# US Electricity Industry Primer

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ENERGY FLAGSHIP
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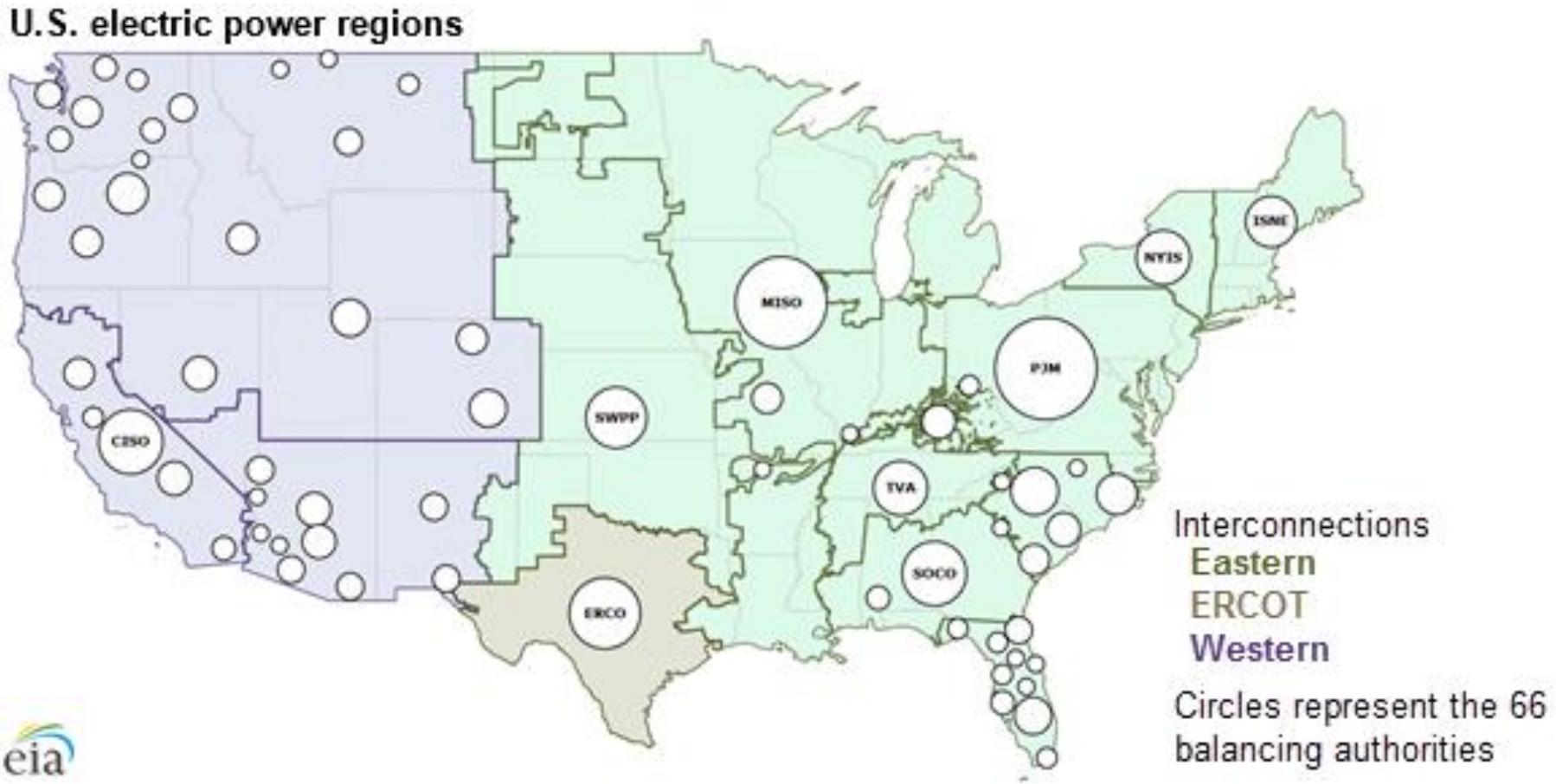
# Agenda

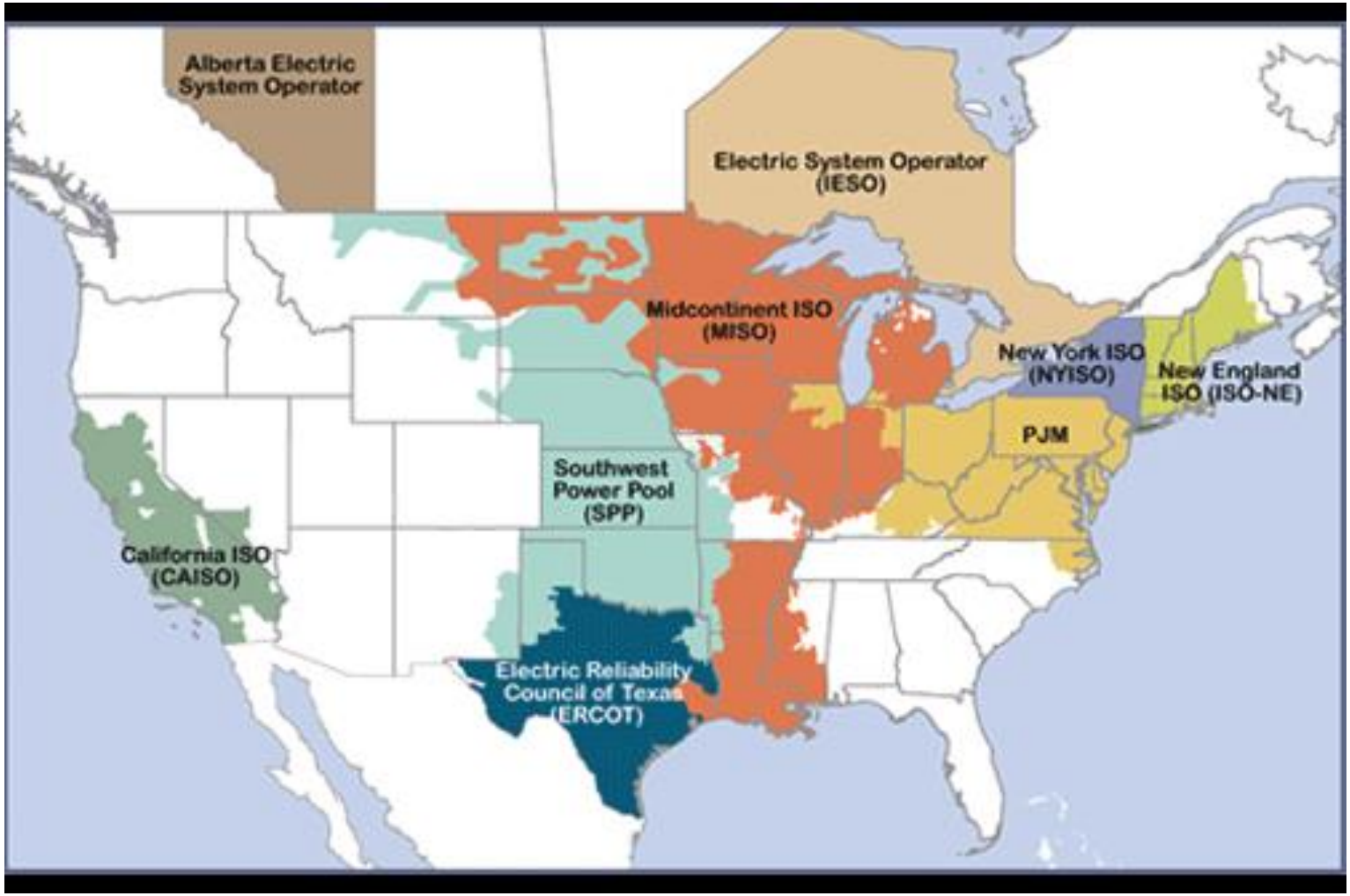
- US Energy Geography and Regulatory Overview
- California and New York General Overview
- A brief interlude on Customer Energy
- New York's Reforming the Energy Vision (REV)
- California's DER Action Plan

# US ENERGY GEOGRAPHY AND REGULATORY OVERVIEW

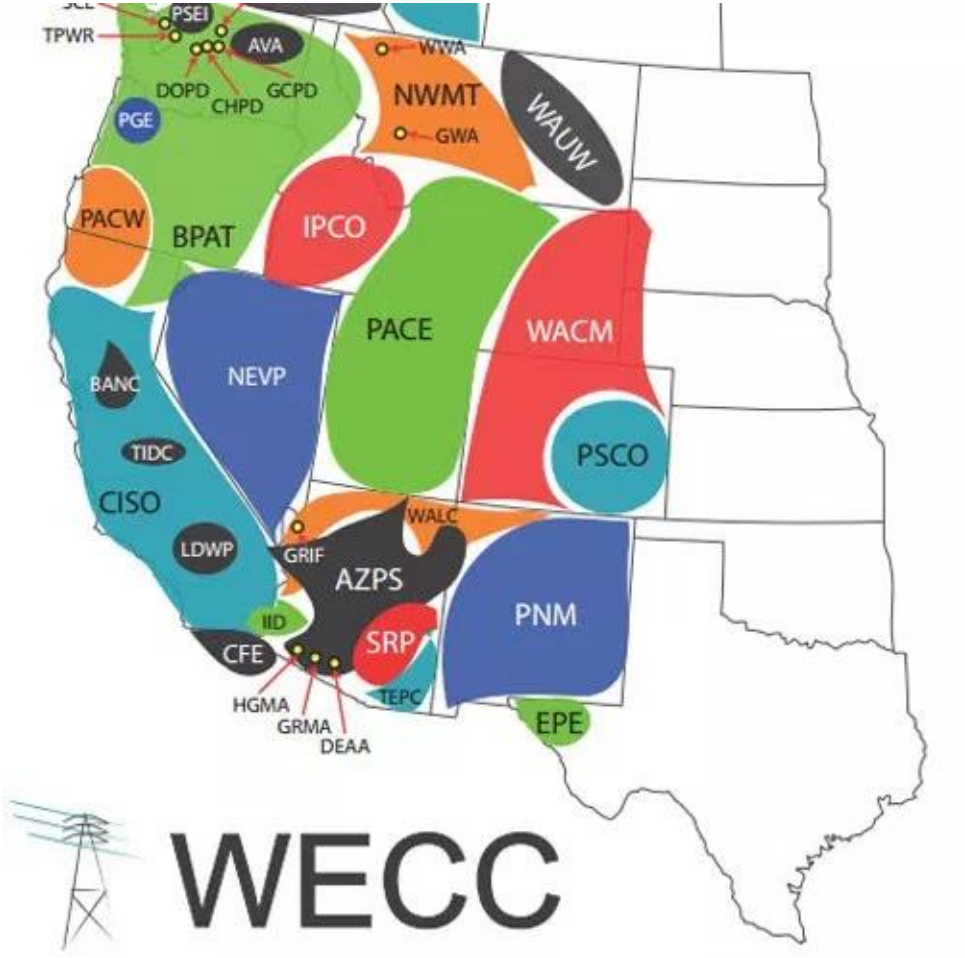
# Three grids and 66 Balancing Authorities in the United States



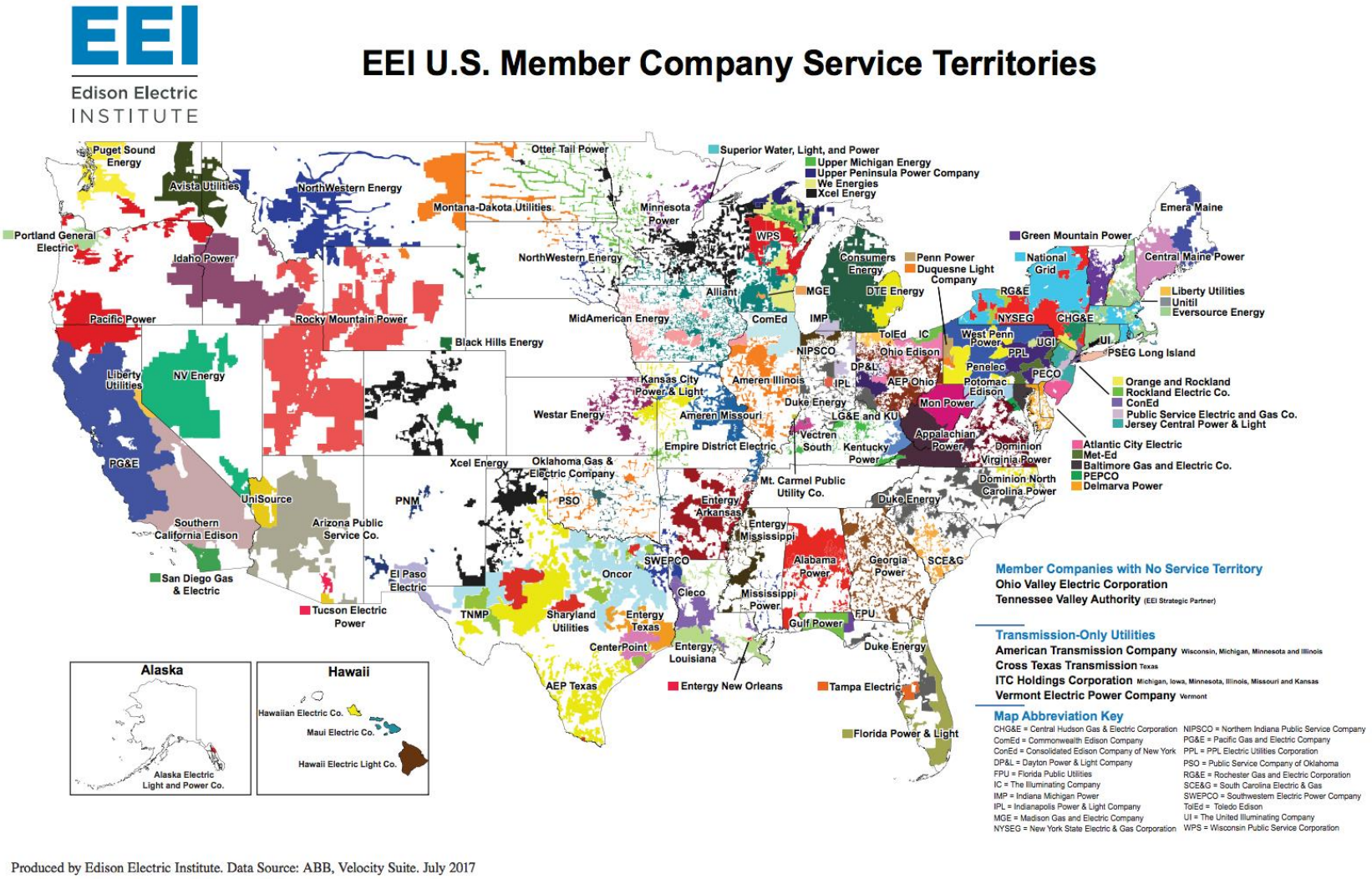
# Seven Organised Markets



# Balancing Authorities in the West

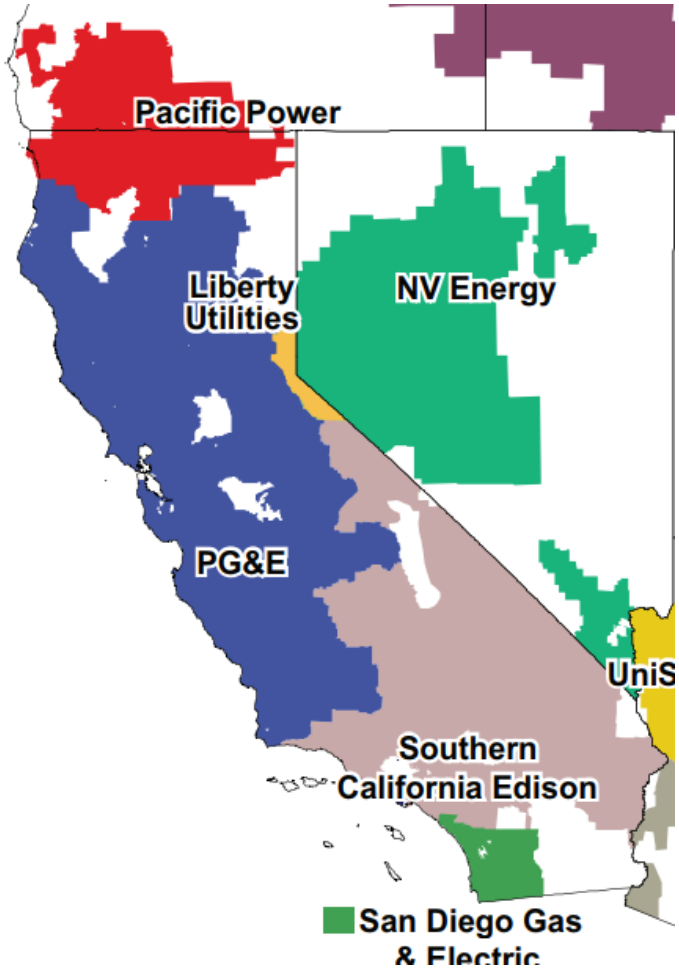


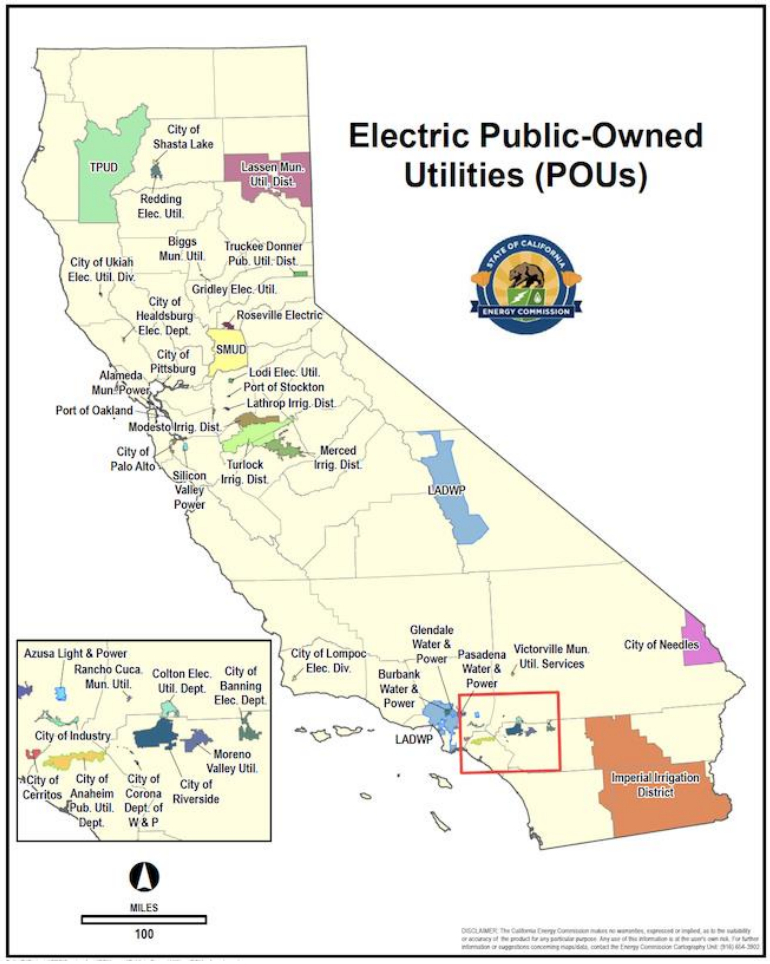
# Investor-Owned Utilities



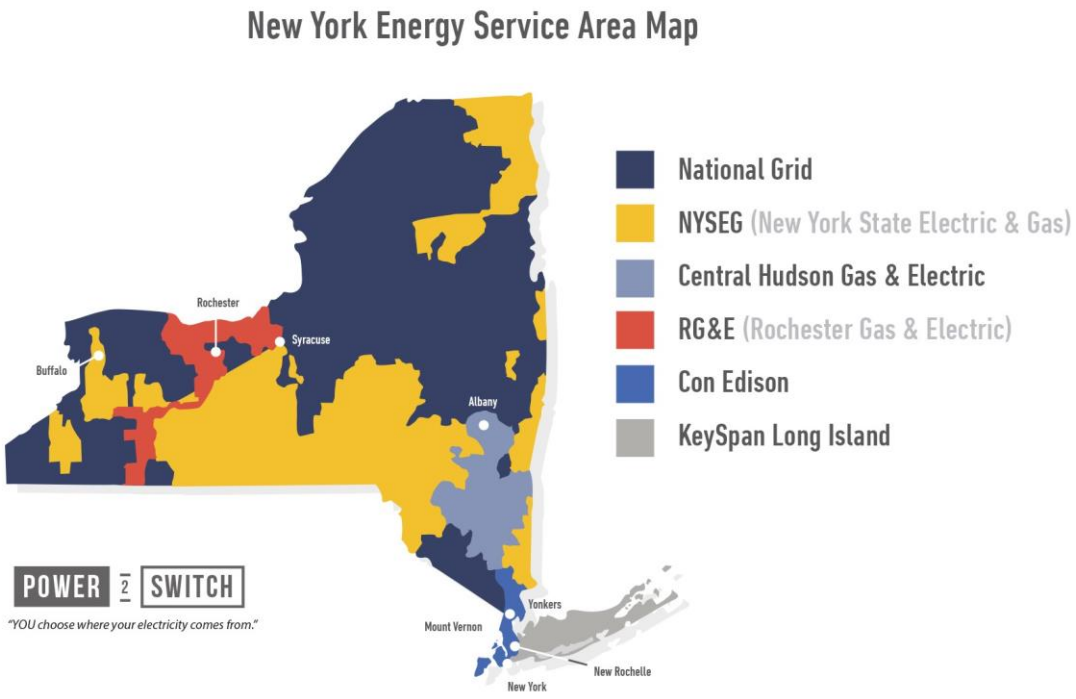

Produced by Edison Electric Institute. Data Source: ABB, Velocity Suite. July 2017

# California's IOUs and POUs



# New York Energy Service Map – Networks/POLRs



# Electric Industry Oversight

| | Federal | State | Local |
|---|---|---|---|
| Industry Structure | | | |
| Interstate Transmission Rates | | | |
| Wholesale Rate Design (PURPA) | | | |
| Resource Adequacy | | | |
| Retail Rates | | | |
| Generation Mix (CCA) | | | |

# CALIFORNIA AND NEW YORK GENERAL OVERVIEW

# Alphabet Soup in the Electricity Industry

## California

- **CalISO**: California Independent System Operator (AEMO)
- **CPUC**: California Public Utility Commission (AER)
- **CEC**: California Energy Commission
- **AB 32**: California Global Warming Solutions Act

## New York

- **NYISO**: New York Independent System Operator (AEMO)
- **NYPSC**: New York Public Service Commission (AER)
- **NYSERDA**: New York State Energy R&D Authority
- **RGGI**: Regional Greenhouse Gas Initiative

## Federal

**FERC**: Federal Energy Regulatory Commission (AEMC)

**NERC**: North America Electric Reliability Corporation (No Aussie)

# California and New York by the Numbers

| | California | New York | Period |
|---|---|---|---|
| **Population** | 39.5 million | 19.8 million | 2017 |
| **Per Capita Personal Income** | $58,272 | $60,991 | 2017 |
| **Electricity Prices** | | | |
| **Residential** | 18.91 (cents/kWh) | 18.52 (cents/kWh) | May-18 |
| **Commercial** | 15.6 (cents/kWh) | 13.71 (cents/kWh) | May-18 |
| **Industrial** | 12.64 (cents/kWh) | 6.54 (cents/kWh) | May-18 |
| **Utility-Scale Net Electricity Generation (share of total)** | | | |
| **Petroleum-Fired (%)** | 0.0% | 0.4% | May-18 |
| **Natural Gas-Fired (%)** | 29% | 36.5% | May-18 |
| **Coal-Fired (%)** | 0.2% | 0.0% | May-18 |
| **Nuclear (%)** | 10.8% | 32.4% | May-18 |
| **Renewables (%)** | 58.4% | 30.1% | May-18 |
| **Distributed Energy Resources** | | | |
| **Distributed Solar** | 9,800 MW | 1,400 MW | 2016 |
| **Energy Efficiency** | 584 MW | 214 MW | 2014 |
| **Demand Response** | 2,998 MW | 37 MW | 2014 |
| **Non-Hydro Storage** | 215.6 MW | 47.5 MW | 2015 |
| **Electric Vehicles** | 126,283 | 11,278 | 2014 |

Source: U.S. Energy Information Administration and Dept of Energy



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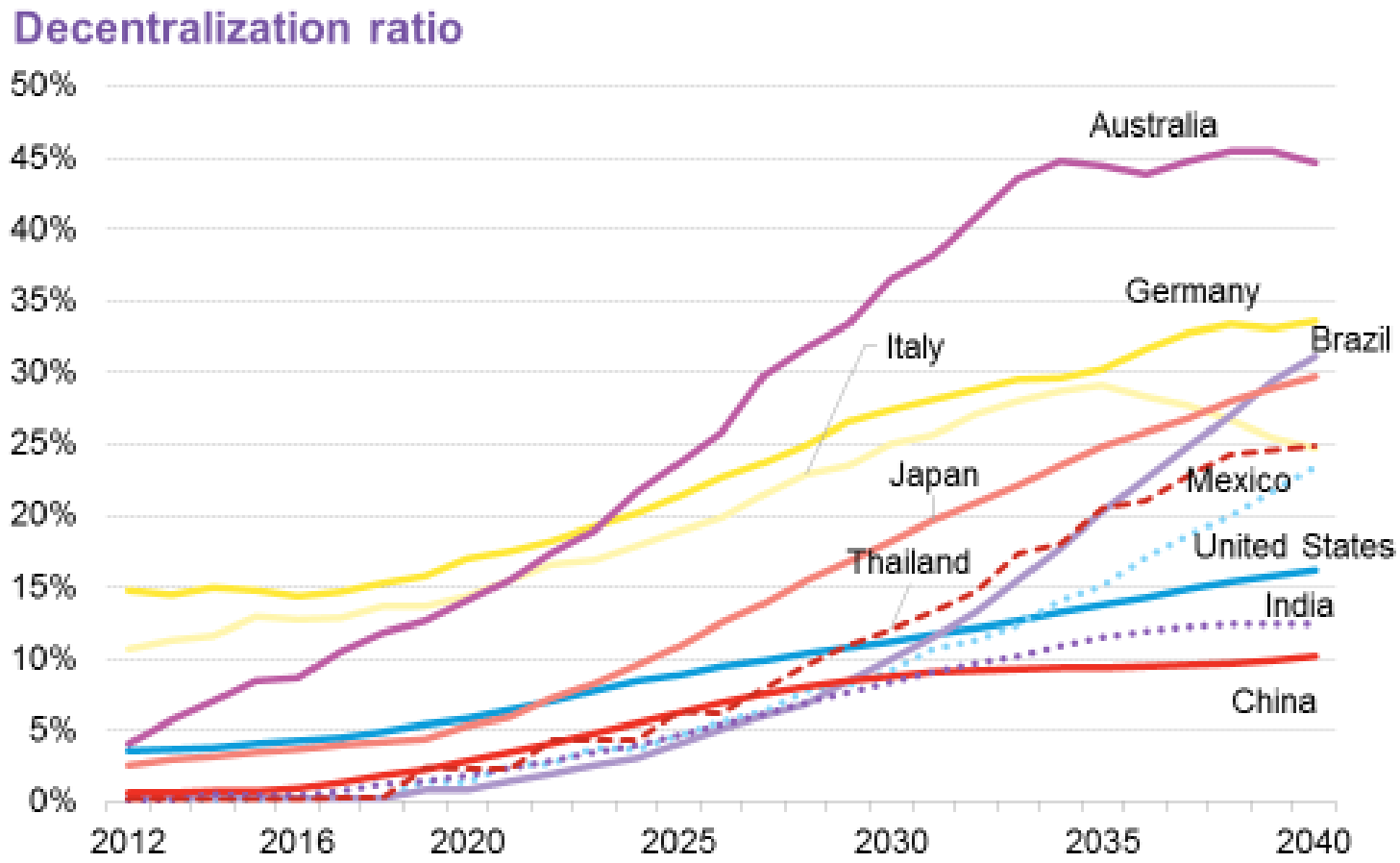
# State Mandates

| | California | New York |
|---|---|---|
| RPS: | 50% by 2030 | 50% by 2030 |
| Storage: | 1,8325 MW by 2024 | 1,500 MW by 2025 |
| Public Benefits Fund | | |
| RE: | $0.0016 mills/kWh | Collections set by NYPSC every year |
| EE: | $0.0054 mills/kWh | |
| RD&D: | $0.0015 mills/kWh | Administered by NYSERDA |
| Administered by Utilities and CEC | | |

# A BRIEF INTERLUDE ON CUSTOMER ENERGY

# Australia poised to lead the world in customer energy resources

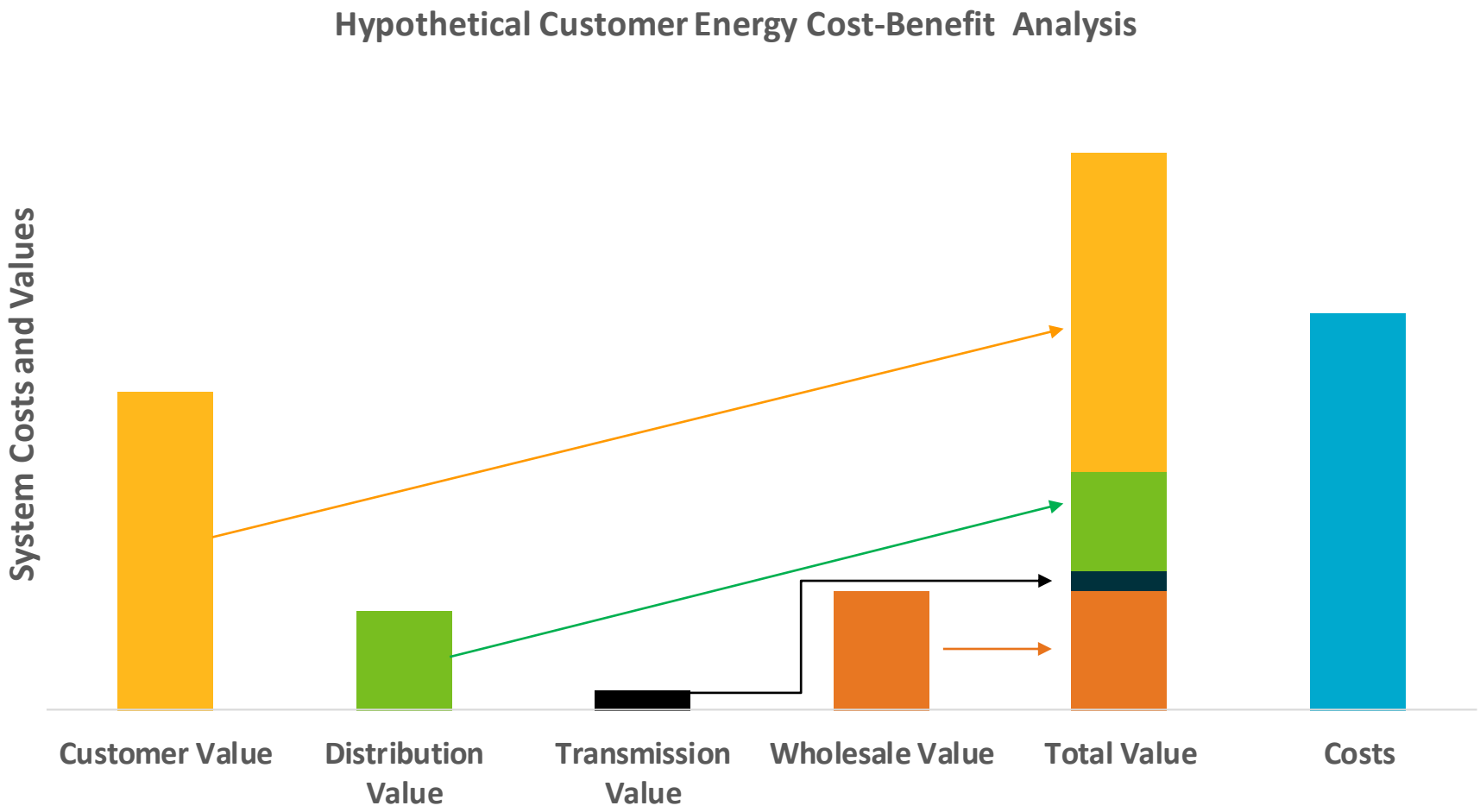



*Source: Bloomberg New Energy Finance Note: decentralization ratio is the ratio of non-grid-scale capacity to total installed capacity.*

# Organising Customer Energy Resource Services

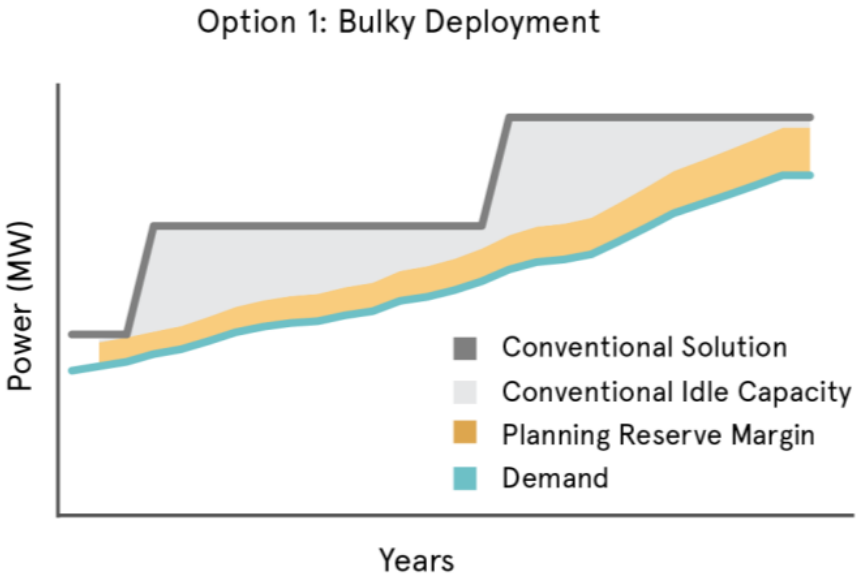
| Grid Domain | Services provided by Customer Energy Resources | Monetized? |
|---|---|---|
| Customer | Customer Energy Services | Yes |
| | Bill Management | Yes |
| | Backup Power | Yes |
| Distribution | Distribution Capacity Deferral | No |
| | Voltage Support | No |
| | Network congestion management | No |
| | Reliability | No |
| Transmission | Transmission Capacity Deferral | No |
| Wholesale Market | Frequency Regulation | Yes |
| | Spin/Non-Spin Reserves | ? |
| | Resource Adequacy/Capacity | Yes |
| | Energy | Yes |
| | Flexible Ramping | ? |

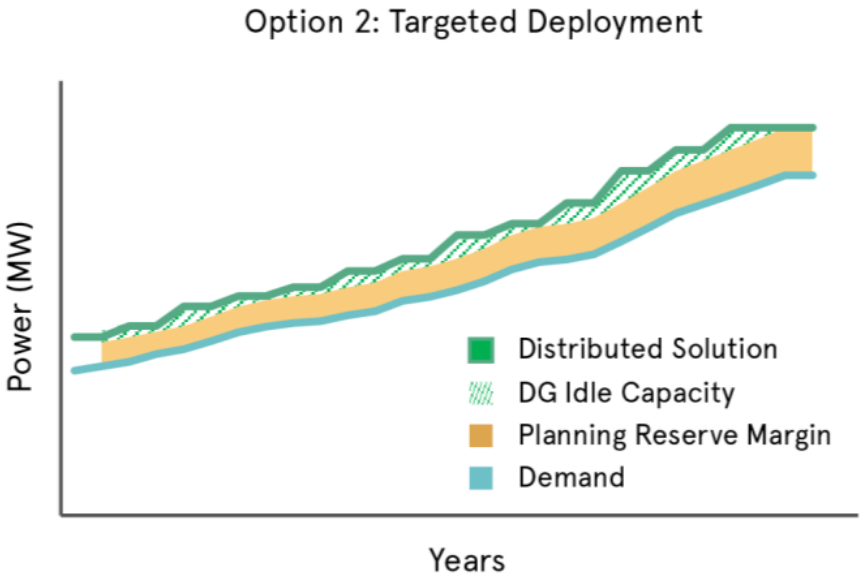
# Maximising the value of customer energy resources requires new approaches to energy market design




Customer Energy Resources include energy efficiency, energy storage (batteries), load management (including demand response), and distributed generation.

# The benefits of small rather than big energy resources



# NEW YORK'S REFORMING THE ENERGY VISION (REV)

## REV GOALS

- Making energy more affordable for all New Yorkers
- Building a more resilient energy system
- Empowering New Yorkers to make more informed energy choices
- Creating new jobs and business opportunities
- Improving our existing initiatives and infrastructure
- Supporting cleaner transportation
- Cutting greenhouse gas emissions 80% by 2050
- Protecting New York's natural resources
- Helping clean energy innovation grow

# REV is a strategy to build a clean, resilient, and affordable energy system for all New Yorkers.

**REV is transforming New York State's energy policy and initiatives** to make sure energy efficiency and clean, locally produced power are at the core of the State's energy system.

**REV is changing the way government and utilities work** to make clean energy financially beneficial to everyone. And most importantly, REV is putting customers first by designing new initiatives to impact real people and provide individuals and communities with the opportunity to take an active role in achieving the following State energy goals by 2030.

## 40% Reduction
### in GHG emissions from 1990 levels

Reducing greenhouse gas (GHG) emissions from the energy sector—power generation, industry, buildings, and transportation—is critical to protecting the health and welfare of New Yorkers and reaching the longer term goal of decreasing total carbon emissions 80% by 2050.

## 50% Electricity
### will come from renewable energy sources

Through Governor Cuomo's aggressive Clean Energy Standard commitment, renewable energy sources, including solar, wind, hydropower, and biomass, will play a vital role in reducing electricity price volatility and curbing carbon emissions.

## 600 trillion Btu Increase
### in statewide energy efficiency from 2012 levels

Energy efficiency results in lower energy bills and is the single most cost-effective tool in achieving New York's greenhouse gas reduction objectives.

**ny.gov/REV4NY**

NEW YORK STATE OF OPPORTUNITY. | Reforming the Energy Vision



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# REV Demo Projects and Initiatives

- REV is driving New York's six IOUs to work with energy innovators to lower costs, test advanced technologies, and design new replicable business models through REV Demonstration Projects (REV Demo Projects). Together utilities and their partners are trying out ways to power our homes and businesses reliably at lower costs while reducing emissions. As with all things REV, clean, resilient, and more affordable energy are the driving forces.

- REV's 40+ initiatives to build a clean, resilient, and more affordable energy system for all New Yorkers are found in the New York State Energy Plan
- They’re grouped into seven general categories. Renewable Energy; Building & Energy Efficiency; Clean Energy Financing; Sustainable & Resilient Communities; Energy Infrastructure Modernization; Innovation and R&D; Transportation

# REV's NY Prize Competition for Microgrids

**What is NY Prize**

A first-in-the-nation competition to help communities create microgrids - standalone energy systems that can operate independently in the event of a power outage

**1. Feasibility Studies**

- $100,000 to 83 feasibility studies across New York

**2. Design**

- $1,000,000 to 11 microgrid designs across NY

**3. Build-Out**

- RFP issued by end of 2018 for $5M+ grants

# CALIFORNIA'S DER ACTION PLAN

# (Some of) California's Supportive DER Policies

| Policy | Description | Applicable DERs and customers |
|---|---|---|
| Net-metering | Customers receive full retail bill credit for energy exported | Solar; Batteries with solar – all customers |
| Time-of-Use Rates | Customers charged rated based on time of day that electricity is used | All DERs (mandatory for non-resi +net-metering); Opt-in for resi |
| Critical Peak Pricing | Customers pay peak pricing on event (high demand) days | Default for all non-resi; PG&E opt-in for resi |
| Electric Vehicle Rates | TOU rates exclusively for EV charging on separate meter | EVs – all customers |
| Energy Efficiency | Upstream incentives to manufacturers for lighting, etc. | EE – all customers |
| Energy Efficiency | Midstream (to distributors) and downstream (to customers) for HVAC, appliances, lighting | EE – all customers |
| Energy Efficiency | Free installation of approved weatherization and EE measures | EE—qualifying low-income residential |

# California's DER Action Plan

**The DER Action Plan serves as a roadmap for decision-makers, CPUC staff, and stakeholders working in support of California's DER future in order to facilitate proactive, coordinated, and forward-thinking development of related DER policy.**

## Rates and Tariffs

- By 2018, establish plans to maximize the take-up of time-varying rates by DER customers
- By 2019, default [certain] residential customers to TOU rates;

## Distribution Grid Infrastructure, Planning and Procurement

- By 2018, consider developing guidelines to clarify the circumstances in which utility/affiliate ownership of DERs is appropriate;
- By 2020, fully operationalise advanced smart inverter functionalities to enhance integration with the grid.

## Wholesale DER Market Integration

- By 2018, assess regulatory options to ensure wholesale market rules and interconnection tariffs support behind-the-meter DERs;
- Rules and procedures are in place governing how DERs may participate in the wholesale market while providing distribution capacity and other services to distribution utilities.

# Integrated Distribution Planning Framework

## Integrated Distribution Planning Process (IDPP)

## Sourcing Process to Satisfy IDPP Needs

1. **Assumptions, Scenarios & Scope**

Develop forecasts, assumptions and planning scenarios.


2. **Distribution Planning Assessment**

Distribution Grid Studies

- Thermal
- Voltage
- Protection
- Safety and Reliability

3. **Distribution Grid Needs**

Distribution Grid Needs

- Load Serving Capacity
- DER Hosting Capacity
- DER Aggregator Requirements
- Coordination with Transmission Planning

4. **Evaluate Options**

Prioritize Grid Needs

↓

Locational Net Benefit Analysis

↓

Investment framework/technical Feasibility

Implement "Wires" alternatives for locations deemed infeasible for DERs

↓

**Implement "Wires" Solution**

5. **Distribution Portfolio**

Sourcing Process to satisfy needs identified in IDPP


Source: Mark Esguerra, Planning the 'Networked Grid' Integrated Distribution Planning, PG&E, March 17, 2016

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# California Microgrid Roadmap

- CEC staff are developing a Roadmap for the Commercialization of Microgrids in California (to be finalized by the end of 2017).

- The CEC released a competitive solicitation with $50 million in Electric Program Investment Charge (EPIC) funding to deploy field examples of advanced microgrids and produce business cases for scalable and repeatable standardized commercial-scale microgrid configurations.

- 12 projects awarded (as of May 2018), including Commercializing Virtual Wide Area Urban Microgrids for Grid Resilience & Disaster Readiness and Power Begins at Home – R2M2 Resilient Replicable Modular Microgrids: Assured Energy Security for Military Bases

# Notable Differences between NY REV and California on DERs

- New York REV is more highly publicised, but much more DER action is occurring in California
- NY REV came from the Governor's plan and while it did include significant funding, it lacked legislative backing. There were few directives or mandates, but plenty of discussion.

- California's DER program was directed largely by the legislature through a number of laws created over more than a decade.
- Those laws created mandates, but generally left the details up to California's significant regulatory arsenal: CPUC, CEC, CalISO and others to implement them.

# Thank you

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