Powering the Nation Update 2010

Introduction

Public bodies and private investors in power plant depend on a good understanding of the costs of production of electricity from alternative technologies to make key business decisions. Recognising this need Parsons Brinckerhoff issued the original Powering the Nation report in 2006 to provide a comprehensive perspective on power generation costs. The report was updated in 2008 to take account of the shift in costs as the market experienced rapid growth just ahead of the recent recession.

Since 2008 there have been significant changes in the economy and in the UK power generation marketplace. The cooling of the economy now has the potential to reduce costs of power plant, but the restricted availability of lending for project finance and working capital for suppliers has conflicted with this underlying trend of falling costs.

Another major change since 2006 has been the rise in importance of carbon emissions associated with power generation. The commitment to an 80% reduction by 2050 in the Climate Change Act 2008, the publication of government policy documents such as the Low Carbon Transition Plan to 2020 and the implementation of EU Directives, such as the Renewables Directive, radically changed the options open for new power generation investment.

The 2010 update of Powering the Nation addresses these changes, drawing upon current cost estimates and data from recent studies of large scale renewable technologies such as for Round 3 offshore wind and for exploitation of tidal power in the Severn estuary. The changing circumstances also make cost forecasting more difficult and changes have been made to the presentation of data to emphasise the range of potential costs rather than the implication that there is a single correct value for costs for any technology.

This brief report sets out the assumptions that have been made in deriving the estimates before presenting our findings and contrasting them with the figures for the 2008 update.

Assumptions

Levelised costs

Using a discount factor of 10%, levelised costs for electricity delivered at the plant HV grid connection were calculated. Current uncertainties related to the treatment of transmission costs for offshore wind and the geographical distribution of generation types means that the resulting costs were not strictly comparable, and therefore excluded from our calculations. Ideally we would have liked to compare costs at a 'national balancing point' including transmission costs representative of the location of the different types of plant. Nevertheless the discrepancies in generating costs between the current presentation and such an idealised analysis will be relatively small unless, for example, the offshore transmission costs were allocated exclusively to offshore wind generation. In that case levelised costs for offshore wind might be increased by 2-3p/kWh resulting in a typical cost of 19p/kWh.

Fuel Costs

Modelled coal and gas cost estimates were equal to the high, central and low forecasts published by DECC in 2009 as part of the Low Carbon Transition plan. Gas oil was included

as an alternative fuel for OCGT plant and the cost projections for this fuel were equal to the DECC high, central and low cases for crude oil scaled to reflect the 2009 gas oil price, also quoted by DECC in DUKES table 4.1.2. The biomass cost projections reflected the assumption made by PB that the price would be less volatile than the gas price but less steady than the coal price. Therefore the modelled biomass price was escalated from the DECC 2009 cost to reflect the average year on year change of coal and gas costs. Nuclear fuel cost was escalated from £4.60/MWh according the medium demand growth curve of the IAEA Uranium Supply to 2050 report (2001) with a cap at £300/kg when extraction from seawater becomes economical. The Low nuclear fuel cost projection was established as constant at £4.60/ MWh, while the High cost projection rose to the £300/kg cap according to the High uranium demand curve used by the IAEA.

Carbon Costs

Carbon cost estimates for 2020, 2030 and 2050 from DECC's 2009 report "Carbon Valuation in UK Policy Appraisal" were utilised and a linear interpolation algorithm was employed to calculate the interval years.

Capital Costs

PB estimates were updated according to available cost data from recent tenders where possible and adjusted according to our assessment of changing market costs where no recent references are available.

Operation and Maintenance Costs

These were updated from the assumptions made for Powering the Nation 2008 update where appropriate.

Decommissioning Costs

Decommissioning costs were included where these will form a significant cost component and will exceed the scrap value of the plant. A decommissioning fund has been assumed in each case for these costs. The assumed contribution to the nuclear fund has been assumed to range between £0.4 and £1.2/MWh to cover both plant decommissioning and contribution to the disposal facility for waste.

Plant Economic Lives

A range of plant life-spans were assumed where appropriate. Alternative offshore wind cases incorporated costs incurred though replanting with identical blades and generators at midway though a 30 or 40 year life. Nuclear plant was assumed to have a 40 year life.

Construction Schedule

The same assumptions for construction schedule have been made as for the 2008 update of Powering the Nation.

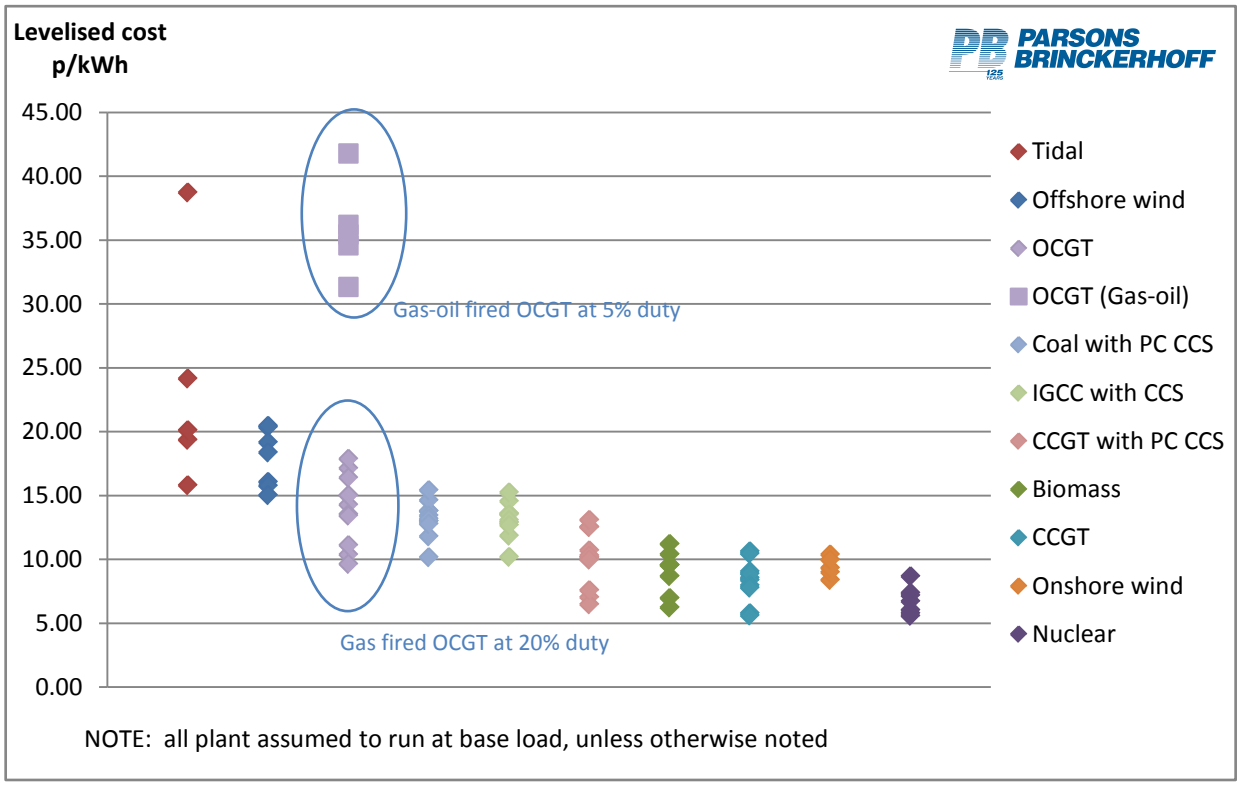
Presentation

We have decided to present the results slightly differently to the 2008 update to emphasise the range of uncertainty in plant costs and highlight the variation in cost contributions of different elements. This avoids the implications of labelling a 'central' generating cost for any generating plant type.

We have removed or revised certain plant types as they are not permitted to be constructed at the present time, e.g. unabated coal, because they are no longer considered likely to be a major contributor to capacity, e.g. BFBC biomass becomes 250MW biomass, or because there is not a leading technology type offering credible large scale application cost data e.g. wave.

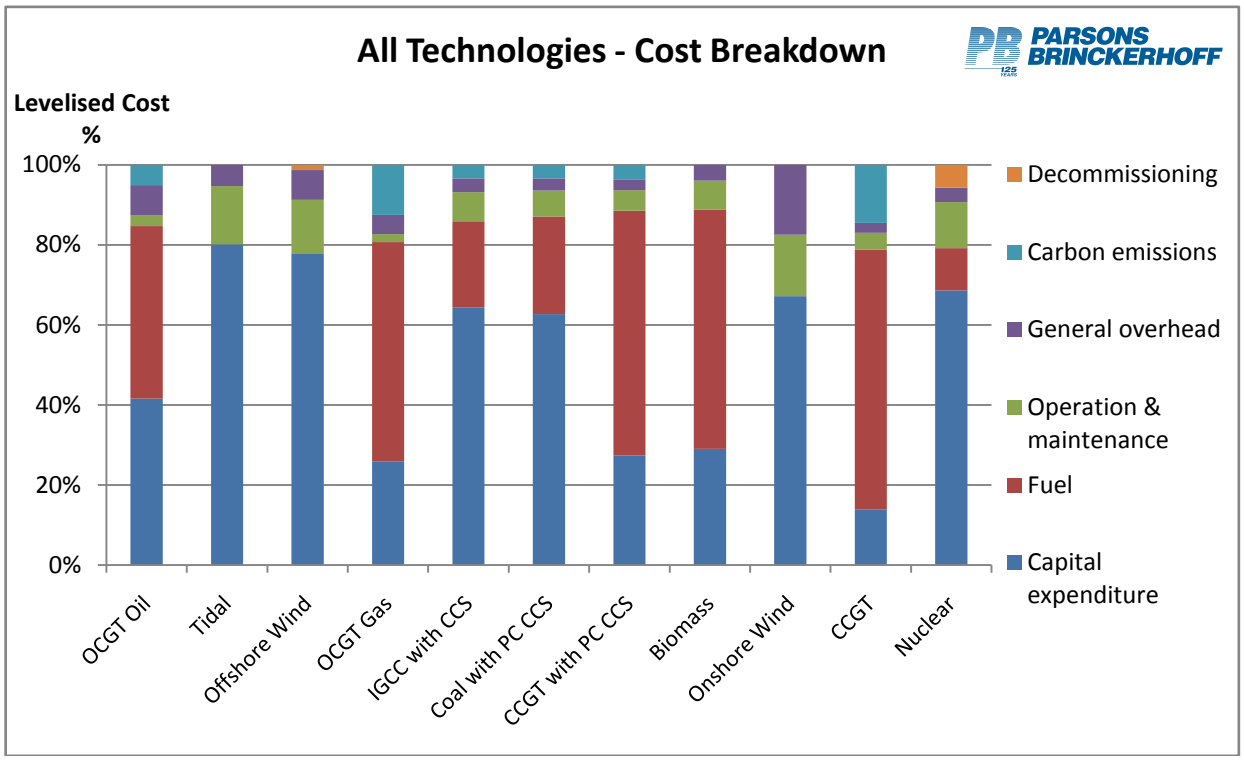
We have added CCS plant types to the original groups using the best available cost data to estimate their levelised costs of production.

Results



Levelised costs

The two sets of data for open cycle gas turbine (OCGT) reflect two alternative duties for this type of plant. The conventional duty of mid-merit to peak is represented by the gas fired OCGT with a typical load factor of 20%. The peak duty (5%) for OCGT may be increasingly required to manage transient conditions when there are fast declines in wind generation as weather patterns cross the country. In this case the plant would need to be oil-fired as gas supplies would be unlikely to be delivered quickly enough through the gas network.



Cost Breakdown

The cost breakdown graph emphasises the large variations in capital and fuel price contributions among the different plant types. The renewable technologies all have high capital cost contributions whereas the gas and oil burning gas turbine types all have substantial fuel cost components. Nuclear plant is similar to the renewables in having a high capital cost element and only a small fuel cost component. The plant types including carbon capture and storage have a significantly higher capital cost contribution, reflecting the high investment cost for these plant types.

The operation and maintenance costs vary over a small range reflecting the relatively consistent costs of this component, although the OCGT plants have a comparatively low value resulting from their restricted operating regime.

The general overhead costs are also relatively consistent, although onshore wind incurs higher costs due to the scattered distribution of relatively small installations and the recent increase in business rates.

Decommissioning costs are shown for offshore wind and nuclear and can be seen to be relatively small, if uncertain, elements in the total costs.

Comparison of findings with Powering the Nation 2008

Since 2008 there have been significant shifts in the market for power plant in the UK with particular advances in understanding of the opportunities for large scale renewable generation. This improved understanding has enabled better estimates for tidal and offshore wind to be developed.

Elsewhere changes in fuel prices, for gas in particular, has resulted in rising costs from several technologies.

The progress on preparing for a new programme of nuclear plant has resulted in clearer nuclear prices with manufacturers tendering for plant internationally so that up-to-date reference cost data is more widely available enabling all parties to better estimate the realistic outturn prices for nuclear generation.

These shifts have resulted in the 2010 price estimates diverging from the 2008 values. Indicative changes for the various types are as follows:

Plant type	Change relative to 2008
Tidal	+10%
Offshore wind	+70%
OCGT Gas	+5%
IGCC	+30% (change includes addition of CCS)
BFBC/ Large biomass	-5% (increase in capacity to 250MW)
Onshore wind	+20%
CCGT	+25%
Nuclear	+40%

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