BTO's Connected Role in a Clean, Abundant, Resilient & Economic Energy Future

Building Technologies Office's Peer Review

April 30, 2018

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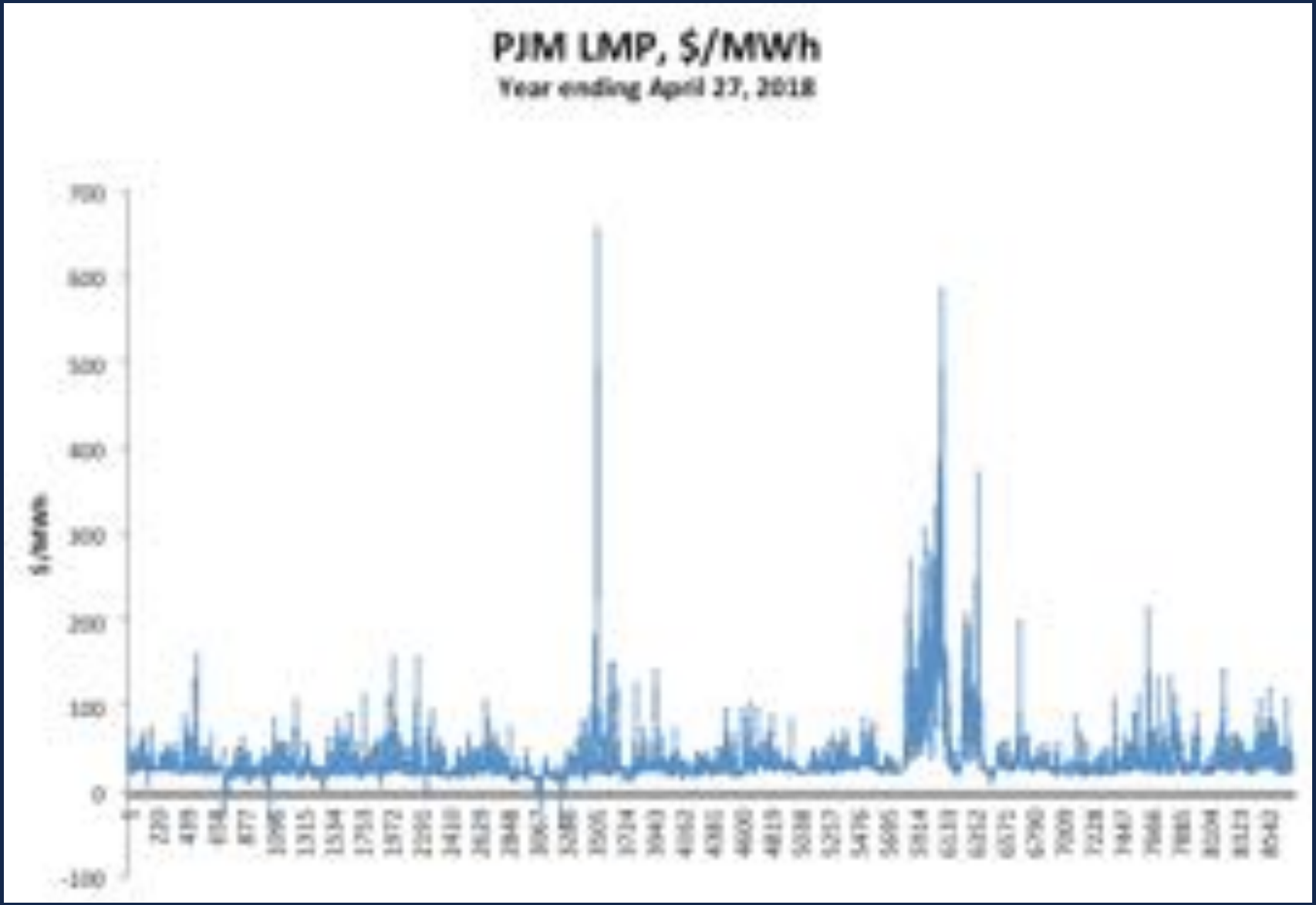
Evolving Context for BTO – Beyond EE

Abundant Energy Resources

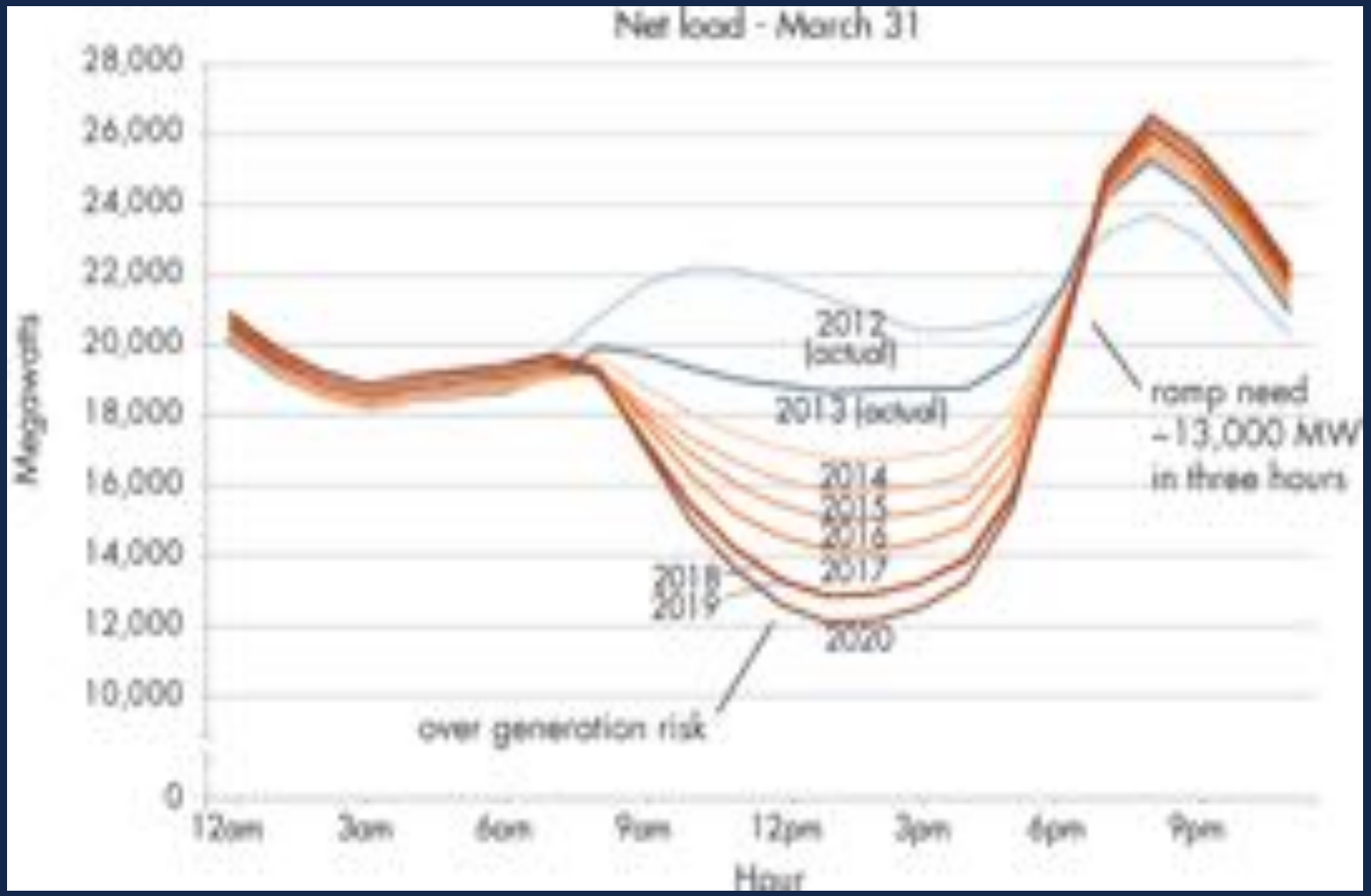
Evolving Context for BTO – Beyond EE

Abundant Energy Resources

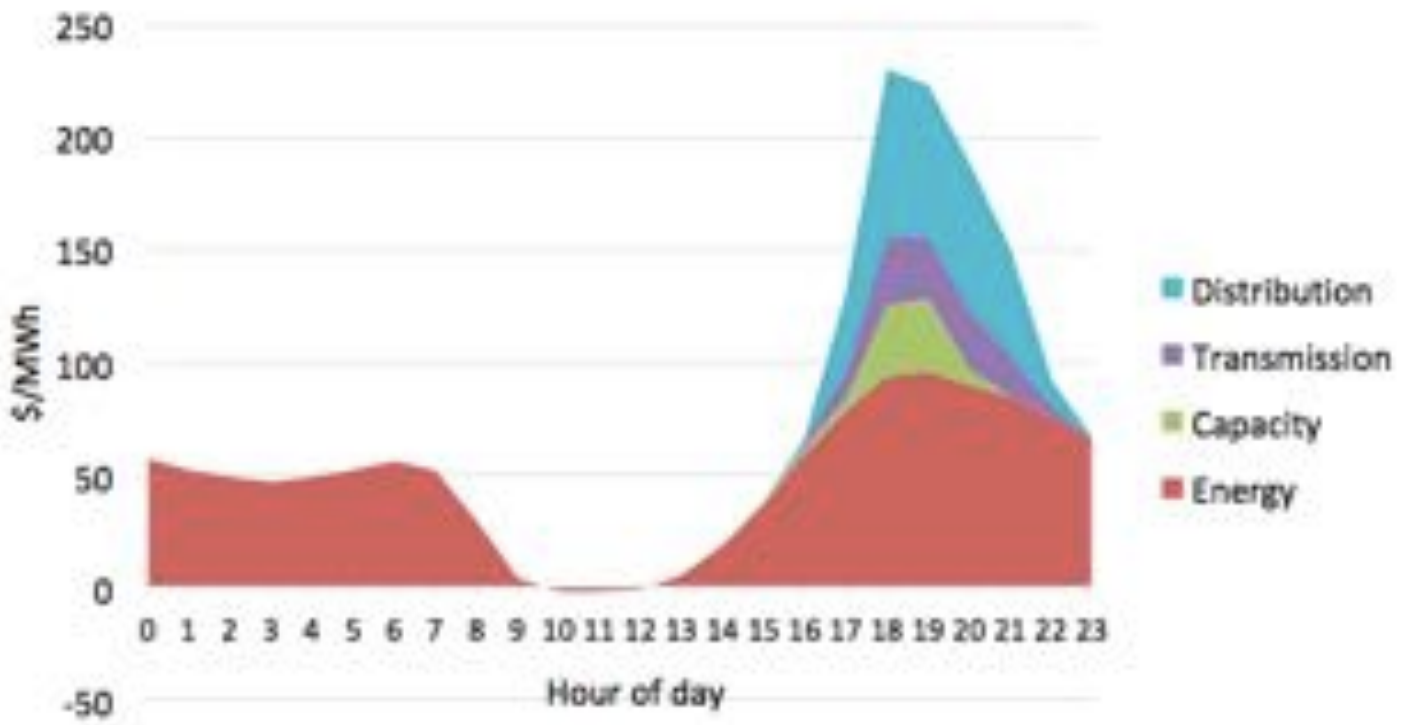
… but highly time-varying grid conditions (cost, resilience, emissions)


PJM LMP, $/MWh
Year ending April 27, 2018
$/MWh
700
600
500
400
300
200
100
0
-100

The Duck Curve



Hourly Marginal Costs (PG&E 2024) – Annual Average



Source: NRDC "HPWH Demand Flexibility Study Preliminary Results" March 2018

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Abundant Energy Resources

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Energy Storage – rapidly growing role

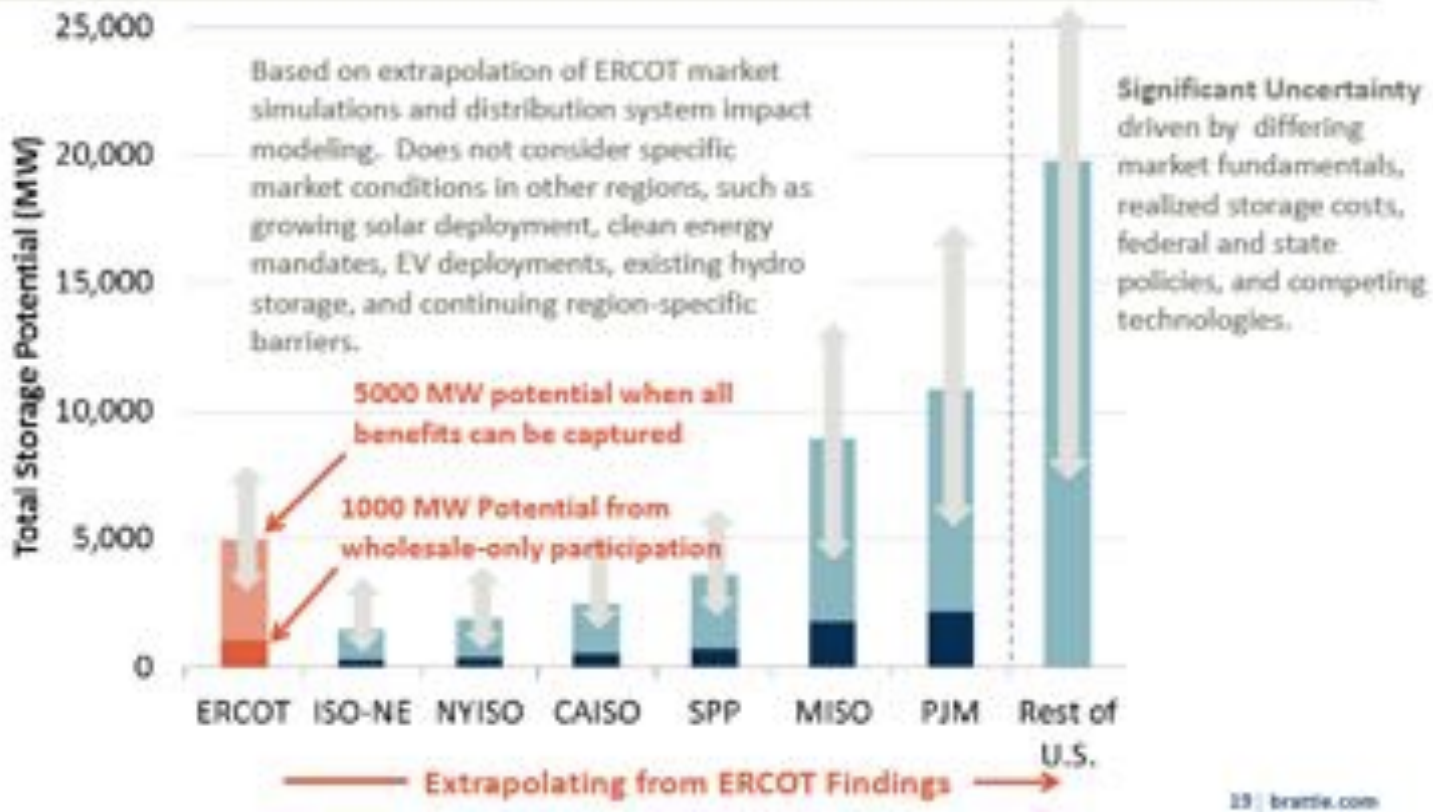
Storage Mandates, Other State Policy, & Market-driven

Activities beyond mandates from Brattle Group, “Battery Storage Development” Jan 18, 2018

THE Brattle GROUP

U.S.-Wide Storage Potential

At a cost of $350/kWh (installed), Order 841 could unlock 7,000 MW based solely on wholesale-market participation in RTOs. This increases to 50,000 MW US-wide if all benefits can be captured, but requires states to unlock T&D and customer benefits.



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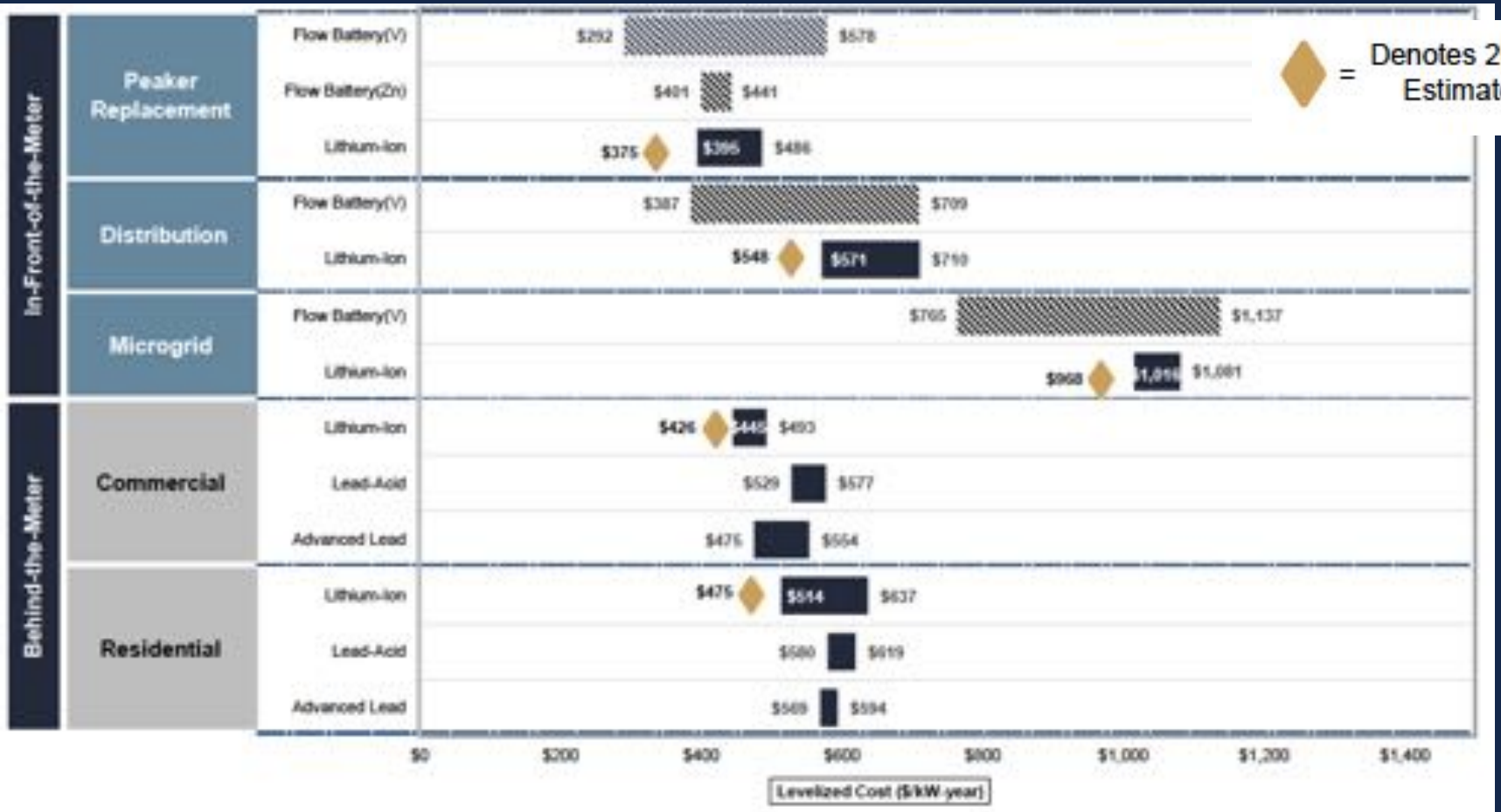
Energy Storage – rapidly growing role

Responsive loads - great potential in legacy DR, consumer IOT, advanced tech

Unsubsidized Levelized Cost of Storage Comparison—$/kW-year



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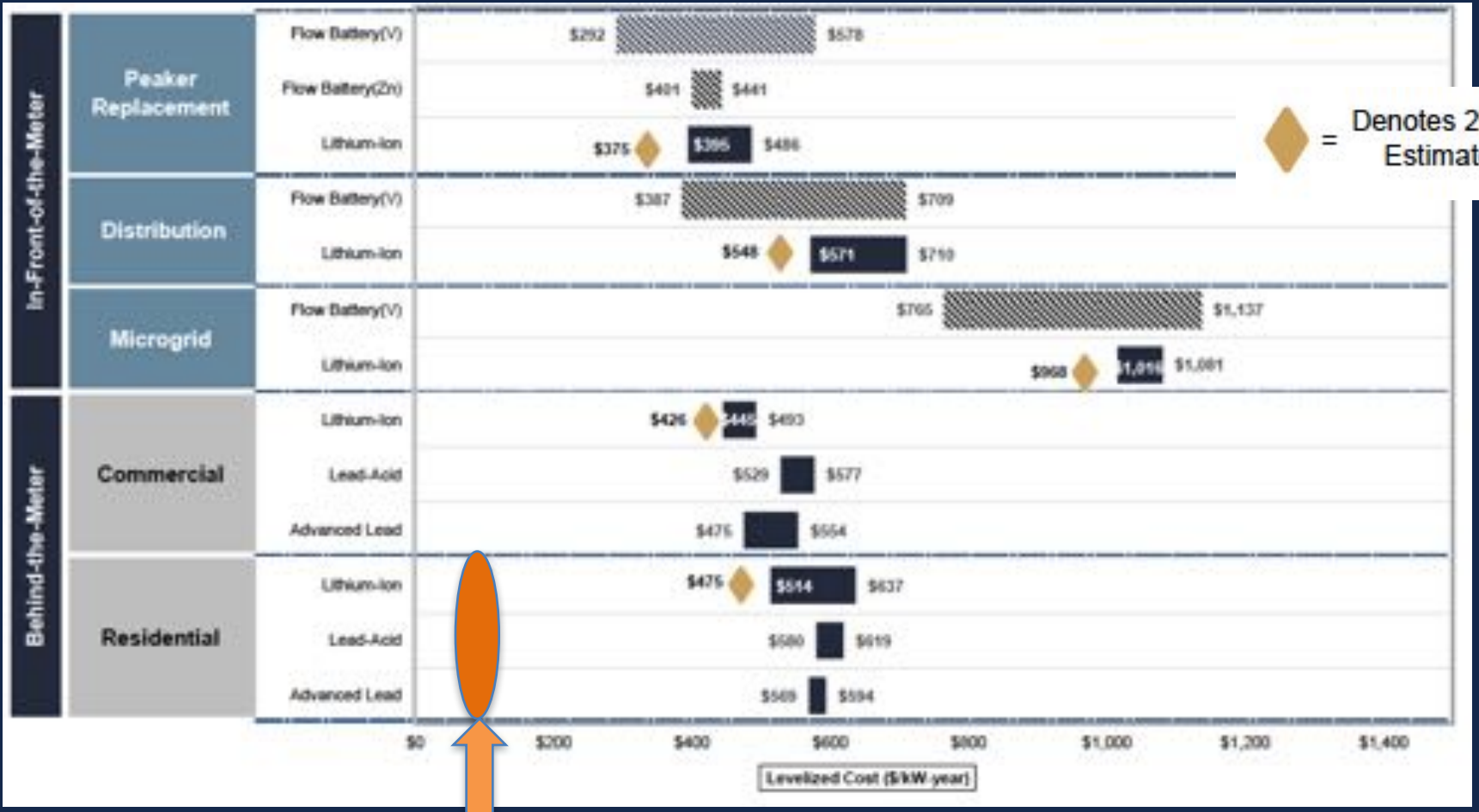
LAZARD'S LEVELIZED COST OF STORAGE ANALYSIS—VERSION 3.0

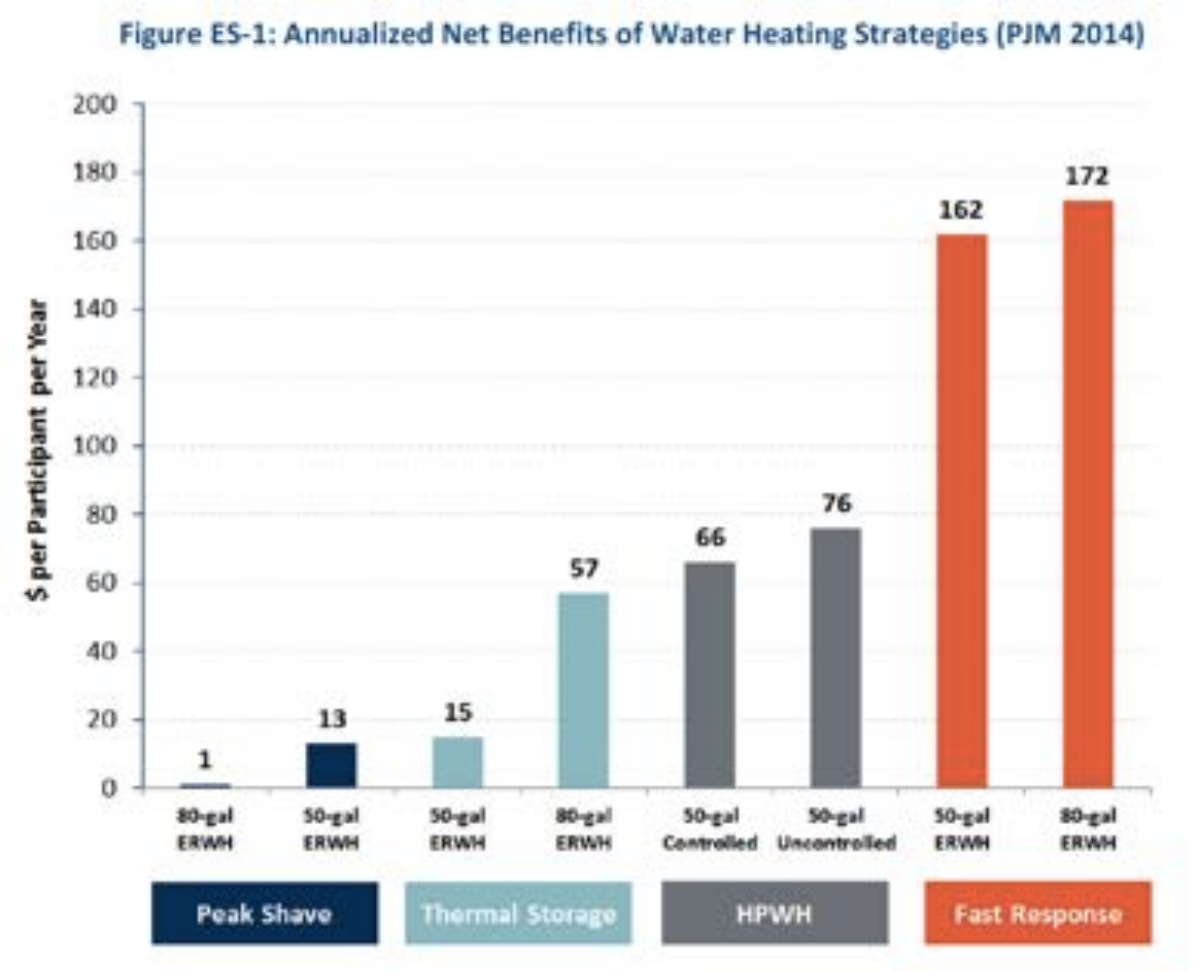
Unsubsidized Levelized Cost of Storage Comparison—$/kW-year



Connected water heating

The Hidden Battery

Opportunities in Electric Water Heating



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NRDC NATURAL RESOURCES DEFENSE COUNCIL

PLMA

Evolving Context for BTO – Beyond EE

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Energy Storage – a rapidly growing role

Responsive loads - great potential in legacy DR, consumer IOT, advanced tech

Enormous stakeholder interest in responsive loads

Interest in Advanced Electric Water Heaters

- **Manufacturers**
- **Utilities**
- **FERC** and **some states**
- **CEE, NEEA** and **Energy Star**
- **ARPA-E**
- **Consumers?**

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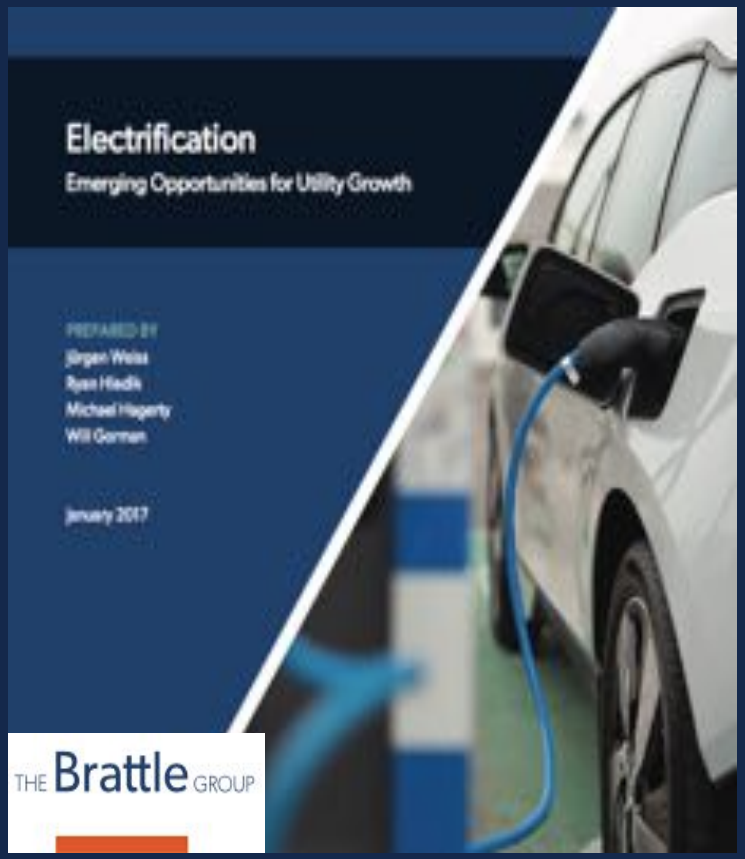
Beneficial electrification ←→ Responsive loads

The Electricity Journal
Volume 29, Issue 6, July 2016, Pages 52–58

Environmentally beneficial electrification: The dawn of 'emissions efficiency' ☆ ☆☆

AMERICA'S ELECTRIC COOPERATIVES

RAP®



EPRI ELECTRIC POWER RESEARCH INSTITUTE

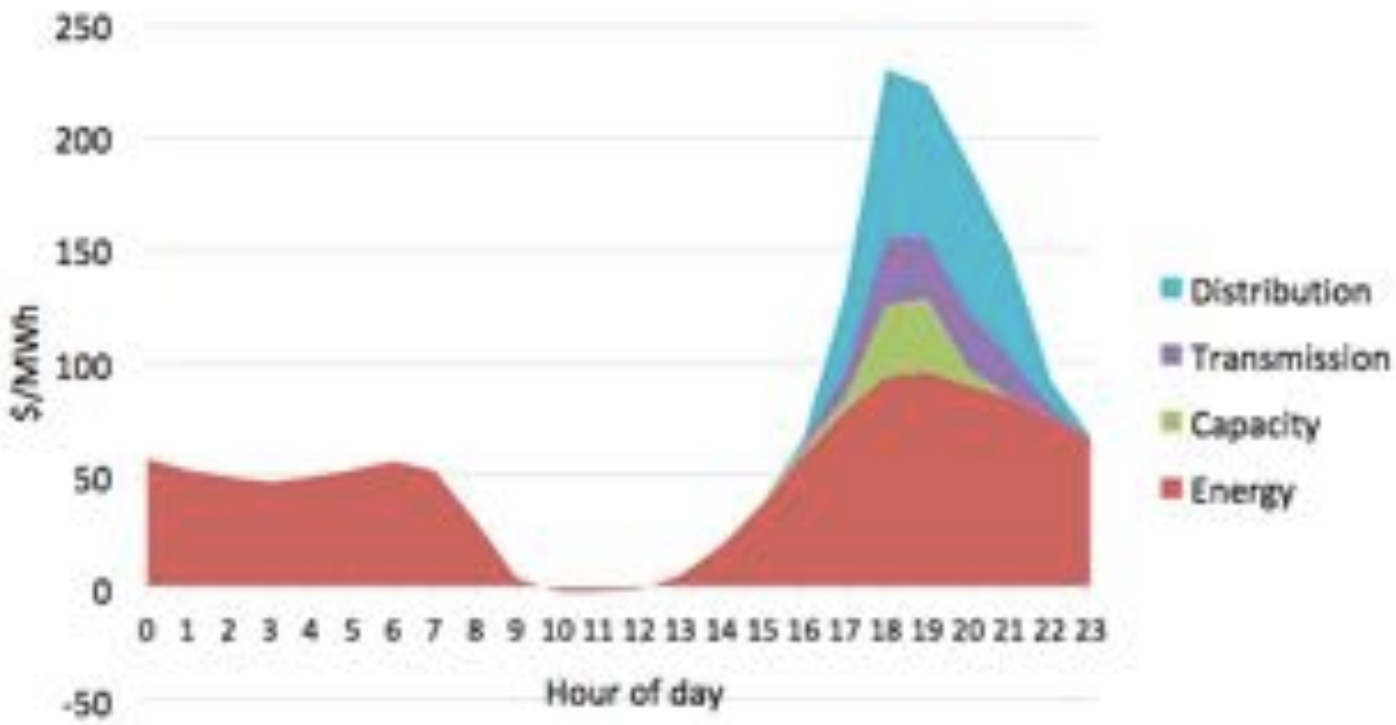
Agenda Industries Location Registration Sponsors

ELECTRIFICATION 2018

INTERNATIONAL CONFERENCE & EXPOSITION

AUGUST 20-23, 2018
LONG BEACH, CALIFORNIA

Hourly Marginal Costs (PG&E 2024) – Annual Average



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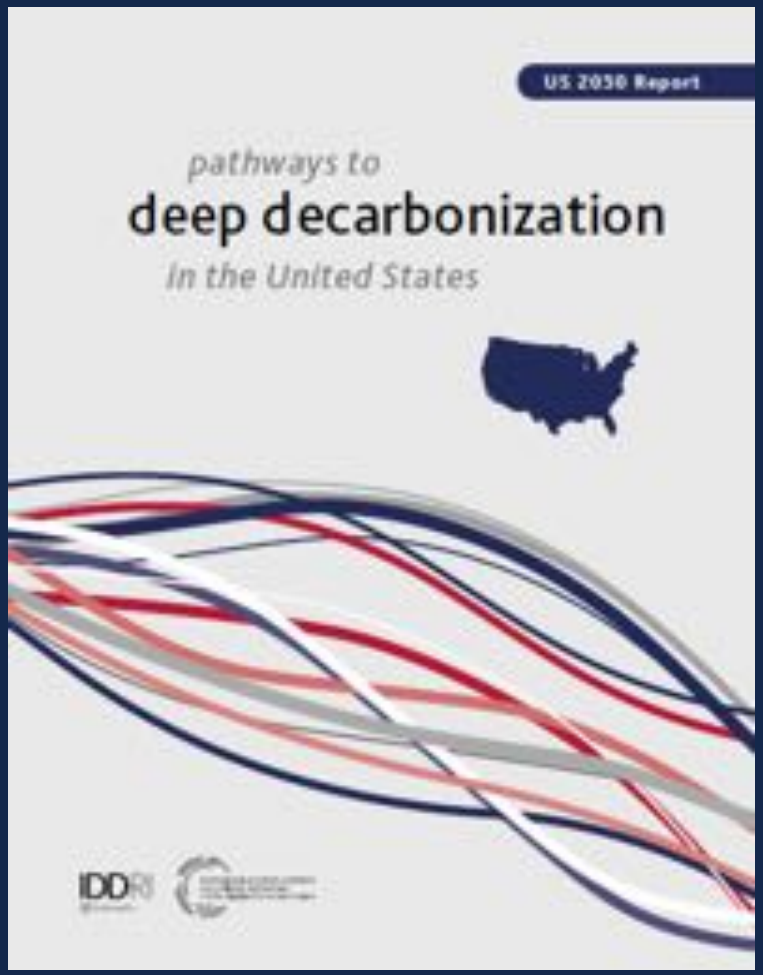
Beneficial electrification ←→ Responsive loads

Managing carbon pollution ←→ Responsive loads

NRDC
SEPTEMBER 2017
R: 17-09-A

REPORT
AMERICA'S CLEAN ENERGY FRONTIER:
THE PATHWAY TO A SAFER CLIMATE FUTURE

A BETTER LIFE WITH
A HEALTHY PLANET
PATHWAYS TO NET-ZERO EMISSIONS
A NEW LENS SCENARIOS SUPPLEMENT


US 2050 Report
pathways to
deep decarbonization
in the United States
IDDRI

Implications for BTO

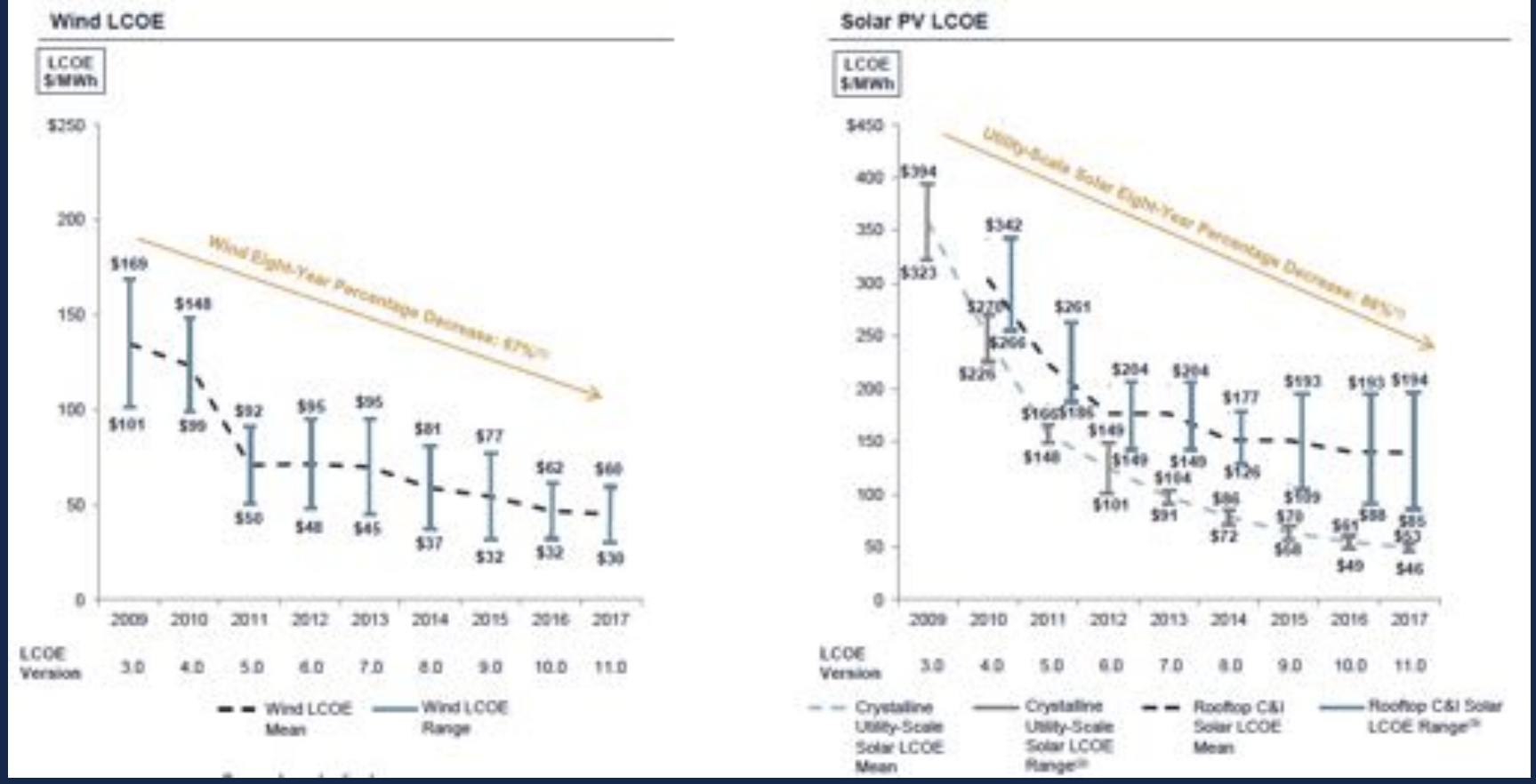
Great value in BTO's connected work

An energy saving goal/metric **doesn't mesh with the opportunities of responsive loads (nor of other DERs)**

Need a **responsive loads road map**

Lexicon
Goals & metrics other than 'saving energy'
Total potential
Policy tools & options
Evolving from historic EE focus

Unsubsidized Levelized Cost of Energy—Wind & Solar PV (Historical)



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