

**POWER ENGINEERING COMPETENCY FRAMEWORK FOR POWER ENGINEERING PROFESSIONALS IN PUBLIC SERVICE  
TECHNICAL SKILLS AND COMPETENCIES (TSC) REFERENCE DOCUMENT**

<b>TSC Category</b>	Decentralisation					
<b>TSC Title</b>	Distributed Energy Resources Implementation and Interconnection					
<b>TSC Description</b>	Manage the implementation of Distributed Energy Resources (DER) and their interconnection with electric power systems and the regional power grid					
<b>TSC Proficiency Description</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>	<b>Level 5</b>	<b>Level 6</b>
				<b>&lt;Insert TSC Code&gt;</b>	<b>&lt;Insert TSC Code&gt;</b>	<b>&lt;Insert TSC Code&gt;</b>
				Apply knowledge of power engineering in tender specification and project management for implementation of DER	Assess DER technologies for projects taking into consideration technical feasibility and interconnection requirements with power systems	Evaluate proposals and provide technical guidance on implementation and interconnection of DER with power systems and the regional power grid
<b>Knowledge</b>				<ul style="list-style-type: none"> <li>• Power distribution network configuration and distribution protection</li> <li>• Types of types of DER, including generators, solar, and wind power</li> <li>• Principles, operation and performance characteristics of DER and grid control</li> <li>• Operating principles of grid connected inverters</li> <li>• Principles of microgrids and islanding</li> <li>• Concepts of energy storage for residential and grid applications</li> <li>• Concepts of fault-clearing, reclosing and network protectors</li> <li>• Techniques for testing and commissioning DER installations</li> <li>• Technical performance mandates for DER</li> <li>• IEEE 1547-2018 standard and other</li> </ul>	<ul style="list-style-type: none"> <li>• Power system operations in Singapore</li> <li>• Distribution planning techniques and DER siting</li> <li>• Types of analysis in DER planning</li> <li>• Operating methods involving DER</li> <li>• DER and microgrid protection, control and stability</li> <li>• DER impact on power system protection, power system stability and power quality</li> <li>• Interfacing requirements of DER installations to power grids</li> <li>• Requirements for existing network upgrade to accommodate DER</li> <li>• Testing and commissioning of DER installations</li> <li>• IEEE 1547-2018 standard and other relevant regulations,</li> </ul>	<ul style="list-style-type: none"> <li>• Challenges in traditional power system operations</li> <li>• Energy security and efficiency issues</li> <li>• Distribution planning and operating methods involving DER</li> <li>• Power flow analysis, quasi-static time series and reliability analysis for DER planning</li> <li>• DER application issues</li> <li>• DER flickers and harmonics</li> <li>• Performance of whole power grids with anticipated trending in DER</li> <li>• DER policy in alignment with national energy policy and strategy</li> <li>• Performance standards for DER integration with power grids</li> <li>• IEEE 1547-2018 standard and other relevant regulations, industry standards,</li> </ul>

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				relevant regulations, industry standards, codes of practice and safety procedures	industry standards, codes of practice and safety procedures	codes of practice and safety procedures
<b>Abilities</b>				<ul style="list-style-type: none"> <li>Specify technical requirements of DER projects</li> <li>Assess performance, operation, and safety considerations of DER installations</li> <li>Manage the safe and reliable interconnection of DER to electric utility systems</li> <li>Witness testing of the interconnection and interoperability between DER and utility electric power systems</li> <li>Review standard mandates for DER capabilities including voltage regulations, frequency regulations, interoperability, and ride through</li> <li>Oversee testing and commissioning of DER interconnection with electric utility systems</li> <li>Analyse impacts of DER on power quality and reliability</li> <li>Review compliance with relevant regulations, standards and codes of practice</li> </ul>	<ul style="list-style-type: none"> <li>Conduct simulation study on DER proposals</li> <li>Advise on distribution planning and DER siting</li> <li>Assess the impact of DER on power system power quality, transmission and distribution protection</li> <li>Analyse and evaluate interfacing requirements of DER installations with power grids</li> <li>Review system configuration designs for DER projects</li> <li>Evaluate requirements for existing network upgrade to accommodate DER projects</li> <li>Assess DER application issues involving islanding, voltage regulation, fault-clearing, grounding and harmonics</li> <li>Review compliance with relevant regulations, standards and codes of practice</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate trends in DER technologies and their deployment</li> <li>Approve technical requirements and performance standards for DER installations</li> <li>Collaborate with stakeholders to develop DER infrastructure</li> <li>Advise on optimum locations for large scale DER with understanding of localised grid capability</li> <li>Manage the operation and maintenance of DER facility</li> <li>Coordinate DER infrastructure development with Singapore's energy policy and power grid infrastructure planning</li> <li>Resolve DER application issues involving islanding, voltage regulation, fault-clearing, grounding and harmonics</li> <li>Evaluate impact of renewable generation intermittency and DER switching on/off on system power quality</li> <li>Recommend procedures for compliance with relevant regulations, standards and codes of practice</li> </ul>

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