



Emerging Technologies Summit

MAKING THE CONNECTION:
From Energy Efficiency Innovation to Delivery

April 19 – 21, 2017

The 411 on DER from IOUs

DAVID WYLIE, ANGELA CHUANG, GARY BARSLEY, TONY RAFATI, KEN
CHAWKINS

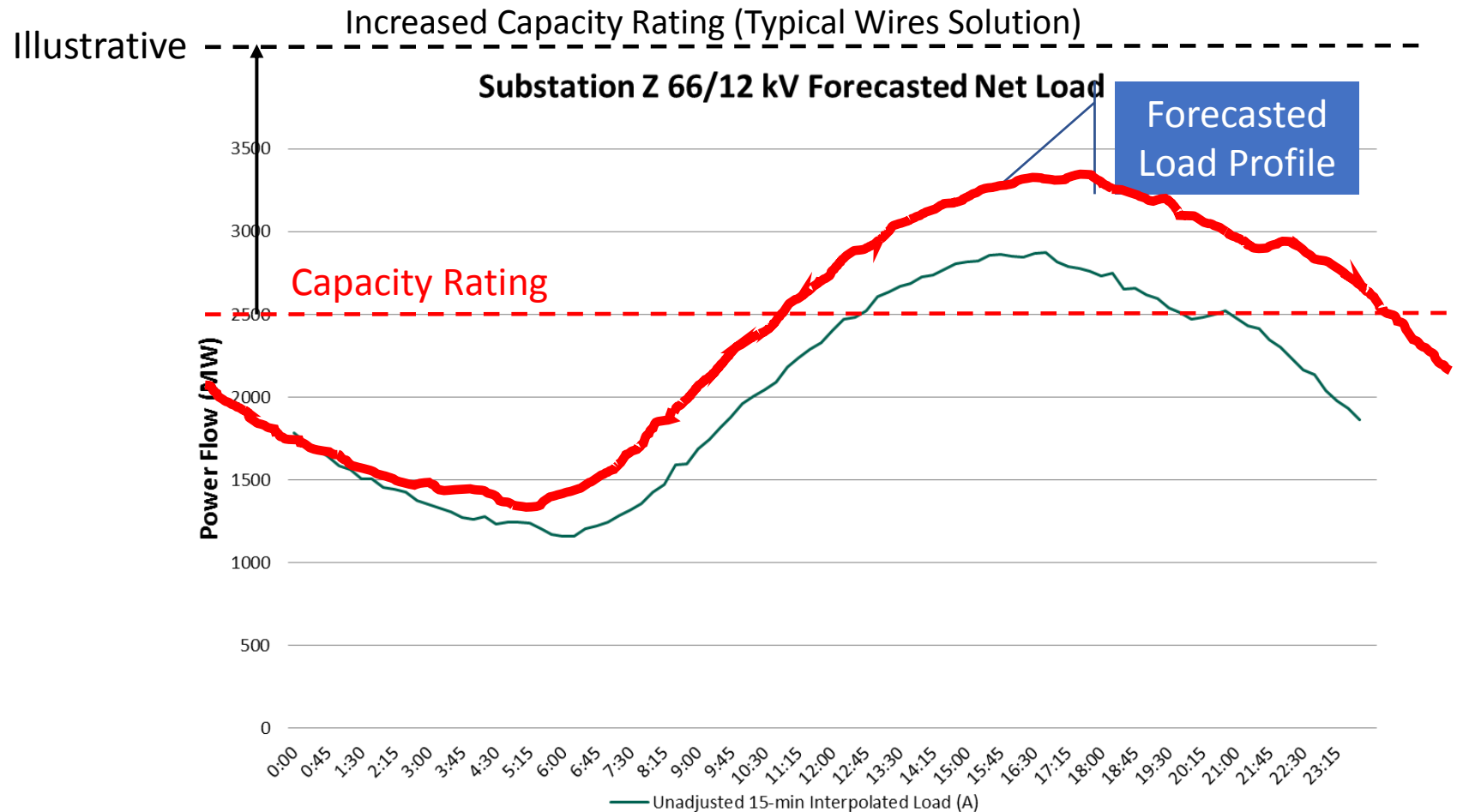


The 411 on DER from IOUs

Moderator: David Wylie, P.E.
ASWB Engineering



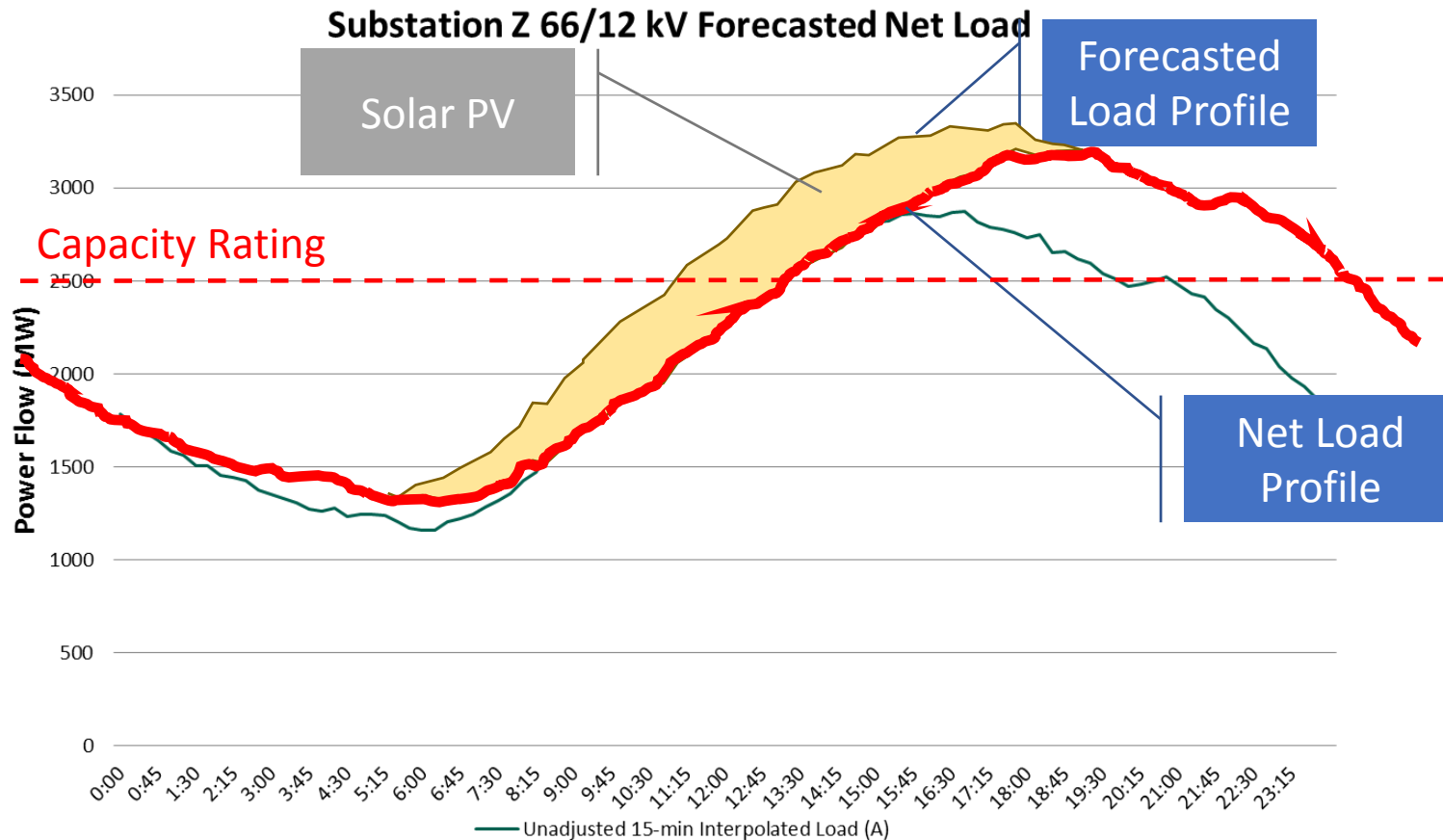
Substation Load Profile with Forecast Overload



Alter Substation Load Profile Using DER

Portfolio Illustrative

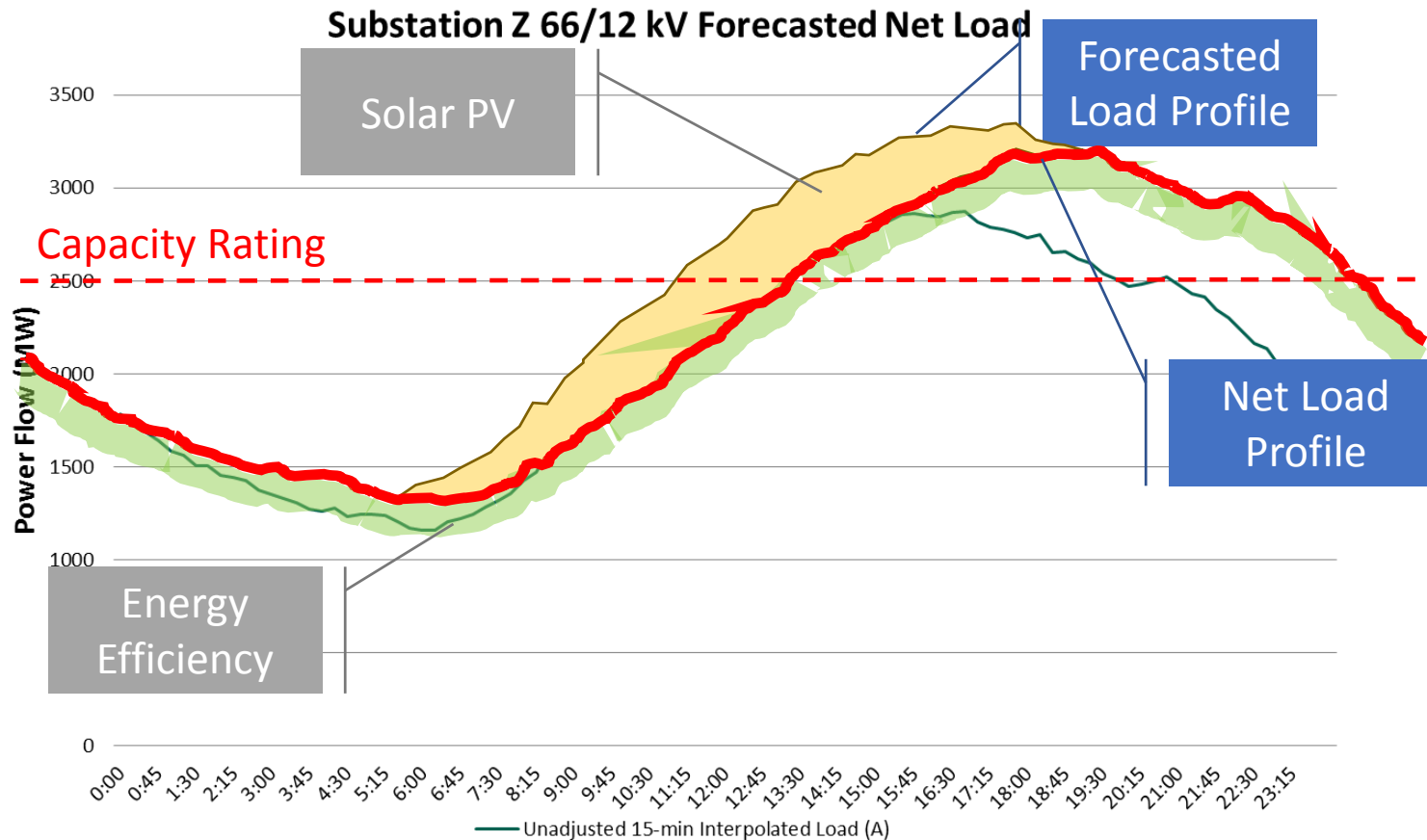
Solar Can Impact Load Profile During Daytime Hours



Alter Substation Load Profile with DER Portfolio

Energy Efficiency Programs can Permanently Reduce Load Profile

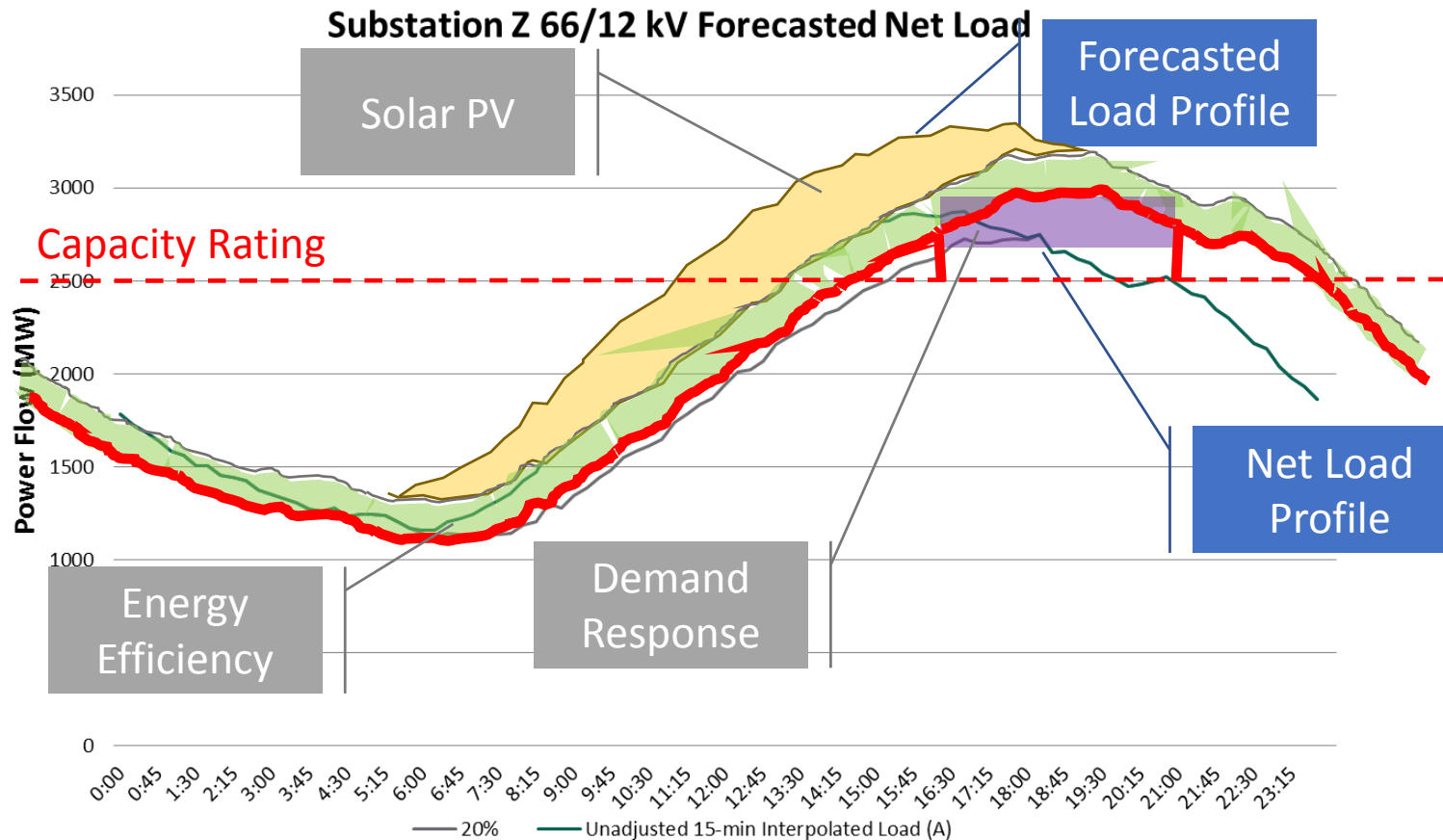
Illustrative



Alter Substation Load Profile Using DER Portfolio

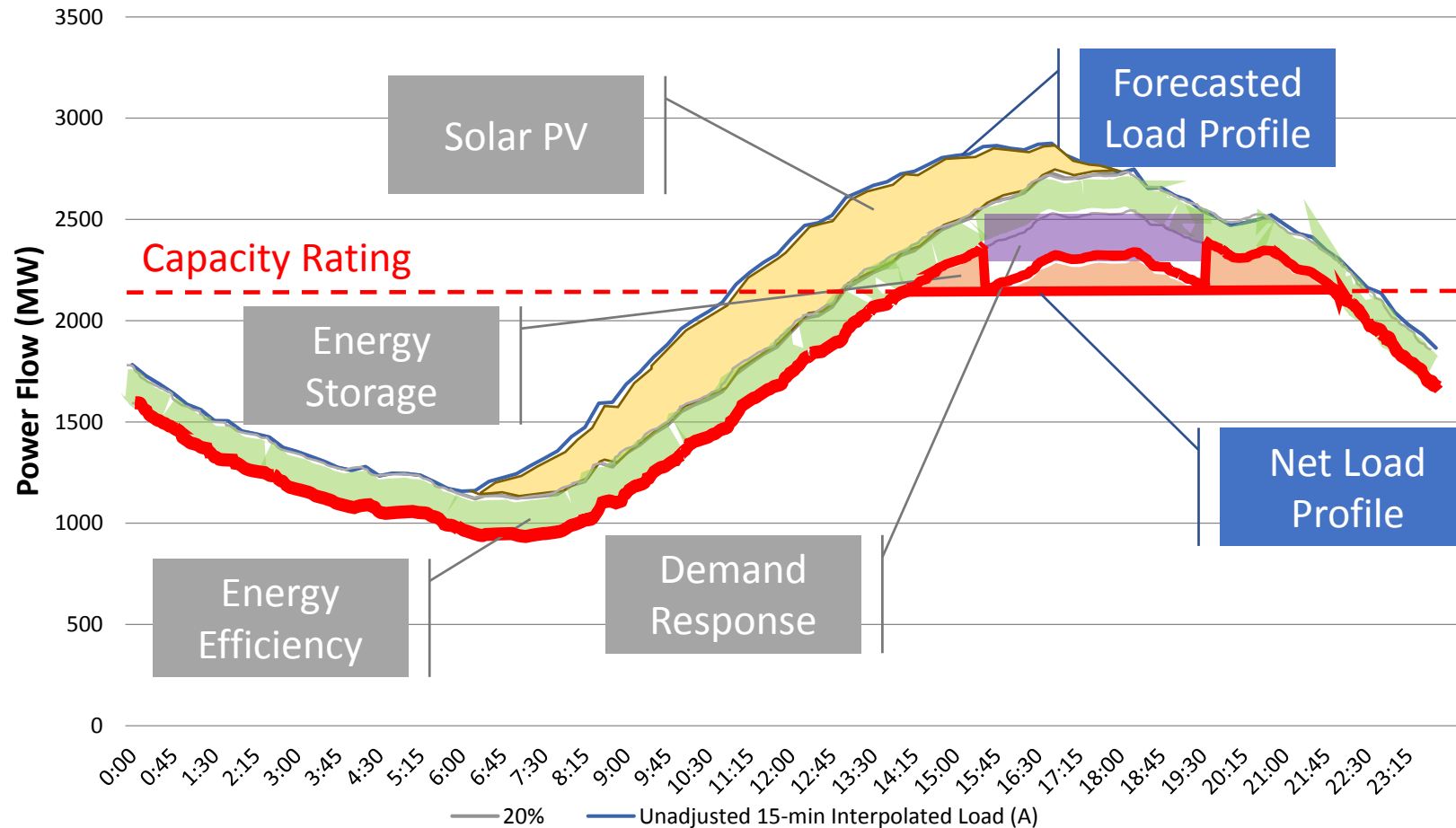
Illustrative

Demand Response Programs can Temporarily Reduce Load Profile



Alter Substation Load Profile Using DER Portfolio

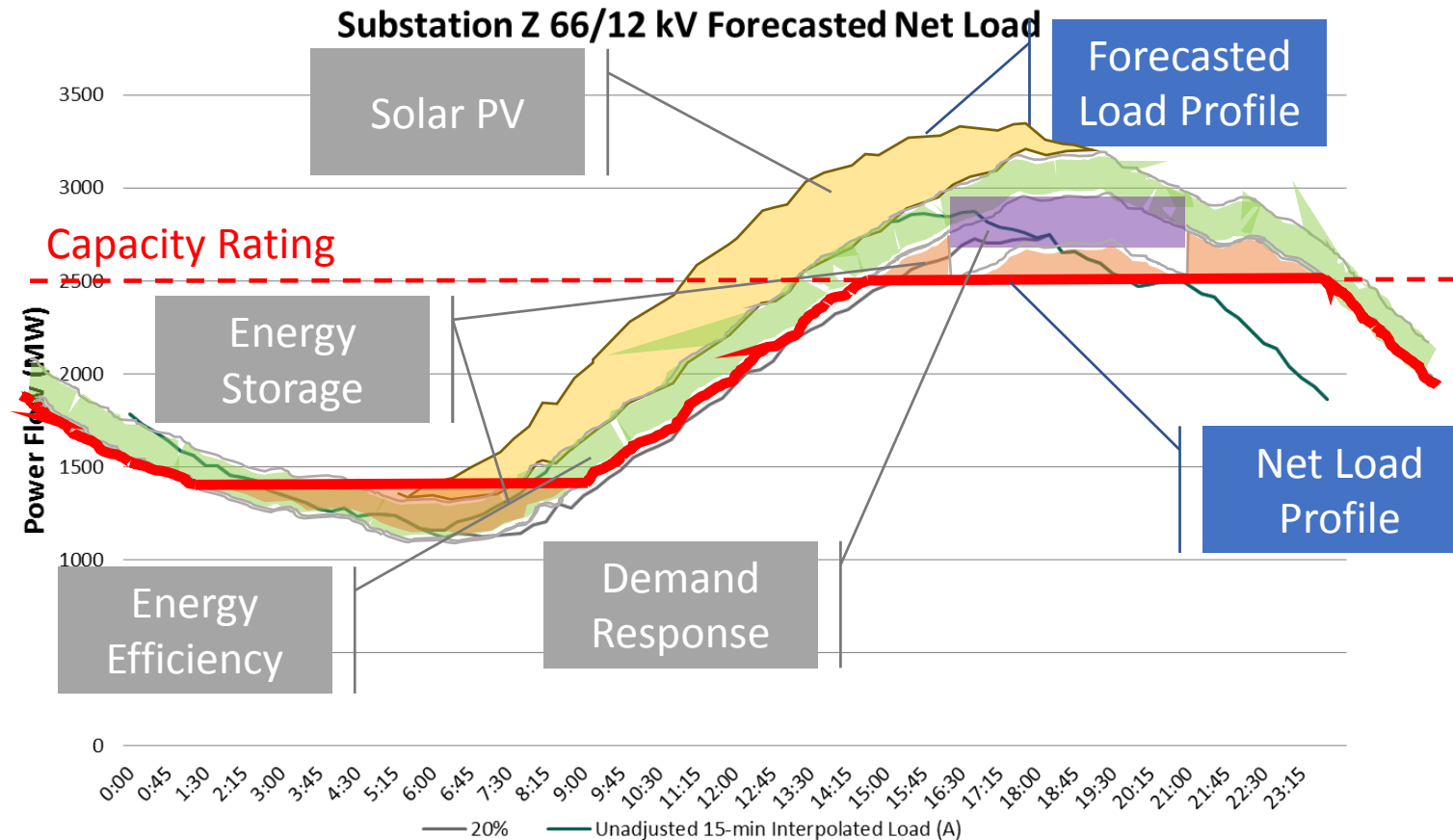
Illustrative Energy Storage can be Dispatched to Prescriptively Reduce Load Profile
Substation Z 66/12 kV Forecasted Net Load



Alter Substation Load Profile Using DER Portfolio

Illustrative

Energy Storage Also Requires Charging Which Will Impact Load Profile

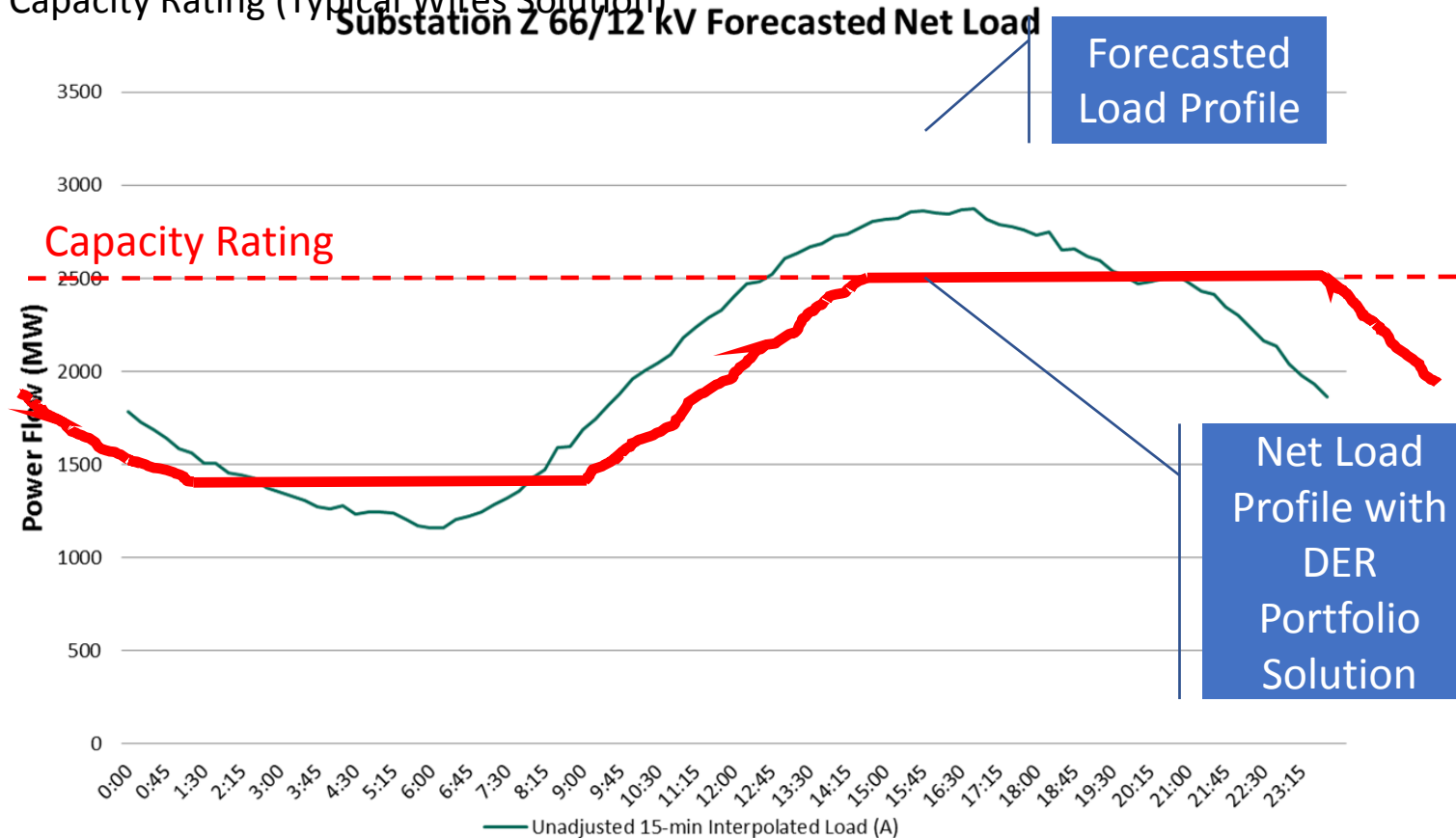


Alter Substation Load Profile Using DER Portfolio

Illustrative

Customized DER Portfolios Can Address Capacity Needs On Distribution

Increased Capacity Rating (Typical Wires Solution)



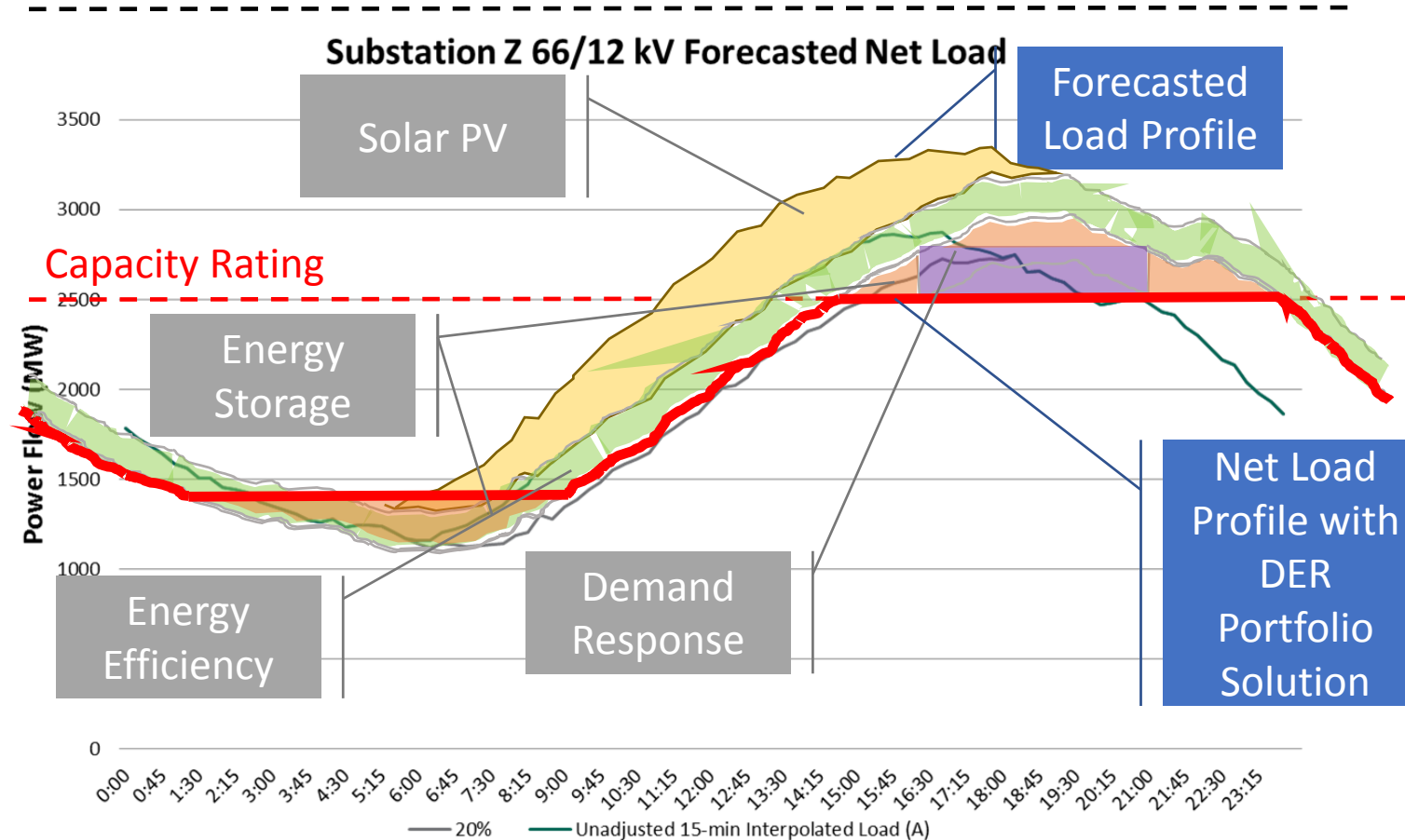
Alter Substation Load Profile Using DER Portfolio

Portfolio

Illustrative

Operators Need Visibility to DER Portfolio Performance in Real Time

Increased Capacity Rating (Typical Wires Solution)



Avoided distribution capacity costs (\$/kW-year)



- **PG&E: \$67.70**
- **SCE: \$30.10**
- **SDG&E: \$52.24**

- **Range: \$1-300**

Driving towards Fast and Flexible Distributed Resources

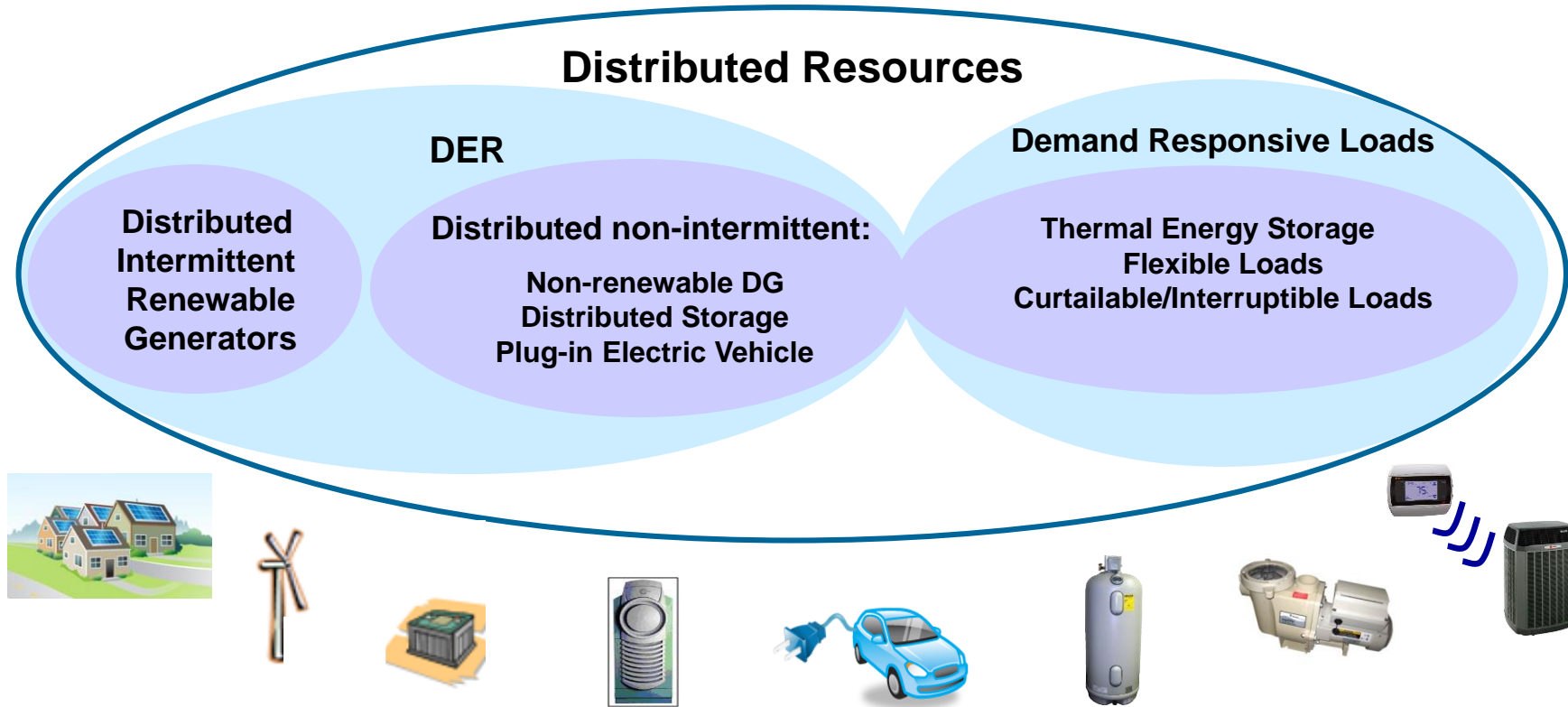
Angela Chuang
Sr. Technical Leader

April 21, 2017



Terminology

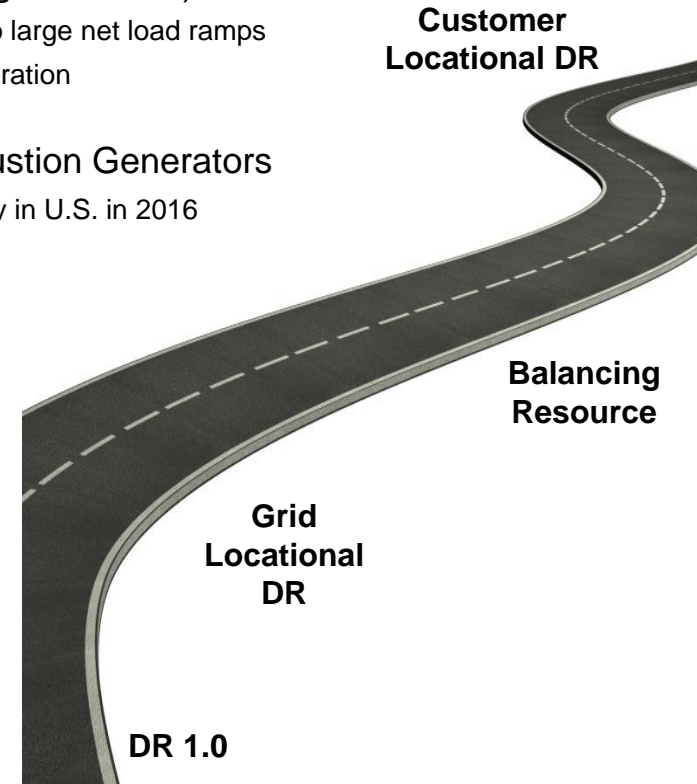
Distributed Resources = Demand Response and Distributed Energy Resources



Source: EPRI Report 1020313 (2009)

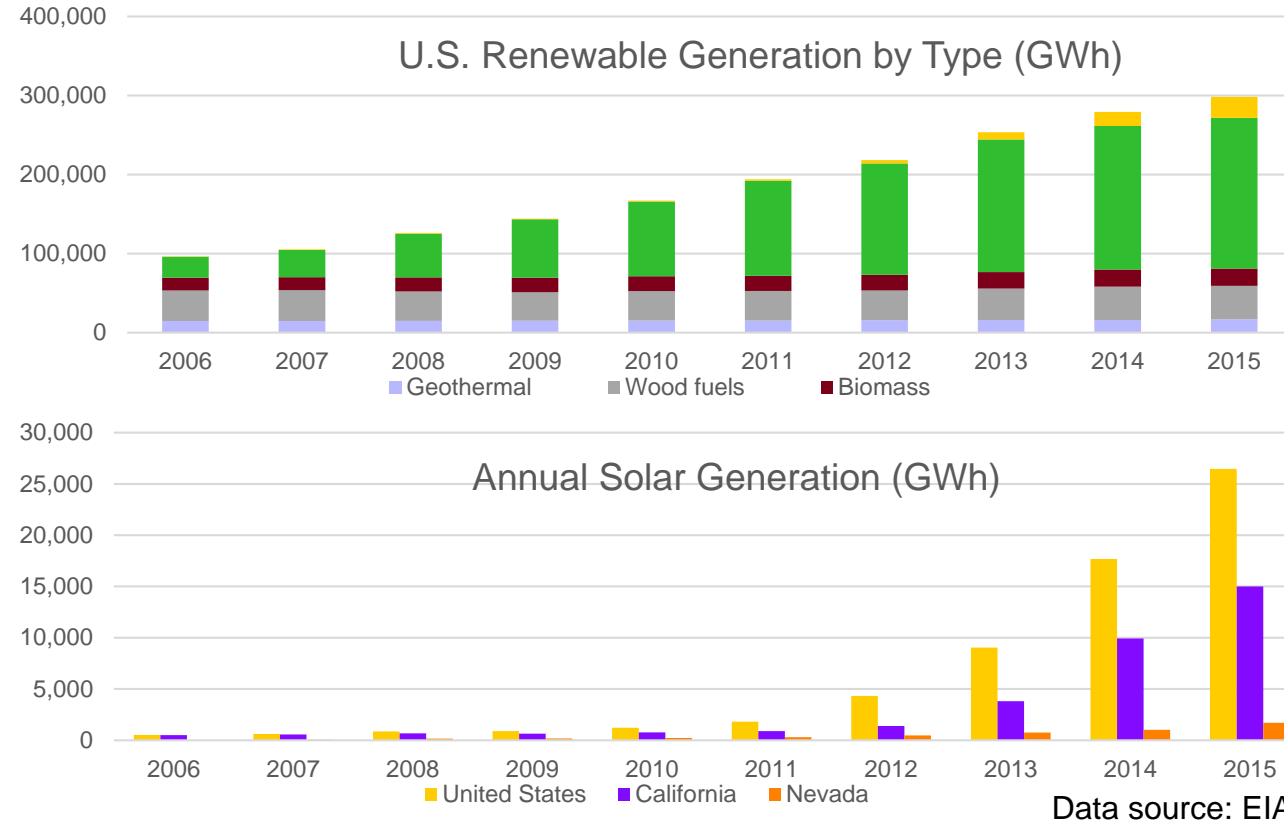
Drivers Impacting Distributed Resources

- Rising Intermittent Renewable Penetration (as RPS and targets mature)
 - Ramping energy needed to maintain supply and demand balance due to large net load ramps
 - Negative prices and renewable curtailments during periods of over-generation
- Reversal of EPA Provisions for Emergency DR from Combustion Generators
 - Non-compliance of combustion generators led to sudden loss in capacity in U.S. in 2016
 - Behind-the-meter-generation (BTMG) decline in ISO/RTO DR programs
- Changes in System Load
 - PJM winter peaks approaching towards summer peaks
 - Driving need for year-round availability of resources
 - Consumers becoming prosumers
- Changing Role of Distribution Systems
 - Local network-level constraints and grid needs
 - Widespread DER Integration (e.g., NY REV)
 - FERC NOPR on Storage and DER



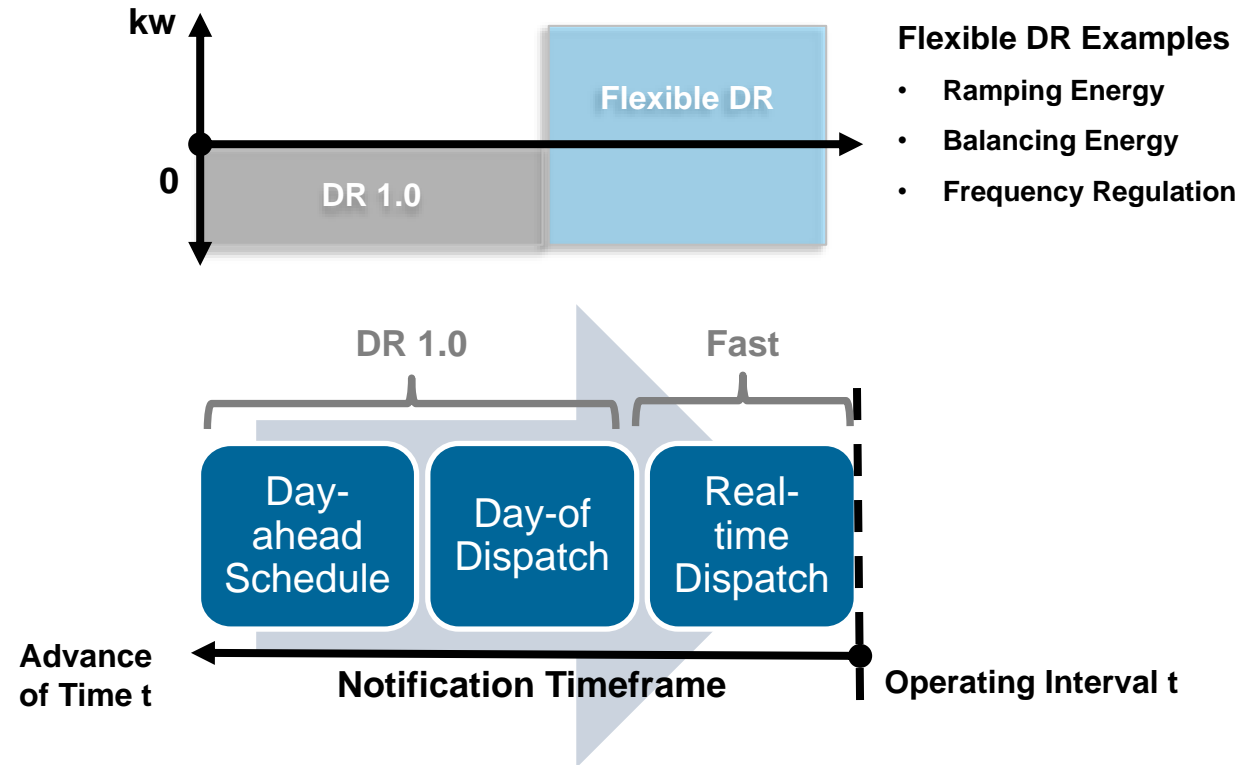
A Key Driver

Intermittent Renewable Penetration



Future Opportunities

Flexible DR beyond Fast



DR Roadmap

Advancing Stages of Capability

| | Stage | Location | Response Conditions |
|------------------------|---------------------------|---------------------------|--|
| DR 1.0 | Resource Adequacy | System-wide | Annual System Peaks (System-wide emergencies) |
| | Forward Economics | Generation or Energy Node | Day(s)-Ahead Economics (DA Schedule) |
| Grid Locational DR | Distribution Management | Distribution Facility | Real-Time Conditions (Overloads, Faults) |
| | T&D Deferral | Network Node | Real-time Conditions (Congestion) |
| | Ancillary Service Reserve | Transmission Facility | Contingency Event (Major Outages) |
| Locational DR 2.0 | Balancing Resource | Generation or Energy Node | Real-Time Conditions (System Imbalance, Schedule Deviations) |
| Customer Locational DR | Elastic Demand | Customer Facility | Varies by Customer Choice (e.g., Green Power, Local Power, Premium Power, Free or Cheap Power) |

Source: EPRI Report 3002006223 (2016)

Contact

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Together...Shaping the Future of Electricity

“The 411 on DER’s” - What’s New, and What is SCE’s Role?

Gary Barsley, Manager, Emerging Products

Southern California Edison

About SCE



Southern California Edison

We are modernizing the power grid to enhance system reliability, support consumer use of clean energy technologies, and help California meet its clean energy goals

- **One of the nation's largest** investor-owned utilities
- Providing electric service in the region for more than **120** years
- Serving nearly **14 million** people in a **50,000-square-mile** service area
- Generate about **16%** of electricity with the remaining **84%** purchased from independent power producers
- Investing more than **\$12 billion** over three years (2015-17) to expand and prepare our electric system infrastructure for new technologies (PV, storage, electric vehicles)

The Growth of DERs at SCE

Customer Systems at SCE- Significant growth continues

- 220,000 projects for over 1700MWs of customer PV
- 360 projects for over 24 MWs of customer storage
- 150 projects for over 50 MWs of customer fuel cells
- 100,000 customer EVS

Utility Involvement- Significant activity

- EV Charge Ready Program – Phase 1 to install 1500 customer EV chargers by end of 2018
- Multiple DER Market Solicitations (LCRs; PRP; etc)
- Major ongoing investments in “2-Way” smart grid
- Managing the impacts (and the infamous “Duck Curve”)

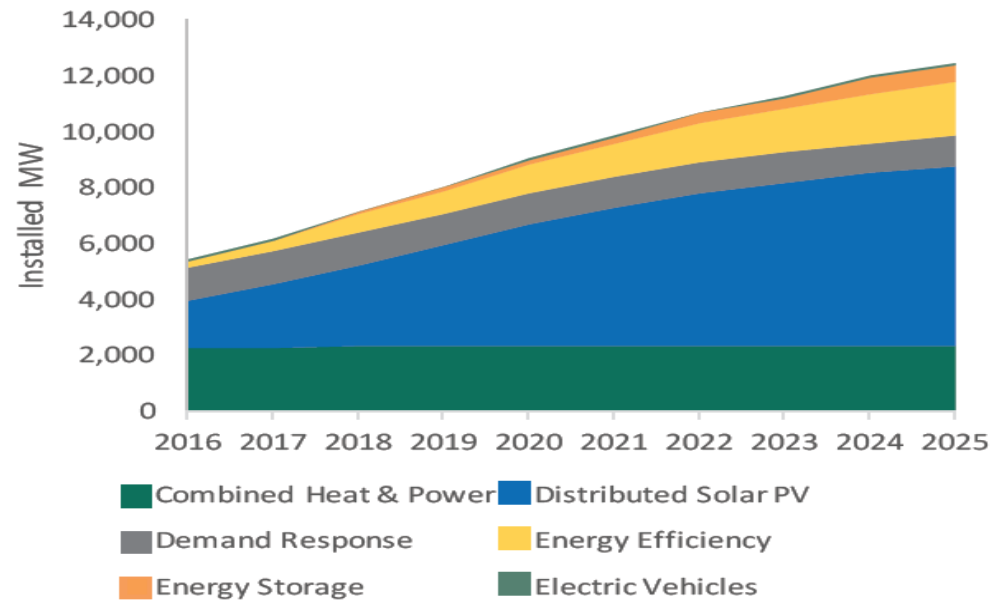
The Growth of DERs at SCE

The Emerging Clean Energy Economy: Customer-Driven. Modernized. Reliable.

The Power Grid of the
Future: Choice, Innovation,
Opportunity, and Challenge

Southern California Edison, September 2016

Figure 1:
DER Forecast in Southern California Edison Territory



DER penetration could more than double in SCE territory over next decade.

<https://www.edison.com/content/dam/eix/documents/our-perspective/der-dso-white-paper-final-201609.pdf>

What's Driving DERs in our Area?

Technology 411

- Lower prices and more competitive markets
- Added product capabilities
- Potential utility grid benefits (locational; other support)

Policy / Regulatory 411

- NEM and other Tariff Changes
- CA ZNE aspirational goals
- Potential new Utility Business Models
- CA Statewide ET Model

Customer 411

- Consumer-friendly access to new DERs
- More customer choice
- Added value to customers
- DER Solicitations

SCE Activities to Support DERs

SCE is modernizing our grid to support this continued growth and introduction of clean technologies, collectively referred to as Distributed Energy Resources or DERs. These are:

- **Distributed renewable gen resources:** Solar power generated from rooftop solar PV panels or other customer energy resources.
- **Energy efficiency:** Reduced demand by improving the efficiency of homes and workplaces through improved technologies.
- **Energy storage:** Batteries that can be charged during off-peak times, and then discharged during peak times, to reduce peak energy needs.
- **Electric vehicles:** Plug-in cars and other innovative vehicles.
- **Demand response:** SCE's Summer Advantage Incentive and similar incentive programs to reduce the peak use of electricity.

An Example of DER Activities at SCE

ZNE- Zero Net Energy Support

- Aggressive goals
 - All new Res. construction to ZNE by 2020
 - All new Comm. construction to ZNE by 2030
 - 50% of existing Comm. buildings to ZNE by 2030
- More market participation & offerings
 - Home builders, architects, equipment suppliers
- Utility assessment support
 - Tech development, field deployment projects

SCE's ZNE Demonstration Projects*

| | Project Name | Sector | Vintage | Type | Status |
|----|---|-------------|------------------|-----------------------|-------------|
| 1 | Low-Income Multifamily, Pomona | Residential | New Construction | Low-Income Community | In Progress |
| 2 | ZNE Schools Pilot (Prop 39) | Commercial | Retrofit | Education | In Progress |
| 3 | Low-Income Multifamily (LIMF), Lancaster | Residential | Retrofit | Low-Income Community | In Progress |
| 4 | ZNE Training Facility Retrofit, ETI in Commerce | Commercial | Retrofit | Training Facility | In Progress |
| 5 | Grid Integration of ZNE Communities, Fontana | Residential | New Construction | Production Community | In Progress |
| 6 | ZNE Office, South Pasadena | Commercial | New Construction | Office Development | In Progress |
| 7 | ZNE New Home, Ontario | Residential | New Construction | Production Home | Complete |
| 8 | ZNE Recreation Facility Retrofit, UCSB | Commercial | Retrofit | College Recreation | Complete |
| 9 | Solar Decathlon Student Mentorship | Residential | New Construction | Residential Education | Complete |
| 10 | ABC Green Home 1.0, 2.0, 3.0 | Residential | New Construction | Custom Homes | In Progress |
| 11 | Irvine Smart Grid Demonstration (ISGD) | Residential | Retrofit | Community | Complete |
| 12 | Low-Income Retrofit, San Bernardino | Residential | Retrofit | Low-Income Home | Complete |
| 13 | Multifamily, Lake Forest | Residential | New Construction | Multi Family | In Progress |
| 14 | Multifamily, Ontario | Residential | Retrofit | Low-Income | In Progress |

*listing of relevant projects – not comprehensive

Grid Integration of ZNE Communities



Project Partners



Implemented ZNE Measures

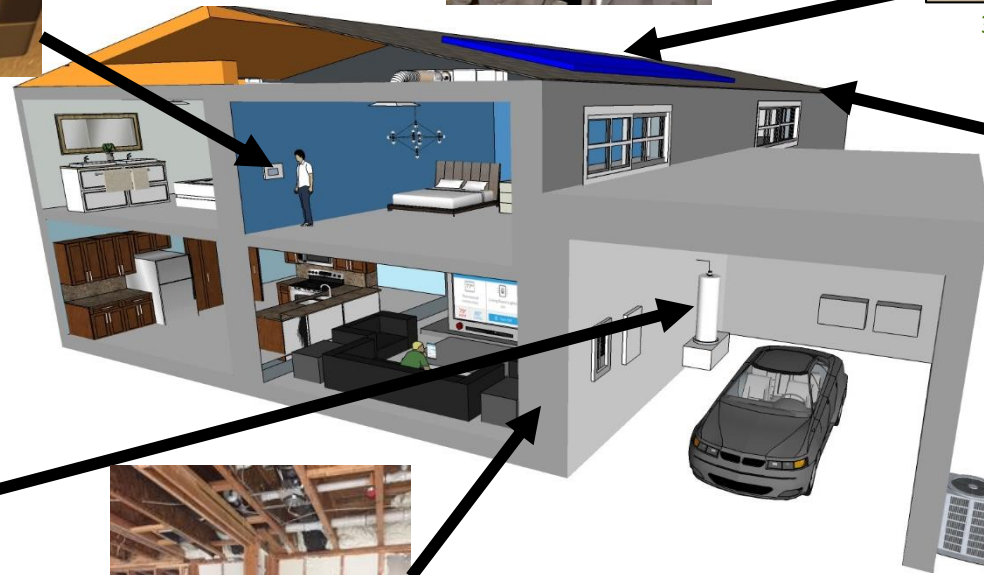


Thermostats/HEMS

All LED lighti



3.5 – 4.5 kW PV



High Performance Envelope



Electric Heating and Water Heating



Foam Insulation



Plus:

- Plug load controllers
- Circuit-level monitoring

Net Zero Energy Homes



Designed to generate as much energy as it uses over the course of a year.

Thank You!

*Gary Barsley
Southern California Edison
Emerging Products
"gary.barsley@sce.com"*



Distributed Generation Integration



Tony Rafati
San Diego Gas & Electric
04/21/2017



A  Sempra Energy utility®

Supply and Demand



Certain

VS

Uncertain



Predictable

VS

Unpredictable





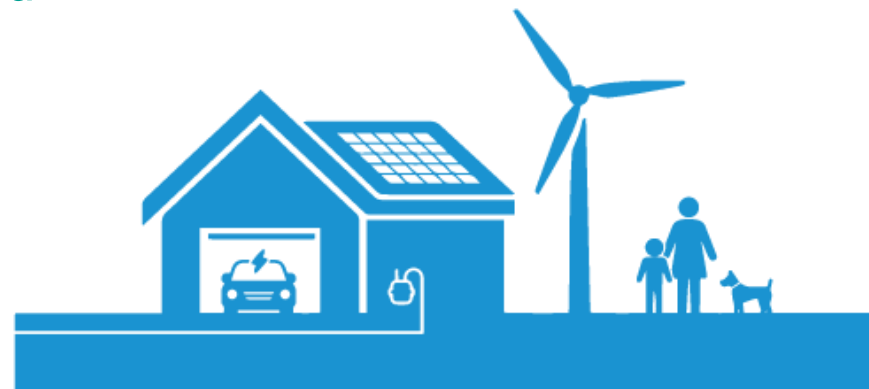
A  Sempra Energy utility®

The What?

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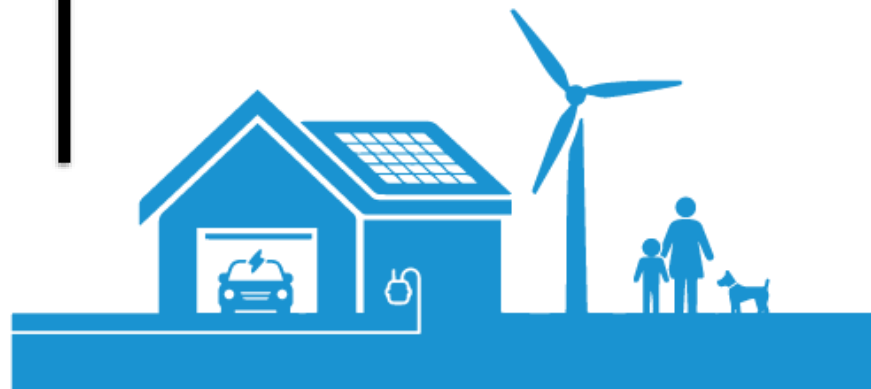
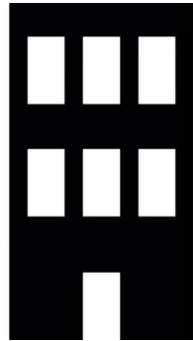
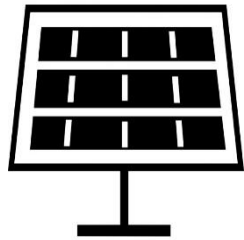
Fast and dynamic swings in Distributed Generation output





A  Sempra Energy utility®

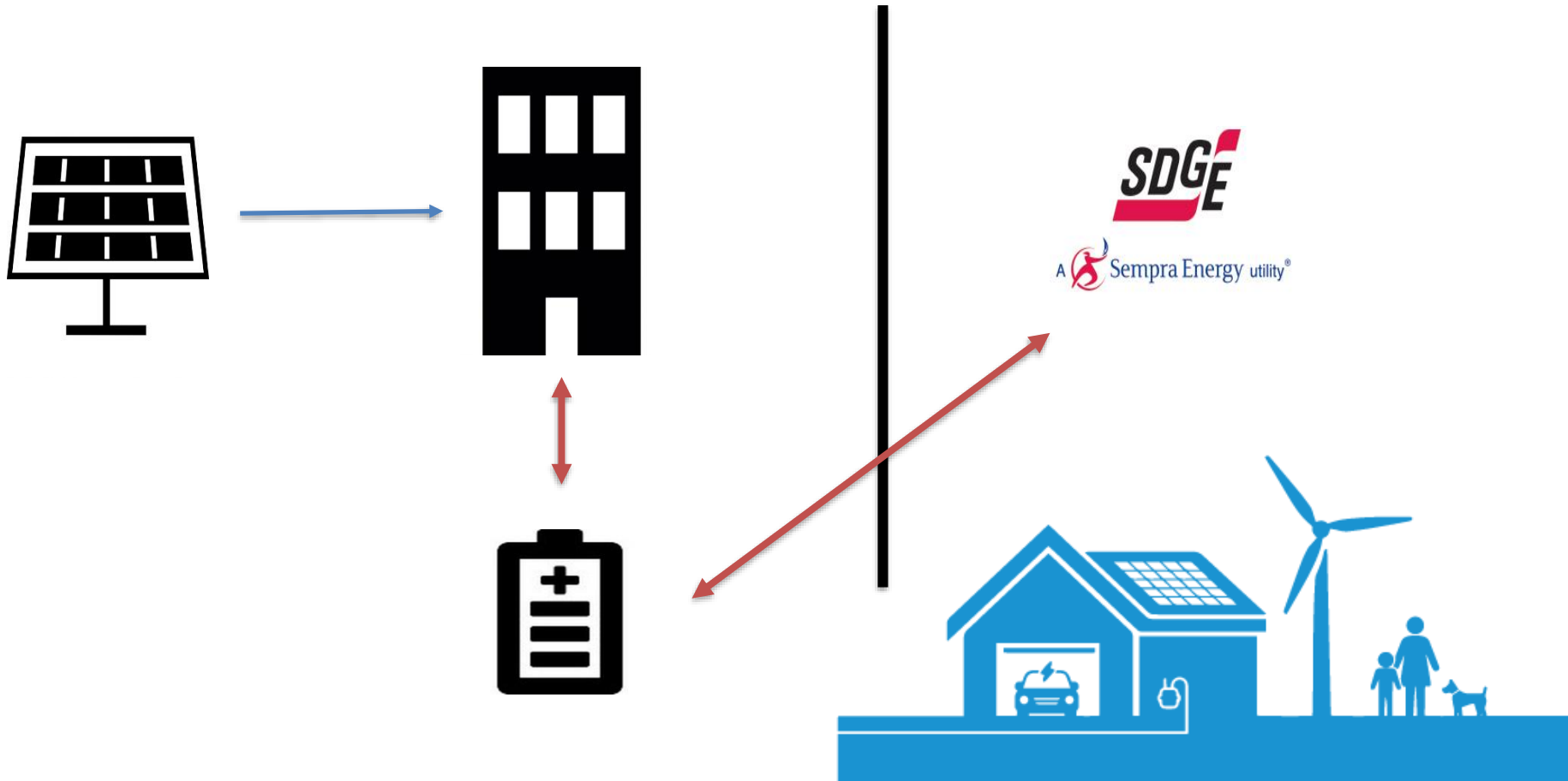
The How?





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The How?





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Regulatory 411

Beginning January 1st, 2018

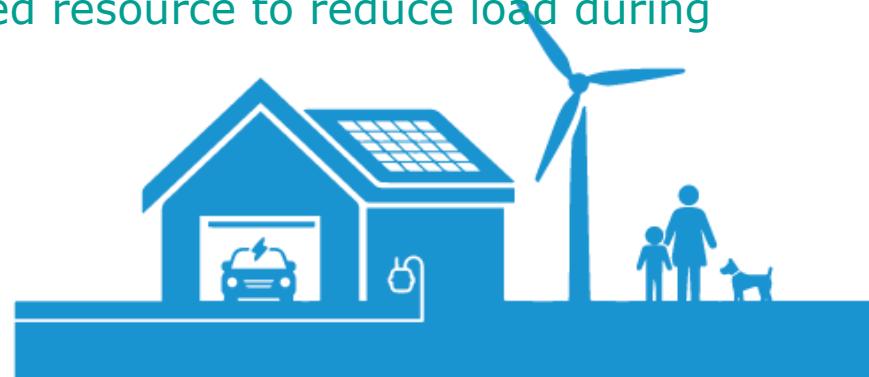
Commercial Customers

A) agree not to use a *prohibited resource* to reduce load during a demand response event or B) in cases where the customer is required to use the prohibited resource for safety reasons, agree to a default adjustment.

Residential Customers:

A new and separate provision shall be included in the tariff or contract for each program explaining the prohibition and requiring a residential customer to agree not to use a prohibited resource to reduce load during a demand response event.

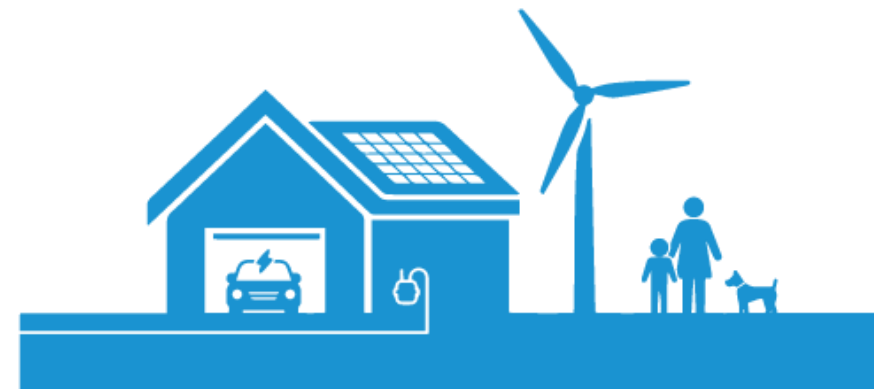
D.16-09-056 issued on October 5, 2016





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Questions





**DISTRIBUTED ENERGY RESOURCES
EMERGING TECHNOLOGY SUMMIT
APRIL 19-21, 2017
ONTARIO, CA**

SoCalGas Service Territory



- Nation's largest natural gas distribution utility
- In business for 145+ years
- 12 counties, 500+ communities served
- 21.6 million customers
- 5.9 million gas meters
- 20,000+ square miles of service territory

The Natural Gas Advantage in DER

- Natural Gas Distributed Generation (DG) is a DER with many benefits
 - CHP efficiencies range 60-80%¹
 - Grid is 33% - 42% efficient¹
 - Lower environmental impacts
 - Both GHG and Criteria Emissions
- Municipalities' electric rates have increased
- California electric rates are 2nd highest in contiguous United States²

¹<https://www.epa.gov/chp/chp-benefits>

²https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a (10/14/16)

U.S NG-fueled DER - \$30 billion market by 2030

- Decreasing technology costs, favorable spark spreads, emission mandates, and grid resiliency concerns may create an incremental market of \$28 billion between 2015 and 2030 in small industrial and commercial natural gas fueled DER (CHP and fuel cells)
- Natural gas fueled DER developers have traditionally targeted the public sector leaving an opportunity to capture growing private sector interest

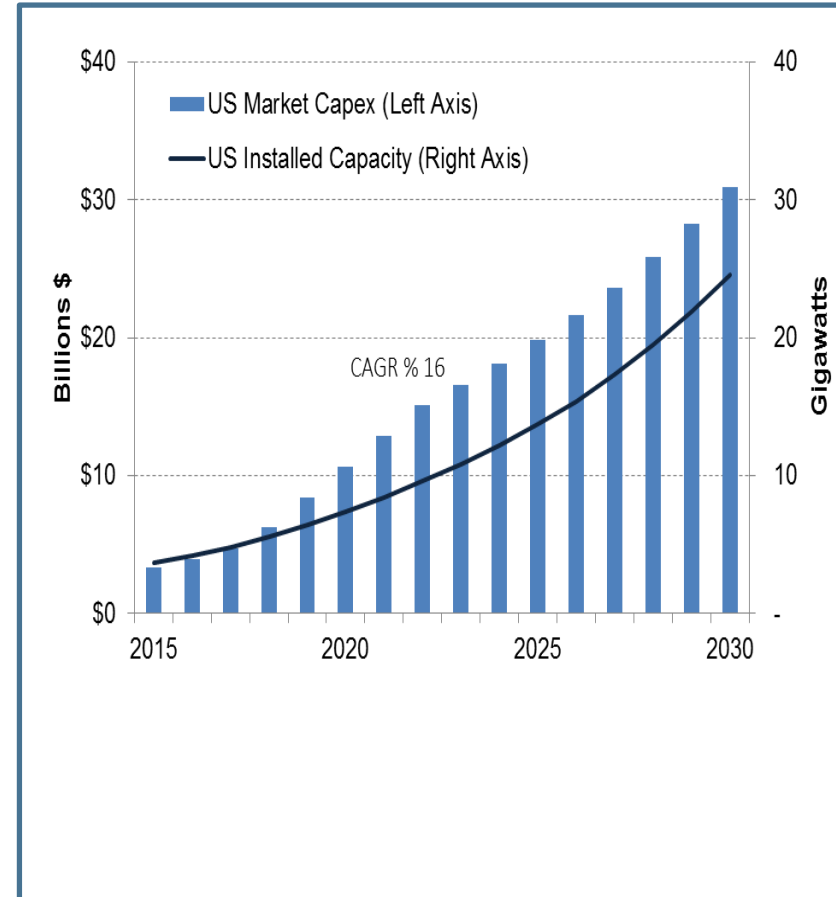


Chart: "Distributed Generation Deployment Forecast" Navigant Consulting, September 2014

California Market Challenges

- Diminished financial subsidies
- Stringent emissions monitoring requirements
- Lack cost effective technology solutions in US
- Over-procurement of renewables
- Electric utilities opposed to NG DER
 - “Death Spiral” narrative
 - DLC/Standby charges
 - Interconnection delays
- DER Tariff
- SGIP program moving towards battery storage

Regulatory / Legislative Challenges

- DER proceedings focused on batteries and solar
- CHP not seen as energy efficiency measure
- Source versus Site view
- Natural gas lumped in with other fossil fuels
- Natural gas is not considered a GHG reducing solution
- Renewable natural gas not considered in equations

Future of NG DER Technology

- » CHP and Fuel Cell applications
 - Smaller, more efficient, cheaper
 - Cleaner

- » Tri-Gen Technology
 - Clean production of electricity, water and hydrogen
 - Biogas and/or natural gas
 - Efficiency of electrical generation for on-site use or grid support
 - Water for on-site use
 - Hydrogen for transportation and/or other energy use

- » Power To Gas Storage – Battery?
 - Enables production of renewables
 - Encourages clean hydrogen
 - Captures carbon

Future of NG DER Technology

- » Renewable Gas
 - Used with DER can produce a negative carbon footprint
 - Unless we want to stop eating meat....Future!

- » Community-Based CHP
 - “Micro-Grid” type system
 - Protection from grid issues

- » What have we not developed yet?
 - Technology neutrality is critical
 - Give smart people target (financial, environmental and practical) and then get out of the way!

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