State Energy Storage Policy

Best Practices for Decarbonization

And Emerging Practices for Equity

Colorado PUC
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Celebrating 20 Years of State Leadership

Clean Energy States Alliance

The Clean Energy States Alliance (CESA) is a national, nonprofit coalition of public agencies and organizations working together to advance clean energy.

CESA members—mostly state agencies—include many of the most innovative, successful, and influential public funders of clean energy initiatives in the country.

www.cesa.org

CleanEnergy States Alliance

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State of California Energy Commission

Connecticut Green Bank

Department of Energy & Environment

Energy Trust of Oregon

IPA Illinois Power Agency

Governor's Energy Office (Maine)

State of New Hampshire Department of Energy

Massachusetts Clean Energy Center

Maryland Energy Administration

EGLE Michigan Department of Environment, Great Lakes, and Energy

BPU New Jersey Board of Public Utilities

New Jersey's Clean Energy Program – njcleanenergy.com

New Mexico EMNRD Energy, Minerals and Natural Resources Department

New York State NYSERDA

mn Commerce Department

SMUD Powering forward. Together.

State of Rhode Island Office of Energy Resources

Vermont Department of Public Service Clean Energy Development Fund

Virginia Energy

Rhode Island Commerce Corporation

Commissioner Stephanie Garcia Richard New Mexico State Land Office

Illinois Commerce Commission ICC

OEI Wisconsin Office of Energy Innovation

Prairie Island Indian Community in the State of Minnesota

Washington State Department of Commerce

Connecticut Energy Environment

DOER Massachusetts Department of Energy Resources

Oregon Department of Energy

Colorado Energy Office CEO

Inclusive Prosperity Capital

MassDEP

OPC-DC Office of the People's Counsel – Advocacy | Education | Protection

Energy Storage Technology Advancement Partnership (ESTAP)

Conducted under contract with Sandia National Laboratories, with funding from US DOE Office of Electricity.

- Facilitate public/private partnerships to support joint federal/state energy storage demonstration project deployment
- Support state energy storage efforts with technical, policy and program assistance
- Disseminate information to stakeholders through webinars, reports, case studies and conference presentations

CESA also has a monthly Energy Storage Working Group meeting for member states interested in energy storage

Clean Energy Group

Affordable, reliable, clean energy for all.

Climate Resilience and Community Health

Distributed Energy Access and Equity

Energy Storage and Flexible Demand

Fossil Fuel Replacement

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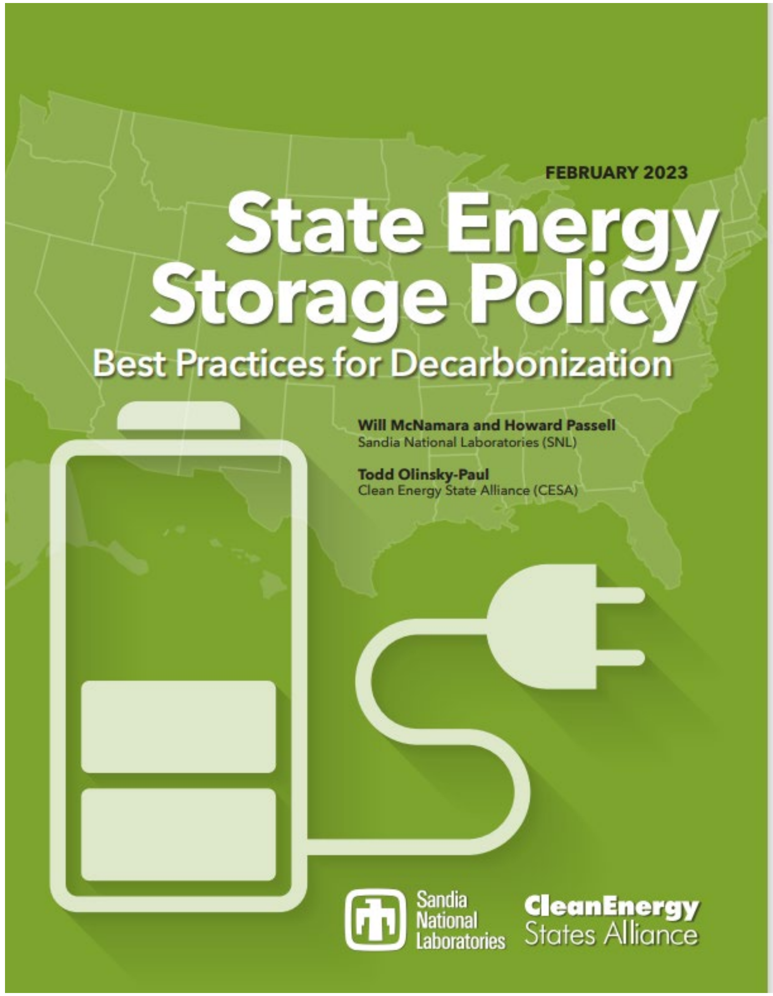
Agenda:

1. Best Practices in State Energy Storage Policymaking
2. Emerging Practices for Energy Storage Equity
3. ES4SE (DOE-OE Energy Storage for Social Equity program)

1. Best Practices in State Energy Storage Policymaking

Report: State Energy Storage Policy Best Practices for Decarbonization

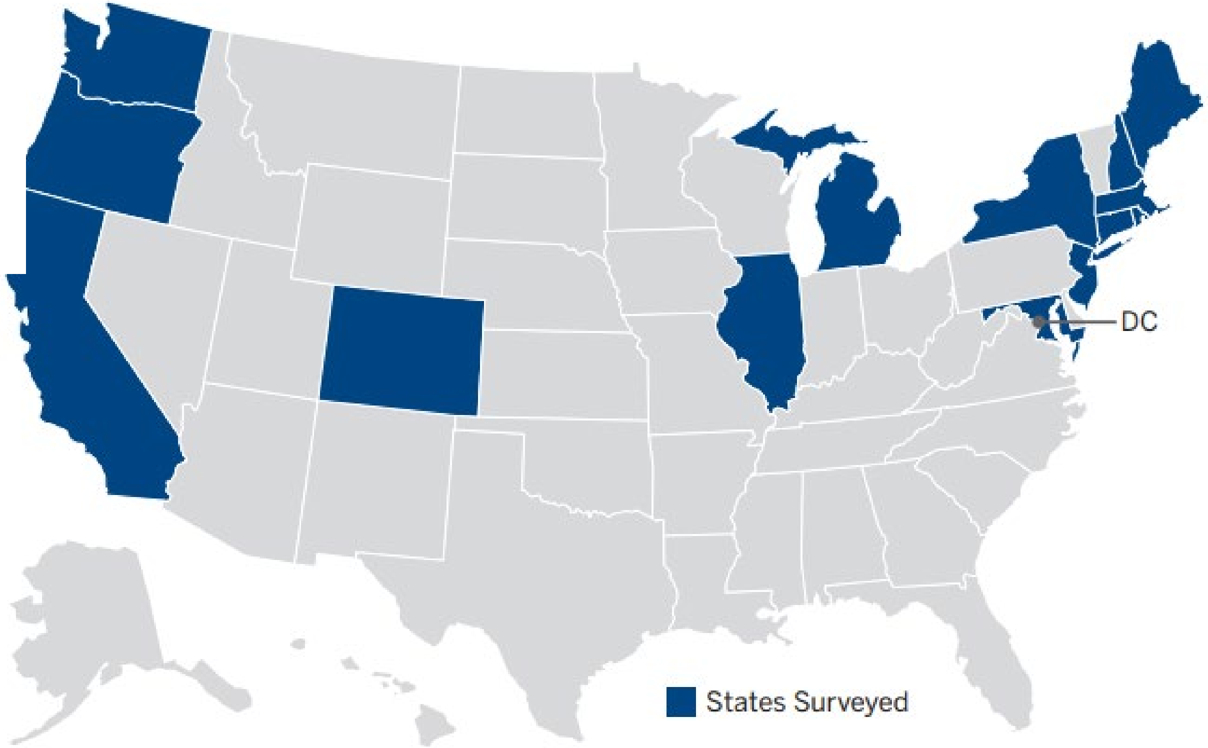
1. States survey
2. Industry survey
3. State case studies



1. THE STATE SURVEY

22 responses from 14 leading decarbonization states plus DC:

California	Maine	New Hampshire
Colorado	Massachusetts	New York
Connecticut	Maryland	Oregon
District of Columbia	Michigan	Rhode Island
Illinois	New Jersey	Washington



- Respondents represented state utility commissions, state energy offices, and governors' offices
- Intent:
  - Highlight best practices
  - Explain barriers
  - Underscore the urgent need to expand state energy storage policymaking to support decarbonization

RESULTS: PRIORITY APPLICATIONS

States seek to maximize the benefits of ES while reducing uncertainty and risk. Respondents identified a number of priority applications:

- Supporting electric reliability and resilience on the distribution grid
- Cost control
  - Enabling electrification
  - Avoiding costly T&D upgrades
  - Increasing flexibility of end-use loads (such as EV charging)
  - Peak demand reduction
- Enabling higher levels of solar PV interconnected with the grid, and the use of solar coupled with storage for interconnection upgrade mitigation.
- Exploring different applications and use cases through demonstration projects and programs
- Exploring location-specific benefits, such as resilience and peak cost reductions
- Aggregating BTM storage to serve grid needs through price signals and performance payment mechanisms

RESULTS: KEY POLICY LEVERS

1. Procurement mandates, targets, or goals
2. Ownership models for ES assets
3. Inclusion of ES in utility IRPs
4. Incentives, tax credits, or other subsidies
5. Prioritization of specific use applications for ES technologies
6. State-sanctioned benefit-cost analysis
7. Distribution system modeling for location-specific siting of ES technologies
8. Changes to existing net metering programs to accommodate BTM energy storage
9. Changes to legacy interconnection standards to enable deployment of BTM ES
10. Changes to existing RPS programs to include or specifically carve out ES requirements
11. Use of time-variant electric rates to spur the development of BTM storage technologies
12. Retail rate re-design
13. Equity policies specific to ES technologies

RESULTS: THE TOP FIVE STATE POLICY LEVERS

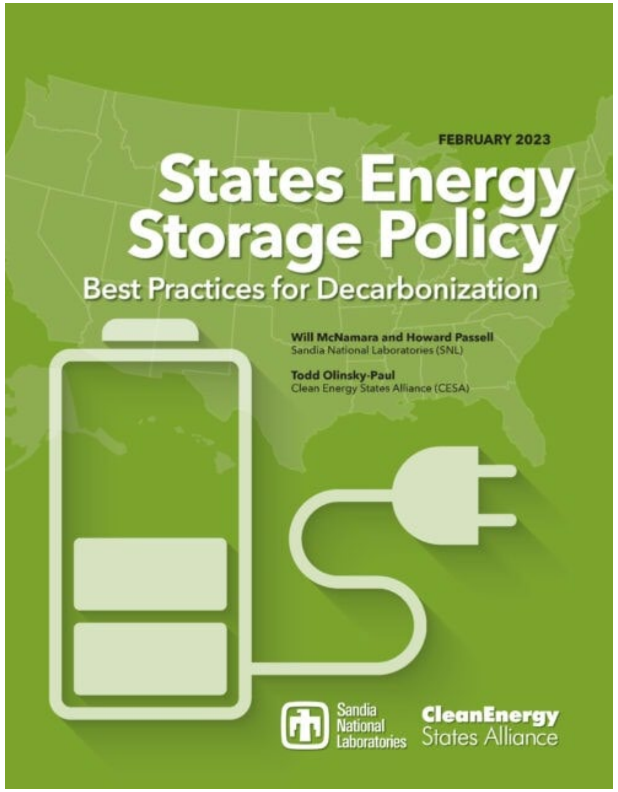
1) **Procurement mandates/targets/goals.** Twelve states have adopted a procurement target. Carve-outs for specific types of storage (e.g. distributed/BTM, equity-focused, or long duration) are beginning to appear in state procurement programs. Note most procurements are measured in MW.
2) **Utility ownership of energy storage.** Largely determined by competitive status of state. Where utilities are allowed to own storage, utility resource planning becomes a priority. Some states have allowed utility ownership despite restructured status by defining storage as an asset that utilities can own (e.g. Massachusetts) or by defining circumstances under which utilities can own storage (e.g. New York).
3) **Incentives (subsidies, tax credits).** Incentives can be designed to support specific state policy goals through adders (e.g., equity access, resilience and reliability, emissions reduction, peak shaving). Only one state (Maryland) has tried state tax credits (and has now abandoned the program).
4) **State-sanctioned benefit-cost analysis of ES.** States and regulated utilities apply various cost-effectiveness tests to justify public funding for storage programs. States can affect the outcome by choosing which test to apply, and including or excluding specific storage services from the analysis.
5) **Distribution system modeling for locational values/siting.** Challenge is a lack of available modeling tools. Sophisticated modeling approaches will need to identify distribution grid needs under various scenarios and evaluate multiple solutions.

2. THE INDUSTRY SURVEY

In addition to the state survey, we also surveyed six energy storage development companies and one industry consultant, to compare their policy priorities with those of the state energy agencies.

- Enel North America
- Key Capture Energy
- New Leaf Energy (formerly Borrego)
- Nostromo Energy
- Sunrun
- Tesla
- An independent consultant to the energy storage industry

We wanted to find out whether the storage policies most frequently adopted by states were the policies most valued by developers.



NOTE: These were non-utility energy storage developers

INDUSTRY SURVEY RESULTS AND TAKEAWAYS

Industry respondents:

- ***Unanimously agreed*** that state energy storage policies, programs, and regulations are essential to their business
    - Affirmed that their companies invest most of their efforts toward building market share in those states that adopt the most favorable energy storage policies

  Takeaway: Supportive state ES policy is essential to build markets!

- Were ***nearly unanimous*** (6 out of 7) in viewing states with decarbonization goals or policies as generally more welcoming than states without

  Takeaway: Storage-supporting policies and targets, such as decarbonization, are also very important!

- ***Unanimously cited*** incentives/tax credits as being the single *most* helpful type of state energy storage policy

  Takeaway: While markets remain immature, direct incentives are most effective to bridge the energy storage economics gap (for non-utility developers).

Recommendation: Set supportive clean energy targets and use direct incentives, such as rebates, performance payments and tax credits, to provide gap funding until markets mature.

INDUSTRY SURVEY RESULTS AND TAKEAWAYS

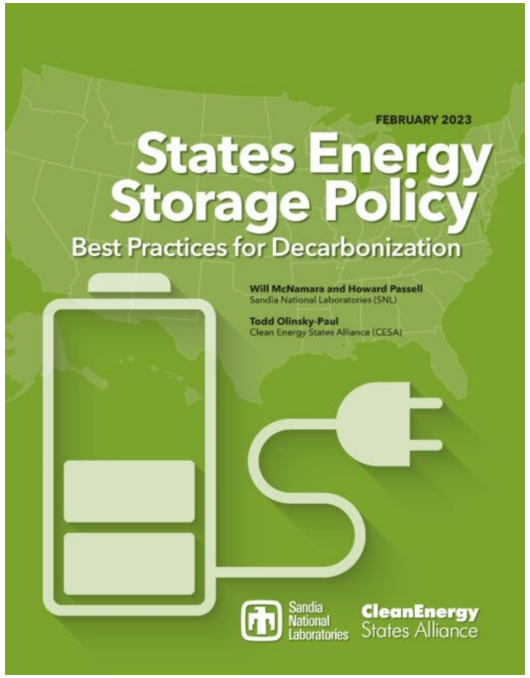
- Industry respondents were:
  - ***Nearly unanimous*** (6 out of 7) in citing utility ownership of energy storage as the *least* helpful policy

  Takeaway: non-utility storage developers likely view storage-owning utilities as unwanted, and maybe unfair, competition

- Distribution system modeling and changes to solar net metering regulations were also cited by several respondents as being among the *least* helpful state policies
- Asked which energy storage policy types they *most* want to see states adopt, industry respondents gave a range of answers. Most popular:
  - Incentives/tax credits
  - Procurement/RPS requirements
  - Changes to interconnection standards
- While affirming the importance of state policies, two respondents noted that wholesale market policies are also very important, citing Texas as an example of a state that lacks storage policies but is attractive due to wholesale energy market opportunities

3. State Case Studies

We conducted in-depth case studies, interviewing policymakers from five key states: **California, Illinois, Massachusetts, New York, and Oregon**



Through the survey and case studies, some common barriers were identified:

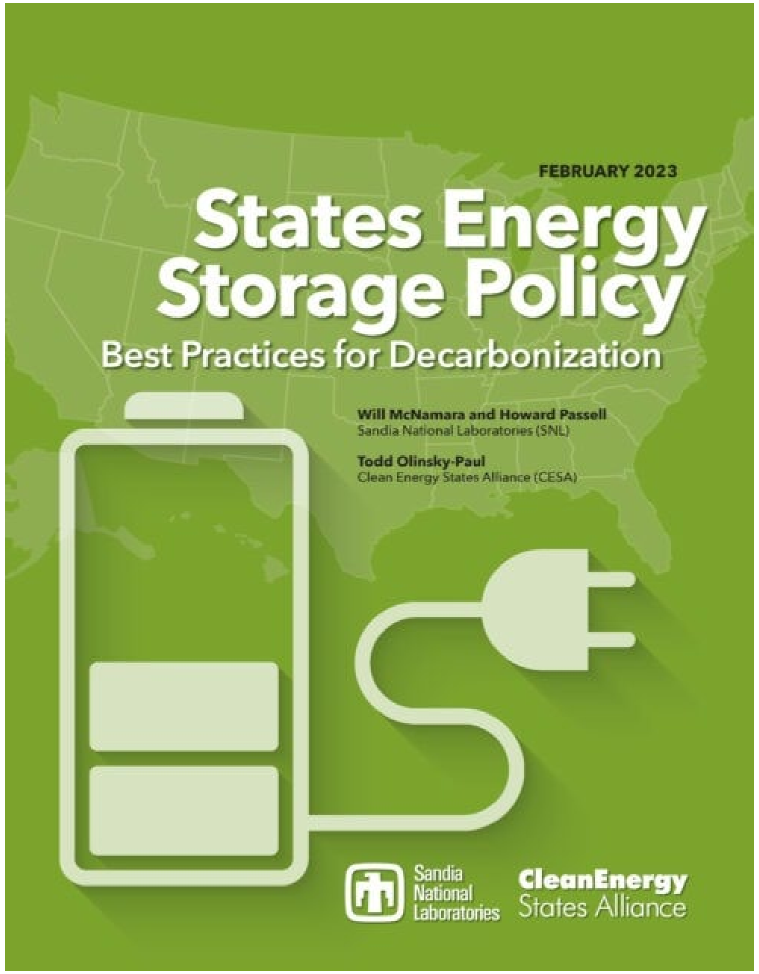
- Grid **interconnection** barriers
- Questions of **equity** in energy storage program development
- Uncertainties about storage **valuation**, especially non-energy and non-monetizable benefits
- Difficulties in **harnessing storage to meet state energy and environmental goals**, especially distributed storage
- **Knowledge barriers**, especially future energy needs and future storage capabilities
- Uncertain or divided **regulatory authority**
- Insufficiently developed **markets**
- Questions about **who should pay** for energy storage investments, and how to allocate costs equitably
- Perceived **high costs** of energy storage
- Uncertainties about **how to bring energy storage to scale**, especially to provide longer-duration grid services

These barriers, and steps states are taking to address them, are explored more fully in state case studies in the report.

DOWNLOAD THE REPORT

Download the full report:
https://www.cesa.org/resource-library/resource/states-energy-storage-policy-best-practices-for-decarbonization/

Thanks to US DOE-OE and Sandia National Laboratories



U.S. DEPARTMENT OF ENERGY

Sandia National Laboratories

CleanEnergy States Alliance

2. Emerging Practices for Energy Storage Equity

Upcoming Report: "The Pursuit of Equity in Energy Storage Programs: Emerging Practices in State Policy"

Preliminary results:

States that have adopted equity energy storage policies have numerous reasons for doing so. These may include:

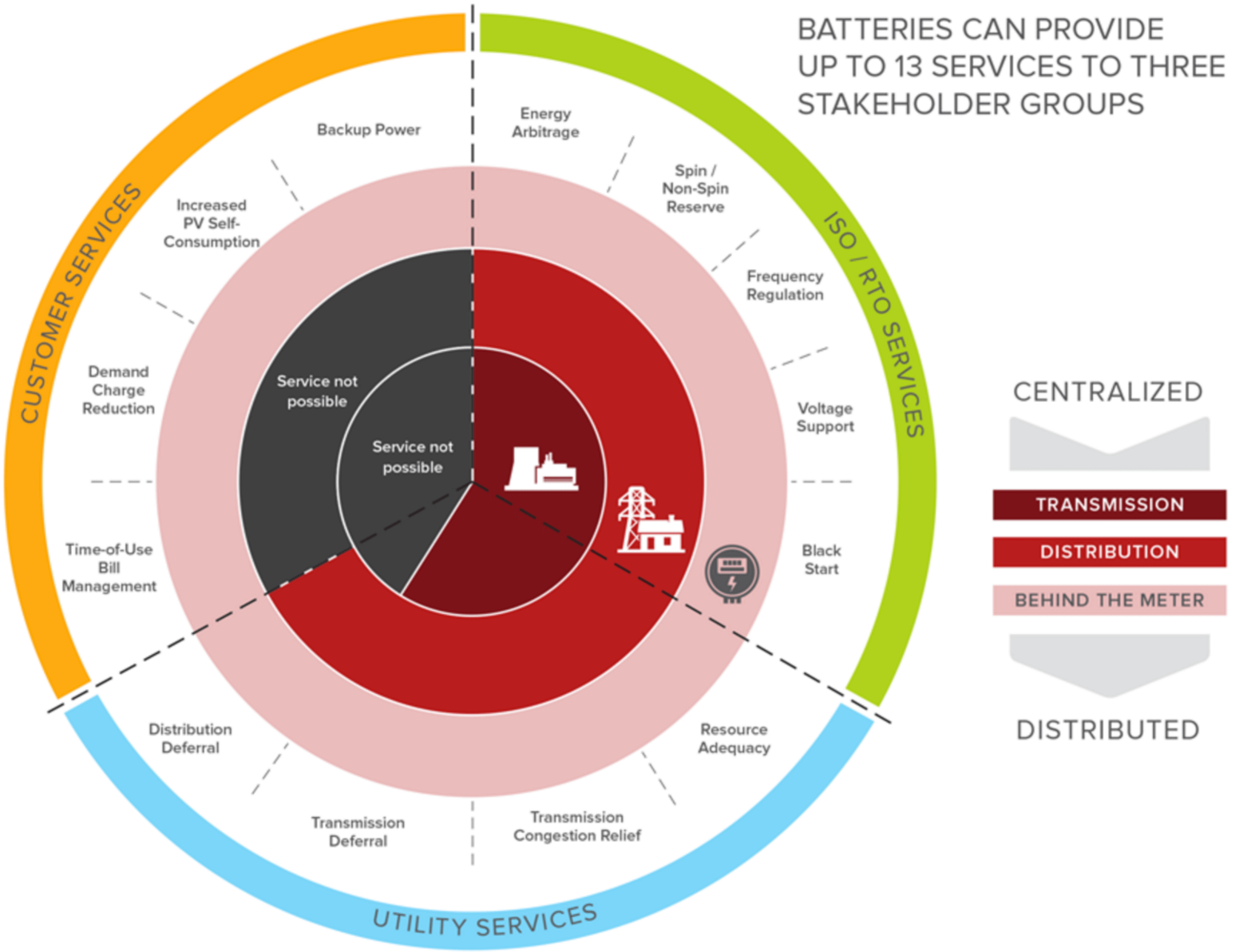
- Commitments to equitable energy policy overall
- A belief in resilient/reliable power or energy storage as a right
- The perception that energy storage may at times be the most cost-effective and fastest solution to address recurring power outages in underserved and remote communities
- A need for equitable storage policy to support larger state energy policy goals
- Requirements for equity attached to federal funding opportunities (e.g. community benefits plans)

The state programs surveyed have incorporated the following types of equity provisions:

1. Capacity carve-out, such as a Justice40 commitment, in incentive or procurement programs
2. Incentive adder for income-eligible participants and those residing in historically underserved communities, and commercial entities serving those communities
3. Front-loaded incentive payments for income-eligible participants
4. Low- or no-cost financing for income-eligible participants
5. Optional on-bill financing
6. Pre-development technical assistance to determine technical and economic feasibility and project optimization, and to support funding applications
7. Community benefits requirement, for example a requirement that commercial projects qualifying for equity incentive adders show how the project will benefit the host community
8. Provisions for a variety of ownership models, for example incentive eligibility for both owned and leased systems

Distributed vs Bulk Storage Equity

- Most state ES equity experience to date is in distributed storage programs rather than bulk storage.
- One reason for this is that local community benefits, which can advance energy and environmental equity, are more readily obtained when energy storage is sited closer to load.



BUT: This does not mean that equity cannot or should not be a goal of large-scale energy storage procurement and regulation!

Example: NY PSC Order Establishing Updated Energy Storage Goal and Deployment Policy (New York Public Service Commission Case 18-E-0130)

- 35 percent equity carve-out applied to procurement of the state's 6 GW energy storage target
  - Applies both to bulk and distributed energy storage procurement
- NY PSC directs allocation of the carve-out to areas of the state that will most benefit disadvantaged communities and reduce reliance on high-emitting peaking plants
  - For bulk power storage, the Commission specifies which capacity zones of the state should be prioritized for hosting large-scale energy storage projects to provide the greatest benefit to disadvantaged communities
  - For distributed storage, at least 35 percent of procured energy storage projects must be located within disadvantaged communities
- New York State Energy Research and Development Authority (NYSERDA) must incorporate considerations for disadvantaged communities and their participation within its implementation plans

Three observations:

1. Whenever possible, consideration of equity provisions should take place when programs are initially designed, rather than as a later add-on (although late is better than never)
2. The process of developing equity provisions should incorporate input from a wide variety of stakeholders, including representatives of underserved communities and equity advocacy organizations
3. Once equity programming is in place, its effectiveness should be evaluated regularly, and provisions should be adjusted if they are found to be ineffective

States can apply US DOE's four core tenets of energy justice: distributive justice, recognition justice, procedural justice, and restorative justice

These underly the federal Justice40 Initiative, and increasingly inform state-level energy storage equity programs

- *Distributive*: programs that seek to ensure that availability and affordability of energy systems and services are key to realizing distributive equity
- *Recognition*: focusing on those in society who have been historically ignored or misrepresented in the energy system, and determining whether proposed projects or programs would create additional social or environmental impacts within the communities being served
- *Procedural*: increasing public participation through the notions of transparency, accountability, and due process to identify underserved and affected communities and design energy storage deployment mandates or consumer-based incentives to install storage to benefit those communities
- *Restorative*: programs that seek to reverse and repair the harms done by legacy programs through the creation of improved environmental and social conditions within communities, including job and enterprise creation, as well as remediation of legacy pollution

Tarekegne B, O'Neil R, Twitchell J. Energy Storage as an Equity Asset. Curr Sustainable Renewable Energy Rep. 2021;8(3):149–55. doi: 10.1007/s40518-021-00184-6. Epub 2021 May 20. PMCID: PMC8134812.

CleanEnergyGroup

Phase Out Peakers

Replacing peaker power plants with clean alternatives in environmental justice communities.

NEW YORK CITY ENVIRONMENTAL JUSTICE ALLIANCE · N·Y·C·E·J·A · 1991

STRATEGEN

MCAN Mass Climate Action Network

SLINGSHOT

UPROSE

BEAT Berkshire Environmental ACTION TEAM

NYLPI JUSTICE THROUGH COMMUNITY POWER

THE POINT

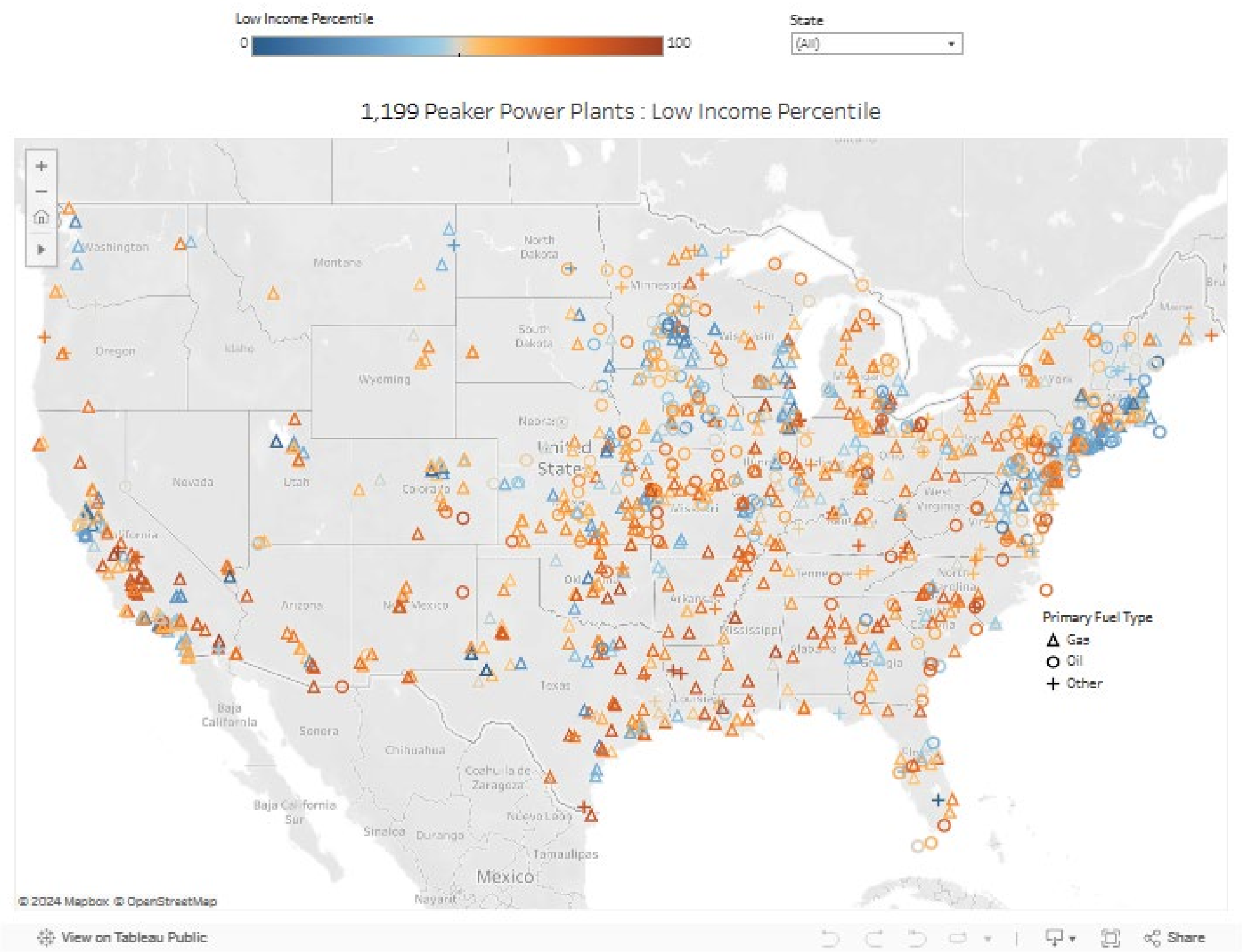
Ravenswood Generating Station in Queens, NY. Credit: Bigstock

www.cleanegroup.org/initiatives/phase-out-peakers

Fossil-Fueled Peakers:

- May run on natural gas, oil, kerosene or even coal
- Run infrequently, but are very costly
- Highly polluting
  - Human health impacts
  - Environmental impacts
- Often sited in populated areas
- Disproportionately sited in poorer and underserved communities
- Cause equity concerns

Interactive maps are available at CEG's Phase Out Peakers project page: https://www.cleanegroup.org/initiatives/phase-out-peakers/



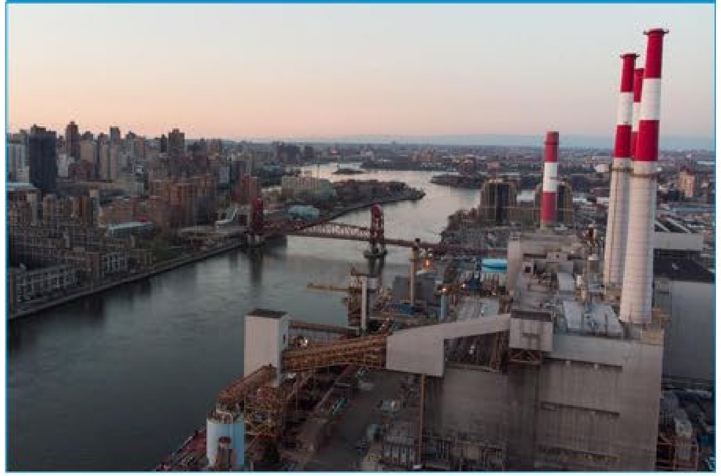
Peaker Distribution and Emissions: Low-Income Percentiles

Percentile	Number of peakers	Population within a 3-mile radius	Low-income percentage of population	Average nitrogen oxide (NOx) emission rate
0 - 25th	85	1.8 million	0 - 14%	13.2 lb/MWh
25th - 50th	334	17.5 million	14 - 28%	20.3 lb/MWh
50th - 75th	578	33.5 million	28 - 46%	30.4 lb/MWh
75th - 100th	202	10.2 million	46 - 93%	15.5 lb/MWh

Yes, Batteries Can Replace Peakers!

Successful Projects: a Few Examples

New York City



LS Power's 316 MW (8-hr) battery to replace Ravenswood oil and gas peaker plant

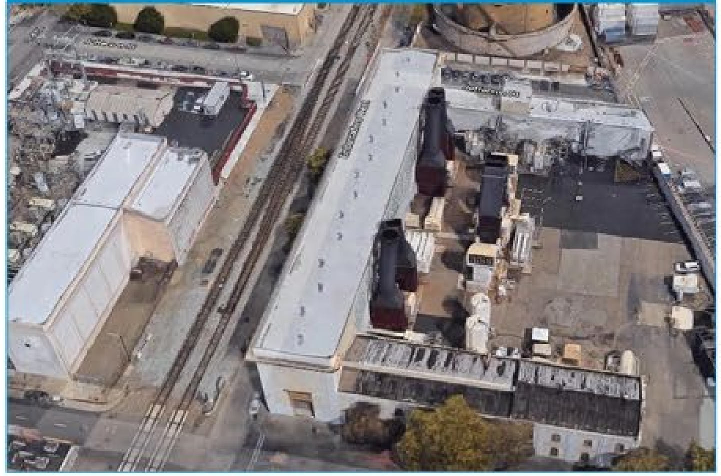
- Expected to be online 2022-2024
- Approved & waiting contractor

Los Angeles

SoCal Edison is using 195 MW of 4-hr batteries to replace Puente Gas Power Plant (262 MW)

- Decision followed the push-back of community & environment advocates

The Bay Area



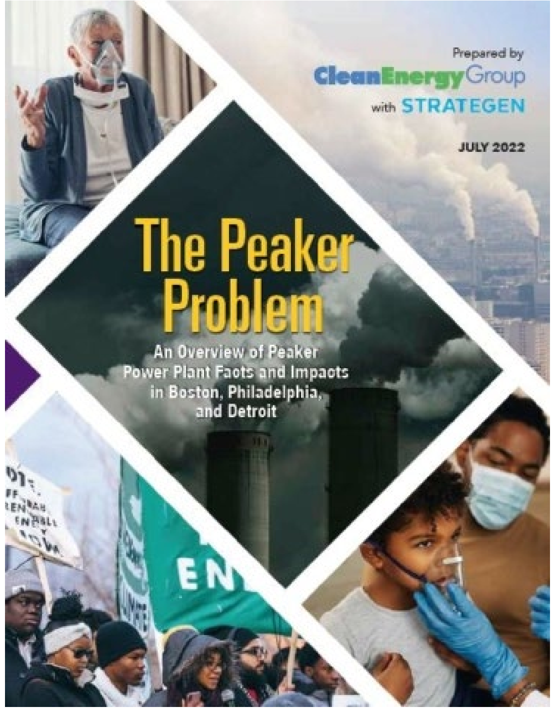
East Bay CCA replaces Oakland peaker with 20 MW (4-hr) battery and home solar+ storage

- 2 MWh of batteries on 500 low-income units in the area before 2022.

Peaker Replacement:
A Community Issue

Clean Energy Group's *Phase Out Peakers* program works with community-based organizations to support peaker replacement initiatives

- New York City
- Philadelphia
- Boston
- Western Massachusetts
- Detroit



These reports and others are available at CEG's Phase Out Peakers project page: https://www.cleanegroup.org/initiatives/phase-out-peakers/

Peaker Replacement: A State Issue

Clean Energy States Alliance works to support state energy agencies in developing energy storage for peaker replacement

Several states have combined energy storage procurement with fossil-fueled peaker replacement initiatives:

- New York State – procurement target of 6,000 MW energy storage by 2030; PSC is requiring 35% equity procurement with focus on underserved communities and peaker replacement. Related target – phase out peakers with high nitrogen oxide emissions by 2025

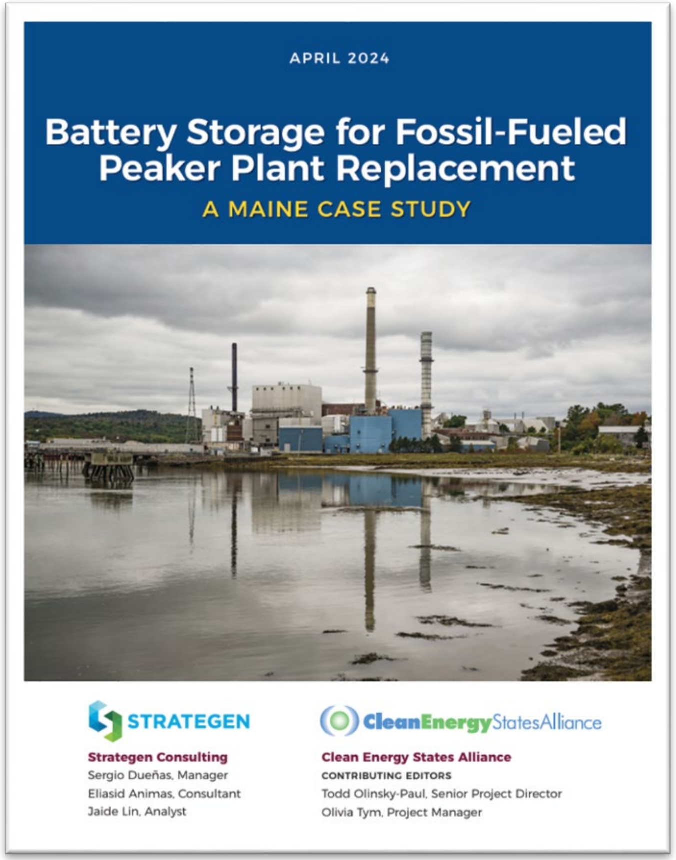
- Massachusetts – procurement target of 1,000 MW energy storage by 2025; Adopted the nation's first Clean Peak Energy Standard, which requires peak power to be increasingly sourced from renewables and storage

Numerous states have adopted emissions caps, clean energy goals and climate plans that will require peaker replacement:

- 100% clean energy targets – 23 states plus DC and Puerto Rico
- Climate action plans – 33 states

Report: Battery Storage is More Cost-Effective Than New Gas Peakers in Maine (and the rest of New England)

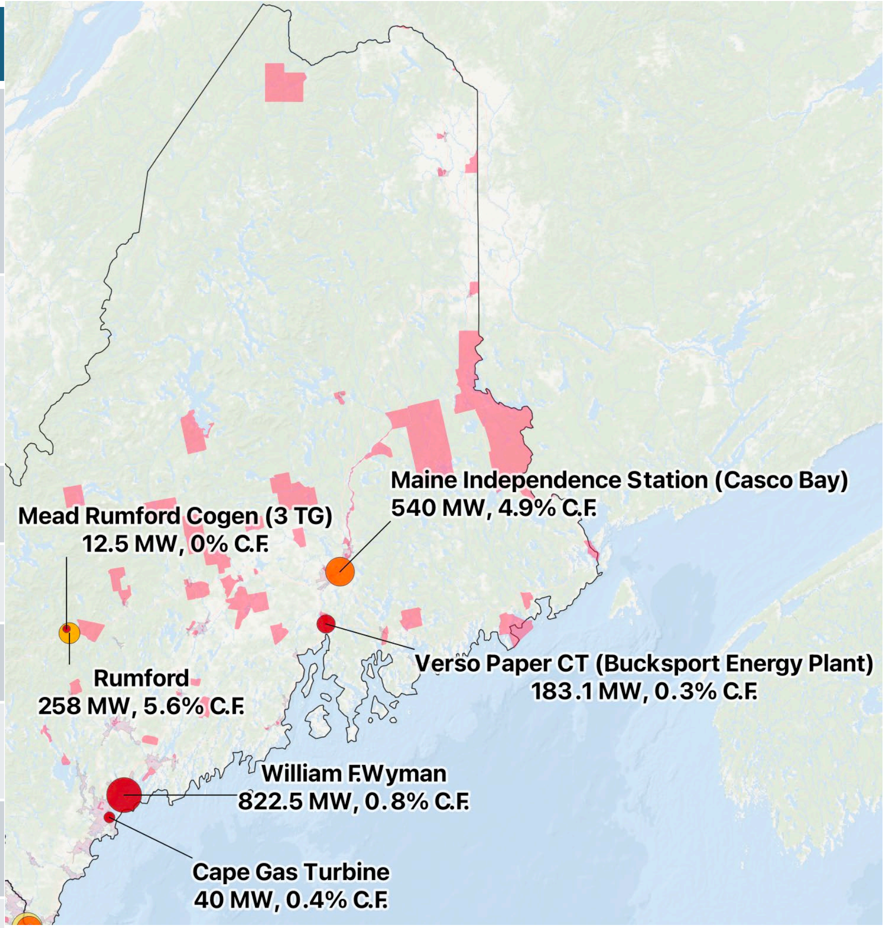
- Clean Energy Group and Clean Energy States Alliance contracted Strategen to conduct an economic analysis of battery storage for peaker plant replacement in Maine
- This report is intended to support Maine's upcoming 200 MW energy storage procurement
- Due to the nature of the regional energy capacity market, the results should be applicable across all six New England states
- **Takeaway: When the costs of air pollution are included in the analysis, new batteries are more cost-effective than new gas peakers.**



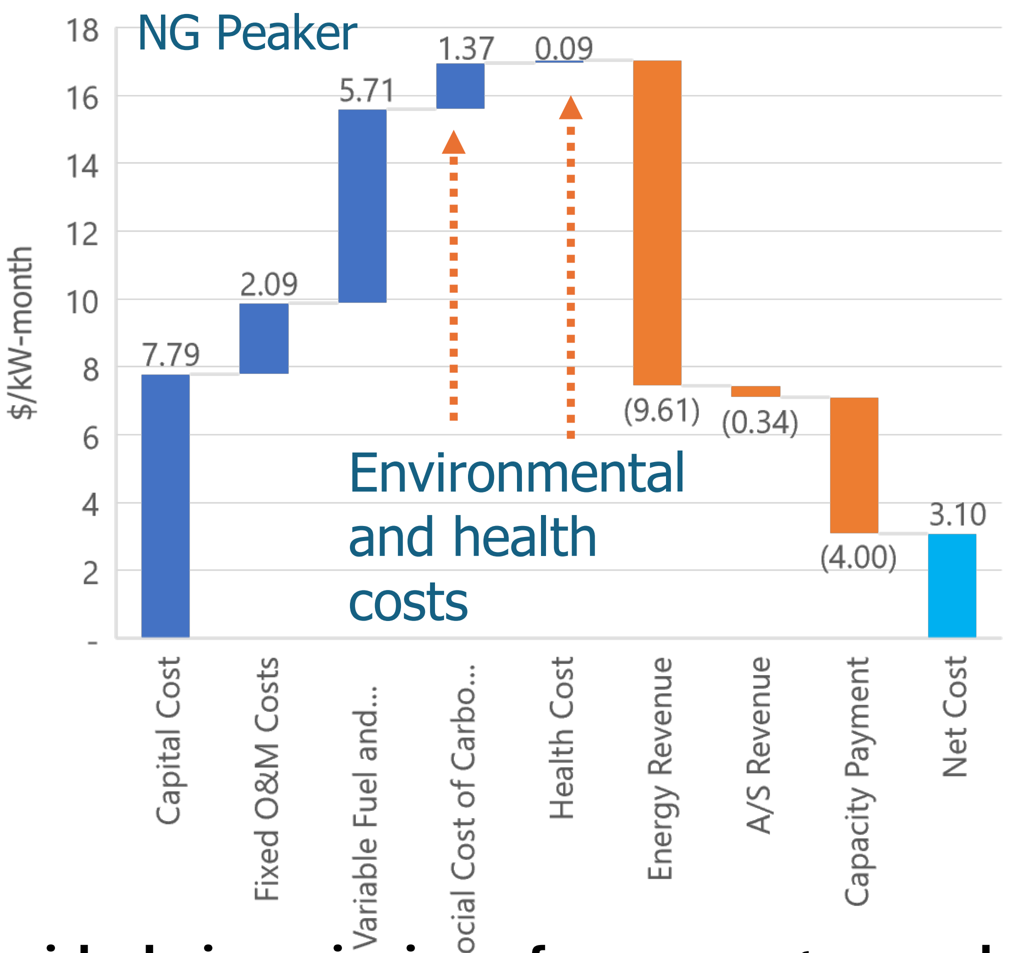
Average health costs of air pollutants in urban areas were obtained from "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates under Executive Order 13990," U.S. Government Inter agency Working Group on Social Cost of Greenhouse Gases, February 2021. See https://www.whitehouse.gov/wp-content/ uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf. Cost numbers have been adjusted for inflation

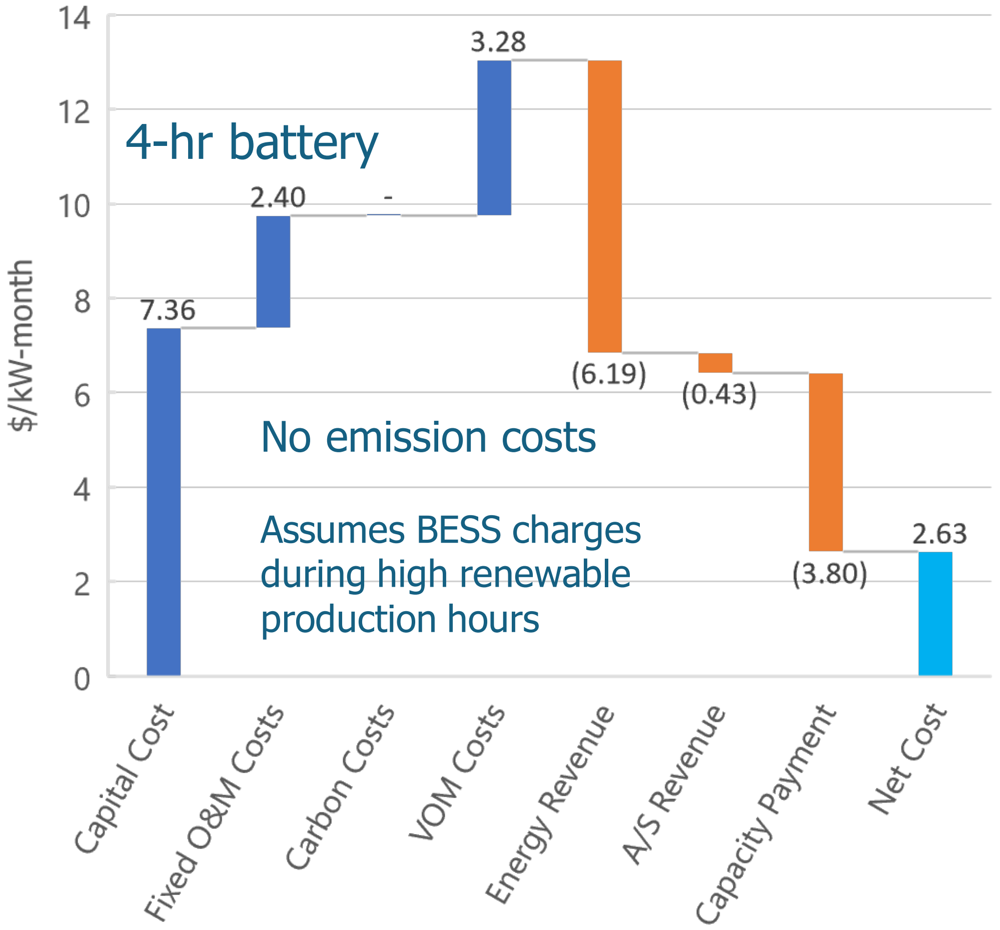
1. Selection of target peakers

	Wyman	Cape Gas	Bucksport	Casco Bay	Rumford
Technology	Steam turbine, residual fuel oil	Gas turbines, distillate fuel oil	Gas turbine, ng and distillate fuel oil	**Combined cycle**, natural gas	**Combined cycle**, natural gas
Units (MW)	Two units (114 and 605 MW)	Two units (20 MW each)	1 unit (183 MW)	1 unit (540 MW)	1 unit (258 MW)
Age	59 and 46 yrs	54 years old	23 years old	24 years old	24 years old
Owner	NextEra	NextEra	JERA	Vistra	Carlyle Group
Utility	CMP	CMP	CMP	Versant Power	CMP
Heat Rate (Btu/kWh)	10,990	20,730	12,300	~7,500	~7,500
2022 Capacity Factor (%)	3.3	0.1	0.6	14	19
Variable O&M Costs ($/MWh)	83	300	-	-	-



Cost-benefit comparison: New NG Peaker VS 4-hr Battery





Avoided air emissions from new gas peakers would save Maine an estimated $7.1 million annually based on the morbidity and mortality of NO_X and SO_2 and precursors of fine particulate matter (PM2.5). These are externalities that fossil fuel generators do not pay for.

Findings

When the societal costs of air emissions are counted, energy storage is cheaper than a new F-frame gas peaker in Maine (and New England)

Table 4

Comparison of New Peaking Alternatives' Net Costs Under QC and ELCC Cases, Inclusive of Health and Societal Costs ($kW-month)

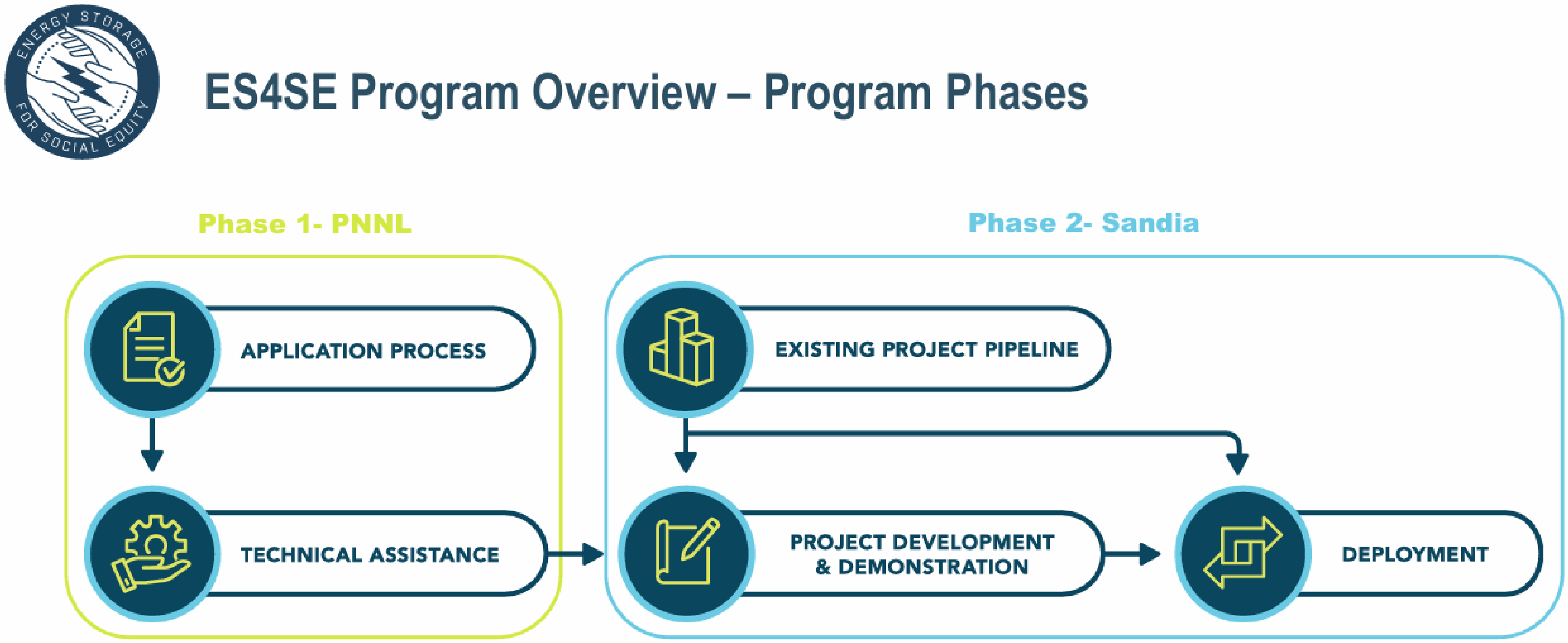
QC		ELCC	
Asset	**Net Cost**	**Asset**	**Net Cost**
BESS, 2-hr	(0.54)	BESS, 4-hr	2.63
BESS, 4-hr	2.42	New F-Frame	3.10
New F-Frame	3.10	BESS, 2-hr	3.12

Source: Strategen Consulting

Takeaway: The state can create a more level playing field for storage by internalizing externalities, such as emissions costs, in benefit-cost analysis (and valuing these non-monetizable services).

3. ES4SE – Energy Storage for Social Equity

A program of US DOE-OE, PNNL and Sandia



OUTCOMES

Connect disadvantaged communities with energy solutions that support equitable outcomes

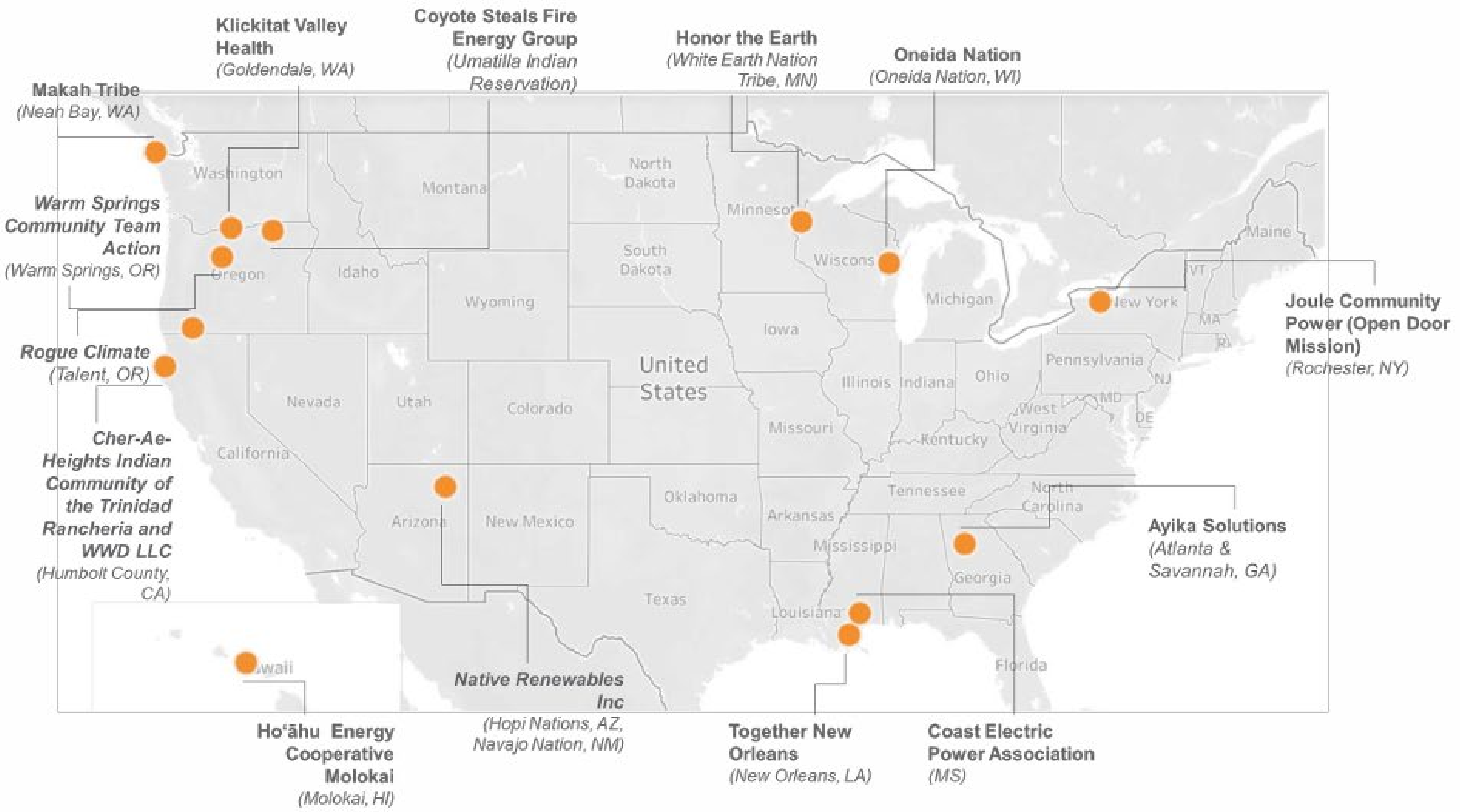
Demonstrate the role of energy storage in energy equity

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

Energy Storage for Social Equity Initiative is a distinctive new technical assistance program



- Focus on the problem with many possible solutions
- Linking Grid and Community Resilience
- Workforce and equity are part of the assistance
- Cohort of Communities
- Direct connection to future project funding
- Easy Access and Targeted Outreach

More Information: www.cesa.org

Thank You!

And thanks to Sandia National Laboratories and US DOE-OE

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