Energy Storage for Social Equity Research

2021 DOE OE Energy Storage Peer Review

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Agenda

• Energy Storage as an Equity Asset
• Energy Storage for Social Equity Roundtable
• Energy Storage for Social Equity Initiative
  ▪ Technical Assistance Program
  ▪ Project Development & Deployment Program
Energy Storage as an Equity Asset

• **Energy Justice:** The goal of achieving equity in both the social and economic participation in the energy system, while also remediating social, economic, and health burdens on those historically harmed by the energy system, e.g., frontline communities.

• **Just Transition:** A transition away from the fossil fuel-based economy to one that provides dignified, productive, and ecologically sustainable livelihoods; democratic governance; and ecological resilience.

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### Introduction

Public interest and regulatory efforts that target the climate crisis and advance an energy transition that leaves no one behind have started to increase at all levels. For example, at the federal level, the House Select Committee on the Climate Crisis offered a climate action plan that sets a goal of an economy-wide net zero emissions by 2050 and the reduction of pollution in environmental justice (EJ) communities [1]. State-level climate action is also accelerating with 15 states and territories aiming to move towards a 100% clean energy future [2]. For example, New York state’s economy-wide climate law requires 70% renewable energy (RE) in the electricity sector by 2030 with 35% of clean energy revenue flowing to underserved communities and a broader goal of 100% carbon-free electricity by 2040 [3]. Similarly, New Jersey’s Board of Public Utilities (NJPB) recently developed an Office of Clean Energy Equity that is tasked with oversaw the distribution of clean energy technologies to ensure equitable access by all residents [4].

A key enabling in the future of this decarbonized and renewable energy (RE)-dominated power system is the integration of energy storage. Energy storage technologies—pumped hydropower, battery storage, flywheels—mitigate the non-dispatchable production of RE by storing the energy output for use when needed. Recently, large-scale battery storage has seen an increasing penetration in the power grid [5]. Energy storage systems (ESS) can be integrated at various points on the grid. ESS can be located at the transmission level to relieve congestion, at the distribution level to improve reliability, and behind-the-meter (BTM) to relieve targeted congestion and provide load reduction. The flexibility in storage deployment at the point of demand or at the grid scale provides convenience and quick response in matching supply and demand. This enhanced system operation lowers peak demand and leads to a reduction in the energy burden on consumers [6]. In cases where extreme weather events could affect the reliability of the power infrastructure, storage can maintain electric service, support critical loads, and enhance grid resilience.

A valuable, but less examined, benefit of energy storage is its ability to contribute to the just energy transition. The concept of just energy transition alludes to a process of adding justice and equity concerns in the energy transition from high-carbon energy sources to a renewable energy-dominated resource portfolio [7]. Specifically, a just energy transition focuses on achieving to ensure that the costs and benefits of the
Common Understanding of Energy Justice

- Distributive Justice (where?)
  - The unequal allocation of benefits and burdens and unequal distribution of the consequences

- Recognition Justice (who?)
  - The practice of cultural domination, disregard of people and their concerns, and misrecognition

- Procedural Justice (how?)
  - The fairness of the decision-making process

- Restorative Justice
  - The response to those impacted by the burdens of energy projects

**Key Terms**

<table>
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<tr>
<th>Key Term</th>
<th>Definition</th>
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<tr>
<td>Energy Burden</td>
<td>Percent of household income spent to cover energy cost.</td>
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<tr>
<td>Energy Insecurity</td>
<td>The inability to meet basic household energy needs.</td>
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<tr>
<td>Energy Poverty</td>
<td>A lack of access to basic, life-sustaining energy.</td>
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<tr>
<td>Energy Vulnerability</td>
<td>The propensity of a household to suffer from a lack of adequate energy services in the home.</td>
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**Key Principles:**

- Availability
- Transparency and accountability
- Due process
- Intergenerational equity
- Affordability
- Sustainability
- Intrigenerational equity
- Responsibility
- Intragenerational equity
- Responsibility
Distributed Effects

<table>
<thead>
<tr>
<th>Availability</th>
<th>Access to energy technologies across the socio-economic spectrum</th>
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<tbody>
<tr>
<td>Energy storage for equity</td>
<td>Targeted incentives for households that cannot access energy technologies</td>
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<tr>
<td>Affordability</td>
<td>Low-income households spend a high percentage of their income on energy cost (three times higher). This is exacerbated by systemic inequities across demographic indicators: race, gender, ability status, age, health status, geography, income, education</td>
</tr>
<tr>
<td>Energy storage for equity</td>
<td>Helps reduce energy burden ▪ Curbing demand charges ▪ Community-serving facility support ▪ Affordable housing energy cost ▪ Helps decrease household energy insecurity ▪ Supports grid reliability and resilience through backup power</td>
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Energy Storage for Social Equity Roundtable

- 850 registrations
- 6 hours of content over two days
- 7 speakers, 4 panels, 4 pre-readers
- ~450 participants

June 28 - 29, 2021
10 am - 1 pm PST
1 - 4 pm EST
Energy Storage in Power Plant Decommissioning

Dynegy Oakland Power Plant, California (1978–2022)
• Replacement — 43 MW battery storage facility
  ▪ Reduces toxic emissions, improves air quality, health outcomes, and quality of life for frontline communities

• Replacement — long-duration battery storage (currently at the feasibility study stage—$350,000 grant out of the $25 million clean energy transition fund)

• Replacement — Manatee Energy Storage Center, 409 MW/900 MWh battery storage facility
  ▪ ~$100 million savings to ratepayers, 1 million tons of CO$_2$ emissions reduction, improved service reliability, increased clean energy integration, and ~70 new jobs created during construction

See Capturing Benefits from Power Plant Decommissioning
## Distributed Effects – Non-Energy Local Effects

<table>
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<tr>
<th>Benefit Title</th>
<th>Benefit categories</th>
<th>Description</th>
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<tr>
<td>Emissions reduction</td>
<td>Environmental</td>
<td>Storage facilitates the removal of fossil fuels from the grid through decommissioning strategies and renewable energy expansion.</td>
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<td>Energy costs</td>
<td>Economic, Social</td>
<td>Storage creates a resource to manage peak demand and reduce cost.</td>
</tr>
<tr>
<td>Equity enhancement</td>
<td>Social, Economic</td>
<td>Storage systems can provide targeted benefits to underserved communities including revenue generation and energy independence.</td>
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<tr>
<td>Increased property value</td>
<td>Economic</td>
<td>Storage provides the capability to keep heating and cooling systems reliably operational and may decrease energy costs leading to an increased property value.</td>
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<tr>
<td>Job creation</td>
<td>Economic, Social</td>
<td>Storage creates job opportunities across the asset’s lifecycle, including battery manufacturing, operation, maintenance, and management.</td>
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<tr>
<td>Less land use</td>
<td>Environmental, Social</td>
<td>Storage decreases the need to build new or maintain existing power plants.</td>
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<tr>
<td>Resilience benefits</td>
<td>Social, Economic</td>
<td>Storage mitigates energy outages and disruption costs (financial and otherwise).</td>
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</table>

See Capturing Benefits from Power Plant Decommissioning
Measuring Equity

Target Population Identification

- Program equity index
- Program accessibility
- Energy cost index
- Energy burden index
- Late payment index
- Appliance performance
- Household-human development index

Investment Decision Making

- Community acceptance rating
- Program funding impact
- Energy use impacts
- Energy quality
- Workforce impact

Program Impact Assessment

- Profits
- Program acceptance rate
- Energy savings (MWh)
- Energy cost savings ($)
- Energy burden change
- Change in household-human development index score

See Metrics for an Equitable and Just Energy System
https://www.pnnl.gov/sites/default/files/media/file/Metrics%20for%20Energy%20Equity_0.pdf
DOE Invests $27 Million in Battery Storage Technology and to Increase Storage Access

SEPTEMBER 23, 2021

Funding Supports Domestic Manufacturing of Next-Generation Flow Batteries and a New DOE Initiative to Advance Equitable Access to Energy Storage

WASHINGTON, D.C. — The U.S. Department of Energy (DOE) today announced $27.8 million in funding for four research and development projects to scale up American manufacturing of flow battery and long-duration storage systems. DOE also launched a new $9 million effort—the Energy Storage for Social Equity Initiative—to assist as many as 15 underserved and frontline communities leverage energy storage as a means of increasing resilience and lowering energy burdens. Together,
ES4SE Program Overview

**Goal:** support disadvantaged communities affected by unreliable and expensive energy systems. Through this program, eligible communities have access to direct, non-financial technical assistance and potential support for new energy storage project development and deployment.

**Outcomes:**
- **Connect** disadvantaged communities with energy solutions that support equitable outcomes
- **Demonstrate** the role of energy storage in energy equity
- **Develop** methods and metrics to analyze impact of investment on equity
- **Report** on lessons learned and best practices to support future work across DOE
- **Grow** and strengthen DOE project pipeline

**Application Process** → **Technical Assistance** → **Project Development & Demonstration** → **Deployment** → **Existing Project Pipeline**
TA Eligibility and Selection Criteria

Eligibility Criteria

- Technical assistance will be beneficial to a disadvantaged community
- Disadvantaged community experiences problems or challenges with their energy system that can be addressed or partially mitigated through electric service delivery and/or energy storage
- Applicant must have the capacity to support the technical assistance process
- Applicant must have credibility to support the disadvantaged community

Selection Criteria

- Impact potential of energy storage to contribute to community objectives
- Unique value of laboratory analysis (limited funding, need for scoping work, potential public benefit, etc.)
- Strength of team described in the application to support the technical assistance process, develop a cohort with other participants, and support the community
- Likelihood of technical feasibility to enable implementation of solution identified in technical assistance
ES4SE TA Timeline

**September 2021**
1st Review Panel Meeting

**December 2021**
Application Deadline

**February 2022**
2nd Review Panel Meeting

**March - December 2022**
TA Conducted

**December 2022**
ES4SE Closing Webinar

Application Launch *September 2021*

TA Application Review *January 2022*

ES4SE Opening Webinar *March 2022*

Reports Finalized *December 2022*
Acknowledgment and Resources

Support provided by Dr. Imre Gyuk, U.S. DOE Office of Electricity, Energy Storage Program

Energy Equity at PNNL
https://www.pnnl.gov/projects/energy-equity

Energy Storage for Social Equity Initiative (ES4SE)
https://www.pnnl.gov/projects/energy-storage-social-equity-initiative

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Thank you