Guest Column

How Battery Energy Storage Systems (BESS) are driving our clean electricity future

By Bruce Fairless

Among the many ways America's electrical infrastructure is undergoing a fundamental transformation is the massive growth in the number, size, and capacity of Battery Energy Storage Systems (BESS) used to store output from renewable sources like solar and wind for periods when the grid most needs power.

Last year, U.S. BESS installations increased by 96 percent, according to the American Clean Power Association (ACP), to more than 17,000 megawatts of total installed output. BESS systems across the country can now store more than 45,000 megawatt-hours of electricity, according to ACP—enough to keep approximately 1.5 million average homes lit, powered, and cooled for a full day.

With battery costs coming down, renewable energy installations continuing to grow, and steadily rising state-level requirements to replace fossil fuels with "green" energy, 2024 is expected to be another year of record growth for BESS installations.

Three of the most common scenarios for installing BESS today are:

1. Alongside large-scale ground-mounted or canopy-mounted solar installations, as an integral feature of new-build solar farms;
2. Adjacent to existing utility substations when there is available space and need for large scale BESS;
3. And, more and more, on the grounds of and as replacements for "peaker plants" powered by petroleum-based fuel and used for just a few days or even a few dozen hours per year, typically the hottest summer afternoons and evenings when electric demand for air conditioning and refrigeration is soaring, and wholesale prices go to 10 or 20 times year-round average levels.

One big advantage to converting fossil-fuel-powered peaker plants to BESS is that facilities and high-voltage grid interconnections already exist and can be revamped for connecting battery output to the grid, rather than having to run through what is often a years-long process of securing approval from grid operators, energy facility siting boards, and utilities for constructing and activating new interconnection capacity.

Having recently tested more than 30 sites in New York City for locating BESS, as well as participating in dozens of other BESS projects in a range of environments, we've learned that some of the key considerations for developers considering where to site BESS include:

- Does the location feature a large, flat area for placing BESS containers? If not, how much earthwork, removal of bedrock, or construction of retaining structures will be necessary, and how does that affect the economics of the project?
- Does the site location feature organic soils, deep fill soils, or other soil conditions that may require costly interventions to provide a stable base for the BESS?
- How close are the nearest abutters? Will a sound barrier wall—typically 20 feet high—be necessary, to mitigate noise from the BESS operations? How expensive will that be to construct?
- In areas like New York City or other big cities where real estate is at a premium, how close can developers come to installing BESS in every available square foot of a location?
- Even if the BESS site is not close to a big energy producer like a solar farm or wind turbine array, or to already-existing grid interconnection infrastructure, is it close enough to a big energy user (like a factory, hospital, or big-box supermarket) that the proximity of large demand for its output would make the economics sustainable for the developer?
- Given that demand for BESS appears likely to continue to grow as states push for net-zero emissions by 2050, how much room for expansion will there be at a given site? How complex and costly would it be to add more storage and supporting electrical and physical infrastructure in future years?

BESS installations have sometimes been referred to as the Swiss Army knives of the electric grid, because they can perform so many different functions at once: making solar and wind more useful and valuable by capturing and storing surplus power during excess-generation periods and returning it to the grid when it's dark or the sun goes behind clouds or the wind dies; replacing peaking units and the fossil-fuel emissions they create; serving as long-duration sources of power in a localized area in the same way as baseload generators; serving as ultra-short-duration guarantors of electric power availability and quality; and much more.

By asking some of the questions we've listed above, project developers can help focus their efforts and investments on the areas where BESS can do best—technically, financially, and with maximum community acceptance and support.

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