



Reserve Margin - IRP 2010 Input Parameter information sheet (Supply input)

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	Reserve Margin
Purpose	<p>Electric power systems must be designed to have adequate generation capacity to cost-effectively meet anticipated consumer demand at all times, and to operate reliably in the face of possible unplanned equipment outages and fluctuations in demand due to occurrences such as unusually cold weather conditions.</p> <p>The extra generation capacity that is available to meet such contingencies and that also allows reserve capacity for planned outages is referred to as the reserve margin.</p> <p>Reserve Margin, as used in this parameter information sheet, refers to the amount of electric generation resources planned to be available in the electricity generation system, as compared to the system's expected maximum demand for the year. It is calculated as follows:</p> $\text{Reserve Margin} = \frac{\text{Generation Resources} - (\text{Maximum Demand} - \text{DMP} - \text{DSM})}{(\text{Maximum Demand} - \text{DMP} - \text{DSM})}$



<p>Impact on the IRP</p>	<p>IRP is the methodology through which generation expansion planning is performed in order to facilitate investment decisions that will achieve and maintain an adequate reserve margin. Because the reserve margin is a static measure of generation reliability, it must be reviewed and, if necessary, revised every few years or when significant system changes occur. This is common practise in both Europe and North America.</p> <p>The reserve margin is not a sophisticated measure. The percent reserve margin does not explicitly evaluate the effects of unit size or performance, the size of the system or the strength of its interconnections in each situation but does establish general guideline. Utilities generally use more sophisticated methods to evaluate reliability with the results expressed as a reserve-margin outcome.</p>																																							
<p>The assumptions included in establishing the parameter values in this sheet</p>	<p>The reserve margin used is based on the <i>Stage 3 Report. Electrical Resource Needs Analysis: Adequate Reserve Margin for Development of Third National Integrated Resource Plan for South Africa.</i></p> <p>The capacity included in the Reserve Margin calculation for each plant should be the capacity credit for that facility. The capacity credit is not the facility's installed capacity, but rather the generation capacity available under specified conditions. The table below shows illustrative values for various generation technologies.</p> <table border="1" data-bbox="368 1211 1406 1704"> <thead> <tr> <th>Technology</th> <th>Credited Capacity (% of Total Operational Capacity)</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>Coal-fired</td> <td>100</td> <td></td> </tr> <tr> <td>Combine-cycle Gas Turbine</td> <td>100</td> <td></td> </tr> <tr> <td>Open-cycle Gas Turbine</td> <td>100</td> <td>Assuming large fuel storage</td> </tr> <tr> <td>Pumped Storage</td> <td>100</td> <td></td> </tr> <tr> <td>Hydro</td> <td>100</td> <td>Large pond</td> </tr> <tr> <td>Hydro</td> <td>Less than 100</td> <td>Small pond, intermittent water inflow</td> </tr> <tr> <td>Nuclear</td> <td>100</td> <td></td> </tr> <tr> <td>Wind</td> <td>5 to 25</td> <td>Intermittent, depending on wind</td> </tr> <tr> <td>Concentrated Solar without Storage</td> <td>Less than 100</td> <td>Intermittent, depending on sun</td> </tr> <tr> <td>Concentrated Solar with Storage</td> <td>100</td> <td>Not intermittent, storage compensates</td> </tr> <tr> <td>Biomass, biogas</td> <td>10 to 100</td> <td>Whether intermittent or not</td> </tr> <tr> <td>Co-generation</td> <td>10 to 100</td> <td>Whether intermittent or not</td> </tr> </tbody> </table> <p>The assumptions and method for calculating these capacity credits need to be agreed beforehand.</p>	Technology	Credited Capacity (% of Total Operational Capacity)	Comment	Coal-fired	100		Combine-cycle Gas Turbine	100		Open-cycle Gas Turbine	100	Assuming large fuel storage	Pumped Storage	100		Hydro	100	Large pond	Hydro	Less than 100	Small pond, intermittent water inflow	Nuclear	100		Wind	5 to 25	Intermittent, depending on wind	Concentrated Solar without Storage	Less than 100	Intermittent, depending on sun	Concentrated Solar with Storage	100	Not intermittent, storage compensates	Biomass, biogas	10 to 100	Whether intermittent or not	Co-generation	10 to 100	Whether intermittent or not
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<p>Parameter</p>	<p>The current level is 15% Reserve Margin. An expected un-served energy measure of less than</p>																																							



Value	0,002% of the total expected energy in each year (or less than 20GWh in absolute terms). Cost of Unserved Energy: R75 000/Mwh
Range of Parameter Value	<p>Internationally, percent reserve margin requirements usually fall in the range of 15% to 25%.1</p> <p>Source: Review of Methodology and Assumptions Used in NEMMCO 2003/04 Minimum Reserve Level Assessment. 11 January 2005.</p> <p>In NIRP3, the following results were obtained:</p> <p>“This study concludes that a 14% reserve margin is required in order to meet a “1 Day in 1 Year” reliability criteria. However, there is still some confusion on the genesis and evolution of the “1 Day in 1 Year” reliability criteria in South Africa.” and further...</p> <p>“The analysis conducted in this report show that there are significant improvements (i.e., reductions) in the total CUE as the reserve margin progresses from 13% to 19%. After 19%, there is very little improvement in CUE. This, combined with the relatively low cost of new OCGTs, is what drives the economic approach to the reserve margin calculation to arrive at a 19% answer.”</p> <p>Source: Electrical Resource Needs Analysis: Adequate Reserve Margin for Development of Third National Integrated Resource Plan for South Africa</p>
Preconditions necessary to make possible for this parameter to be included in the IRP	<p>Preconditions necessary to make possible for this parameter to be included in the IRP are:</p> <ol style="list-style-type: none">1. The level of the reserve margin and the methodology for establishing it must be approved by the DoE.2. Acceptance by the DoE of value of the cost of unserved energy to be used in the IRP.
Parameter Owner	DOE with input from NERSA and System Operations Planning Department.