



Water - 2010 Input Parameter Data Sheet (Externality)

This sheet is to be used as the primary stakeholder engagement tool. This document provides the information that will allow the stakeholders to make a meaningful contribution to the IRP Input parameters.

Parameter	Water (is used for Electricity Production purposes and cooling for thermal plants in RSA – and excludes water consumption for the production of coal).
Purpose	<p>The electricity industry accounts for about 2% of total fresh water use. Any failure in water supply to this sector will directly affect electricity production and hence economic activity.</p> <p>Consequently, water for electricity is considered to be a “strategic use” and must be supplied with a high level of assurance (99.5%). Water infrastructure and resource development requires long lead times of the order of 8 to 10 years. Bulk water infrastructure is implemented by the DWEA and will be via a project-financing model.</p>
Impact on the IRP	<p>South Africa is a semi-arid country with annual rainfall levels about half the world average. South Africa is ranked the 30th driest country in the world with only 8.6% of the rainfall available as surface water. This is one of the lowest conversion ratios in the world. The spatial distribution of the water resources in the country, are such that there is a mismatch between demand and supply.</p> <p>The availability of water could be a severe constraint on generation technology and plant location.</p> <p>Different generation options considered in the IRP studies have different water requirements. The choice of cooling technology for the production of electricity, and the associated air pollution abatement requirements has a significant impact on water usage. Also the steam cycle in electricity generation power plants requires demineralised water, whilst water for the cooling systems needs to be within certain quality thresholds. Hence poor water quality increases treatment costs, requires capital-intensive water and waste treatment technology options, increases effluent generation and water use.</p> <p>The preferred location of future coal-fired power stations (dictated largely by proximity to coal</p>



reserves) is not coincident with water resource availability. Existing and new water assets are required to be developed, operated and managed effectively to ensure a reliable and continuous supply of water. There are long lead times between investment decisions and the commencement of production for electricity generation and water delivery from bulk water infrastructure projects. These investments are of a long-term nature and capital intensive and contribute to the water cost drivers and may impact on choice of supply mix. For example, from a fuel availability point of view it may be prudent to build coal fired power stations in the Waterberg area. However the water in the Waterberg area is severely restricted at present and the long-term water supply will need to be augmented to accommodate additional power stations in that area. The current lead-time for the water projects in the Waterberg is almost 10 years at a cost exceeding R10 billion. The potential cost share of each future user still needs to be determined. The table below gives estimates on the Waterberg water pipeline cost.

Early estimates of Waterberg pipeline cost

Estimated MCWAP Pipeline Cost Phase 2a					
Including Sasol			Excluding Sasol		
Cost (Real)	Marginal	Nominal	Cost (Real)	Marginal	Nominal
08-Apr		Cost	08-Apr		Cost
Rbn	Rbn	Rbn	Rbn	Rbn	Rbn
6,8		12,9	3,8		8,1
7,2	0,4	13,3	4,7	0,9	9,0
7,5	0,3	13,6	5,7	1	10,0
7,8	0,3	13,9	6,75	1,05	11,1
8,1	0,3	14,2	7,3	0,55	11,6

Such costs and lead times for water projects could have an enormous impact on the choice and timing of options in the IRP plan.

The assumptions included in establishing the parameter values in this

Water availability is one of the important requirements that must be taken into account when siting a power station. The following are the assumptions to be considered for the water parameter:

- Type of plant
- Efficiency of plant



sheet	<ul style="list-style-type: none">• Choice of cooling technology• Location of power plant• Inclusion of emission removal equipment, eg FGD, CCS• Climatic conditions of the host country (area) where plant is going to be located																																				
Parameter Value	<p>The consumption of water is highly dependent on the technology choice for both the production of electricity and the cooling. For instance, dry-cooling is more than 15 times more efficient in the consumption of water compared to wet-cooling (0.12 litres per kWh compared to 1.90 l/kWh). The introduction of pollution abatement technologies, such as flue gas desulphurisation (FGD) to reduce sulphur dioxide emissions, increases water use from 0.12 to approximately 0.37 l/kWh. The tables below give an indication of specific and overall water consumption for pulverized fuel (PF) plant and a fluidized bed combustion (FBC) plant respectively.</p> <table border="1" data-bbox="368 1005 1449 1337"><thead><tr><th>Component</th><th>Specific Water Use [l/kWh]</th><th>Annual Water Consumption [Mcm/a]</th></tr></thead><tbody><tr><td>Dry Cooling PF</td><td>0.16</td><td>6</td></tr><tr><td>FGD</td><td>0.25</td><td>9</td></tr><tr><td>CCS</td><td>0.10</td><td></td></tr><tr><td>Sub-Total</td><td></td><td>15</td></tr><tr><td>Coal Washing</td><td>0.15</td><td>5</td></tr><tr><td>Total</td><td></td><td>20</td></tr></tbody></table> <table border="1" data-bbox="368 1379 1449 1630"><thead><tr><th>Component</th><th>Specific Water Use [l/kWh]</th><th>Annual Water Consumption [Mcm/a]</th></tr></thead><tbody><tr><td>Dry Cooling FBC</td><td>0.16</td><td>6</td></tr><tr><td>FGD</td><td>0.25</td><td></td></tr><tr><td>CCS</td><td>0.10</td><td></td></tr><tr><td>Total</td><td></td><td>6</td></tr></tbody></table> <p>Note: FBC can be operated without FGD provided the SO_x standards are not too stringent. However there is a point where the FBC technology on its own does not comply and require FGD.</p> <p>Concentrated Solar Power (CSP) will be located in the desert/semi-desert areas of the country. As such, the water for CSP plant might require re-allocation of water rights in the short to</p>	Component	Specific Water Use [l/kWh]	Annual Water Consumption [Mcm/a]	Dry Cooling PF	0.16	6	FGD	0.25	9	CCS	0.10		Sub-Total		15	Coal Washing	0.15	5	Total		20	Component	Specific Water Use [l/kWh]	Annual Water Consumption [Mcm/a]	Dry Cooling FBC	0.16	6	FGD	0.25		CCS	0.10		Total		6
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	medium-term, and new water supply infrastructure (possibly pipelines) in the longer term.
Range of Parameter Value	Dependent on technology choices and range from 0.1 to 1,9 l/kWh
Preconditions necessary to make possible for this parameter to be included in the IRP	This parameter is a constraint on generation technology and siting options. Investment in generation can only proceed if reliable water supply is assured.
Parameter Owner	DWEA/DoE