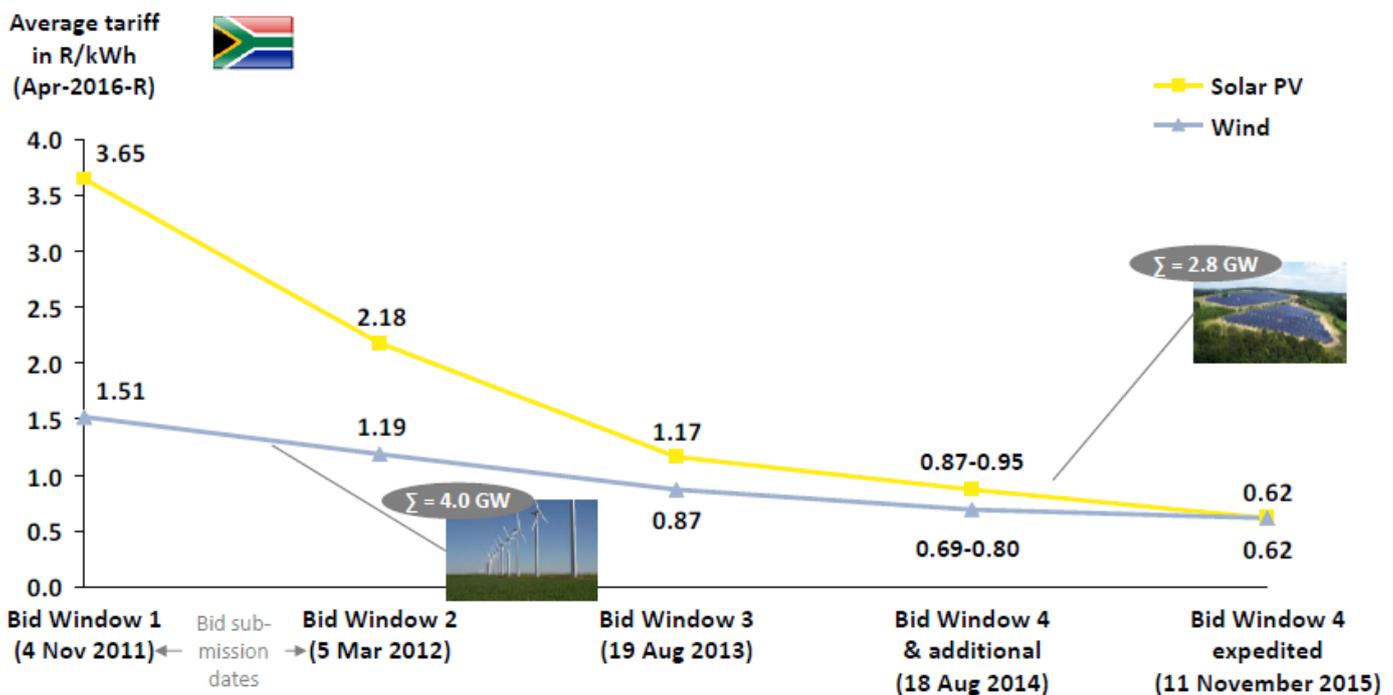


Electricity costs fact sheet

Calculating the full costs of energy supply options is a complex undertaking, even when social and environmental costs such as water and air pollution and their impacts on human health and productivity are left out of the reckoning. These are just one group of the costs that are traditionally external to commercial undertakings and carried by society, with these weighing most heavily on the poor, particularly local communities. Many other external costs are borne by the state, including the waste legacy of abandoned coal mines.

The cost of infrastructure required to support energy supply, even dedicated infrastructure such as railways for coal transport, is generally not included. Producing liquid fuels or electricity from coal uses vast amounts of water and relies on South Africa's extensive network of inter-basin water transfer systems, including on-going dam-building in the Lesotho highlands to increase transfers to the Vaal system, and onwards to the Waterberg coal-fields in Limpopo. When a small levy was first introduced on non-renewable electricity generation the primary reason given was to pay for the building of roads that were being destroyed by huge coal trucks in Mpumalanga.

For the purposes of South Africa's electricity supply planning such externalities are not factored into cost-optimisation modelling¹, or the recent debates about the costs of electricity generation from various technologies. This fact sheet therefore focuses on the effective cost of electricity fed into the transmission system. As may be seen this analysis² of the prices awarded for solar PV and wind power supply, costs can change substantially over time. (Since the value of a currency changes over time, the following table shows bid prices over the full bidding period adjusted for inflation, thus prices for the early years are here higher than they were set and reported at the time):



Sources: South African Department of Energy IPP Office's publications on results of first four bidding windows <http://www.energy.gov.za/IPP/List-of-IPP-Preferred-Bidders-Window-three-04Nov2013.pdf>; http://www.energy.gov.za/IPP/Renewables_IPP_ProcurementProgram_WindowTwoAnnouncement_21May2012.pptx; <http://www.ipprenewables.co.za/gong/widget/file/download/id/279>; IPP Office on Bid Window 4 expedited; StatsSA on CPI; CSIR analysis

Terminology

Levelised Cost of Electricity (LCOE): The principle of an LCOE is to give an indication of the cost of electricity from a particular technology or power plant over its lifetime – essentially the total of all costs involved, divided by the amount of electricity it is expected to supply – rendered in current monetary value. While the methodology for calculating

¹ The small levy charged on non-renewable electricity supply that represents some externalised costs (without specifying which costs) is sometimes included in costs assumptions

² Comparative analysis based on recent IPP announcements; Dr Tobias Bischof-Niemz, Head of CSIR's Energy Centre; Ruan Fourie, Energy Economist at the CSIR's Energy Centre; Pretoria, 14 October 2016

LCOE³ is different to that used in arriving at a bid price, these are broadly comparable, though an LCOE is an estimation and a bid price is an agreement and thus fixed (indexed to inflation).

Capital costs: estimated 'overnight' expenditure (excluding interest charged during construction) for plant, equipment and other resources in order to provide generation capacity. Planning generally uses benchmark capital costs from independent experts⁴ for making decisions between different supply investment options, as actual costs for plant construction may over-run the targeted cost.

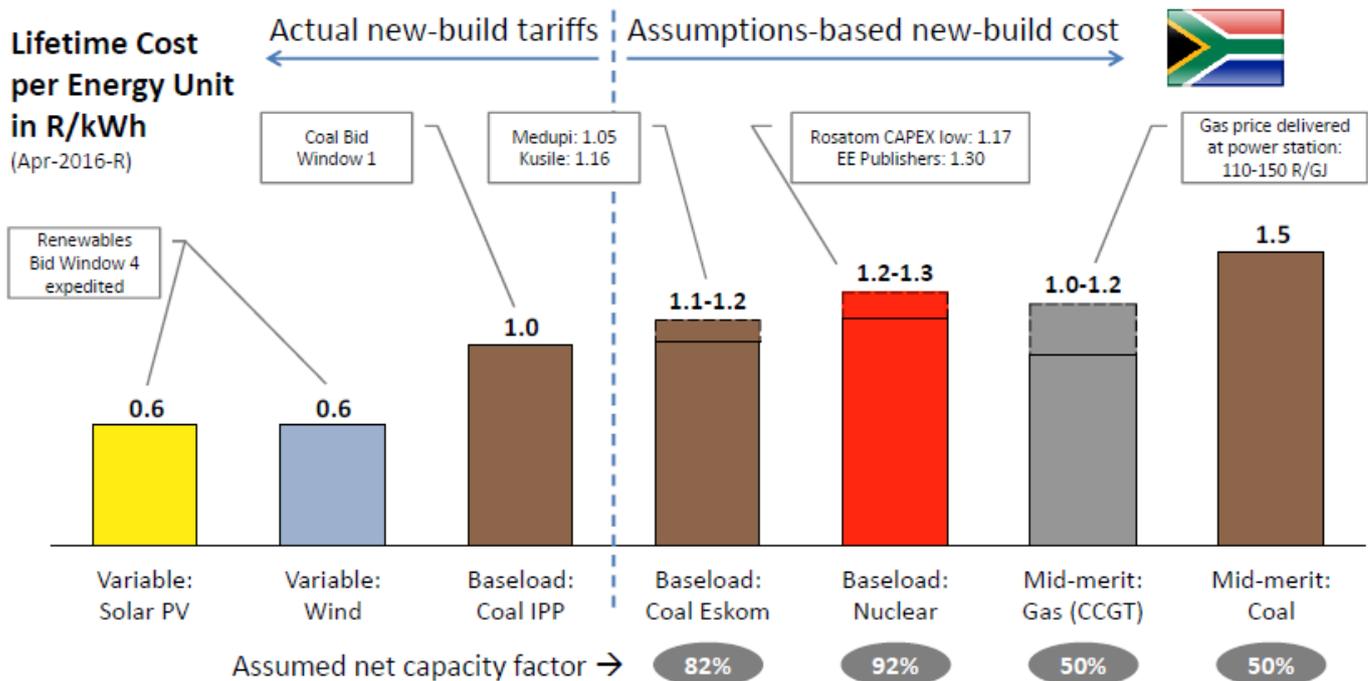
Cost of Capital, or the costs of financing: This is basically the interest to be paid on capital raised to deliver the plant and will depend on who is borrowing from whom, what entity is underwriting the financing etc.

Discount rate: As the cost of capital will be project-specific, for planning purposes a discount rate is used that may be seen as representing the cost of capital impartially. The larger the up-front capital costs as a proportion of total costs, such as for electricity generation technologies with low or no fuel costs, the greater the impact of financing arrangements, or of the choice of the discount rate for modelling purposes. A major change in cost-optimisation modelling outputs can be caused by a small change in the discount rate, which for SA's Integrated Energy Planning is set, as recommended by Treasury, at 8%.

Bid price: the price agreed for paying independent power producers under different bidding windows or rounds of the competitive bidding process. The bid price is made up of capital costs, financing costs and other elements imposed by the competitive bidding programme, including a provision for socio-economic development. There are different methodologies for different types of technology, including for covering the grid connection costs.

Tariffs or electricity prices: a combination of charges covering various aspects of supply including distribution, grouped into a coherent set of tariffs, that may be applied at different rates for various classes of electricity users.

Cost of new power generators in South Africa: (as above: CSIR Energy Centre; Pretoria, 14 October 2016)



Note: Changing full-load hours for conventional new-build options drastically changes the fixed cost components per kWh (lower full-load hours higher capital costs and fixed O&M costs per kWh); Assumptions: Average efficiency for CCGT = 55%, OCGT = 35%; nuclear = 33%; IRP costs from Jan-2012 escalated to Apr-2016 with CPI; assumed EPC CAPEX inflated by 10% to convert EPC/LCOE into tariff; Sources: IRP 2013 Update; DoE IPP Office; StatsSA for CPI; Eskom financial reports for coal/diesel fuel cost; EE Publishers for Medupi, Kusile & nuclear cost; CSIR analysis

³ While there is a common formula for LCOE, how the different components are quantified can differ and different assumptions (e.g. load factors) are used by different institutions, so different assessments are common for the same plant type in one country or market.

⁴ For South Africa's Integrated Resource Planning for electricity, benchmark costs were commissioned from the Energy Price Research Institute (EPRI) in California, USA.