NARUC Summer Policy Summit

Committee on Energy Resources and the Environment

This session will begin at 1:45 p.m.

NARUC Summer Policy Summit

Lessons Learned From DER Aggregations Nationwide

- Katie Guerry, Senior Vice President of Regulatory & Government Affairs, Convergent Energy and Power
- Amy Heart, Vice President, Public Policy, Sun Run
- Natalie Mims Frick, Electricity Markets and Policy Department, Lawrence Berkeley National Lab

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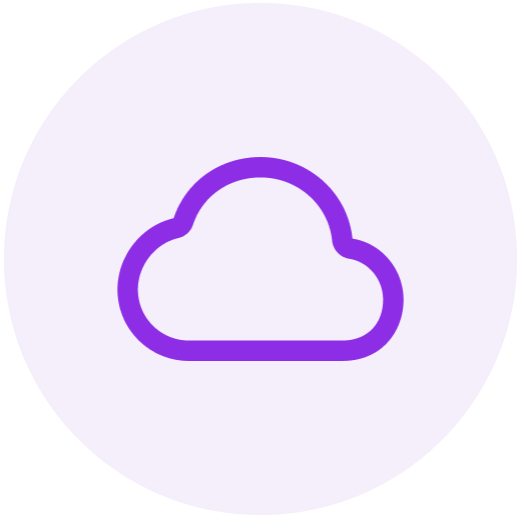

What is the biggest barrier to DER Aggregation?

ⓘ Start presenting to display the poll results on this slide.

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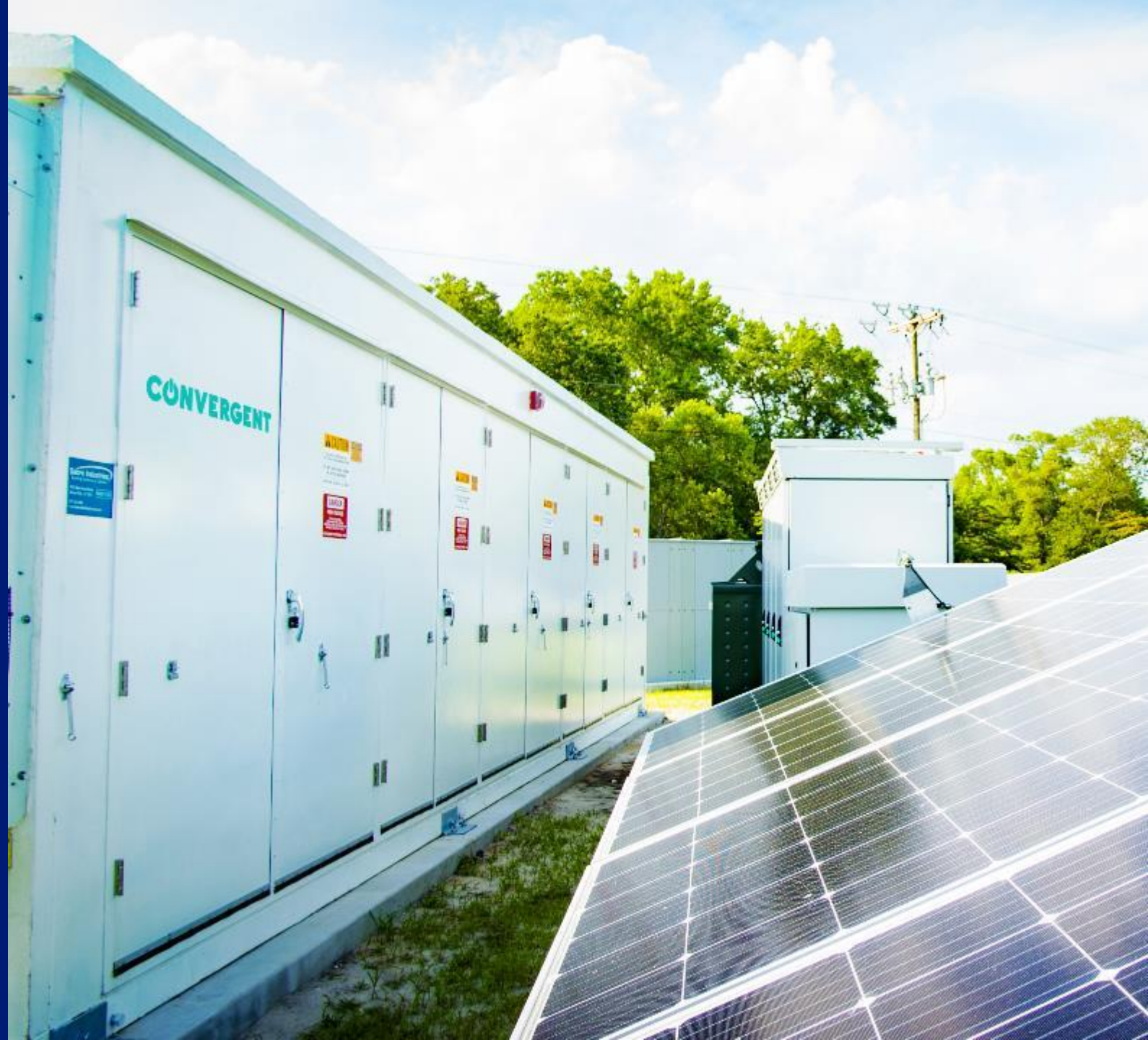
Lessons Learned From DER Aggregations Nationwide

Katie Guerry

SVP Regulatory Affairs

NARUC Summer Policy Summit – July 2023



ABOUT CONVERGENT

Convergent Energy and Power (Convergent) is a leading provider of energy storage and solar-plus-storage solutions in North America.

Convergent has over a decade of expertise in financing and managing solar and storage development cycles to help commercial, industrial, and utility customers reduce their electricity costs and improve reliability.

Founded in 2011, we are backed by ECP, a $27B energy-focused private equity firm. All project capital needs are provided via Investment Committee approval in a straightforward and expeditious capital request process; over $500M has been invested in projects in operation or allocated to projects under development.

Example Customers

Southern California Edison · HG&E Empowering Your World · nationalgrid · New York ISO Independent System Operator · Shell · NSG Group · Ford · Choptank Electric Cooperative, A Touchstone Energy® Cooperative

Powered by Results

7-Figure Savings

- We've saved businesses up to 40% off their electricity bills and deferred multimillion infrastructure upgrades for utilities.

500 MW/800MWh

We are one of the largest independent operator of energy storage systems in North America.

100%

We have a 100 percent project completion rate for utility-permitted projects.

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How DER Investor/Owner/Operators Make Money

Revenue Stacking

Revenue Streams

- Cut Demand Charges
- Cut *Coincident* Capacity/Transmission Charges
- Cut Energy prices and/or energy arbitrage
- Qualify for Federal/State/Local Incentives
- Sell & Deliver In Retail Programs (Often Quasi-Incentives)
- Sell & Deliver in Wholesale Programs
  - ➢ ***Role of Aggregations***

- ✓ **Revenue For Developers Include BOTH:**
  - ➢ **Sharing In Total Savings Achieved**
  - ➢ **Payments (E.g., State, Utility, System Operator)**
- ✓ **Number/Combo/Weighting Of Revenue Streams**
  - ➢ **Varies By State**
- ✓ **Participating in Aggregations**
  - ➢ **Often Not The Core Revenue Stream for C&I**
  - ➢ **Leverages Additional Capabilities of the DER**
- ✓ **Cost Allocation Rules of Jurisdiction**
  - ➢ **Key Driver In Customer Savings**

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Important Themes For Policy Implementation

Key Considerations For Implementation Via Regulations

Keep it Simple

- Overcomplicating will strand resources and increases costs
- Focus on capturing a specific value to kick start penetration
- Extract additional value from existing DERs with experience over time
- Simple Tariff additions/changes/options - Cost effective ways to send investment signals
  - Regulators Should Leverage Cost Allocation Rules To Influence Behavior

Competition Yields Innovation & Cost Savings

- Third party investments are critical to advancement of DERs
- Risk of DER investments should be on investors not ratepayers
- Maximizes return on investment for consumers

Solve For Needed Physical Solutions

- Start with a physical need that DERs can solve
  - Peak shaving during periods of system stress
  - Renewable Integration
  - Cost Reductions
  - Grid Services / Non-Wires Alternatives (NWAs)

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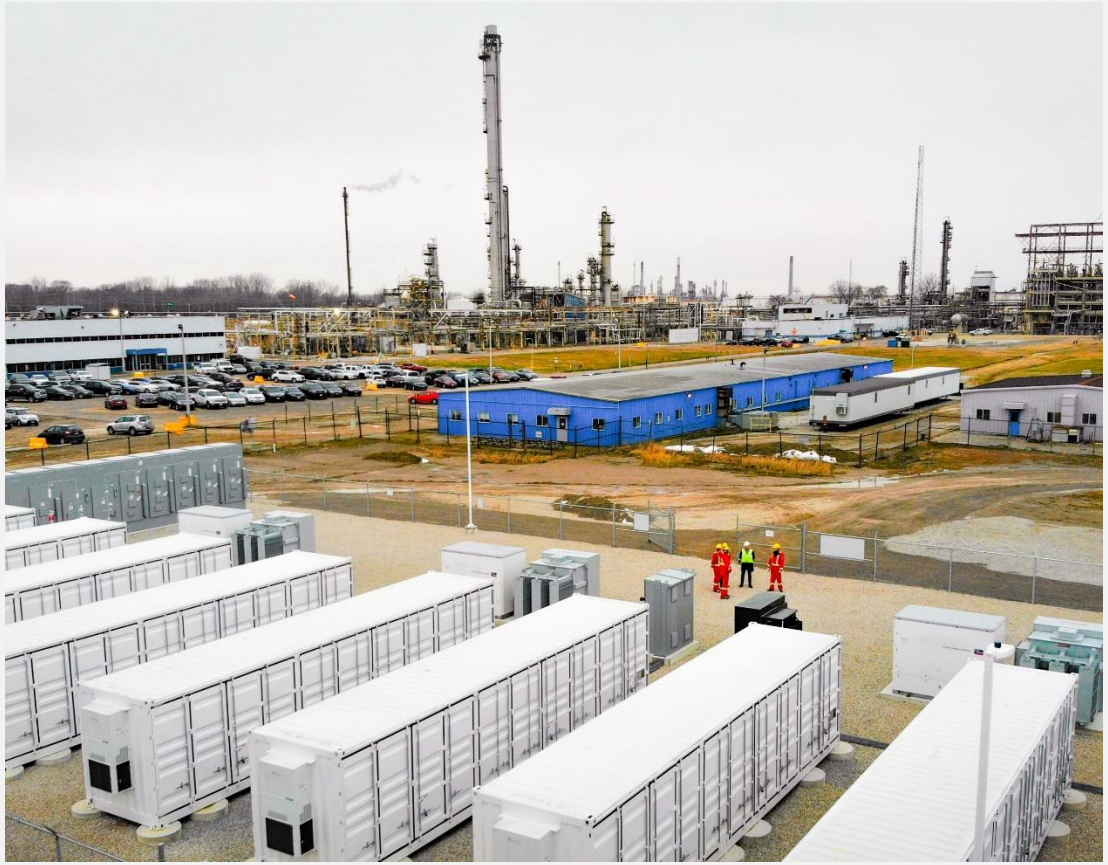
Case Study: Coincident Peak Shaving for Shell Sarnia Manufacturing Centre



Sarnia, Ontario

- **CUSTOMER:** Shell Sarnia Manufacturing Centre (Shell) (Industrial)
- **SOLUTION:** This system is a joint venture between Convergent and Shell New Energies, designed to reduce Global Adjustment charges while increasing the reliability and long-term sustainability of the grid.
- **APPLICATION:** Behind-the-Meter Peak Shaving
- **STATUS:** Operational (2019)
- **CONTRACT:** Shared Savings Agreement (Joint Venture)
- **MARKET:** IESO (Ontario)
- **SIZE:** 10 MW / 20 MWh (Storage)
- **TECHNOLOGY:** Lithium-Ion
- **NOTABLE:** At the time of development, this system was tied with Convergent's other 10 MW system as the largest behind-the-meter battery energy storage system in North America.

For more, watch a short video

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Case Study: Renewables Integration for Choptank Electrical Cooperative

Willards, Maryland

- CUSTOMER: **Choptank Electrical Cooperative (Electric Cooperative)**
- SOLUTION: **This system is creating locally-produced and reliable renewable generation to offset the utility's wholesale energy procurement costs and use more pollution-free electricity.**
- APPLICATION: **Wholesale Market Cost Reduction and Renewables Integration**
- STATUS: **Operational (2019)**
- CONTRACT: **Shared Savings Agreement (Acquisition as "Purnell")**
- MARKET: **PJM**
- SIZE: **1 MW / 2 MWh (Storage), 1 MW (Solar)**
- TECHNOLOGY: **Lithium-Ion and Solar PV**
- NOTABLE: **One of the first solar-plus-storage systems on the Eastern Seaboard.**

For more, watch a short video or see the case study

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Case Study: Resource Adequacy for Southern California Edison (SCE)

Orange County, California

- **CUSTOMER:** Southern California Edison (Investor-Owned Utility)
- **SOLUTION:** These two systems support local reliability for South Orange County, California, and regional reliability in the West Los Angeles Basin.
- **APPLICATION:** Resource Adequacy
- **STATUS:** Operational (2022)
- **CONTRACT:** Resource Adequacy (RFP as OCES 2 and OCES 3)
- **MARKET:** CAISO
- **SIZE:** 6 MW / 24 MWh (OCES 2) and 9 MW / 36 MWh (OCES 3) (Storage)
- **TECHNOLOGY:** Lithium-Ion
- **NOTABLE:** The battery storage systems address one of the challenges facing California's grid: the distance between where most of the energy is produced versus where it is consumed—in this case, the Los Angeles Basin. Built in partnership with Calpine, the landlord of these systems (and to which we sold a 20 MW project awarded to us by SCE in the same RFP (OCES 1)).

For more, watch a short video

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Case Study: Solar-Plus-Storage Providing a Non-Wires Alternative for National Grid

WINNER!
2022 THE CLEANIE AWARDS'
PEOPLES' CHOICE PROJECT OF THE YEAR

Cicero, New York

- **CUSTOMER:** National Grid (Investor-Owned Utility)
- **SOLUTION:** National Grid selected Convergent to cost-effectively increase capacity at its Pine Grove substation, boosting benefits for customers and the amount of solar energy on the grid. National Grid utilizes the system on peak days to provide seamless reliability to customers served by the substation. On off-peak days, Convergent will participate in the market to provide clean energy for National Grid customers.
- **APPLICATION:** Non-Wires Alternative (Solar-Plus-Storage)
- **STATUS:** Operational (2022)
- **CONTRACT:** Non-Wires Alternative (Solar-Plus-Storage)
- **MARKET:** NYISO
- **SIZE:** 10 MW / 40 MWh (Storage), 10 MWac (Solar)
- **TECHNOLOGY:** Lithium-Ion and Solar PV
- **NOTABLE:** The first solar-plus-storage system providing an NWA to a utility under contract

For more, watch a short video or see the case study

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Thank you!

Katie Guerry

SVP Regulatory Affairs

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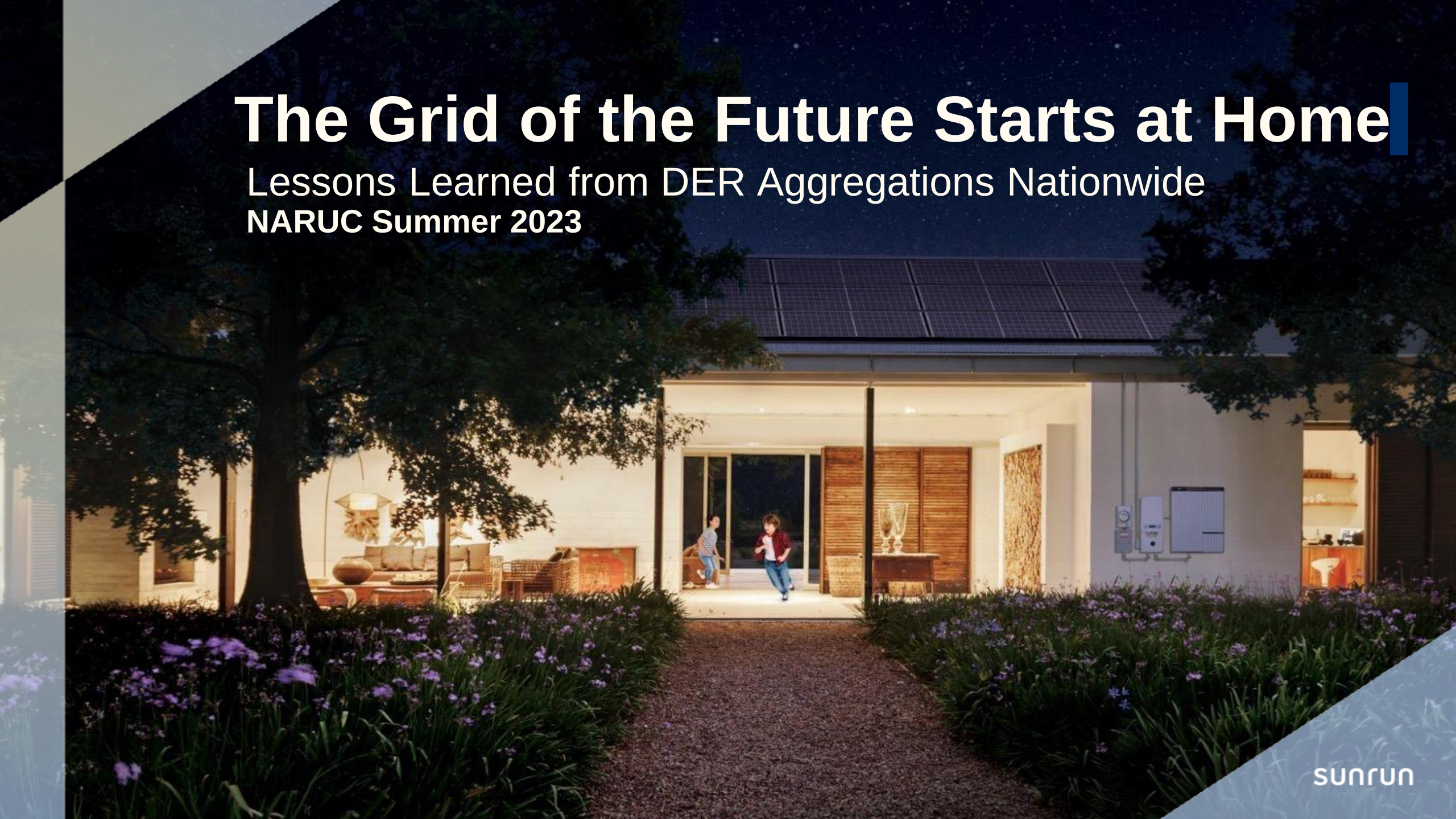
The Grid of the Future Starts at Home

Lessons Learned from DER Aggregations Nationwide

NARUC Summer 2023



sunrun

Commitment to Our Future

We believe in the power of the individual to build a customer-led clean energy future

2007 Changed solar industry with solar-as-a-service model for home solar

2016 Batteries added as option to provide resiliency for homes & the grid

2019 Won bid for first residential virtual power plant in wholesale market

2021 Partnership to introduce V2H/V2G Ford Home Integration System

OUR IMPACT

5.9 GW installed solar capacity (ranked second nationally)

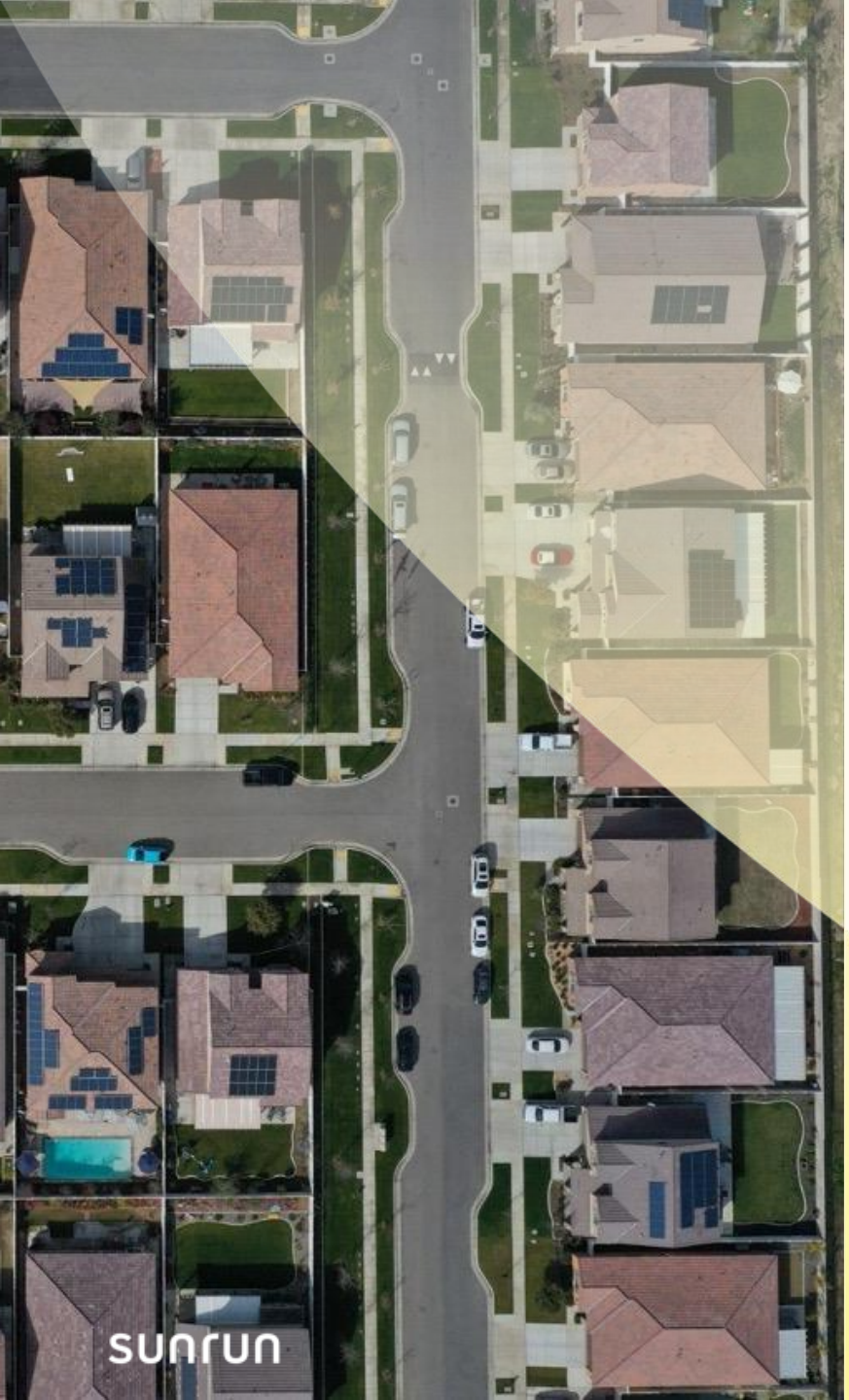
Equivalent of 1 nuclear plant / year in installations starting in 2023

800,000+ customers

22 states plus DC and Puerto Rico

12,000 Sunrun employees, creating local workforce

Over 50% racially and ethnically diverse workforce
with national recognition on diversity and inclusion efforts



DERs Needed Today for Reliability & Key to Affordable, Clean Future Grid

INCREASED RELIABILITY FOR FAMILIES & GRID

- 2022: 140 million people in 40 states with blackouts & calls to conserve due to extreme weather & peak constraints
- US has most power outages of any developed country with 1.3 billion outage hours in 2020
- 2023: ISO-NE reported DERs and state solar+battery programs helped reduce supply capacity constraints

MORE EFFICIENT GRID. FAST & SCALABLE.

- Residential solar deployment = 2 nuclear plants quarterly
- DERs can save US rate payers $473 billion by 2050 clean grid
- **Brattle Report: DERs could offset $15-35 billion in ratepayer-funded capacity investment over 10 years**

Virtual Power Plant Examples

sunrun

ISO-New England

Residential VPP in a wholesale capacity market

First-of-its-kind, only one-of-its-kind in US

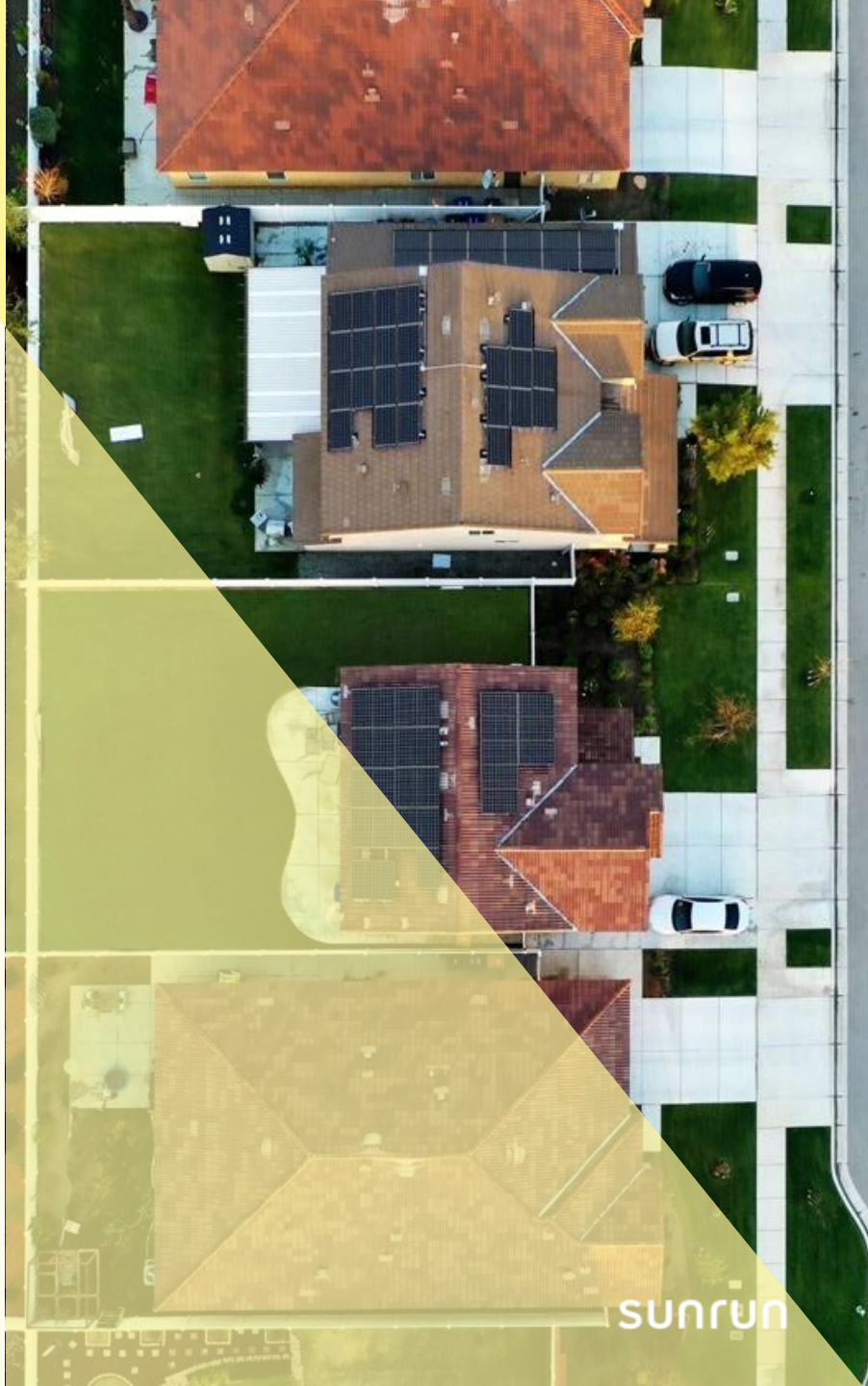
- **2019** Sunrun won cost-competitive, forward looking bid
- **2022** Sunrun shared 1.8 GWh+ of electricity from thousands of home solar systems
- Peak demand window June-August,1-5 PM
- Systems remain on retail NEM tariff
- Predated Order 2222. Bid is capacity, not energy market.
    - No other RTO has working pathway for DER to export
    - ERCOT (TX) created ADER pilot program 2022

Connected Solutions

Open Access Peak Load Reduction Program

Pay for Performance Program

- Multi-state, multi-utility, terms based on needs & customer
- Programmed to export energy during times of peak demand to help balance out the grid and avoid peaking plants
- No more than 60 events per year
- MA example:
    - No more than 3 hours per event
    - June 1- September 30, 3- 8 pm
    - 5 year enrollment
    - Upfront enrollment & annual performance payment
- Similar programs in AZ, CA, CO, CT, HI, MA, NH, NV, NY, R.



Puerto Rico

17 MW Virtual Power Plant

RFP, Exclusive Program for Targeted Solution

- 2022 - Sunrun selected to develop PR’s first VPP
- Lower energy costs for all, reduce pollution, & help harden fragile grid
- 17 MW. 7,000+ Sunrun home solar-plus-battery systems
- Dispatches begin in 2024
- Pay for performance and enrollment
- Enrolled batteries will maintain adequate reserves to power through potential grid outages at homes
- Limited RFPs issued utilities in CA; closed in AZ

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Distributed Demand-Side Resources Aggregation by Utilities: Insights and Challenges from Arizona

Presented by Natalie Mims Frick
Contributions from Lisa Schwartz

NARUC Summer Policy Summit

July 18, 2023

This work was funded by the U.S. Department of Energy Office of Electricity, under Contract No. DE-AC02-05CH11231.
This presentation was funded by the Office of Energy Efficiency and Renewable Energy

DER Aggregation Example: Arizona (1)

- The Arizona Corporation Commission (ACC) directed Arizona Public Service (APS) to file a tariff for Distributed Demand-Side Resources (DDSR) Aggregation in 2020 (Decision 77855).
- The ACC required that the tariff provide compensation for multiple values provided by DDSR aggregation, including capacity, demand reduction, load shifting, locational value, voltage support, and ancillary and grid services.
- ACC requested and approved technical assistance from Berkeley Lab to support review of the tariff.
- APS issued a request for proposals (RFP) in June 2021 to inform the tariff and select an aggregator to provide grid services in 2023 (DDSR pilot).
  - Berkeley Lab reviewed the draft RFP based on criteria established by the ACC and compared it with typical practices by other U.S. utilities. We identified several issues, some of which APS addressed in the final RFP.

APS's DER Aggregation Programs

Program	Forecasted Capacity	Participation	Availability	Event Parameters
Cool Rewards	116 MW+	~80k t-stats	June 1-Sept 30	≤3 hours/event ≤20 events; ≤3 consecutive days
Peak Solutions	50MW	75+ C&I customers	June 1-Sept 30	≤5 hours/event ≤18 events; ≤3 consecutive days
Res. Battery Pilot	1 MW	126+ res. batteries	Year round	≤4 hours/event ≤100 events/year
Energy Savings Days	7 MW	340k emails sent to res. customers	June 1-Sept 30	≤5 events Voluntary request to reduce peak usage in afternoon/evening

DER Aggregation Example: Arizona (2)

- APS received responses from 6 bidders (see table) and selected one aggregator to provide all three grid services with residential batteries. APS also used RFP responses to inform tariff design and define tariff issues and values.
- A Berkeley Lab expert review of APS's cost/benefit analysis found undercounted and excluded benefits.

	Product A	Product B	Product C
Product Focus	System capacity, energy and load shifting value	Locational value on 6 APS feeders	Ancillary services
Requested Capacity Range	5-40 MW aggregated load	1-5 MW aggregated load	1-5 MW system support
Bids Submitted	6	4	2
Capacity Range Among Bids	5-40 MW	1-2.8 MW	5-15 MW

- For example, using a 10-year battery life, instead of APS's proposed program term (5 years), would make most capacity bids cost-effective. And a more conventional de-rating of energy and capacity benefits would make most locational value bids cost-effective.
- Berkeley Lab's analysis (Attachment 3) of the proposed aggregation found significant reductions in peak load for the utility system. And considering reliability and resilience benefits, 66% of Product A (capacity) customers and 50% of Product B (locational value) customers would be expected to benefit financially.
- APS discontinued the DDSR pilot program with the RFP selected aggregator (see next slide).
- Separately, the ACC rejected APS's tariff and required the utility to issue a new RFP and DDSR Aggregation tariff (see next slide).

Some Lessons Learned

RFP

- **Keep the proposal fee modest.** (The RFP fee was $10,000; a separate fee was required for changing terms such as in-service date.) Many utilities do not require any proposal fees for RFPs seeking demand-side resources, as the effort required to submit a responsive bid is barrier enough to eliminate non-serious respondents.
- **Do not include a preference for proposals offering multiple products.** Firms that can site and install DDSR to provide capacity for seasonal peak capacity needs may not have expertise to provide ancillary and grid services. And firms that specialize in providing certain types of services may offer lower prices for them.
- **Appropriately value all benefits** and use best practices for inputs and calculations.
- For locational value, **target feeders where reducing demand has infrastructure deferral value** — e.g., where an upgrade is likely needed within 6 years. (Distribution deferral benefits were not analyzed because the targeted feeder was not constrained.)

DDSR Aggregation Pilot

- **Identify customer needs.** APS customers were interested in whole home backup over the cooling season. Such systems exceed the largest battery the aggregator offered, resulting in low participation.
- **Consider aggregator and installer infrastructure.** The aggregator did not have a significant presence in Arizona, and their largest installer went bankrupt.
- **Mitigate competition with the utility**. APS's residential battery pilot is similar to the DDSR aggregation offer that APS selected, and the offers were marketed to customers at the same time. APS's DDSR aggregation could have instead tested a *combination* of resources — e.g., demand response plus batteries.

DER Aggregation Resources for Regulators

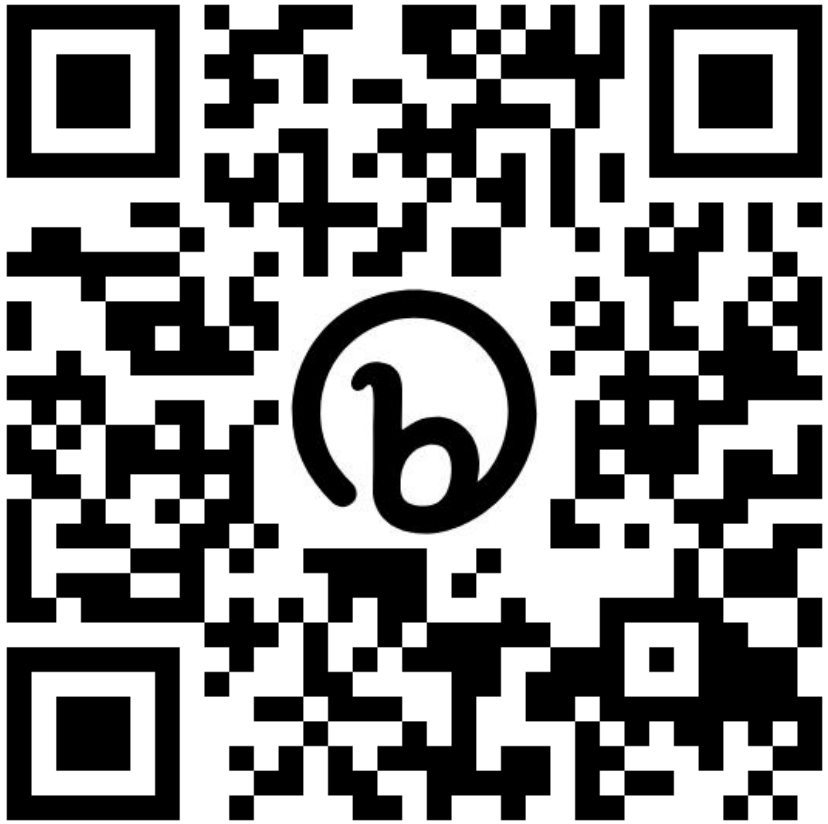
Wholesale Market Resources

- NASEO and NARUC, Summary of Expert Recommendations for Supporting DER Aggregator Participation in Wholesale Markets and Operations in Line with FERC Order 2222
- Energy Systems Integration Group, DER Integration into Wholesale Markets and Operations
- Advanced Energy United, FERC Order No. 2222 Implementation: Preparing the Distribution System for DER Participation in Wholesale Markets
- Electric Power Research Institute, DER Aggregation Participation in Electricity Markets: EPRI Collaborative Forum Final Report and FERC Order 2222 Roadmap
- Advanced Energy Economy and GridLab, FERC Order 2222 Implementation: Preparing the Distribution System for DER Participation in Wholesale Markets (2022)
- FERC Dockets EL-16-92/ER17-996

Retail and Mixed Wholesale/Retail Market Resources

- Berkeley Lab, Regulation of Third-Party Aggregation in the MISO and SPP Footprints
- Berkeley Lab, Opportunities and Challenges to Capturing Distributed Battery Value via Retail Utility Rates and Programs
- Berkeley Lab, Integrated Distribution System Planning
- Berkeley Lab, Locational Value of Distributed Energy Resources
- Arizona Public Service Distributed Demand-Side Resources Aggregation tariff (Docket E-01345A-22-0143 and Docket E-01345A-19-0148)
- CPower, Regulating Demand Response and Aggregators in the Midwest While Safeguarding Local Jurisdiction: A Guide for State Regulatory Commissions, Electric Cooperatives and Municipal Electric Utilities (2022)
- US DOE Loan Program Office, Pathway to Commercial Liftoff for Virtual Power Plants (forthcoming)
- Demand Response Information Workshop, Missouri PSC. Recording forthcoming.

DER Aggregation Resources for Regulators



bit.ly/DER-Resources

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Following this session, what do you see as the biggest barrier to DER Aggregation?

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Thanks for attending. The next session begins at 3:15 p.m.