PORCHLIGHT
SOLAR PROJECT

FREQUENTLY ASKED QUESTIONS ON

BATTERY ENERGY STORAGE SYSTEMS

General Q&A

Why are batteries needed?

As the U.S. energy landscape evolves to more renewable energy sources, such as wind and solar generation, and less conventional fossil fuel generation, energy storage will play an essential role in stabilizing the grid. The electric grid matches supply and demand at every moment to function reliably. Energy storage systems store excess energy in times of low demand to be used later, especially during peak demand hours and emergency or grid outages. Storage helps place energy on the grid when needed instead of only when the wind is blowing, or the sun is shining.

How is energy storage useful on a grid-scale?

Energy storage is needed on a grid-scale for three main reasons:
1. When charged with renewable energy like solar, energy storage delivers firm, flexible, clean energy and capacity.
2. Energy storage can store energy in times of excess production and discharge that energy when it is needed.
3. Energy storage provides a real-time balance of power supply and demand, creating more reliable, stable, and productive power grids for our country.

What are the main benefits of utility-scale energy storage systems?

Energy storage systems can improve the reliability of the electricity grid to help keep the power on for residents and businesses during extreme weather conditions.

Adding more energy storage to the U.S. electricity grid can help to keep electric costs down for consumers.

More energy storage helps ensure the U.S. energy grid remains reliable as more renewable energy comes online.

How does an energy storage system work?

In the most basic explanation, an energy storage system charges by taking AC power from the grid or colocated generation facility and converting it to DC power to store in batteries. The system will automatically stop charging once the battery is at full charge. When there is an energy need on the grid, the system discharges energy back to the grid by converting the energy from DC back into AC.

Is energy storage technology safe?

Energy storage has been a part of our electricity grid since the 1930s and has a safety record that is similar to, or better than, other electricity generation, distribution, or management methods. Energy storage facilities have multiple layers of protection and monitoring systems in place to help mitigate any unsafe conditions. Additionally, these facilities are secured with perimeter fencing around the entire site to prevent unauthorized access.

Why here?

1. We site energy storage facilities to maximize benefits to the grid and to customers.
2. Stand-alone storage facilities are typically closer to the electrical load and/or connected to the bulk transmission system (transmission lines/substations) in order to service energy users efficiently.
3. Co-locating solar and batteries at the same site helps to smooth the power supplied by the intermittent solar output and enables the two systems to share some hardware components, which can lower costs rather than having them at different sites.
4. Co-location can also reduce costs related to site preparation, land acquisition, labor for installation, permitting, interconnection, and developer overhead.

Technical Q&A

How do these batteries compare to the batteries in my phone or computer?

All batteries accept, store, and release electricity on demand. Batteries use chemistry, in the form of chemical potential, to store energy.

The batteries used for grid-scale applications are similar to the lithium-ion batteries in your phone or laptop computer, except they are much larger and monitored closely on a 24/7 basis by trained professionals. Grid-scale battery systems utilize the same types of battery cells found all around us, but are incorporated into a state-of-the-art grid-scale resource. Grid-scale batteries are rechargeable, and the heavy-duty design of grid-scale batteries allows them to be charged and discharged daily for decades.

Does electricity go straight from the panels to the batteries?

It is possible to design a system where electricity directly flows this way (DC-coupled); however, the locations of solar and storage often involve placing power conversion equipment between the solar and batteries (AC-coupled).
The energy produced by the solar panels can flow directly to the batteries if the electrical grid does not have the demand to use the energy being produced, thus storing the energy for a later time.

Are they sustainable?

Yes. Energy storage batteries have a useful life of approximately 20 years and will require repowering later in the project lifecycle. The original batteries will be removed and recycled for continued use in other applications.

How efficient is battery storage?

Battery efficiency is a key metric used to select batteries for a project; the batteries we use have a round trip efficiency of 90-95% or greater (5-10% losses when charging and discharging the batteries). There may also be additional losses when charging and discharging the battery due to other system component losses.

Are battery systems cost-effective?

Battery energy storage costs continue to decline as the production and supply chains increase efficiencies. Energy storage is at an attractive cost to utilities and other energy users, as evidenced by large increases in grid-scale energy storage installations over the last several years. Energy storage system costs are expected to continue to fall, thus leading to an increased number of installations throughout the U.S.

Will batteries be added to a solar system at start of construction, or later?

Battery storage may be installed either at the time a solar energy facility goes into operation or at a later time to an existing solar system.

How does energy or battery storage work with solar?

The solar panels absorb the energy created by the sun, creating DC electricity. The battery charges in times of excess energy production and discharges when energy is needed. Energy storage helps to balance the grid, creating a more reliable and stable transmission and distribution system. Clean, reliable energy is delivered to commercial, industrial, and residential customers.

What maintenance do batteries need? How often?

Annual maintenance involves visual inspections, various system checks and tests, cleaning, and adjustment as required.

Is energy storage a separate interconnection? What is the process?

Batteries that are stand-alone go through their own interconnection process in the same manner as a solar facility. Batteries that are connected to solar may still have a separate interconnection process depending on the system design and regional transmission requirements.

What are the different types of battery storage installation layouts?

Energy storage installations either utilize outdoor containers or dedicated-use buildings. In outdoor container design, batteries are installed in climate-controlled outdoor containers, with multiple containers daisy-chained to central inverters. An alternate higher-density system will utilize a dedicated-use climate-controlled building(s) that house multiple aisles of batteries in an open-rack configuration connected to inverters outside of the building. There are advantages to both systems depending on local codes and site considerations, but the bulk of the systems to date have been pre-engineered containerized systems.

How are they protected from outside elements?

Outdoor enclosures are designed with outdoor ratings such as NEMA 3R / IP66 to prevent water ingress. These systems are also designed with appropriate anchor bolts and latching to comply with various wind ratings per the local building code, based upon ASCE 7. This is the same code other commercial and industrial facilities are designed to.

What type of batteries will be used?

Generally, all projects will use lithium-ion batteries, which are sealed rechargeable batteries ideally suited for decades worth of use. Grid-scale battery systems utilize the same type of battery cells found all around us incorporated into a state-of-the-art grid-scale resource. These rechargeable batteries are monitored closely on a 24/7 basis by trained professionals. Their heavy-duty design allows the grid-scale battery systems to be charged and discharged daily for decades.

What is the most common battery for utilities?

Lithium-ion batteries are the most common battery used for utilities. These are also the most common batteries used in electric vehicles, laptops, and cell phones.

How much electricity do they produce?

They produce the same power (MW) as equivalent solar facilities. The energy (MWh) produced is based upon the power and duration: energy = power x time. The nameplate energy rating will generally be based upon a 1- to 4-hour duration depending on the projected use case. For example, a 50 MW x 4-hour system can deliver 200 MWh in a single charge.

Is the power stored as AC or DC?

The energy is stored as DC and must be converted to AC to be sent to the grid.

What size will the system be?

A good rule of thumb is 10-20MW per acre for a containerized 4-hour duration system, though specific site conditions are needed to evaluate the layout fully. Battery building systems will be denser but may have other setbacks and siting requirements.

Will I see lower electricity bills?

Energy storage can lead to cost savings in two primary ways. The first is by lowering the overall cost of providing electricity. The second is by allowing customers to avoid premium pricing (or "peak demand"). Industry insiders call this saving money on "both sides of the electric meter." But broader energy storage deployment can save consumers money in additional ways. Shorter outages for residents after a storm or an equipment failure can help save not only money but lives. And fewer outages overall lead to less economic losses.[1]

What type of enclosure will be used?

The type of enclosure varies by manufacturer. Typically, they are housed in an enclosure similar to a 40' ISO shipping container or smaller. Some may be smaller module-type units that measure 5ft x 5ft x 7ft.

Fire & Safety Q&A

What about thermal runway and fires? What is the likelihood of a battery fire?

Lithium-ion cells rarely experience failure leading to fire, however, modern codes and standards such as NFPA-855 and UL-9540a require several independent preventative features to be included in order to minimize the risk of fire. With these features in place and fully operational, the likelihood of a fire is reduced even further. These features include a battery management system, remote monitoring, gas detection, ventilation, and in some installations, fire suppression.

How will offsite personnel know if an incident has occured onsite?

Remote monitoring will occur over the lifetime of the battery, ensuring that personnel are remotely notified of problems via alarms as soon as they occur.

How will our local fire department be prepared or trained to handle a fire situation at a battery storage system?

An emergency response plan will be developed which will provide detailed response procedures. This plan will be reviewed by the local Fire Marshall and fire department, and training will be conducted to familiarize the local responders with this plan.

What does a developer do to work with the local fire protection personnel to prepare for a new energy storage system?

Emergency signage, emergency operations plans, and training are provided in conjunction with local fire services to ensure the hazards are communicated and planned for. An emergency response plan will be developed which will provide detailed response procedures. This plan will be reviewed by the local fire marshal and department, and training will be conducted to familiarize local responders.

If a fire does take place, what measures are taken to help minimize the extent of fires?

I. In most instances of a fire in a containerized battery system, fire water will be applied to the exterior of the container by the fire department to reduce the heat of the container and minimize the possibility of fire spread. Full details of approach will be included in the emergency response plan and fire safety plan.

II. In addition, battery installations incorporate some form of flammable gas detection / elimination / ventilation equipment. These sensors act to detect, eliminate, and/or ventilate flammable gases from the container atmosphere.

III. In instances where self-contained outdoor enclosures are utilized, the enclosures are tested per UL-9540a and equipped with relief mechanisms as required. Additionally, fire suppression can be employed to further reduce damage to internal components.

IV. Fire suppression equipment, including water-based suppression, is required for all battery installations that can be entered by personnel (such as buildings). If required, these systems will be designed to meet all applicable local and national codes.

What are the steps in a typical fire safety plan for a battery storage system?

A fire safety plan is an extensive document that will be approved by the fire marshal. It will include a site equipment and hazard overview and map; a list of emergency contacts; documentation of the proper reporting and response procedures; descriptions of location and alarm indication, signage, and emergency switches; description of the fire protection and firefighting equipment; and will list required protective equipment (PPE) and safety data sheets.

After contact with batteries, will fire water contain toxins or chemicals that can contaminate ground water?

The primary purpose of water being used on an outdoor battery container is to reduce the heat of the container. A vast majority of the water sprayed onto the container will only contact the container housing and will not contact the battery modules themselves. The small amount of water that does leak into the container will be removed as part of the cleanup and decommissioning process.

In the event of a deluge event inside a dedicated-use battery building, the water will be treated in the same manner as deluge water used in other types of electrical fires and dealt with in a similar manner.

In the event of a fire, what is contained in the water used to extinguished the fire? Is foam used or some special extinguisher fluid?

Water used for fire suppression or cooling is normal fire water piped from city or town sources, hydrants, or other typical fire water sources such as well water or water on fire trucks. No special foam or liquid is required.

While not required, inert, non-toxic “clean agent” non-water-based automatic fire suppression such as FM 200 or NOVEC 1230 may be used in select locations within the building, containers, or racking on some systems as additional countermeasures to limit internal damage.

Some enclosures are designed to safely allow an internal fire to eventually burn itself out. In these instances, the fire department will monitor the enclosure to ensure the fire will not spread to adjacent equipment.

What kind of chemicals would be used if a fire does start? Are there concerns regarding the interaction of groundwater and chemicals?

Self-contained, outdoor enclosures are not required to have fire suppression installed as these units are designed to contain the fire through other means. While not required, clean agent suppression such as FM 200 or NOVEC 1230 (non-water-based solutions) may be additional countermeasures to limit internal damage.

To date, we are not aware of any groundwater contamination issues associated with energy storage systems. Groundwater contamination has not been an issue in the market with energy storage facilities. Like other equipment used in electrical systems, the units are designed to hold any potential liquids through multiple layers of containment.

Will there be a bond for potential fire cleanup?

A bond for potential fire cleanup is not usually required.

Do batteries leak?

Lithium-ion cells do not leak electrolytes during normal operation like some 'flooded' lead-acid batteries used in substations and UPS equipment. Lithium-ion battery modules will only leak if they experience a catastrophic failure. Most of the leakage will be in the form of gases, and the volume of liquid electrolytes will be trace amounts of volume compared to that found in the more common flooded lead-acid batteries. The liquid electrolyte is technically in the cell itself, although cells are housed within modules, racks, and containers.

Does an energy storage system create noise?

The energy storage equipment will be designed to be consistent with local noise requirements. The noise emitted is no higher than most electrical transformers or HVAC condensers.

Once the construction phase of the energy storage system is complete and the facility is operational, the primary source of noise will be fans associated with the inverter and battery cooling systems and will be similar to the sound emitted from commercial rooftop HVAC units.

Does the sound from an energy storage system create a public health burden?

According to the Ohio Department of Health Battery Energy Storage Summary and Assessments, information to date does not indicate a public health burden from noise generated by the typical operation and maintenance of a battery system. While some noise is anticipated and unavoidable, it is not expected to create off-site health issues.

The inclusion of setbacks from residential areas should help ensure any noise generated by the battery systems has reached ambient levels by the time it nears a residential structure.
ODH recommends that during construction, operation, and maintenance, state and local construction noise and noise pollution ordinances should be adhered to. ODH also recommends periodic maintenance and inspection of the battery storage area to ensure no leakage or damage has occurred.[2]

Decommissioning Q&A

How long do batteries last?

Batteries can last twenty years or more, depending on their usage. They will undergo some degree of degradation over their lifetime, where they will experience reduced capacity—like how a cell phone battery loses charge capacity over time.

What happens to them at the end of life?

At the end of life, batteries are removed from the system and recycled in accordance with applicable requirements.

[1]American Clean Power, "Resources-Thought Leadership-FAQs-How will energy storage cut power costs," EnergyStorageAssociationArchive.org, 2023, http://energystorageassociationarchive.org/resources/thought-leadership/faqs/

[2]Ohio Department of Health Battery Energy Storage Summary and Assessments, prepared by Ohio Department of Health. Health Assessment Section Bureau of Environmental Health and Radiation Protection Ohio Department of Health (April 11, 2022, page 8).