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The City of Tallahassee is home to the largest airport-based solar farm in the world. This facility complements the City's other generating stations, and the entire grid is connected to a larger regional network to provide system redundancy. A multi-faceted approach helps ensure reliability and efficiency.

As the City moves toward its goal of reaching 100 percent net renewable energy for the community, evaluation and consideration of its electric generation will be at the forefront. This can be a complex topic, so in this article, we will discuss three of its elements: capacity factor for generators, intermittency of the generation resource and balancing of the electric system.

Often misunderstood and overlooked by people outside the industry are the concepts of electric generation capacity and capacity factor. Capacity is the maximum electric output a generator is designed to produce. Capacity factor (CF) is the ratio between what a generation unit is capable of generating at maximum output versus the unit's actual generation output, generally expressed on an annual basis. These two variables can be significantly different.

For example, the City of Tallahassee's two Solar Farms located at the Tallahassee International Airport have a combined capacity of 62 megawatts AC. Since solar is highly variable due to cloud cover, the capacity factor of solar facilities is significantly less than a fossil or nuclear generating unit. For example, using the actual output from the two Solar Farms for 2019 and 2020, the average combined CF is 21.1 percent. By comparison, a fossil plant may have a CF in excess of 85 percent.

Now that we have a basic understanding of capacity factor, our second topic covers when the power is generated. In the case of nuclear or fossil generating units, they can produce power 24 hours per day, seven days per week, 365 days per year. (In theory, they can have a 100 percent capacity factor.) These types of generation resources are normally referred to as base load or intermediate load resources. Renewable resources such as wind and solar photovoltaic are referred to as variable or intermittent resources because they generate only when the wind blows or the sun shines. For an intermittent resource like solar PV, energy is produced generally between 7 a.m. and 6 p.m., with the maximum energy produced between 11 a.m. and 2 p.m. The output is further restricted by cloud cover that moves through the area.

Complicating the issue with solar is the speed in which solar facilities' output can drop. Depending on cloud cover, output can drop from full power to near zero and back up to full power in minutes. While Florida is known as the Sunshine State, we experience more cloudy days than clear sky days. Since the Electric System Operators cannot control the cloud cover, they must always be prepared to make up the loss of renewable generation. This is achieved by having the equivalent fossil generation online and available.

This leads us to the third topic -- balancing the electric system.

In periods of low energy use and high solar PV output, the City simply cannot push the excess generation to electric companies, such as Duke Energy Florida and the Georgia Power Company, that are connected through the regional network. Likewise, during periods of high energy use or loss of solar PV, the City cannot under-generate and take power from the connected electric companies.

The City is obligated to continuously meet its customers' electric demand in real-time. Since electricity cannot be stored in large quantities yet and since customer usage of energy varies throughout the day, the City's Electric System Operators must continuously balance electric demand by increasing or decreasing generation. There are strict federal standards that electric system operators must follow or face severe fines.

The intermittency of solar PV adds to the complexity of the system balancing requirement. In the two years that the solar facilities have been in operation, the 62 megawatts AC of solar is the maximum that can be connected to the City's electric system and still meet the balancing requirements.

These are some of many facets being reviewed as part of the City's Clean Energy Plan development. Learn more at Talgov.com/CleanEnergyPlan.

A typical summer day in Tallahassee, 20 MW Solar Farm while under construction.



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