ASPEN TECH POLICY HUB

OPERATIONAL PLAN

Field Guide on Energy Storage for Advocates and Organizers

Dillon Cruz

ABOUT THIS FIELD GUIDE

Why do I need this Field Guide?

In the fight against climate change, cities across the United States are turning to a range of technologies that reduce carbon emissions in their power grids. In addition to solar panels and wind farms, policymakers are increasingly excited about new or underutilized technologies — in particular, energy storage.

Advocates and organizers who engage in energy policy on behalf of disadvantaged communities must be prepared for conversations about energy storage in the upcoming decade. But because energy storage can feel overwhelmingly technical, we created this Field Guide to help advocates and organizers like you get the basics of energy storage down.

How do I use it?

Read this Field Guide before engaging in any meaningful conversations about energy policy with your local utilities or policymakers. To dive deeper into topics like the underlying technology, financing, and ownership models, we've provided further resources in the "What can I read for further information?" section at the end.

WHAT IS ENERGY STORAGE?

Energy storage is any technology that can store energy and dispatch that same energy when needed.

The most well-known version of energy storage is a battery, such as Energizer's portable AA battery or the powerful, rechargeable batteries that power Teslas. But there are many other types of energy storage too, especially when it comes to powering buildings, neighborhoods, and entire cities.

WHAT ARE THE GENERAL BENEFITS OF ENERGY STORAGE?

There are at least three important benefits of energy storage:

1. **Making the grid more affordable and the air cleaner on a day-to-day basis.** A major driver of high utility bills is peak demand: the hours in the afternoon and evening when cities use the most electricity. During these peak hours, utilities are forced to spin up peaker power plants to meet demand, which are extremely expensive and highly polluting. These high costs are then passed on to consumers. Energy storage, at scale, can replace peaker plants by discharging energy stored in batteries from solar energy in the evenings, meaning lower costs and less pollution for everyone.

2. **Providing backup power when the grid stops providing power.** Grids might fail when major energy grid assets stop working, including disruptions due to extreme weather (such as the 2021 Texas power crisis) or mylar balloons hitting power lines. Utilities might also purposefully turn off portions of the power grid to avoid something undesirable from happening, as with the 2019 California power shutoffs and the ongoing South Africa rolling blackouts. Energy storage can supply communities and important facilities with necessary power when these events occur.

3. **Decreasing the need for major grid infrastructure, ultimately lowering costs.** Enough local energy – in the form of solar panels and energy storage – could replace the power supply a community receives from faraway power plants. This would remove the need for the expensive equipment and machinery needed to generate, transmit, and distribute this faraway power supply. If utilities no longer needed to pay for building, operating, and maintaining these assets, ratepayers would enjoy lower monthly bills. The value of these utility savings is usually called "deferred costs" or "avoided costs."

HOW DO THESE BENEFITS APPLY TO HISTORICALLY DISADVANTAGED COMMUNITIES?

Utilities and advocates should work together to intentionally target better social, economic, and health outcomes for disadvantaged communities. Such disadvantaged communities experience a number of intersectional challenges, including:

- **Paying for energy bills they cannot afford,** meaning they have to make hard decisions between competing essential needs, such as rent, childcare, or healthcare;
- **Living right next to gas-fired power plants and other utility infrastructure,** leading to environmental pollution, poor health outcomes, and urban blight and decay; and,
- **Being served by grid infrastructure with historic underinvestment,** causing local grid failures and blackouts in the face of extreme weather.

To mitigate these harms, long-term energy plans should intentionally design energy storage for low-income and disadvantaged communities by:

1. **Designing inclusive financial incentives.** Utilities could purposefully redesign their policies to allow any residential and commercial customer to use and financially benefit from energy storage. These policies include changing their rate structures, modifying their portfolio of customer-facing programs, and offering inclusive financing such as grants, on-bill repayments, and PACE financing.
2. **Prioritizing frontline grid modernization.** When utilities invest in traditional grid assets (e.g., distribution lines, transformers) and smart grid assets (e.g., advanced metering, energy storage, internet mesh networks), they could prioritize low-income and frontline communities when choosing where to deploy those assets.
3. **Deploying opportunistically.** Utilities do not have to act slowly to deploy storage, nor feel limited by costs. With the rise of state and federal funding, creative forms of community sharing, growing resources for technical assistance, and third-party financing and ownership models, energy storage can be affordably deployed today.
4. **Enabling community power and independence.** Communities should feel empowered to shape the energy grid to their needs without waiting for utilities to take action. Empowering commu-

nities means knocking down unnecessary rules and regulations, providing technical assistance, and other forms of meaningful support. This could go so far as allowing neighborhoods to form microgrids.

5. **Creating local jobs and training.** Deploying energy storage can have non-energy benefits as well, including increasing job opportunities for low-income communities. Utilities should work to increase local access to job and training opportunities like vocational schooling, union membership, apprenticeship positions, and contractual work for installation and maintenance.
6. **Including community voices.** Utilities need to understand the ways in which decisions for the energy grid affect economic, environmental, climate, health, social, and racial justice. These concerns vary wildly among households, neighborhoods, and cities, too. Utilities can find opportunities for collaboration with non-energy partners by engaging with communities and searching for intersectional issues.

HOW CAN I BE TAKEN SERIOUSLY WHEN TALKING ABOUT ENERGY STORAGE?

You can get acquainted with the language! Here are some concepts:

Describing energy storage

To accurately describe energy storage systems, you'll need to know two words:

1. **Power**, or the amount of energy that a storage system can instantaneously dispatch in a given moment, measured in *watts* (W). A helpful analogy might be to imagine a sink faucet and a firehose. Because a firehose can push water out at a much faster rate than a sink faucet can, the firehouse has much greater "power" than the faucet.
2. **Capacity**, or the amount of energy discharged over a period of time, measured in *watt-hours* (Wh). One Wh of *capacity* means that the energy storage system can operate at a *power* output of 1 W for 1 hour before running out of energy. A helpful analogy might be to imagine two water tanks of the same exact volume. They both have the same "capacity." However, a water tank emptied using a firehose (with greater "power") would run out of water in a shorter amount of time than one emptied using a simple faucet (with lesser "power").

Note that these units are part of the metric system, where prefixes like *kilo-*, *mega-*, and *giga-* denote greater scales. Therefore, a gigawatt (GW) is equal to a thousand megawatts (1,000 MW), which is equal to a million kilowatts (1,000,000 kW), which is equal to a billion watts (1,000,000,000 W). See the table below for an idea of the scale of power and capacity across several types of technologies:

Example	Description	Technology	Power	Capacity
Energizer Universal AA Rechargeable Battery	Rechargeable portable battery for small devices	Chemical battery storage	0.48 W	2.4 Wh when fully charged
Tesla Powerwall	Rechargeable residential home battery	Chemical battery storage	5.8–7.6 kW	13.5 kWh when fully charged
Valley Generating Station (owned by LADWP)	Natural gas-fueled power plant	Combustion power generator	690 MW	1,492 GWh in annual output (2018)

Energy storage and the power grid

Depending on **power and capacity**, an energy storage system can power a single customer ("customer-scale"), an entire community ("community-scale"), or several communities ("utility-scale").

Depending on the **siting location** within the power grid, an energy storage system can charge and dispatch energy for a single building ("customer-sited" or "behind-the-meter"), for a segment of the distribution system ("distribution-sited"), or for a segment of the energy generation or transmission systems, like a solar farm ("transmission-sited").

Energy storage systems also differ based on **intended impact**. Energy storage has the greatest environmental impact when it stores excess renewable energy and dispatches it to replace the use of non-renewable energy ("peak-shaving"). But energy storage systems can be designed differently to achieve other outcomes, such as providing power during blackouts ("resilience") and stabilizing grid power during normal operations ("ancillary services").

Related energy technologies

A distributed energy resource (DER) is any sort of energy technology that helps communities and individual users manage their energy consumption, independently of what their utility does. Categories of DERs might include:

- **Energy efficiency technologies,** which reduce energy consumption without changing behavior. These include heat insulation, lower-consumption LED lightbulbs, modern refrigerators, and smart home devices that conserve energy automatically when no one is home.
- **Distributed generation systems,** which create energy locally. These include rooftop solar panels, community windmills, and local hydropower.
- **Distributed storage systems,** which store energy locally. These are what we're referring to when we talk about customer- or community-scale energy storage.
- **Demand response technologies,** which shift energy consumption to optimize for gridwide supply and demand. These include smart thermostats that automatically turn down heating and cooling when the citywide demand is spiking, and several techniques associated with grid modernization.

WHAT CAN I READ FOR FURTHER INFORMATION?

1. The Union of Concerned Scientists's How Energy Storage Works (Oct 2021), Energy Storage FAQ (Oct 2021), and Principles of Equitable Policy Design for Energy Storage (Apr 2019) are great, accessible explainers on energy storage and its use in achieving equitable outcomes.
2. Researchers, policymakers, community organizers, and utilities convened in the summer of 2021 with the Department of Energy's Pacific Northwest National Laboratory to discuss energy storage as a tool for social equity. Read the report here: Energy Storage for Social Equity Roundtable Report (Sep 2021).
3. To dive even deeper into the world of energy storage, including the technology, its economics, financing options, and more, the Clean Energy Group has created a Resilient Power Project Toolkit for anyone to use. This includes a guide on financing and ownership models: Owning the Benefits of Solar and Storage (2018).