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An investigation into the use of smart grid technologies for the Northern Cape Province of South Africa, where extensive solar generation is planned in a constrained network

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Abstract

Large scale distributed generation is expected to be implemented in South Africa for the first time due to government initiated programmes aimed at increasing the utilization of renewable energy resources for power generation. Solar photovoltaic distributed generation is proposed in the vast majority of renewable energy power generation independent power producer applications received in the Northern Cape of South Africa; therefore the integration of these units into the distribution networks presents a great challenge. The current distribution network was not originally designed for integration of distributed generation at such high penetration levels. Expensive and lengthy network reinforcement and strengthening projects will need to be implemented in the distribution network to facilitate safe and reliable interconnection of distributed generation at higher penetration levels. This report gathers and documents the major challenges such as: voltage regulation, equipment thermal ratings, power quality, and protection coordination related to solar photovoltaic distributed generation interconnection to constrained distribution networks. Smart grid technologies which enable higher penetration of distributed generation and provide a cost-effective alternative to network strengthening are investigated. Based on the South African context, a Smart Grid technology approach is proposed and the Smart Grid technologies which offer tangible and direct benefits in the short term are prioritised for implementation.