September 10, 2019

Capturing More Value From Distributed Resource Combinations

RAP Webinar

John Shenot
Senior Advisor

Dr. Carl Linvill
Principal

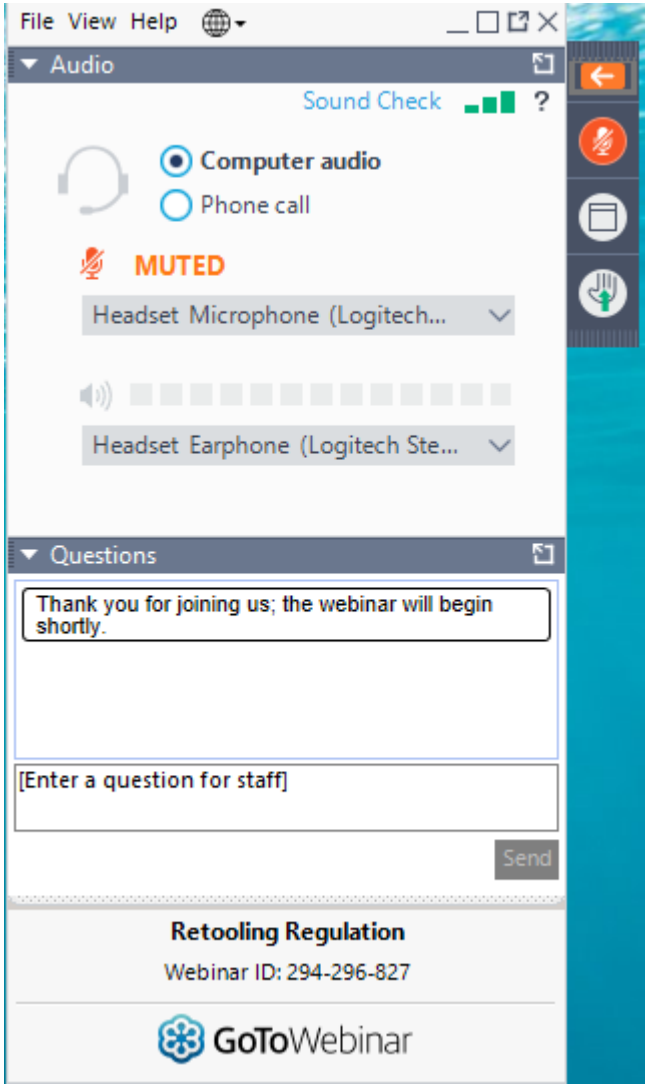
Our Presenters

John Shenot

Dr. Carl Linvill

Questions?

Please send questions through the Questions pane

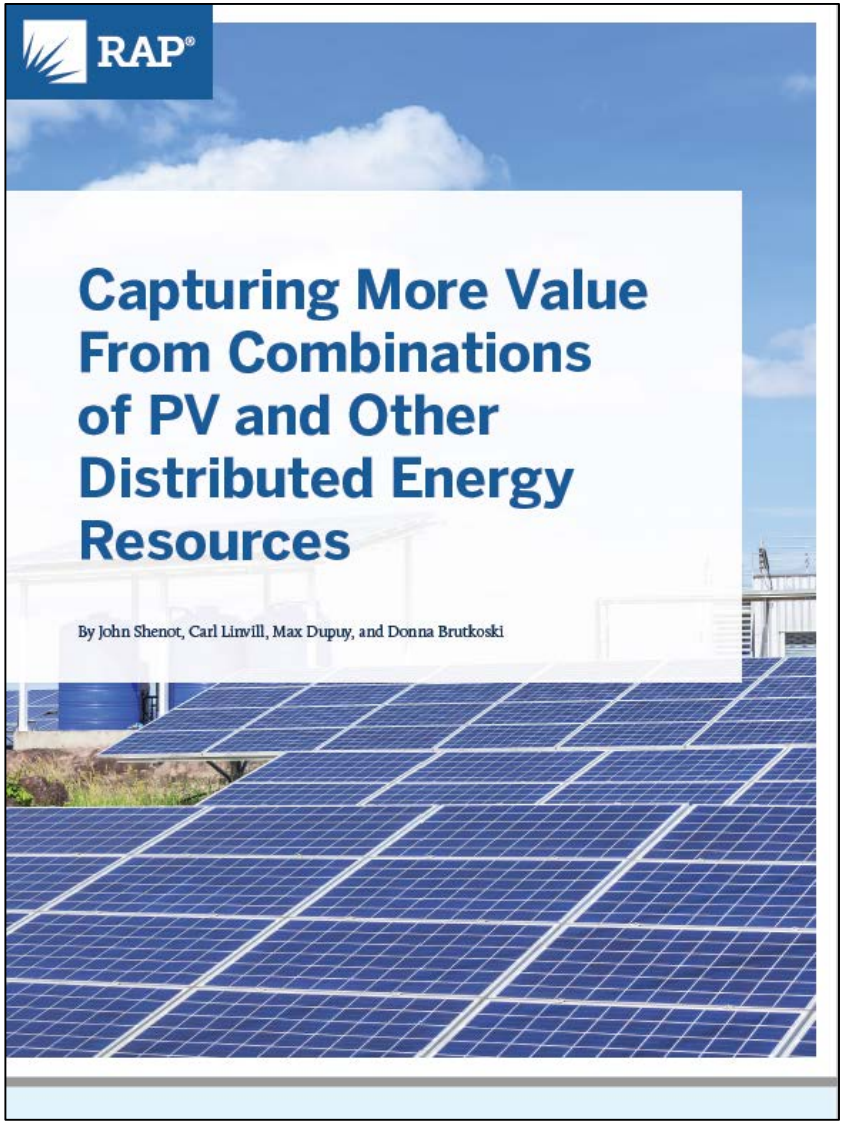


New RAP Publication

This webinar is based on a report RAP produced with support from the National Renewable Energy Laboratory for the U.S. Department of Energy through the DOE Solar Energy Innovation Network.

The opinions expressed are those of the authors.

Full report available at:
https://www.raponline.org/knowledge-center/capturing-more-value-from-combinations-of-pv-and-other-distributed-energy-resources/



Key Takeaways

1. Combinations of DERs offer new value opportunities.
2. To capture more value, we need to enable new technology, improve tariffs, and reform market, planning, and procurement processes.
3. A variety of stakeholders can take steps now to encourage beneficial DERs.

It’s Happening in Owatonna, Minnesota

Steele-Waseca Cooperative Electric is adding value to community solar installations by offering a rebate to subscribers who install controllable electric water heaters.

Photo credit of Steele-Waseca Cooperative Electric
https://swce.coop/swce-field-services/renewables/

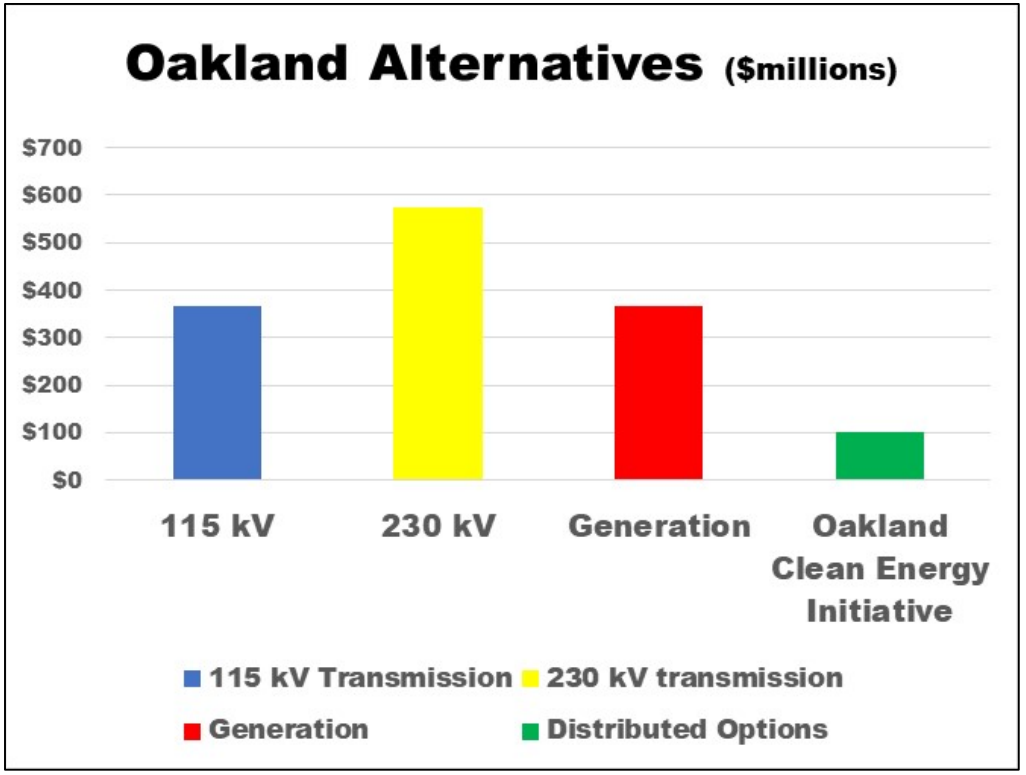
It’s Happening at US Army Bases

More than a dozen Army installations are deploying combinations of DERs to improve resilience.

Solar + Battery Storage at Redstone Arsenal in Alabama

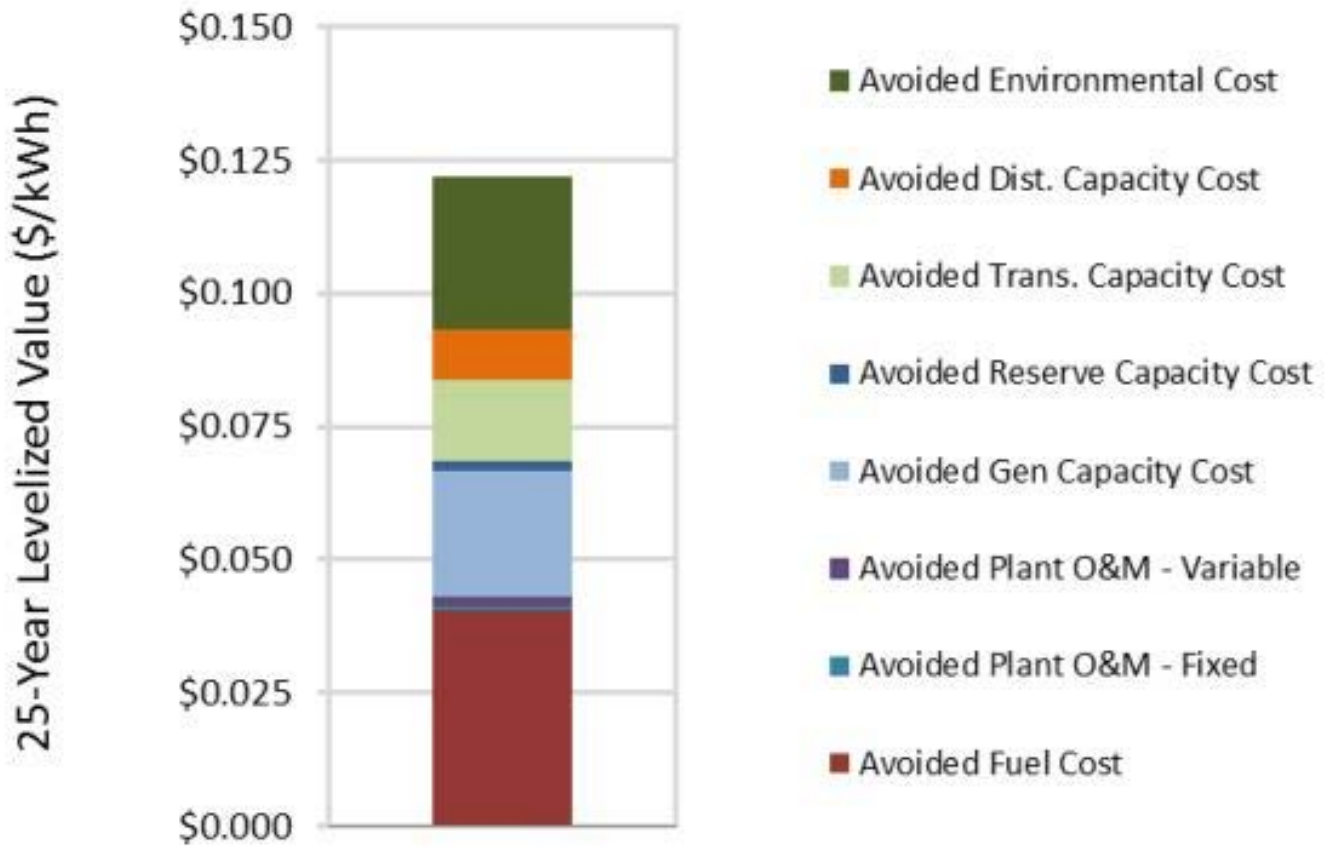
It’s Happening in Oakland, California

The Oakland Clean Energy Initiative crafted by East Bay Clean Energy and PG&E combined DR, EE, and DG to obviate the need for a 230 kV transmission project.



1 Value Streams and Value of Service

Examples of DER Value Streams



Source: Minnesota PUC Briefing Papers, 2014.

Research on the Value of DERs

Well covered:

Much less research:

ALMOST NOTHING: *Combinations* of DERs

Ultimately, any question about the value of an electricity service must consider “value to whom”?

Cost-Effectiveness Tests are Designed to Answer that Question

Though these tests were developed to evaluate ***energy efficiency*** *programs, they are sometimes used to evaluate other DERs.*

Test Name	Question Answered	Summary of Approach
Participant Test (PT)	Will costs decrease for the person or business participating in the program?	Only considers the costs and benefits experienced by program participants
Ratepayer Impact Measure (RIM)	Will utility rates decrease?	Considers the costs and benefits that affect utility rates, including program administrator costs and benefits and utility lost revenues
Program Administrator Cost Test (PAC)[4]	Will the utility's total costs decrease?	Considers the costs and benefits experienced by the utility or program administrator
Total Resource Cost Test (TRC)	Will the sum of the utility's total costs and the participant's total costs (or energy-related costs) decrease?	Considers the costs and benefits experienced by all utility customers
Resource Value Test (RVT)	Will utility system costs be reduced while achieving applicable policy goals?	Considers the utility system costs and benefits plus those costs and benefits associated with achieving energy policy goals
Societal Cost Test (SCT)[5]	Will net costs to society decrease?	Considers all costs and benefits experienced by all members of society

Value of Service ≠ Compensation

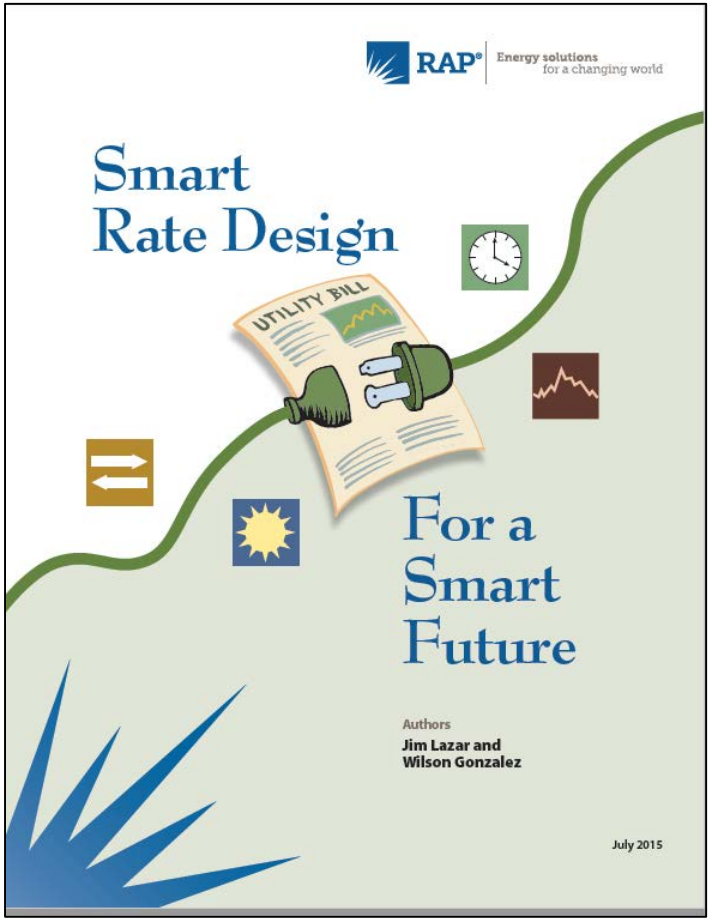
- Cost effectiveness tests do not establish DER ***compensation***
- DER compensation should be sufficient to induce customers to invest in resources that provide benefits to all customers

Quantifying Value is Difficult but Precision is Not Necessary

- Economics of many value streams can be:
  - Time-dependent
  - Location-dependent
  - Interdependent
- Values can be estimated by:
  - Using market prices as proxies
  - Administrative determination

Smart Rates are Essential to Fair Compensation

- Poor rate design can induce private investment for private benefit that *fails to provide public benefit*
- Smart rate design aligns customer investment and operation of DERs with system value



Rate design should make the choices the customer makes to optimize their own bill consistent with the choices they would make to minimize system costs.

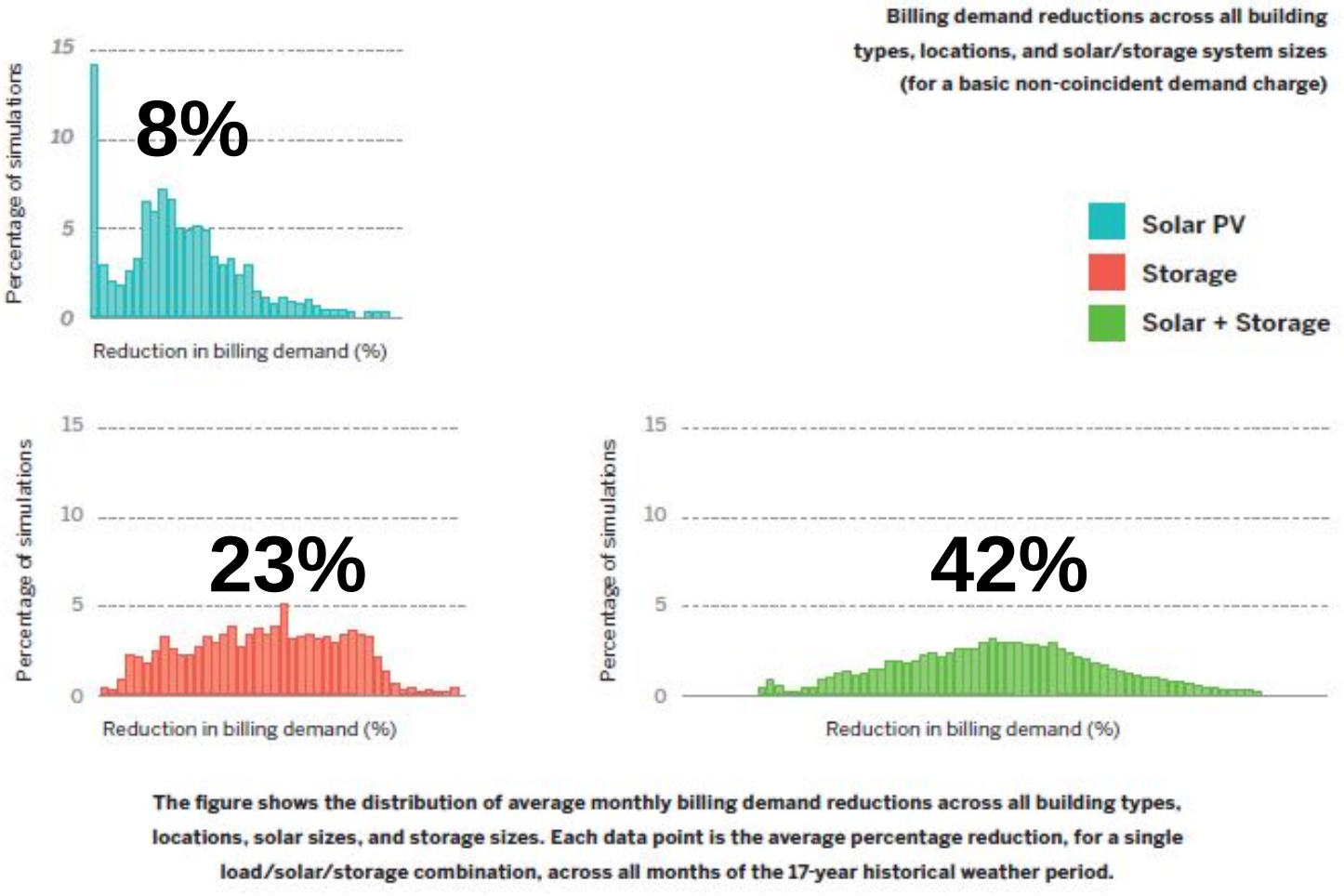
2 The Potential Value of Combinations of DERs

Synergies in Value: *PV + EV*

≥

+

Synergies in Value: *PV + Storage*



The figure shows the distribution of average monthly billing demand reductions across all building types, locations, solar sizes, and storage sizes. Each data point is the average percentage reduction, for a single load/solar/storage combination, across all months of the 17-year historical weather period.

Source: Gagnon et al. (2017). *Solar + Storage Synergies for Managing Commercial-Customer Demand Charges*. Lawrence Berkeley National Laboratory.

Synergies in Value: *PV + DR*

- Combining PV and DR can create value for all ratepayers in the form of avoided energy, capacity, or ancillary service costs
- Flexible loads, like electric water heaters, can shift to take advantage of excess generation from a customer's PV system
  - Especially valuable to the customer if they don't receive full retail rate net metering
- Flexible loads can also "shape and shimmy" to help integrate variable PV generation

3 Current Mechanisms for Capturing the Value of DERs

Four Ways by Which DER Owners Can Be Compensated for Value

Mechanism	Examples
Tariffs or bill credits	Net energy metering, value of solar tariff, NY Phase One value stack tariff
Market revenues	Energy, forward capacity, ancillary services, renewable energy credits
PPAs or contracts	PURPA contract, feed-in tariff
One-time payments or credits	Tax credits for RE or EVs, EE rebates, annual bill credit for DR program participation

4 Examples of Combining PV With Other DERs

Combining DERs for Customer and Utility Value: Sunna Case Study

- Steele-Waseca Cooperative Electric
- Owatonna, Minnesota
- Built community solar garden on headquarters, encourages controllable electric water heating

Photo credit of Steele-Waseca Cooperative Electric
https://swce.coop/swce-field-services/renewables/

The Sunna Project

- $1,225 for one panel

OR

- $170 for one panel + a free electric water heater if the customer subscribes to the grid-integrated water heater program

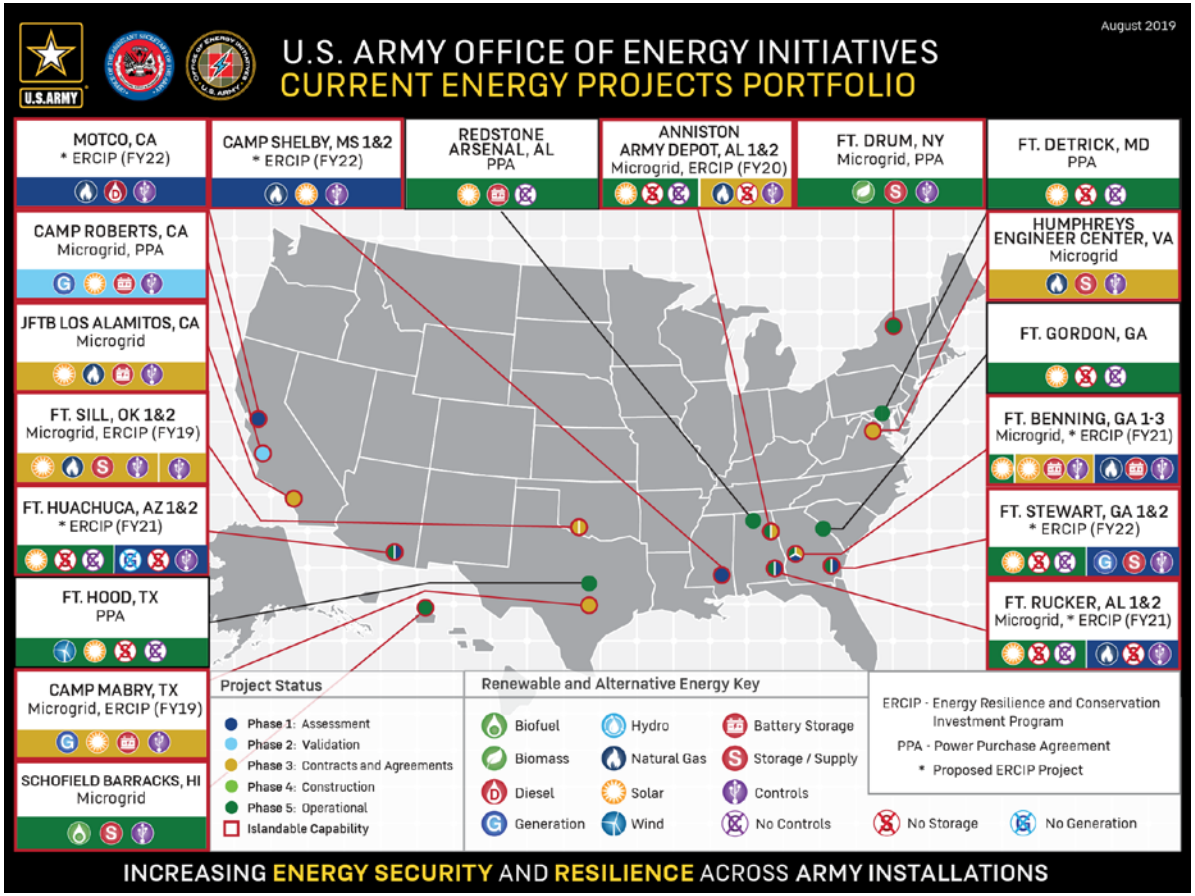
A Wholesale Market Opportunity for a Combination of DERs

- The California ISO Non-Generator Resource (NGR) Model supports resources that can inject and withdraw from the grid
- NGR accommodates storage resources and combined DERs that can perform like storage

The NGR Opportunity at the CA ISO

- Combinations of DERs that can collectively inject and withdraw can qualify
- Qualifying NGR resources may provide energy, reserves and ancillary services in the day ahead or real time market
- As needs emerge, value propositions should emerge

Combining DERs for Resilience: US Army Case Study

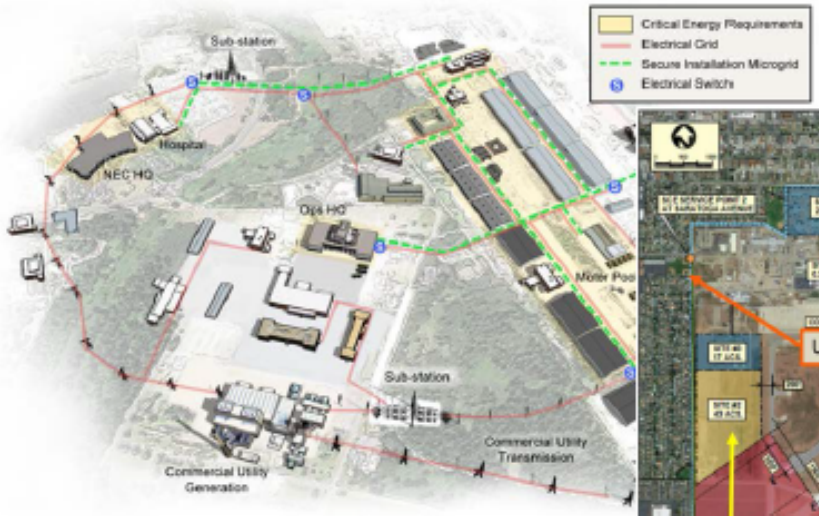


Source: US Army Office of Energy Initiatives

Example of a US Army Project

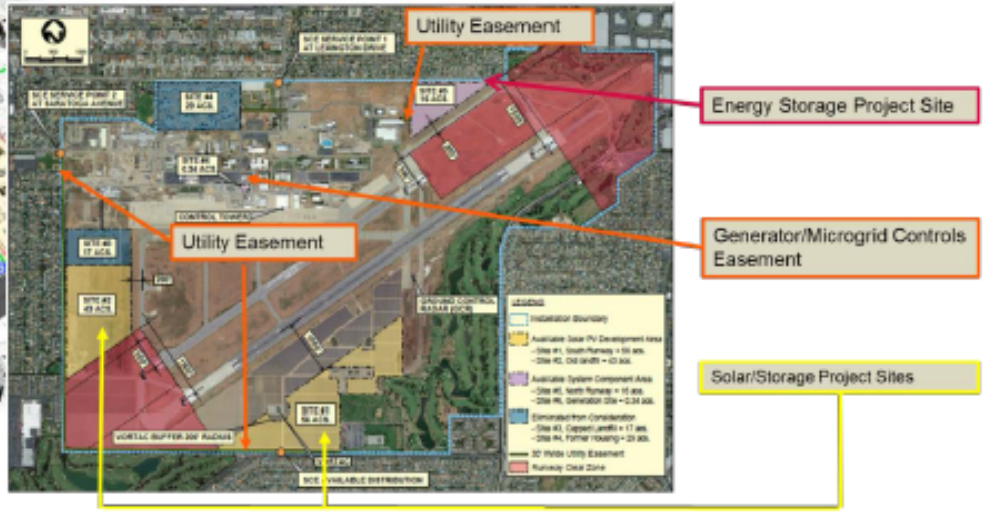
Army proposed outgrant of 115 acres at JFTB Los Alamitos

- Developer would construct, own, operate and maintain 16 MWs of solar power, energy storage, and microgrid components
- During normal ops, the developer sells power to the grid
- During contingency ops, the developer would provide islandable power for critical loads for min 7 – max 30 days



Notional Army Microgrid

Project Development Concept



Combining DERs in a Non-Wires Solution: Oakland Case Study

- The PG&E and East Bay Clean Energy project, the Oakland Clean Energy Initiative (OCEI)
- Replaces a retiring 165 MW Dynegy gas peaker, obviates need for 115 kV and 230 kV transmission
- Combination of resources includes:
  - 25-40 MW combination of EE, DR, PVDG (minimum 19 MW of load reducing response)
  - 10 MW/40 MWh storage
  - Substation upgrades and line re-ratings

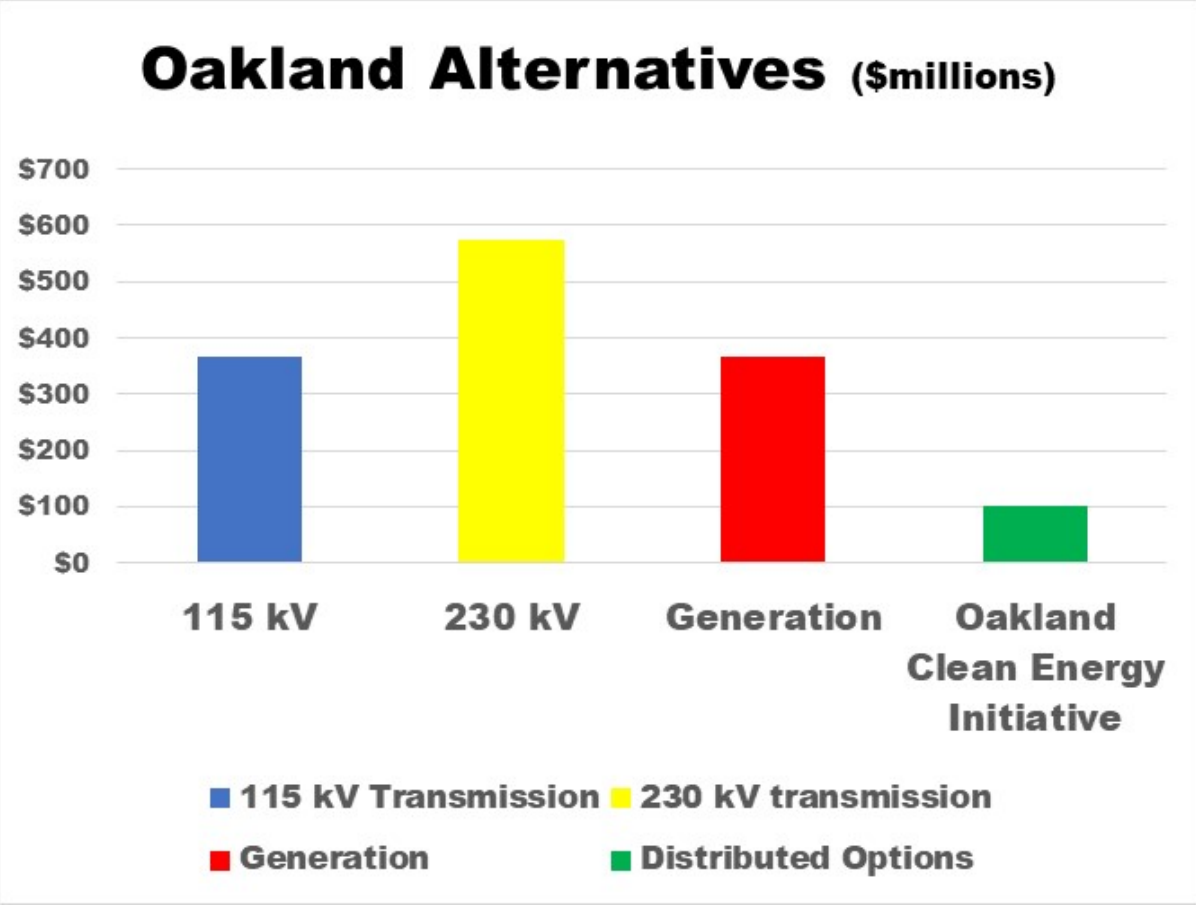
Estimated Cost of Alternatives

	Estimated Capital Cost (2022 $M)	Total Cost (2022 $M)
OCEI	$56-$73[1]	$102[2]
115 kV	$193-$217	$367[3]
230 kV	$316	$574[4]
Generation	$232	$368[5]

CAISO approves clean energy, storage and system upgrades to replace peaker plant, *PV Magazine*, March 29, 2018 https://pv-magazine-usa.com/2018/03/29/caiso-approves-clean-energy-storage-and-system-upgrades-to-replace-gas-plant/

Request for Offers Launches for Oakland Clean Energy Initiative, *Business Wire*, April 13, 2018 https://www.businesswire.com/news/home/20180413005630/en/Request-Offers-Launches-Oakland-Clean-Energy-Initiative

Saves Ratepayers Money, Reduces Emissions



5 A Path Toward Capturing More Value from DER Combinations

Action Items Identified in Five Categories

- Technology, metering, communications, and data systems
- Smart retail rate design (tariffs)
- Wholesale electricity markets
- Planning processes
- Utility procurement

Technology and Data Examples

- Deploy AMI well to secure the full range of cost effective DER capabilities

- Implement IEEE 1547-2018 well to animate advanced inverter capabilities

Smart Rate Design Examples

- Fixed charges should be limited

Rate Element	Based on the Cost Of	Illustrative Rate
Customer charge	Service drop, billing and collection only	$4.00/month
Transformer charge	Final line transformer	$1/kVA/month
Off-peak energy	Baseload resources + transmission and distribution	$.07/kWh
Mid-peak energy	Baseload + intermediate resources + T&D	$.09/kWh
On-peak energy	Baseload, intermediate, and peaking resources + T&D	$.14/kWh
Critical peak energy (or PTR)	Demand response resources	$.74/kWh

Smart Rate Design Examples

- Time-of-use rates should reflect time-varying system value

Rate Element	Based on the Cost Of	Illustrative Rate
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Smart Rate Design Examples

- Critical peak price should reflect system value of obviating stress conditions

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Wholesale Market Examples

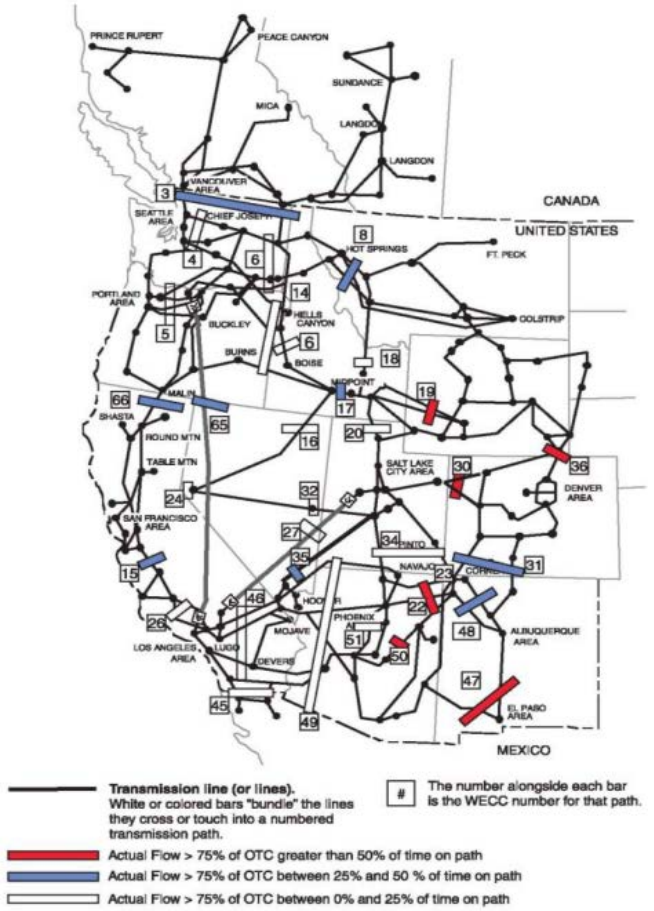
- Transition from forward capacity markets…
  to capabilities markets

Wholesale Market Examples

- Expand opportunities for aggregations of DERs to compete in wholesale electricity markets

Planning Process Examples

- Implement a transparent distribution system planning process that clarifies local needs and options
- Consider non-wires alternatives to transmission and distribution system investments



Utility Procurement Examples

- Use competitive all-source procurement to meet system needs

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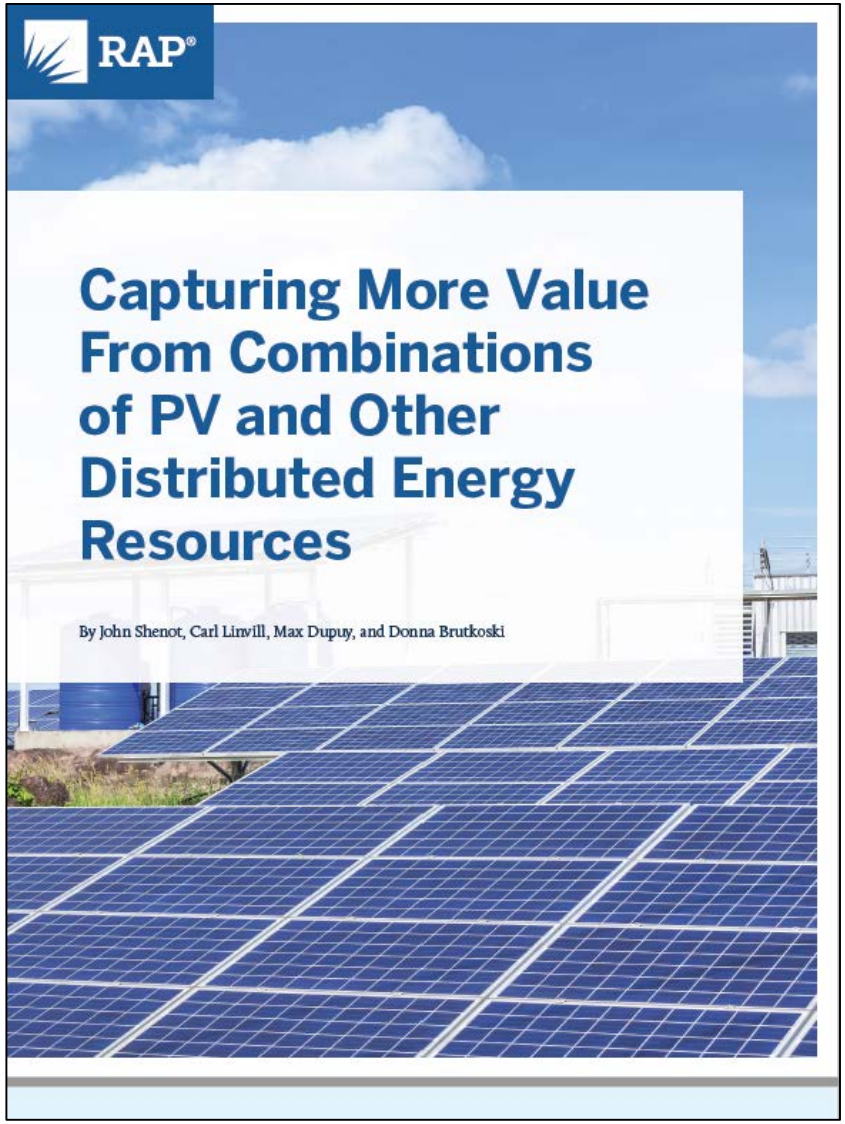

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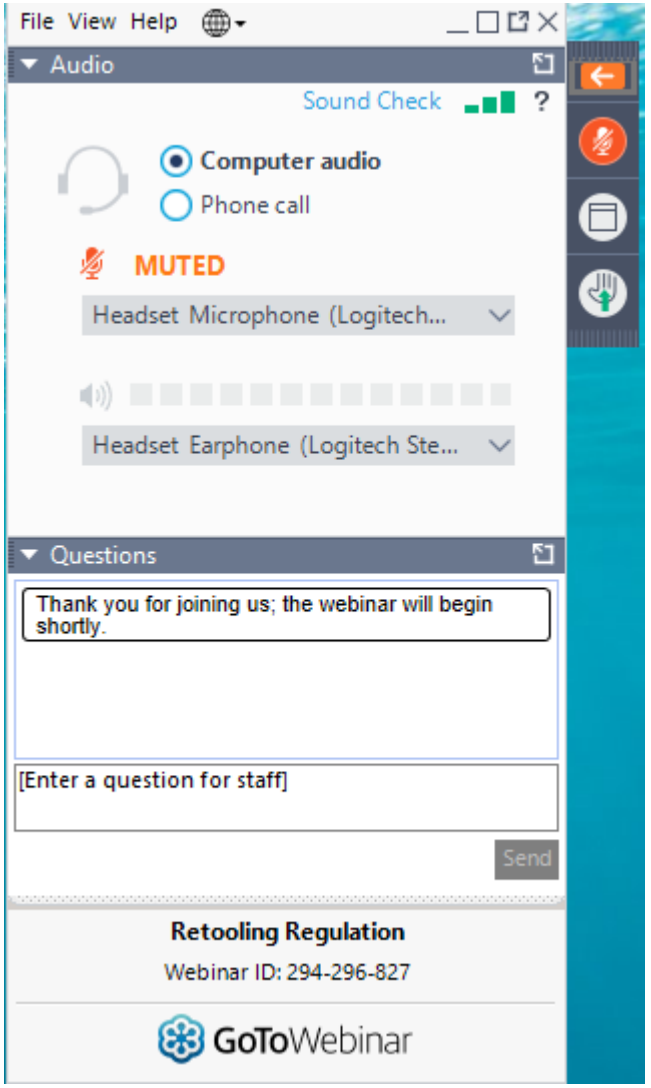

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About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

John Shenot
jshenot@raponline.org

Carl Linvill
clinvill@raponline.org

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