Project Title: Microgrids Advanced Dynamic Control Architecture and Distributed Energy Optimization

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Lead Institution: Texas A&M University at Qatar
Co-Lead PI:
Co-Investigators:

Project/Technology Description

- **Objective:**

The goal of this project is to develop and implement a smart, novel, dynamic, real-time multi-layer concept of microgrid control with complete systematic management.

- **Key Results:**

1) Islanded and grid-connected modes of operation
2) Easy to implement
3) Improved control performance
4) Disclosure of Invention

Technical Approach and Solution:

- **Major Challenges addressed:** The challenge is that several sources must be able to connect seamlessly to or disconnect from the distribution grid whenever and wherever needed. Moreover, controlling many different sources having different characteristics will be very challenging due to the possibility of conflicting requirements and limited communication.

- **Approach/Solution:** Different approach and solutions have been used depending on the system, including grid-connected and islanded modes of operation. More detail information can be found in the final technical report.

Benefits/Potential Applications/Customers/Markets

- **Benefit:** The significance of this project to Qatar and humanity includes novel methodologies and ideas that will advance the research on microgrids and renewable energy systems.

- **Application:**
  - Smart Grid,
  - Agricultural farms
  - Renewable energy-based power generation system

- **Potential Customers/Market:** Qatar will be benefited from this applied research in field of utility, oil and gas sector, production plants by acquiring the necessary technology that will arise.

Key Outcomes

- The basic principles and the latest developments of microgrid controls, including islanded and grid-connected modes have been systematically described, and application examples have been indicated.
- It is demonstrated that microgrid is a very powerful and flexible concept for designing future power system. It presents several advantages that make it suitable for the agricultural farms, critical infrastructures, etc.
- Utilization, automation, and control assets were undertaken in different operational scenarios while taking into consideration the uncertainties of the renewable energy supplies, the energy consumption, and the electrical energy trading market.

Major Impacts: It has significant impact in the development of microgrids and their control.