Protection Design and Operational Requirements for Practical Microgrids

Quanta Technology provides consulting services, practical solutions and testing capabilities to support utilities and electric industry projects in the area of microgrid planning, design and deployment. One of the key aspects of a microgrid system is the design of a proper protection scheme and identification of operating procedures, particularly with the proliferation of Distributed Energy Resources (DERs) and utilization of emerging technologies. Our practical experience and insight into understanding of various microgrid applications come from involvement in feasibility studies, systems design, technology selection, field deployment, and operational analysis of several utility and government-sponsored projects. Quanta Technology experts have helped utilities and developers define protection requirements, implement innovative fault detection and isolation schemes and test them using real-time hardware-in-loop procedures.

Microgrids Protection Analysis

Due to multiple operational scenarios, system configuration alternatives, and possibility of utilizing multiple DERs, microgrid protection design and analysis has become a complex issue and a challenging task. The high penetration of DERs affects traditional protection systems in the following ways:

- Miscoordination among protective devices including unplanned blowing of fuses and desensitization of relay set points
- Misoperation of sectionalizers due to presence of voltage on distribution circuits when DERs are connected
- Misoperation of reverse-power and non-directional relays
- Sympathetic/false tripping of adjacent feeder relays due to DER fault current contributions
- Increased ratings of switchgear due to addition of DERs
- Changes in the feeder voltage profile and associated impacts on voltage-controlling mechanisms
- Auto-reclosing failure

The aforementioned issues can impact conventional protection practices in the distribution system leading to reduced system reliability. Therefore, it is essential to review/re-design existing protection schemes for microgrid applications.

For more information regarding Quanta Technology’s microgrid services and capabilities, please contact: Farid Katiraei at (647) 330-7379 or via email at fkatiraei@quanta-technology.com
Quanta Technology offers comprehensive microgrid protection studies and testing of conventional and/or advanced relay schemes by incorporating practical operating procedures while considering technology constraints. Examples of our services include:

- Review of the existing protection system and suggestion of the microgrid protection philosophy
- Protection system design for microgrids including the protection scheme as well as changes to the existing protective equipment
- Microgrid modeling in simulation software and evaluation of protection system through coordination studies and/or event analysis
- Real-time hardware-in-loop testing of the protection scheme
- Evaluation of communication-based protection schemes for the microgrid and identification of requirements

Microgrid Engineering & Consulting Services

Quanta Technology offers a wide range of engineering and consulting services in the area of microgrids, including:

- Modeling and simulation of microgrid dynamics
- Feasibility, cost-benefit, and reliability analysis
- System architecture and design selection and optimization
- Development of functional requirements and specifications for controllers, DERs (generation and storage) and grid interconnections and protections
- DER integration studies
- Designing functional requirements and performance of energy storage systems
- Load control and resource management strategies
- Functional testing and performance evaluation through real-time hardware-in-loop simulations

Quanta Technology helps utilities plan, design and operate microgrids. We develop protection and control schemes, and help you integrate disparate DERs to minimize impact on the electrical grid.

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