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

TSC Category	Decentralisation					
TSC Title	Hybrid AC and DC Power Distribution and Utilisation					
TSC Description	Manage the upgrading or new implementation of power distribution networks and electrical installations to facilitate the co-existence of AC and DC technologies					
TSC Proficiency Description	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Level 6**
			<Insert TSC Code>	**<Insert TSC Code>**	**<Insert TSC Code>**	**<Insert TSC Code>**
			Oversee installation, operations and maintenance of hybrid AC and DC power distribution systems	Review tender specifications and commissioning works of hybrid AC and DC power networks	Manage power distribution infrastructure projects which have a mix of AC and DC power systems	Plan new or upgrading of existing power distribution infrastructure which presents opportunities or requirements for a mix of AC and DC technologies
Knowledge			• Principles of power distribution • Types of AC and DC power systems • Types of hybrid AC and DC systems • Configuration of hybrid AC and DC systems • Fault location in hybrid AC and DC systems • Electricity measurement tools and techniques • Relevant regulations, industry standards, codes of practice and safety practices	• Power distribution systems in Singapore • Concepts of AC and DC technologies including high-voltage, direct current (HVDC) • Principles of power conversion • Operating principles and configuration of hybrid AC and DC systems • Functions of AC and DC power converters • Hardware configuration and implementation of hybrid AC and DC power distribution systems • Operational modes including AC and DC microgrid operation, DC microgrid operation, AC system operation • Types of energy losses, faults and energy distribution efficiency • Relevant regulations, industry standards, codes of practice and safety practices	• Concepts of power electronics, renewable energy and energy storage systems • AC and DC technologies and their applications • Advantages and applications of hybrid AC and DC power distribution systems • AC and DC power system upgrading, integration and interfacing principles • High-voltage, direct current (HVDC) technologies • Advanced configurations and topologies of hybrid AC and DC systems • Design, control algorithm and implementation of hybrid AC and DC systems • Implantation and operation costs of hybrid AC and DC systems • Relevant regulations, industry standards,	• Integration of renewable energy and energy storages with power grids • Energy security and efficiency issues • AC and DC technologies and their applications • Challenges in power system upgrading, integration and interfacing • Use cases and best practices for implementation of hybrid AC and DC power distribution systems • Feasibility and practicability considerations • Whole-of-government energy security and efficiency principles • Relevant regulations, industry standards, codes of practice and safety practices

					codes of practice and safety practices	
Abilities			• Interpreting single-line diagrams of power distribution systems • Apply the theories of AC and DC technologies in power systems maintenance works • Oversee operations of hybrid AC and DC power distribution systems • Identifying the functions of various components in hybrid AC and DC power systems • Oversee fault locating and identification in hybrid AC and DC power systems • Instrumentation and metering for hybrid AC and DC power systems • Complying with regulations, industry standards, codes of practice and safety practices	• Review single-line diagrams of power distribution systems • Support implementation projects on AC and/or DC power networks • Review configuration parameters and procedures to implement hybrid AC and DC systems • Prescribe appropriate implantation of AC and DC power converters • Witness simulations to test various operational modes with respect to fault location • Monitor and track energy losses and faults • Identify relevant regulations, industry standards, codes of practice and safety practices	• Manage implementation projects on AC and/or DC power networks • Apply design rules and technical requirements for upgrading to hybrid AC and DC systems • Evaluate the quality, performance and reliability of hybrid AC and DC systems • Resolve issues in upgrading power distribution systems to accommodate the co-existence of AC and DC technologies • Evaluate system reliability and resilience with respect to operational modes in the event of faults • Review compliance with relevant regulations, industry standards, codes of practice and safety practices	• Analyse and optimise on integration strategies of distributed energy resources with power grids • Advise the usage of hybrid AC and DC systems for energy efficiency in the future • Work with research organisations to test new hybrid AC and DC technologies • Establish procedures to upgrade power distribution systems to accommodate the co-existence of AC and DC technologies • Guide on issues on long-term performance and reliability of hybrid AC and DC systems • Evaluate feasibility based on financial and economic considerations • Establish procedures to drive compliance with relevant regulations, industry standards, codes of practice and safety practices