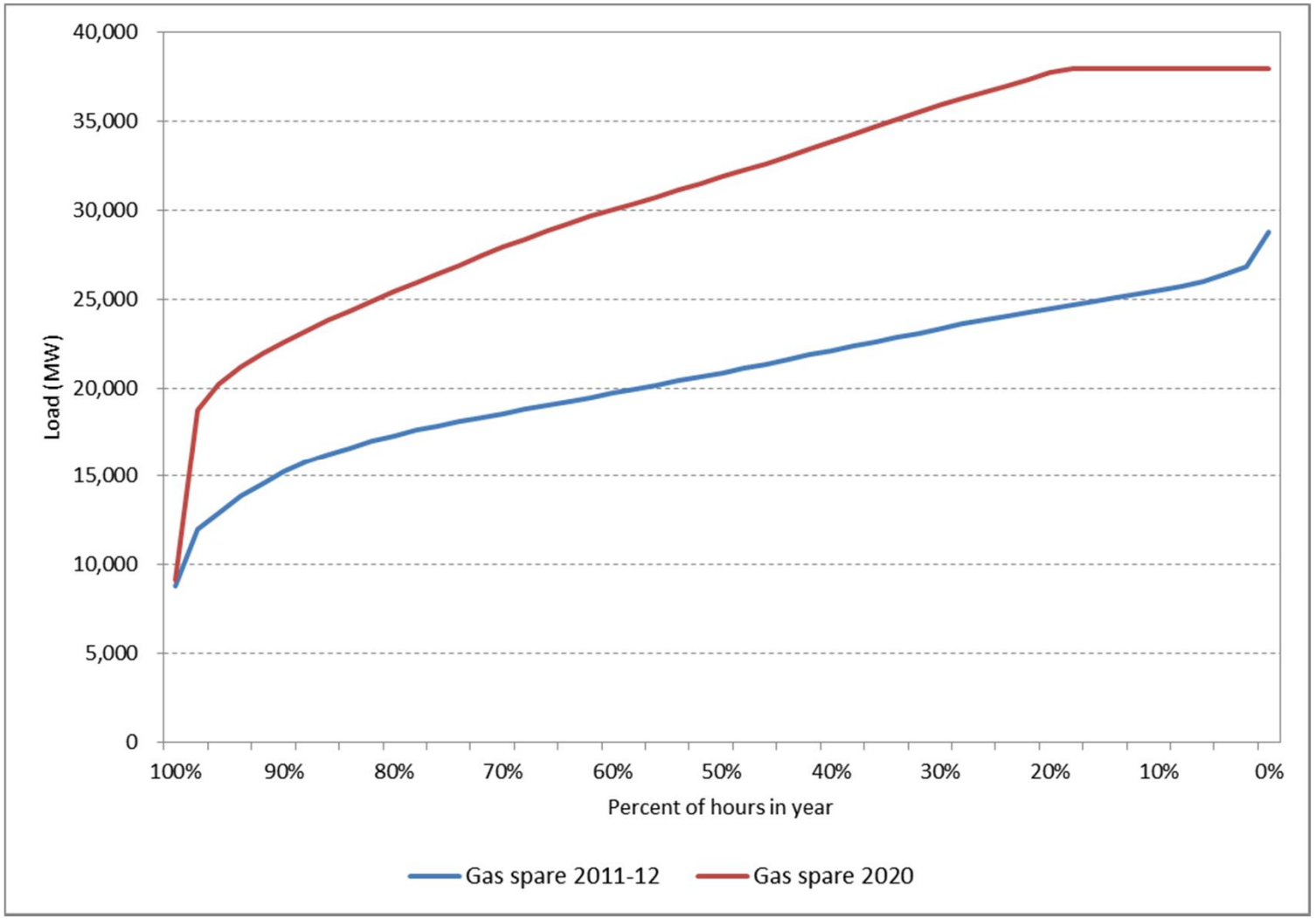
Market prices vary greatly within the day and across seasons



Market prices show that wind power is worth less than power from gas plants



Spare gas capacity 2011-12 & 2020



Increasing wind capacity is altering the incentives to invest in new power plants

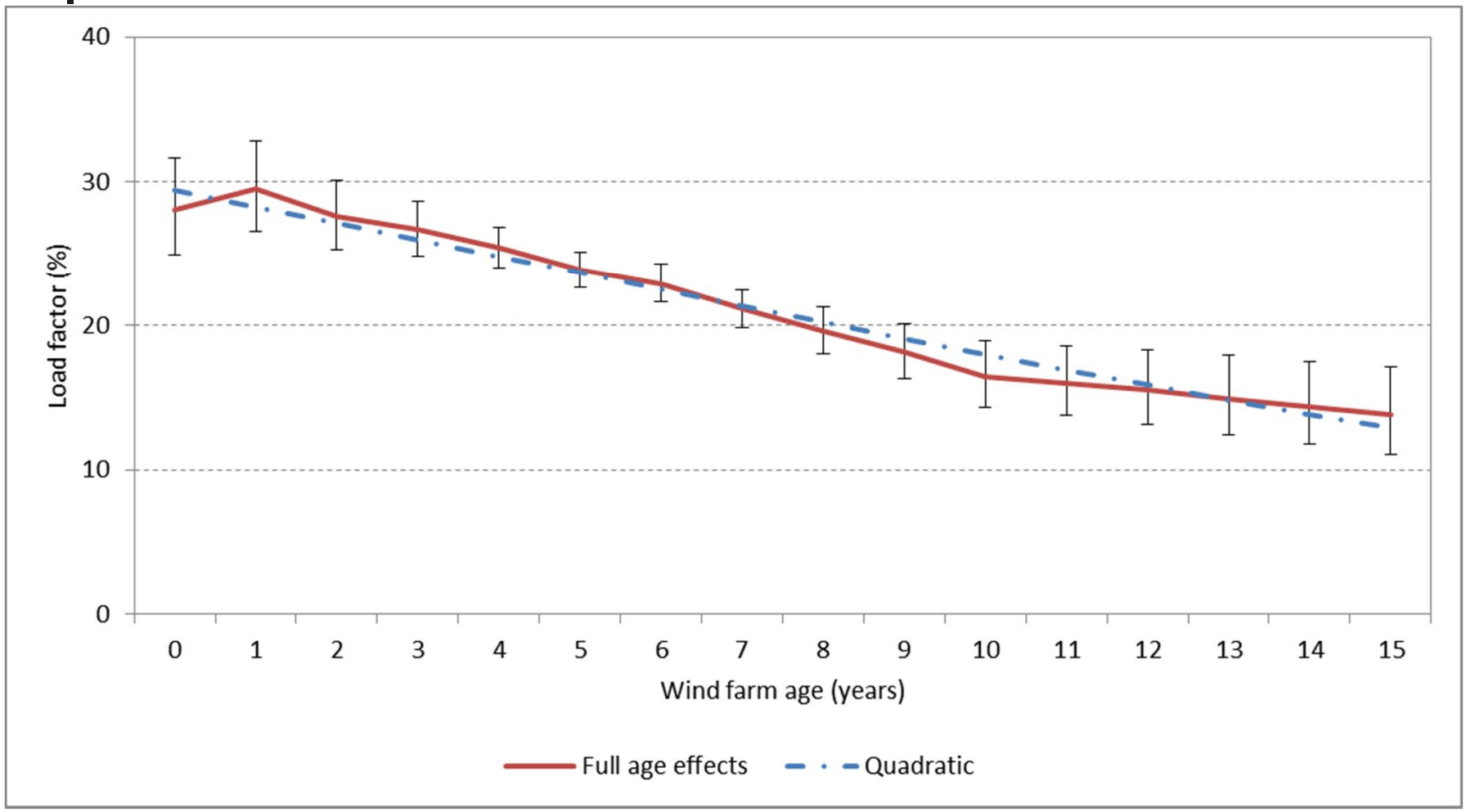
- Lower load factor for gas means that new CCGT plants are not profitable
  - But they are necessary to back up wind
  - Encourages investment in less efficient units
- In Germany and the UK it is more profitable to use existing coal plants & build new ones
- Reduced market return for biomass & similar renewables which require high load factors

Energy market reform

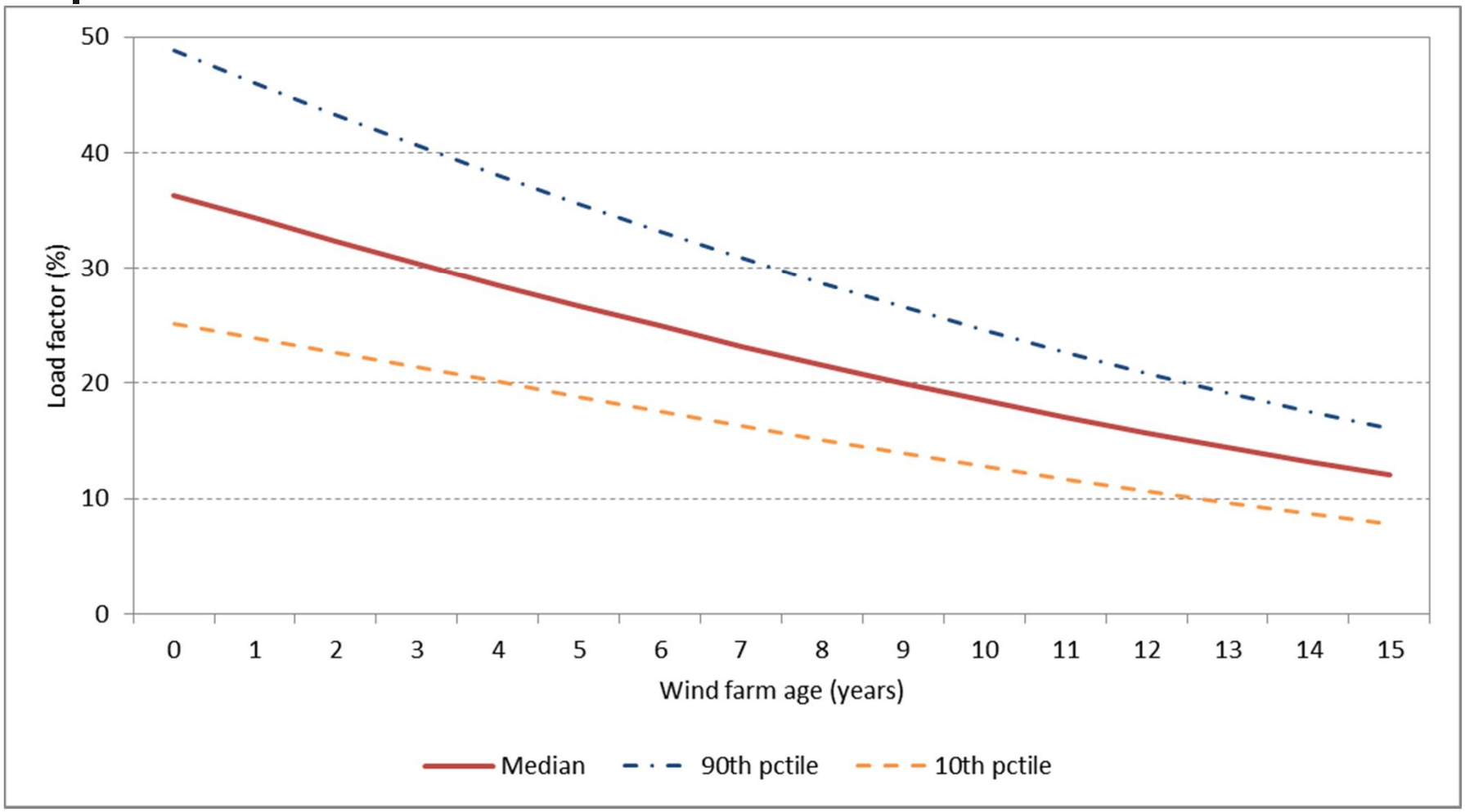
- Capacity mechanism to pay generators to build new plants which won't be used much
  - Future cost to be paid by all electricity consumers
- Reduction in CO2 much lower than predicted
  - Lower thermal efficiency of GTs, cycling, etc
- Increased volatility of prices → higher cost of capital in both generation & supply
  - High strike price for new nuclear plant
  - Large increase in all electricity costs

The performance of wind farms

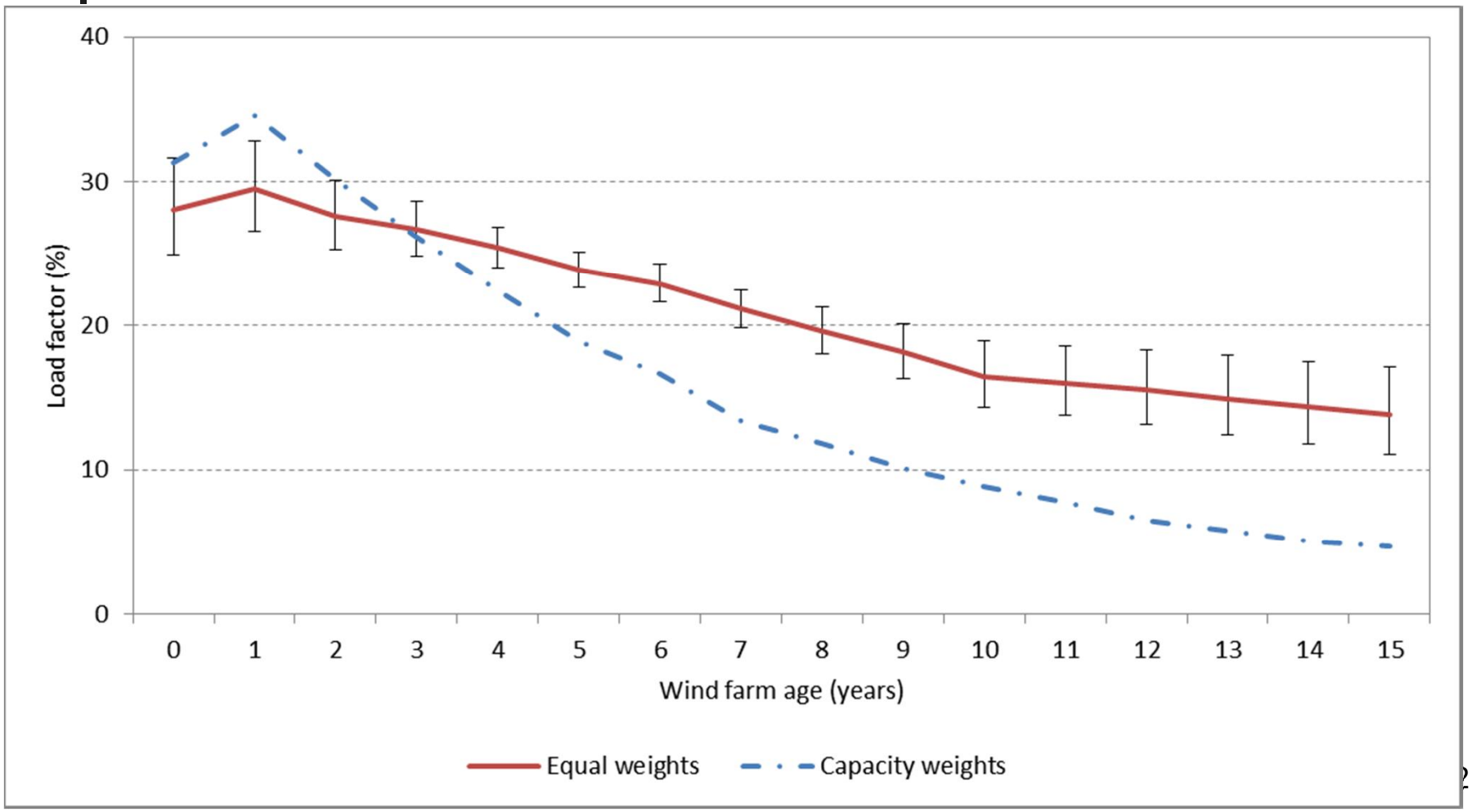
The decline in load factors due to age



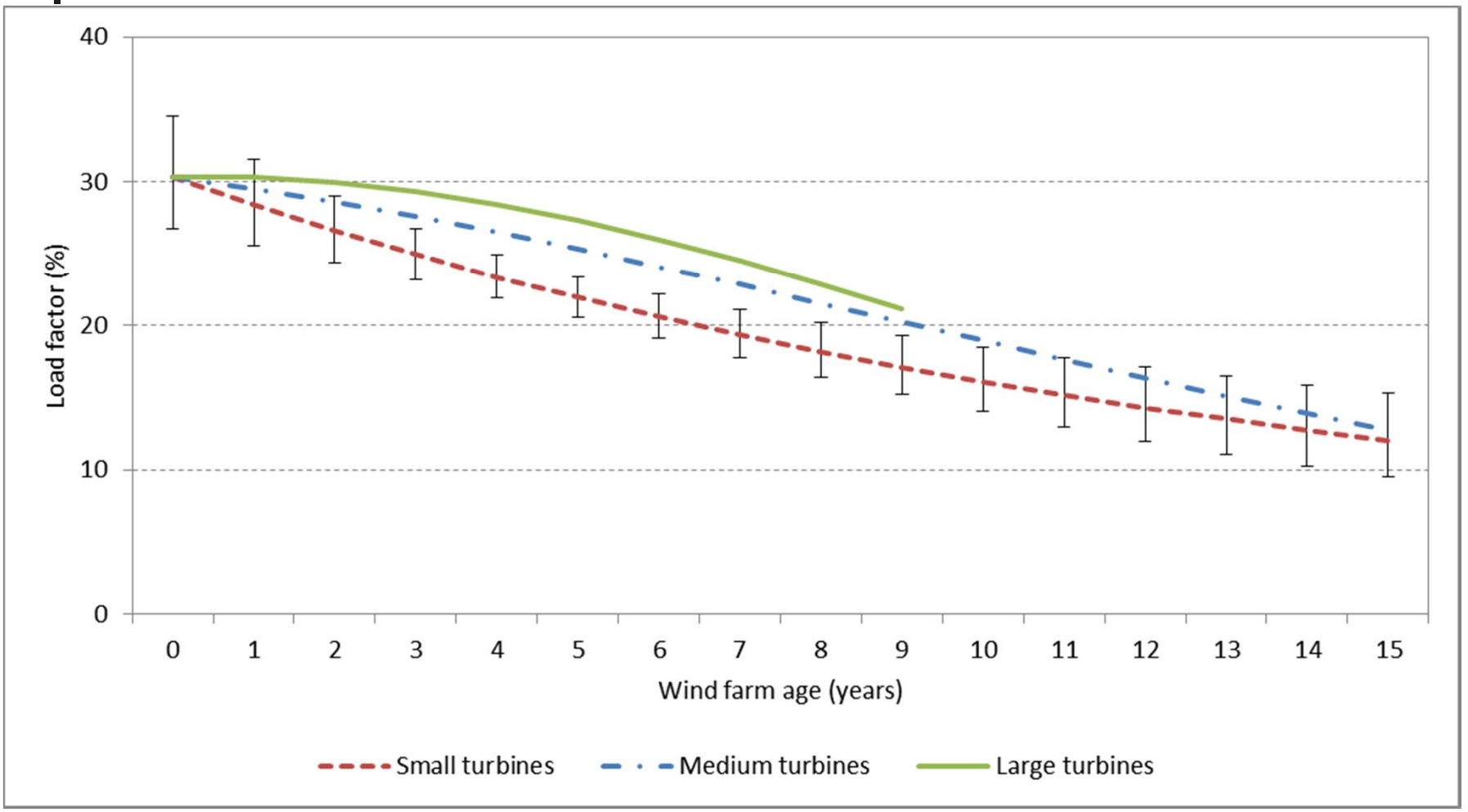
The range of uncertainty about the future performance of wind farms



The performance of large wind farms deteriorates faster than small ones



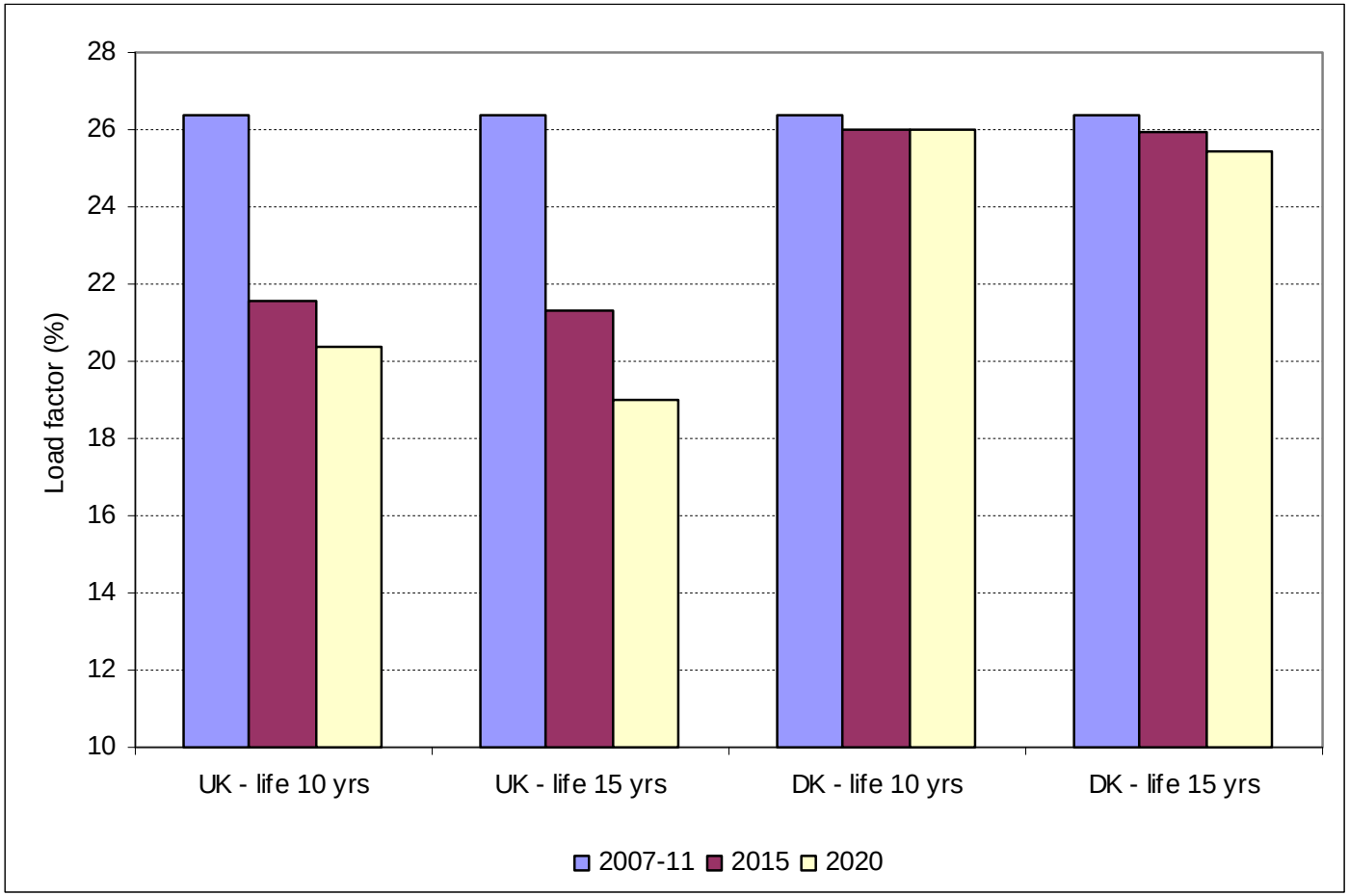
Large turbines perform better initially but their performance declines after year 4



The site characteristics of new wind farms have got worse over time

Year commissioned	Median value of normalised load factor (%)				
	England	Northern Ireland	Scotland	Wales	All
2000	18.9		38.6		21.5
2001	24.0		24.6	24.6	24.3
2002	27.4		23.4	26.0	26.0
2003	21.8		29.2	26.5	26.6
2004	17.2		20.7	17.5	18.4
2005	22.5	22.9	22.0	22.0	22.2
2006	20.6	22.6	21.7	20.8	21.1
2007	18.4	22.3	23.8	16.8	19.7
2008	16.3	21.2	18.5	21.6	17.4
2009	19.5	19.9	20.1	16.7	19.7
2010	19.4	16.3	18.7	16.3	18.7
2011	15.5	20.3	16.4	12.3	16.5

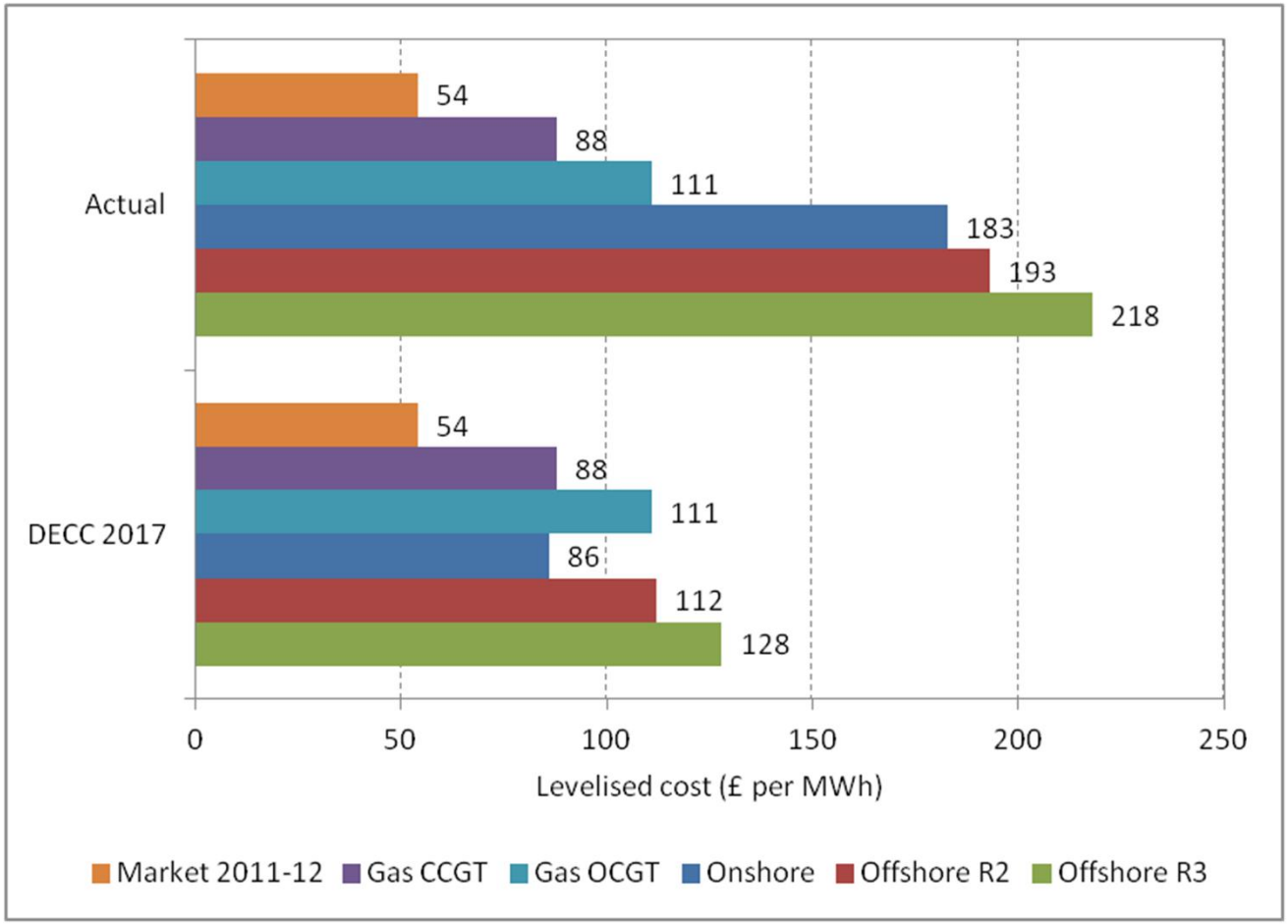
By 2020 the average load factor for UK wind farms will be much lower than in the past



Are new wind farms a good investment?

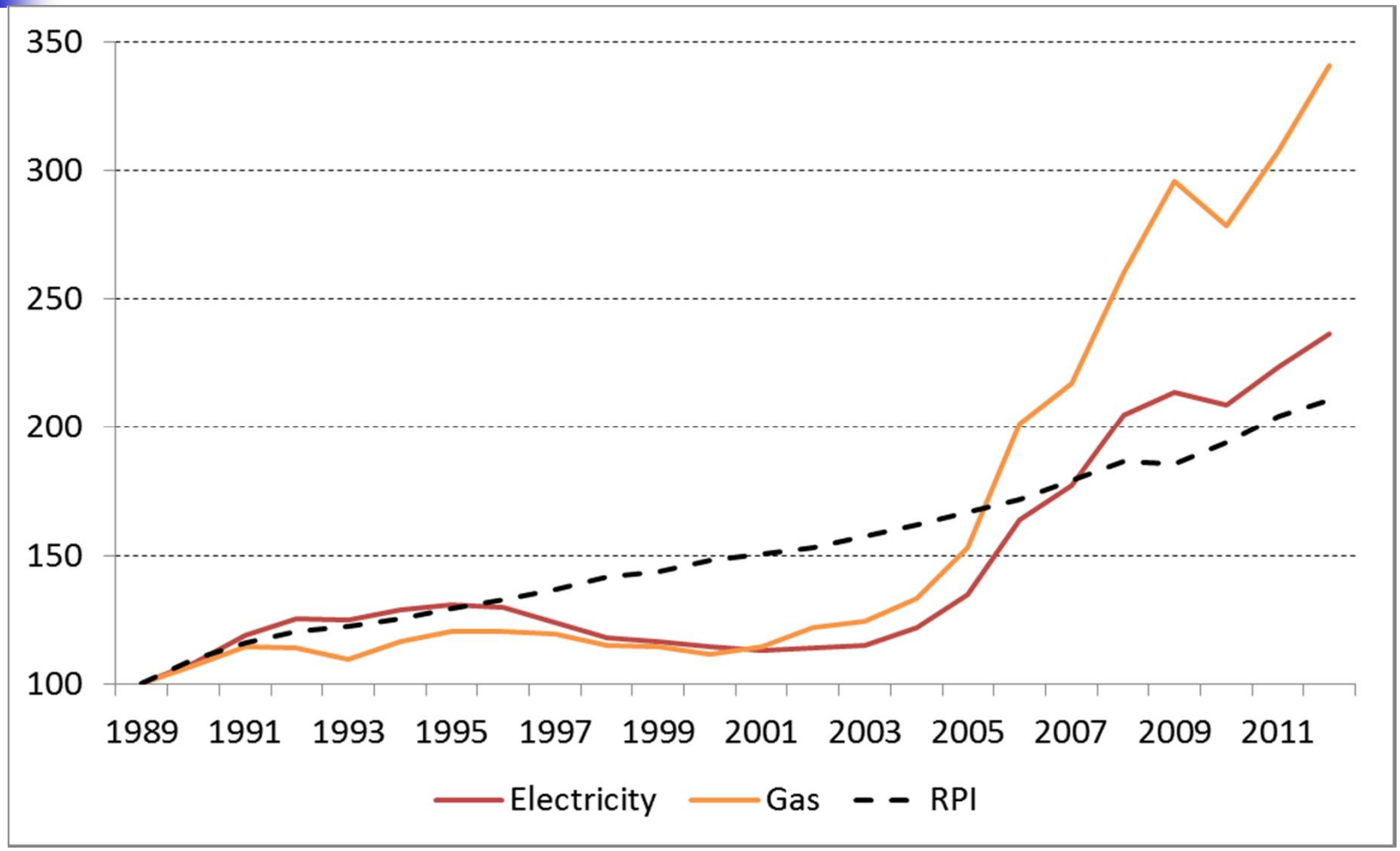
- Economic life of wind farms is no more than 15 years
  - Many onshore wind farms re-powered after 10-12 years
  - After 10 years the residual value of turbines is low, but there is an option value for site redevelopment
  - Costs of meeting renewable targets much higher than current forecasts suggest due to
    - Higher capacity required due to lower average load factors
    - Shorter operating lives implies higher replacement costs
- Implications for financing investments
  - Not attractive to many infrastructure investors
  - Higher cost of capital due to uncertainty about length of investment return and residual values

The levelised cost of wind power based on actual performance is 2-3 times the current pool price



Implications for energy costs

Until 2005 energy prices increased less than general inflation, but gas prices increased sharply over 2005-12



DECC's estimates show large policy increases in electricity prices up to 2020

DECC estimates	Electricity	Gas	Total
A. Domestic: low price scenario			
Without policy	124	37	55
With policy	179	39	68
% policy increase	44%	5%	23%
B. Domestic: medium price scenario			
Without policy	150	50	71
With policy	198	52	82
% policy increase	32%	4%	16%
C. Business: low price scenario			
Without policy	66	22	
With policy	115	25	
% policy increase	74%	14%	
D. Business: medium price scenario			
Without policy	90	34	
With policy	133	37	
% policy increase	48%	9%	

Items omitted from DECC's calculations

- Misallocation of costs
  - Balancing and availability costs incurred by National Grid to ensure system stability
  - Network investments, esp. for transmission, required for wind farms
- Higher capital & operating costs
  - Degradation in performance of wind farms
  - Capacity payments for back-up generation

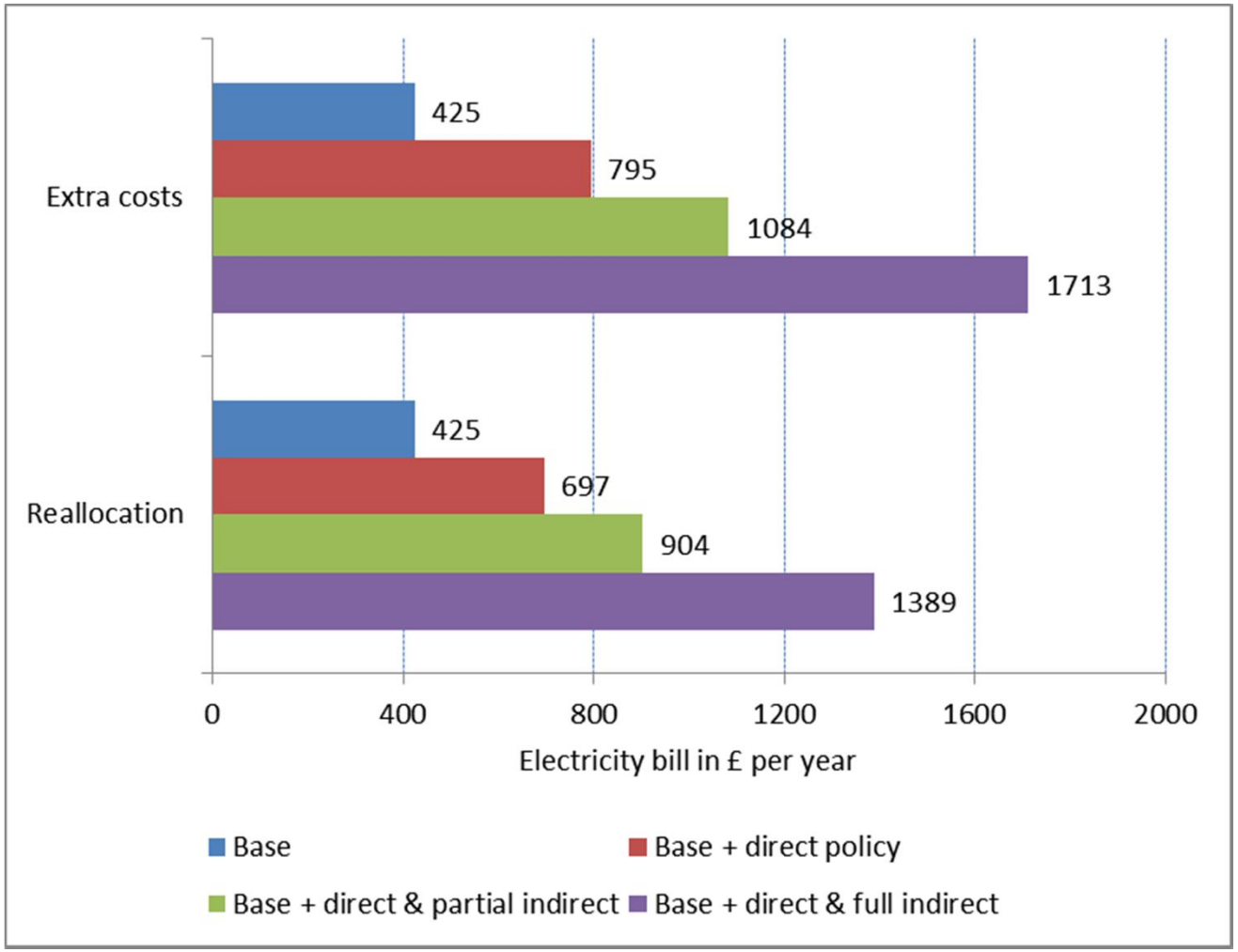
The full impact of higher energy prices

- Higher prices paid by business consumers
  - A portion is passed through to higher prices for goods and services
  - “Non-traded” items such as recreation, eating out, personal services, shops, professional services
  - The remainder not passed through means lower wages and other incomes
- Government – education and the NHS
  - Either higher taxes required to fund public services or lower incomes for public workers

The complete story – allowing for the pass-through of energy costs

	Electricity	Gas	Electricity + Gas
A. DECC estimates adjusted for balancing & transmission			
Direct	64%	5%	31%
Total			
Full pass-through	227%	26%	116%
Partial pass-through	113%	7%	54%
B. Adjustment for wind and capacity payments			
Direct	87%	5%	42%
Total			
Full pass-through	303%	26%	150%
Partial pass-through	155%	7%	73%

The full impact of policies on the average household electricity bill



Some conclusions

- Heavy reliance upon wind power significantly increases the costs of supplying electricity due to higher cost of balancing and transmission
- The poor performance of wind farms requires more investment in capacity as well as backup
- Higher electricity prices paid by businesses mean higher prices and lower incomes for everyone
- The full impact of current policies will be equivalent to increasing the average electricity bill from £425 per year to between £1390 and £1710 per year