Replacing Peaker Plants with Battery Storage
HOUSEKEEPING

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THE RESILIENT POWER PROJECT

• Increase public/private investment in clean, resilient power systems (solar+storage)
• Protect low-income and vulnerable communities, with a focus on affordable housing and critical public facilities
• Engage city, state and federal policy makers to develop supportive policies and programs
SUPPORTING 100+ PROJECTS ACROSS THE COUNTRY

Portland: Assessment of 10 LMI properties including affordable housing, foodbanks, medical centers, and shelters

DC: Largest solar+storage installation at affordable housing in the country

California: Multiple housing properties representing hundreds of units of affordable housing

Boston Medical Center: One of the first hospitals in the country to install storage for resiliency

Puerto Rico: Supporting the installation of solar+storage at more than 60 medical clinics
Resilient Power in Practice: Lessons Learned from the Field

Webinar Speakers

• **Elena Krieger**, Director, Clean Energy Program, PSE Healthy Energy

• **Lucas Zucker**, Policy and Communications Director, Central Coast Alliance United for a Sustainable Economy (CAUSE)

• **Seth Mullendore**, Vice President & Project Director, Clean Energy Group
Peaker Plants vs. Battery Storage

Seth Mullendore, Vice President/Project Director
Clean Energy Group

July 19, 2018
WHAT IS A PEAKER PLANT?

Run during periods of **high electricity demand**

**Less efficient** (worse emissions)

Located **closer to population centers**

**Low capacity factor** (< 10%)

Only **operate for a few hours at a time**
120 GW OF PEAKERS IN THE U.S.

73 GW (67%) of peaking capacity has average capacity factor of 10% or less AND average hours per start of 8 hours or less.

91.5 GW (84%) of peaking capacity has average capacity factor of 10% or less.

80 GW (73%) of peaking capacity has average hours per start of 8 hours or less.

Source: Wood Mackenzie based on EIA
PEAKERS IN THE U.S.

Source: U.S. Energy Information Administration Form 923 Schedule 3B (2016)
“We could replace every gas peaker in the U.S. with batteries right now if we wanted to, but it probably wouldn’t make economic sense everywhere.”

Abe Silverman, vice president for the regulatory affairs group and deputy general counsel at NRG Energy (GTM Forum: Energy Storage vs. Gas, May 2018)
ECONOMICS: PEAKERS VS STORAGE

Within Six Years, Storage Begins to Compete Head-to-Head

Within Ten Years, Storage Almost Always Wins Out

8-Hour Storage Should Be Sufficient to Meet Peaker Needs for ~90% of Starts

Source: GTM Research, Wood Mackenzie
Nearly **3 GW** of aging peakers approaching retirement

Highly **constrained** area

Air pollution represents a major public health problem

BATTERY PEAKER PROJECTS:
ARIZONA PUBLIC SERVICE

First Solar Made Good on Its Promise to Beat Out Gas Peakers With Solar and Batteries

A 50-megawatt battery will give Arizona peak power from the sun.

- 50-MW / 135-MWh battery, 65-MW solar
- 15-year PPA with First Solar
- Request for proposal open to any technology
- Proposals had to deliver power between 3 pm and 8 pm in the summer
BATTERY PEAKER PROJECTS:

SALT RIVER PROJECT

Arizona Is Getting Its First Standalone Battery Peaker

The Salt River Project’s new battery system will charge up on existing energy sources to serve the Phoenix metropolitan area.

- 10-MW / 40-MWh battery
- 20-year PPA with AES
- Peaking capacity for the Phoenix metropolitan area
- Sited near population center
PG&E to replace 3 gas plants with world's biggest battery projects

• 4 proposed battery storage projects, more than 2 GWh
• Built to eliminate need for 3 gas peaker plants with reliability must-run contracts in constrained area
BATTERY PEAKER PROJECTS:
NEVADA ENERGY

Breaking Down the Numbers for Nevada’s Super-Cheap Solar-Plus-Storage

• **Battle Mountain:**
  • 25-MW / 100-MWh battery, 101-MW solar
  • LCOE = $30.94/MWh, Capacity = $93/kW-year

• **Dodge Flat:**
  • 50-MW / 200-MWh battery, 200-MW solar
  • LCOE = $34.87/MWh, Capacity = $73/kW-year
FOR MORE INFORMATION

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Clean Energy Group
Innovation in Finance, Technology & Policy
Using health, environment and equity metrics to target peaker replacement

Elena Krieger, PhD
Director, Clean Energy Program
PSE Healthy Energy

Clean Energy Group Webinar
July 19, 2018
Health, environment and equity considerations for targeting peakers for storage replacement

- **Emissions:** which plants have highest carbon dioxide and nitrogen oxide emissions per MWh?
- **Background air quality:** is the plant operating on days with high air pollution?
- **Demographics:** how many people live nearby and is the plant located in a vulnerable or environmentally overburdened community?
- **Grid constraints:** does local clean energy deployment affect local grid need for the peaker?
California peaker plants

Yuba City Energy Center

Feather River Energy Center

McGrath Peaker
Gas peaker emission rates higher than combined cycle plants

- Nitrogen oxide (NOx) emissions contribute to the formation of air pollutants like ozone and particulate matter.
- High peaker emissions due to lower efficiency, larger proportion of start-up time.

Data source: EPA Air Markets Program Data (ampd.epa.gov)
Peakers disproportionately operate on polluted days

Data sources: EPA Air Markets Program Data (ampd.epa.gov), EPA AirNow (www.airnow.gov)
CA peakers disproportionately located in disadvantaged communities
Storage benefits even greater if displacing oil peakers

• New York and other regions have even higher-polluting oil-fired peakers

• For emission benefits, must ensure that storage is charged with lower-emissions sources (e.g. hydro, not coal)

Data: EPA Air Markets Program
Strategies to incorporate co-benefits into storage peaker replacement

- **Incentives** needed to value:
  - Emissions
  - Equity
  - Resilience

- **Operational strategies** include:
  - Use storage to minimize peaker starts, stops and ramping
  - Charge storage at times of lowest marginal emissions, discharge at times of high marginal emissions
  - Dispatch storage preferentially on poor air quality days

- **Siting strategies** initially include using storage instead of:
  - Repowering old plants
  - Siting new plants

- **Targeted policies** include:
  - Cap-and-trade funds directed to disadvantaged communities
  - Pilot projects
  - Combining air quality, clean energy, equity, and grid services funding to enable projects

PSE is developing a California power plant mapping tool which incorporates all of these data and more. Stay tuned!

[www.psehealthyenergy.org](http://www.psehealthyenergy.org)

krieger@psehealthyenergy.org
Oxnard Demographics

Total Population: 207,252
<table>
<thead>
<tr>
<th></th>
<th>California</th>
<th>Oxnard</th>
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<tbody>
<tr>
<td>People of color</td>
<td>61%</td>
<td>86%</td>
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<tr>
<td>Latino</td>
<td>39%</td>
<td>74%</td>
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<tr>
<td>Immigrant</td>
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<td>38%</td>
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<tr>
<td>Undocumented</td>
<td>7%</td>
<td>17%</td>
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<tr>
<td>Less than high school</td>
<td>18%</td>
<td>34%</td>
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<tr>
<td>Less than bachelors</td>
<td>69%</td>
<td>84%</td>
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<tr>
<td>Non-English at home</td>
<td>44%</td>
<td>68%</td>
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<tr>
<td>Under 18 years old</td>
<td>25%</td>
<td>30%</td>
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History of Environmental Justice
Struggles in Oxnard

- 1999 lawsuit from Rio Mesa school, Oxnard now #1 in state for students attending school near highest levels of toxic agricultural pesticides
- 2004 Halaco toxic waste dumping site abandoned, 2007 designated EPA Superfund Site
- 2007 Oxnard community defeats proposed BHP Billiton liquefied natural gas terminal
- All of Ventura County’s power plants in Oxnard, community fights McGrath Peaker unsuccessfully in 2012
Protesters short-circuit Oxnard power plant meeting
Lawmakers urge against Oxnard power plant
Environmentalist Tom Steyer lends voice in opposition to Oxnard power plant
Regulators want more info before deciding on power plant
Energy needs can be met without new Oxnard power plant, study shows
State energy committee to recommend denial of Oxnard power plant
NRG calls for suspension of Oxnard power plant plans as it mulls full withdrawal
Edison's latest plan sees no need for gas-fired power plants in Ventura County
Editorial: Oxnard power plant approval seems inevitable

There seems to be a growing air of inevitability about the new power plant project at Mandalay Beach.

Editorial: Is Puente a turning point in our energy future?

All the residents, community leaders, environmentalists and city officials fighting plans for a
WE DESERVE CLEAN AIR

YOU GAVE US 3 MINUTES
WE GAVE 2 YEARS
Thank you for attending our webinar

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Upcoming Webinars

Simplifying Resilient Power Design with REopt Lite: A Look at New Features Added to NREL’s Solar+Storage Tool
Wednesday, July 25, 1-2pm ET

Building Markets: Energy Storage in Massachusetts and Offshore Wind in Rhode Island
Thursday, August 9, 1-2:30pm ET

Read more and register at www.cleanegroup.org/webinars