Battery Storage: Coming to a Neighborhood Near You!

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The use of batteries for electricity storage has been a reality for more than 200 years. Recent technological developments and incentives for non-fossil fuel energy systems has resulted in application of batteries at the public utility scale, with installations in excess of 50 Megawatts (MW) of storage capacity not uncommon.

For example, H2M architects and engineers is supporting 174 Power Global on a historic battery energy storage project for Con Edison that will build the largest utility-owned battery site in the state, storing enough solar and wind energy to power 800 homes and businesses. Battery storage systems are helpful for municipalities in reducing the consumption peaks that drive monthly transmission costs and an annual capacity charge for townships.

Municipalities will find battery systems to be useful in areas that see certain challenges, including:

- Demand for greener non-fossil fuel power
- Requirement for back-up or uninterruptible power
- Local resource inadequacy
- Resiliency issues in fire-prone areas
- Impracticality of conventional transmission upgrades to meet peak demand
- Required storage for intermittent power sources, such as solar and wind

Battery energy storage facilities will also be useful in assisting municipalities as they work toward compliance with the statewide Climate Leadership and Community Protection Act (CLCPA).

In 2018, New York State adopted the Climate Leadership and Community Protection Act, which sets a new statewide milestone of 70 percent renewable energy by 2030 and 100 percent by 2040.

This legislation's requirements include:

- 9,000 MW of capacity from offshore wind by 2035
- 6,000 MW of capacity from solar by 2025
- 1,500 MW of energy storage capacity by 2023 increasing to 3,000 MW of energy storage capacity by 2030

Key Considerations

What should be "top of mind" when developing a new energy storage project? There are important considerations throughout the development process, including:

- financial viability
- planning
- siting
- zoning
- permitting
- design and construction
- utility interconnection
- operation
- maintenance

The associated challenges these items pose to a project also depend upon the size of the installation, density of population near the site, and utility interconnection available near the site.

The planning stages address the economic factors that are essential to developing a viable project. Beside the capital costs, zoning and permitting require considerable attention and can add time and money. Knowledge of local government's regulatory approval authority and processes are invaluable in determining the potential risks and benefits for development in a particular location. Many will look for sites proximate to existing substations/interconnection to the electric utility grid. Some projects are co-located with renewables to improve the attractiveness of a paired project from an overall grid operations standpoint.

Siting a facility in an urban area brings with it the benefit of proximity to a load center, thus minimizing impact on the transmission or distribution infrastructure required to connect the stored energy to local customers. Presently, battery energy storage is one method of subsidizing peak power demand without the need for extensive infrastructure improvements if nearby substation capacity exists. Storing the energy locally delays or eliminates the need to upgrade transmission lines by serving the

increased demand through utilization of stored energy. Use of battery energy storage for behind-the-meter applications is another type of installation where there is a growing interest by developers.

Grid issues that come with solar and wind power can be eased when projects are paired with batteries. Development timelines and costs are greatly influenced by each of these factors. Knowledge of zoning issues can help identify siting limitations and concerns. Other siting considerations include whether there is appropriate site access, low fire risk, proximate sensitive noise receptors and environmental habitat impacts. Land use regulations may be difficult to comply with as not all substation capacity is adjacent to industrial or commercially zoned parcels. This can present difficulties, although surmountable, to a BESS developer.

Battery energy storage systems usually consist of modular battery assemblies connected to inverters and then to a step-up transformer. For large-scale applications, there may be multiple medium voltage transformers connected to a collector feeder, which, in turn, is connected to a main high voltage step-up transformer to connect to the utility transmission line or substation. While the modular design simplifies the technical issues, a number of siting considerations remain.

Suitable Plot Size

It can be a challenge for planners in urban and congested suburban areas to find a suitable plot size to locate the equipment. We have developed projects rated at 2 MW on sites as small as 0.3 acres in residential areas. Generally, larger sites allow easier access to siting the modules as well as maintenance. The lessons learned from developing sites focus on the need to work with the local community planning group, the permitting agencies, and the local utility to identify potential issues in developing the site. The selection of the battery module should consider the transportation and rigging required to place the modules at the site. Generally, the modules are located as a single level outdoor installation.

Fire Protection and Access

Fire protection and fire alarm design should be an area of concern whenever siting a BESS development. The industry response to the Arizona Public Service Company (APS) battery fire in 2019 has resulted in improvements in battery monitoring fire detection and fire suppression designs for energy storage modules. It has also resulted in increased scrutiny of the design plans and the facility's emergency planning to deal with such an event. Local codes may have requirements that supersede the national codes.

Knowledge of the expectations of the Authority Having Jurisdiction (AHJ) over the fire codes at the site is helpful even at the initial stages of the design. The AHJ may require a fire alarm panel at the site entrance to alert the first responder of the detected emergency location before they enter the site. The AHJ may also require a subject matter expert be available at the site within a short time after an emergency notification is sent.

Current fire codes may allow installation of BESS in a multi-level structure, but this must be done with careful coordination with the AHJ. Firefighting in a multi-level structure may require particular access and shielding requirements that must be included in the initial design plan and site layout.

Security

BESS are generally unmanned during normal operation. Site security is important both to protect the equipment as well as to prevent injury to curious neighbors. Perimeter access monitoring and notification needs to be considered as part of the project development.

Permitting Constraints

Permitting activities require a good understanding of the local zoning laws, knowledge of the type and numbers of various permits and approvals required, and especially important, the knowledge to get permits and approvals processed in a timely manner to support project development. Knowledge of local permitting requirements, regulatory agencies and municipal landscape are invaluable to a successful project development effort. Permitting delays can be a significant risk for projects required to meet a specific in-service date.

Developing a site in a congested suburban or urban location will typically require notifying and obtaining approval from several agencies. Noise is always a consideration. Sites located near residences, schools or medical facilities are generally governed by regulations that require lower noise generation. Some areas have daytime and nighttime noise limits at the site boundaries. Furthermore, some locations have nighttime sound level limits of 50 dB or less at the site boundary. While BESS are generally not noise generators themselves, considerable noise can be generated by the battery module cooling systems and associated transformers.

Visual Barriers

Visual impact also needs to be considered. Urban areas may not have sufficient setback to allow landscaping to be the visual barrier. In these areas, architectural walls or fences may offer a solution for an acceptable visual barrier to the site. Potential facility lighting in congested areas needs to consider the impact on neighbors. Light trespass needs to be accounted for, while security lighting needs to be effective.

System Design and Interconnection Matters

Interconnection with the local utility requires consideration of existing utility criteria for the size of the battery energy storage interconnection. The electric transmission and distribution system are continually changing as generation and loads are added or removed. This is especially true for distribution systems in areas adding photovoltaic or other inverter-controlled power generators. These criteria are in place for safety and reliability reasons. They may require additional controls and protection, sometimes adding significant project costs, which are ideally identified as the project pro forma cost estimates are developed. Large projects that connect to the electrical transmission system might incur transmission system upgrade costs that could be significant. These costs can be identified and included in the pro forma cost estimates prior to the formal interconnection application and interconnection study results are made.

Battery energy storage systems use inverters. Depending upon the size of the facility, the utility may require a direct transfer trip (DTT) to shut down the energy export in the event of an interruption of the circuit by the utility feeder breaker. This DTT generally requires a dedicated line, and therefore the need to lease a dedicated fiber link between the site and the utility substation. Installation of this line and the equipment necessary to install the DTT bring up cost and time considerations as it may take several months to get the fiber link provided by the communication supplier. The need for installing a DTT can change as the number and types of distributed energy resources are added to the distribution circuit.

BESS sized greater than 5 MW may require a direct connection to a local substation rather than a tap into existing distribution lines. This can be a considerable cost addition. In congested areas these dedicated lines may have to be installed underground.

For larger facilities with power export of 20 MW or more, applications to the Independent System Operator (ISO) need to be made as the facility is considered a "large generator." These large generator interconnections require studies to assess the impact on the transmission system resulting from the addition of the facility. System impact studies will serve to identify adverse impacts such as overloading transmission lines, transformers, or breakers under any of the various scenarios evaluated. The developer may be responsible for the cost of correcting these overloads.

In addition to transmission system upgrades, utilities may have transmission system criteria that requires a substation to be brought up to the current standard if an interconnection dictates any modification to the substation. In one such example, a developer was made aware of the potential upgrade costs in connection to a preferred local substation. These costs were so significant the project was redesigned to connect to a different substation. Knowing the potential impact a project might have on the utility substation is a significant value in planning for overall project and development costs.

Location Planning: Anticipate Local Concerns

Regional experts can add significant value when considering a development location given their knowledge of the nearby neighborhood and community. While most projects see relatively little public/neighborhood opposition and are supported by environmental groups interested in clean energy, it is always sound development strategy to know and anticipate the concerns of the public and local stakeholders. For example, battery projects utilize 24-hour cooling systems to preclude overheating and optimize system performance. As indicated above, these systems can create noise impacts, which may become a point of contention.

Vetting a project site, developing a strategy, and determining realistic timelines go a long way toward minimizing risk. Due diligence teams should include a land use planner and attorney that work in conjunction with a designer to help determine the site-specific opportunities and constraints before a client purchases or leases a property. Local land use regulations and title restrictions play a major role in how long and difficult implementation will be. Having boots on the ground as well as an experienced team to strategize at the site selection phase will help deliver the most viable project.

Construction planning should consider the local availability of labor and if there is a need to use union labor. These requirements can vary significant from region to region, or even within the same metropolitan area. Use of construction project labor agreements may also be a consideration.

Vendor Selection

To implement the battery storage vision, vendor choice is crucial — so a partnership with trusted technical experts who understand all facets of utility-grade challenges and opportunities provides the best recipe for project success.

Selection of the BESS vendor should ensure the system meets UL9450, has been tested in accordance with UL9450A and has the test report available for review. Any additional, location-specific requirements, such as additional fire detection and protection, or ventilation, may not be included in the base offering from the manufacturer and would need to be identified as a required add on.

In summary, utility-scale BESS are available to provide electrical energy storage and support load pocket, peak demand, and intermittent power needs. These systems are finding applicability in many areas where fossil fuel systems and/or traditional upgrades are considered inefficient, impractical, or simply too expensive. Many factors can impact the successful development of such a project as well as its financial viability.

It is important to put together an experienced team that can work collaboratively to plan and execute these projects in the most cost and schedule-efficient manner possible. ❒