**FUTURE SMART GRIDS STRUCTURES**

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**BACKGROUND**

- Most renewable energy based power generation, energy storage systems and modern electronic loads are based on DC technologies.
- This necessitates new grid structure such as hybrid AC/DC and DC grids.
- Power electronic converters are key - 30% of produced power is processed by power converters today, which is expected to increase to 80% in the near future.
- New grid technologies are critical for future smart grids with higher efficiency, better power quality and enhanced capability to accommodate more renewable energy and modern loads.

This project focuses on:

- Hybrid AC/DC grids technologies
- Power electronics technologies
- Power and power quality management technologies

**SHORT-TERM OBJECTIVES**

- Develop advanced power electronics interfaces for renewable energy, energy storage and hybrid AC/DC link.
- Develop AC/DC grid technologies and power management strategies.
- Collaborate with other project teams and themes in smart grid and microgrid research.
- Establish the future smart grid technologies lab with hybrid AC/DC grid infrastructure at the 7th floor of ECERF.
- Develop more active collaborations with international partners on smart grid and power electronics research.

**PROJECT OVERVIEW**

- Hybrid AC/DC grids, renewable energy grid integration, smart grid power quality management, microgrids

**EXPECTED OUTCOMES**

Anticipated Short-Term Outcomes of This Project:

- New technology/IPs in new power converter topologies and smart converter functions for renewable energy integration;
- Power management and power quality control strategies for AC/DC grids and microgrid operations;
- Establishing a preeminent hybrid AC/DC smart grid lab at UAlberta that enables long-term advanced R&D in this area, with national and international collaborations.
- Working with other projects regarding new policies and market mechanisms for smart converters and ancillary functions.

**EXTERNAL PARTNERS**

External partners (existing or under development) include:

- Utility companies
- Power converter manufacturers
- Research institutions

These partners will add additional expertise on power system operation, remote microgrid analysis, hybrid AC/DC systems, and provide strong industrial, local and international collaboration.

**THEME OVERVIEW**

**Grids and Storage**

New technologies enable us to exploit renewable energy resources, but truly harnessing their energy requires the ability to control and adapt to the complex interaction between multiple sources and users. Smart grid technology will enable systems that can adapt to the variation in supply that is common from renewable sources, while new storage technologies will make it possible to retain energy generated at during peak times to be withheld for later use. Developing hybrid grids that can accommodate both AC and DC power, accommodating distributed generation, and effectively interfacing with legacy grid systems will be essential to our energy future.