

ENGINEERING CONSULTING SERVICES

Report for Review of AEMO System Study Procedure and Results – South Australian System Strength Studies

Australian Energy Market Operator

Attention:

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1 Introduction

The Manitoba HVDC Research Centre (hereafter “MHRC”), a division of Manitoba Hydro International Ltd. (hereafter “MHI”), was contracted by the Australian Energy Market Operator Ltd. (hereafter “AEMO”) for review of the study criteria that are being followed to determine system operational procedures and guidelines on the minimum quantity and combinations of synchronous generators in South Australia (SA) with respect to the amount of online wind generation.

MHI reviewed the study objectives, the system modeling approach and selection of study scenarios and the criteria adopted to arrive at study conclusions.

MHI also reviewed the actual PSCAD™/EMTDC™ models being used for the studies, the key aspects of the models, model inputs and assumptions, and the overall methodology. In addition, key study assumptions were also provided by AEMO to be reviewed by MHI.

2 Review Comments

The following review comments are provided with respect to the information provided by AEMO:

- Model validation: AEMO had presented validation of the model response with actual recorded measurements of the SA Black system event of September 2016 for individual wind farm/synchronous generator models, as well as the overall integrated model of the SA power system. The models showed very good accuracy levels as presented in the report published by AEMO. The model has been further expanded and improved for ongoing studies. In addition, detailed protection and relaying modules were added to predict key system element tripping more accurately.
- Studies place a specific focus on support of conventional generation in terms of adequacy or lack of fault level, inertia and synchronizing torque, and the stability of the Heywood Interconnector or its disconnection due to out-of-step conditions. This is an important consideration, and study scenarios are selected to identify acceptable operating criteria (e.g. Impact of increasing the number of conventional generating units).
- The study assumptions as listed by AEMO are valid and follow good engineering practice and judgement.
- The study scenarios that AEMO has considered cover a wide range of critical operational conditions and have been selected based on good engineering judgement.
- AEMO has done a thorough review of study results and considered practical operational situations when arriving at final conclusions (unsuccessful or unsuccessful operating scenario).

3 Reviewer Profile

Dharshana Muthumuni, Ph.D., P.Eng., is the Managing Director of the Manitoba HVDC Research Centre, a division of Manitoba Hydro International. He has over 20 years of experience in engineering studies using a variety of simulation products, including PSCAD™/EMTDC™ and PSS/E. His expertise is regularly sought out by clients around the world for his strong and wide ranging technical knowledge on power system behavior, model development, and simulation studies. He has lead the technical team to solve challenging problems, including HVDC and generation interconnections, wind integration into weak grids, FACTS based solutions, SSR screening techniques, and power quality and harmonics.

Dharshana has worked extensively and closely with equipment vendors to develop simulation models and techniques to address difficult interconnection problems. He has developed many custom models and simulations techniques for specific studies, including working closely with equipment vendors to address their simulation study requirements.

In addition to his engineering study experience, Dharshana has been a key contributor to the development of PSCAD™/EMTDC™ simulation tool and has conducted training workshops on a variety of power system topics for our global clients. He has led our engineering teams on a number of engineering study projects, including the Saudi Electric Company system operation and interconnection project.