

Preliminary Results - South Africa Grid Integration Study

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Motivation

NREL and Eskom have partnered to perform a state-of-the-art grid integration study to (1) improve South Africa's technical capacity to conduct medium- and long-term power system simulations and (2) better understand scenarios under which the South African grid could effectively support higher penetrations of variable renewable energy (vRE).

Problem Statement

With wind and solar prices in South Africa continuing their downward trend and becoming cheaper than most conventional alternatives, an increase in the share of vRE on South Africa's grid is likely. To adequately plan for this vRE transition, we must investigate the effects this may have on the South African grid and examine the power system's ability to support high penetrations of renewable energy—both today and in the future. The South African Grid Integration Study (SAGIS) will investigate the technical, economic, and operational implications of various vRE futures for South Africa, using the latest tools and modelling.

Methodology

NREL and Eskom have cooperated to increase the fidelity of Eskom's planning and operation model through spatial disaggregation, including addition of transmission and geographical representation of resources such as wind and solar resource profiles generated in collaboration with the CSIR. Extensive testing has been performed on NREL's supercomputer, and new software tools to visualize inputs and outputs have also been developed.

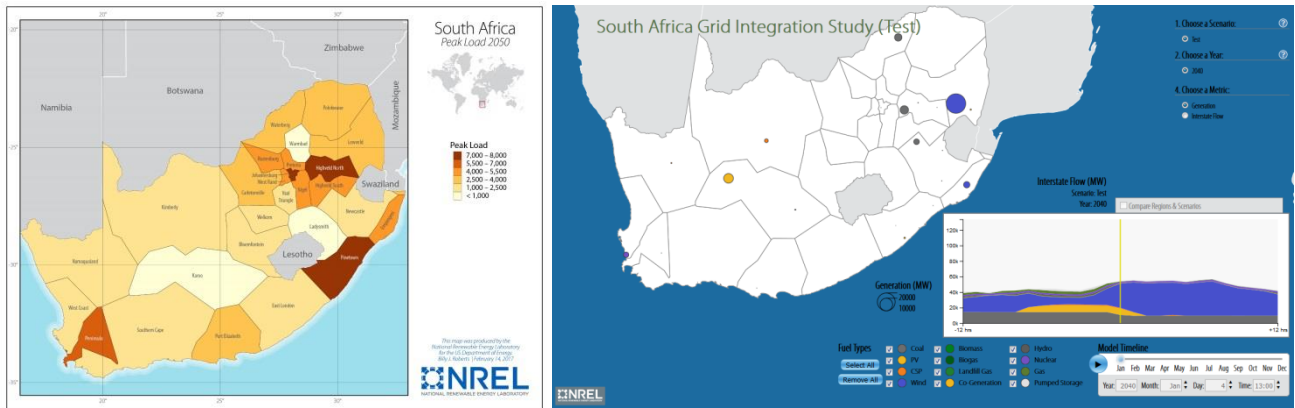
With these new modelling tools, different scenarios of varying vRE will be explored in both long- and short-term models to reveal trends of system stability and costs. Additionally, model inputs related to factors both within our ability to change (e.g. increased demand response) and outside of our control (e.g. weather patterns) will be examined to understand the effects these factors have on the aforementioned trends and provide insight as to what pathways can or must be pursued to enable higher vRE futures.

Results

This paper will present preliminary results of the ongoing SAGIS. We will continue to explore various vRE scenarios to inform a generation build-out plan that more holistically addresses the complexities associated with modelling variable and uncertain renewable energy resources. These results will answer two primary questions:

- 1.) *Given how the South African power system is planned and operated today, what are the technical, economic, and operational implications of different variable RE futures in South Africa? How robust are these results?*
- 2.) *What pathways can or must be pursued in order to achieve higher vRE futures? What are the key dependencies and levers that can be addressed to lead to higher vRE futures?*

NREL and Eskom will complete detailed scenario modelling to answer these and other analysis questions focused on issues of adequacy and grid flexibility under various South African RE futures. Early examples of the investigative tools developed are below:



Conclusions

This study is still ongoing. However, by November we aim to have a thorough understanding of the economic and technical inflexion points of integrating vRE into the South African grid today as well as the drivers and levers that may enable even higher RE futures out to 2035 and beyond.