Postgraduate Certificate in Sustainable Microgrid Management

* Microgrid Economics and Financing

Ancillary Services: These are the services that are necessary to support the transmission of electricity from generators to consumers. Ancillary services include regulation, load following, and standby reserve capacity. In the context of microgrids, ancillary services can be provided by the microgrid itself, or by external sources.

Battery Energy Storage System (BESS): A BESS is a collection of batteries that are used to store electrical energy. BESSs can be used to provide a variety of services to the grid, including frequency regulation, voltage support, and energy arbitrage. In the context of microgrids, BESSs are often used to provide energy storage and to help manage the intermittent nature of renewable energy sources.

Capital Expenditure (CAPEX): CAPEX refers to the upfront costs associated with the construction or installation of infrastructure. In the context of microgrids, CAPEX includes the costs of equipment such as generators, inverters, and transformers, as well as the costs of site preparation, installation, and commissioning.

Distributed Energy Resources (DER): DERs are small-scale energy generating technologies that are distributed throughout the electrical grid. DERs include solar panels, wind turbines, and fuel cells. Microgrids are often built using DERs to generate electricity locally, reducing the need for transmission and distribution infrastructure.

Energy Arbitrage: Energy arbitrage refers to the practice of buying electricity when it is cheap and selling it when it is expensive. This can be done using a BESS to store electricity when prices are low and sell it when prices are high. In the context of microgrids, energy arbitrage can be used to generate revenue and to help manage the intermittent nature of renewable energy sources.

Feed-in Tariff (FIT): A FIT is a policy mechanism that is used to promote the deployment of renewable energy sources. Under a FIT, utility companies are required to purchase electricity from renewable energy generators at a fixed price, usually above the market rate. This provides a guaranteed revenue stream for renewable energy generators, making it easier for them to secure financing for their projects.

Frequency Regulation: Frequency regulation is the process of adjusting the output of generators to maintain the frequency of the electrical grid within a narrow range. This is necessary to ensure the stable operation of the grid. In the context of microgrids, frequency regulation can be provided by BESSs or other fast-responding generators.

Grid-connected Microgrid: A grid-connected microgrid is a microgrid that is connected to the main electrical grid. Grid-connected microgrids can operate in parallel with the main grid, drawing electricity from the grid when needed and selling excess electricity back to the grid. Grid-connected microgrids can also operate autonomously, disconnecting from the main grid during outages or other disruptions.

Grid-forming Inverter: A grid-forming inverter is a type of inverter that is used to connect a microgrid to the main electrical grid. Grid-forming inverters are designed to regulate the voltage and frequency of the microgrid, ensuring that it remains in synchronization with the main grid.

Grid-tied Microgrid: A grid-tied microgrid is a microgrid that is connected to the main electrical grid. Grid-tied microgrids are designed to operate in parallel with the main grid, drawing electricity from the grid when needed and selling excess electricity back to the grid.

Inverter: An inverter is a device that is used to convert direct current (DC) electricity into alternating current (AC) electricity. In the context of microgrids, inverters are used to convert DC electricity from renewable energy sources into AC electricity that can be used by consumers.

Islanding: Islanding is the condition that occurs when a microgrid disconnects from the main electrical grid and continues to operate autonomously. Islanding can occur during planned outages or during unplanned disruptions such as power failures or storms.

Levelized Cost of Energy (LCOE): The LCOE is a measure of the cost of electricity over the lifetime of a generation asset. It includes the costs of construction, fuel, maintenance, and financing, divided by the total amount of electricity produced over the lifetime of the asset. The LCOE is a useful tool for comparing the cost of different generation technologies.

Load Following: Load following is the process of adjusting the output of generators to match the changing demand for electricity. In the context of microgrids, load following can be provided by BESSs or other fast-responding generators.

Microgrid: A microgrid is a small-scale electrical grid that can operate autonomously from the main electrical grid. Microgrids are typically powered by renewable energy sources such as solar panels or wind turbines, but can also include conventional generators such as diesel engines or gas turbines.

Microgrid Controller: A microgrid controller is a device that is used to manage the operation of a microgrid. The microgrid controller monitors the state of the microgrid and the main electrical grid, and adjusts the output of generators and loads to maintain the stability of the microgrid.

Net Metering: Net metering is a policy mechanism that is used to promote the deployment of renewable energy sources. Under net metering, utility companies are required to credit customers for the excess electricity that they generate and feed back into the grid.

Operational Expenditure (OPEX): OPEX refers to the ongoing costs associated with the operation and maintenance of infrastructure. In the context of microgrids, OPEX includes the costs of maintenance, repairs, and replacements, as well as the costs of fuel and other consumables.

Photovoltaic (PV) System: A PV system is a collection of solar panels that are used to convert sunlight into electricity. PV systems are a common source of electricity for microgrids.

Power Conditioning System (PCS): A PCS is a device that is used to convert DC electricity from renewable energy sources into AC electricity that can be used by consumers. PCSs are often used in

conjunction with inverters to provide additional features such as voltage regulation and power factor correction.

Power Electronics: Power electronics is the branch of electronics that deals with the conversion of electrical power. Power electronics devices such as inverters and PCSs are used extensively in microgrids to convert DC electricity from renewable energy sources into AC electricity that can be used by consumers.

Renewable Energy: Renewable energy is energy that is derived from natural resources that are replenished over time, such as sunlight, wind, and hydropower. Renewable energy sources are becoming increasingly popular as a means of generating electricity, due to their low carbon emissions and their potential to reduce dependence on fossil fuels.

Reserve Capacity: Reserve capacity is the amount of electricity that is available to be generated in the event of an unexpected increase in demand or a loss of generation capacity. In the context of microgrids, reserve capacity can be provided by BESSs or other fast-responding generators.

Standalone Microgrid: A standalone microgrid is a microgrid that is not connected to the main electrical grid. Standalone microgrids are typically used in remote or isolated locations where there is no access to the main grid.

Transactive Energy: Transactive energy is a concept that refers to the use of economic signals to manage the flow of electricity on the grid. Transactive energy systems use market-based mechanisms to incentivize consumers and generators to adjust their behavior in response to changes in the grid.

Voltage Support: Voltage support is the process of adjusting the voltage of the electrical grid to maintain the stability of the grid. In the context of microgrids, voltage support can be provided by BESSs or other fast-responding generators.

Volt-VAR Control: Volt-VAR control is the process of adjusting the voltage and reactive power of the electrical grid to maintain the stability of the grid. In the context of microgrids, volt-VAR control can be provided by BESSs or other fast-responding generators.

Wind Turbine: A wind turbine is a device that is used to convert wind energy into electricity. Wind turbines are a common source of electricity for microgrids.