

Abstract

Power system adequacy has been historically insufficient in the Southern African Power Pool (SAPP) region with resulting negative effects on economic growth and electrification efforts. Existing domestic regulatory frameworks and opaque long-term bilateral contracting for procuring capacity in the region have been shown to be insufficient in ensuring system adequacy. The concept of an adequacy product in the form of a Capacity Mechanism (CM) introduced into the SAPP region has not yet appeared in the literature. A Capacity Mechanism (CM) for the SAPP region has been proposed and designed as part of this research to address this. A framework has been developed to consider CMs via the combination of a screening assessment, quantitative (model-based) analysis of more favourable CM options and an identification and quantification of key design elements. The developed framework can also be generalised and applied to other jurisdictions where CMs are under consideration. A regional CM which transparently and explicitly values capacity is proposed in the form of a forward-looking annual Capacity Auction that is locationally disaggregated, supplied by all possible supply-side resources with all feasible SAPP market participants included. The CM should be technology agnostic and account for the dual requirement for firm capacity to meet peak demand and firm-energy to meet annual energy requirements considering the dominance of hydro-based capacity in the region when excluding South Africa. There should be a lead-time of 3-4 years with the possibility of long-term auctions for large hydro-based capacity. Strict market monitoring and adherence to performance incentives and penalties will need to be ensured to avoid exercising of market power considering the dominant size of the South African power system. Appropriately mandated institutions to run Capacity Auctions would include the SAPP Co-Ordination Centre as well as a sufficiently mandated regional regulatory body. A further contribution is made in the form of a public domain power system dataset of the SAPP region with sufficient detail to be used in power system operations and planning efforts by future researchers and practitioners.