Technology Overview

**RENEWABLE TECHNOLOGIES FOR GRID MANAGEMENT**

**THE BENEFITS**

- Renewable energy integrated microgrids are discrete energy systems consisting of distributed energy sources (including demand management, storage, and renewable energy generation), and loads capable of operating in parallel with, or independently from, the main power grid.
- Energy demand management, also known as demand-side management (DSM) or demand-side response (DSR), is the modification of consumer demand for energy.
- Energy storage systems are key to managing variations in energy demand and more importantly so with deployment of variable generation resources such as solar and wind. Technology options for energy storage include electrochemical batteries; flow batteries; fuel cells; flywheels; hydroelectric storage; compressed air energy storage (CAES); supercapacitors; and gravity-based storage.
- Power electronic devices are proven economical solutions for deferring transmission investment, increasing the capacity of existing grid infrastructure, and ensuring dynamic stability during system fluctuations, caused by non-dispatchable renewable generating resources.

**WHAT IS DRIVING ADOPTION?**

- Higher penetration of renewable energy in electricity mix
- Growing demand for distributed power generation
- Growing demand for distributed renewable energy
- Providing ancillary services such as frequency response, voltage control, or power factor correction and ensuring grid stability
- Increasing need for grid stability and resilience

**RENEWABLE ENERGY INTEGRATION THROUGH UTILITY SCALE PROJECTS AND DISTRIBUTED ENERGY RESOURCES (DER)**

- **Renewable Energy Technologies when appropriately employed can effectively reduce electricity peak demand, ensure energy security while simultaneously maintaining grid stability and resilience.**
- **Challenges to Scaling in KSA:**
  - Subsidized electricity costs and low energy demand affect financial viability of renewable energy and energy storage projects including microgrids.
  - Absence of regulatory frameworks to incentivize development of distributed energy resources, microgrids or energy storage projects.
  - Absence of financial incentives to subsidize peak demand periods and R&D.
  - Limited end user awareness and technology and benefits.

**THE OPPORTUNITIES**

- Subsidized electricity costs and low energy demand affect financial viability of renewable energy and energy storage projects including microgrids.
- Absence of regulatory frameworks to incentivize development of distributed energy resources, microgrids or energy storage projects.
- Absence of financial incentives to subsidize peak demand periods and R&D.
- Limited end user awareness and technology and benefits.