



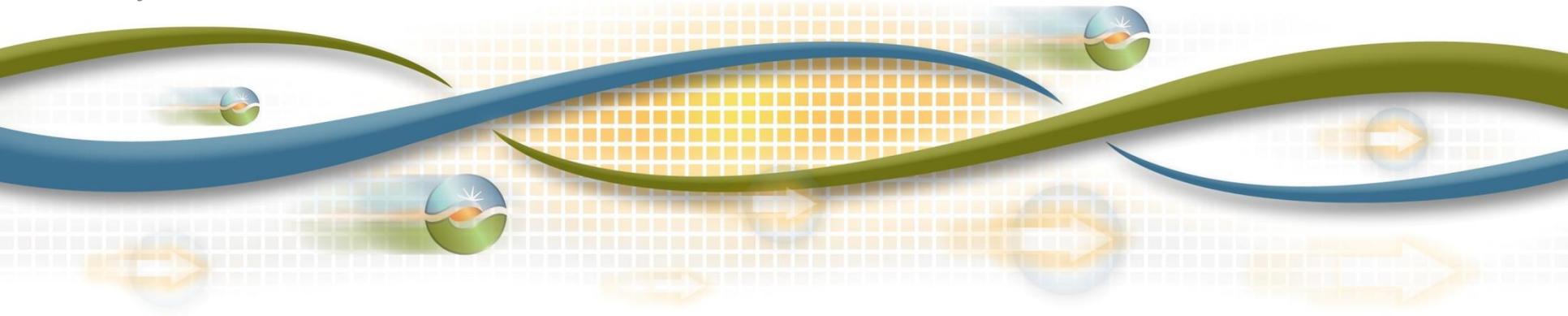
California ISO  
Shaping a Renewed Future

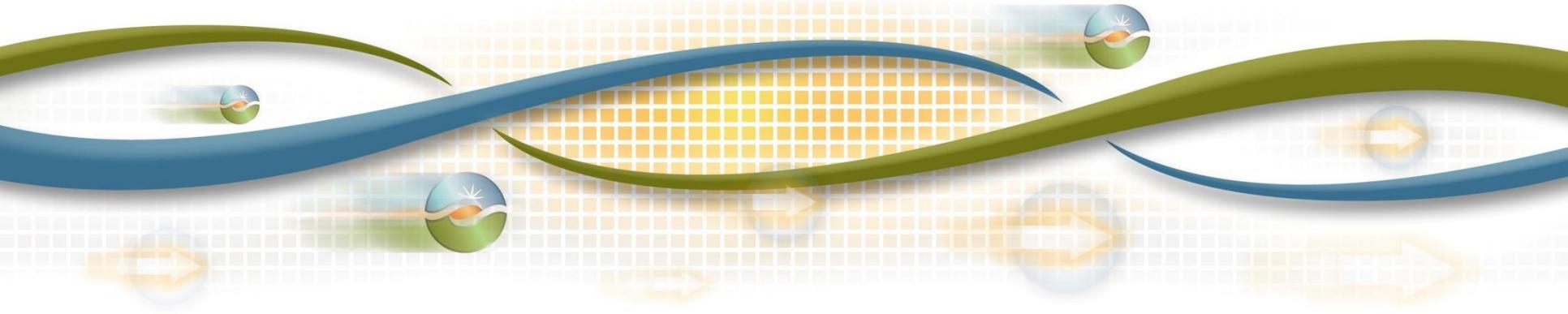
# California ISO Renewables Integration – The Duck Chart

WECC Technical Studies Subcommittee Meeting

**Chris Mensah-Bonsu, PhD**  
**Lead Regional Transmission Engineer**  
**California ISO, Folsom, CA**

WECC, Salt Lake City, Utah  
May 7, 2015





# Who oversees us?



We are governed by a governor appointed/  
Senate confirmed **Five Member Board**

We are regulated by  
**FERC** Federal Energy Regulatory Commission

We are compliant with  
**NERC** North American Electric Reliability Corporation

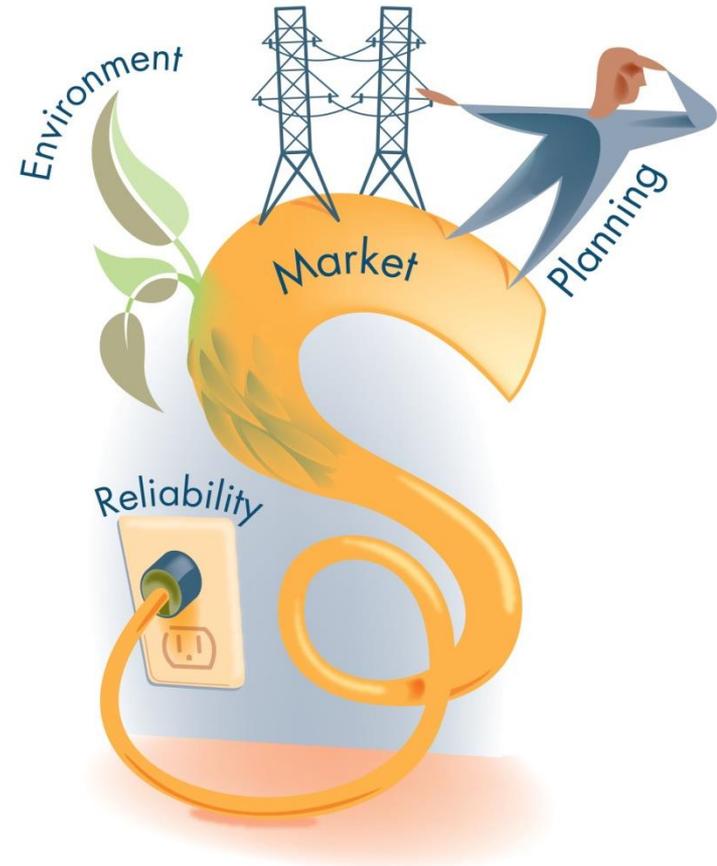
We are part of  
**WECC** Western Electricity Coordinating Council

# Shaping the industry

The ISO, a nonprofit public benefit corporation, maintains the constant and reliable flow of electricity for the health, safety and welfare of consumers

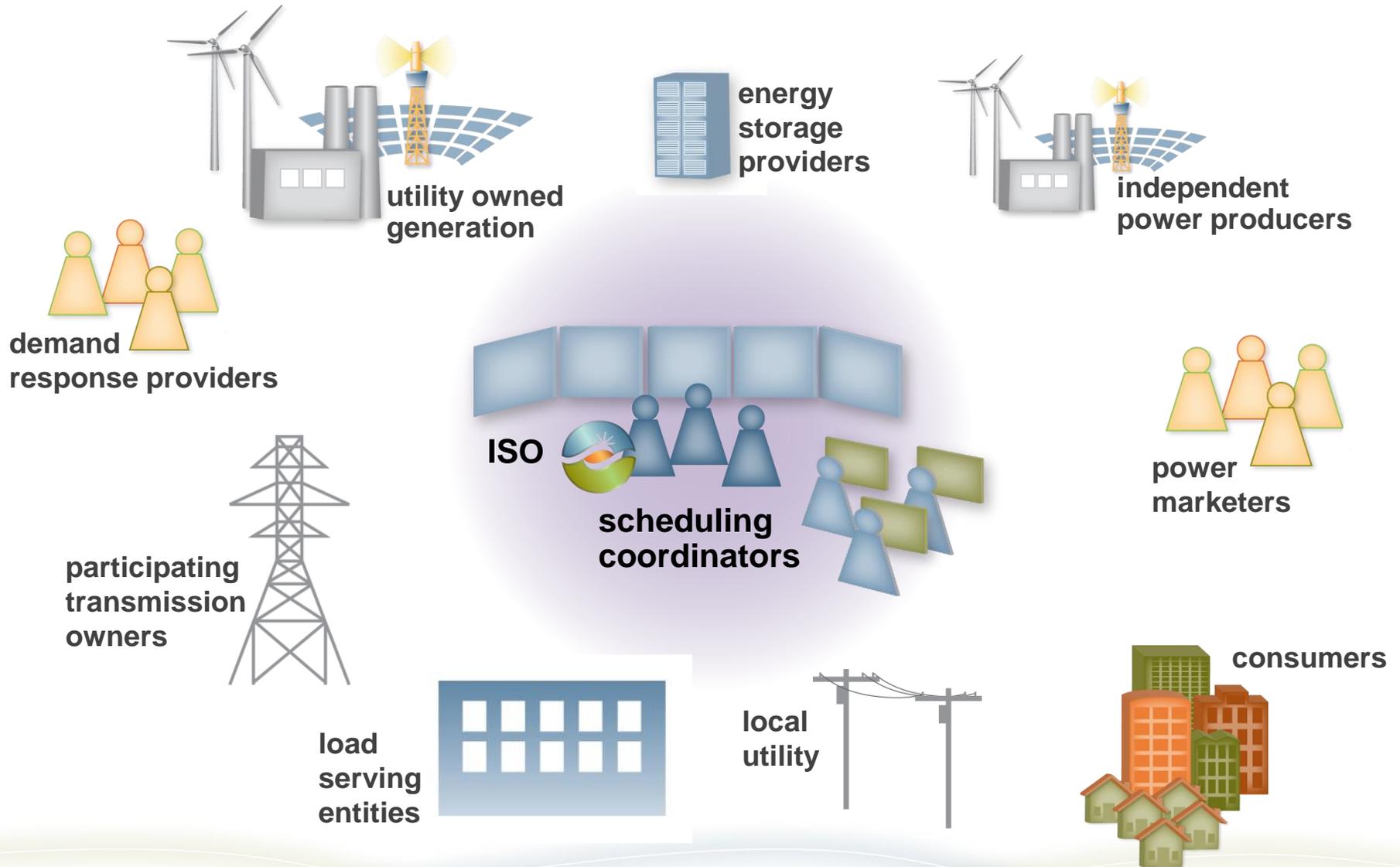
How?

- Facilitating fair and transparent wholesale **electricity market**
- Performing comprehensive **transmission planning**
- Clearing the way for **clean, green resources** to access the grid

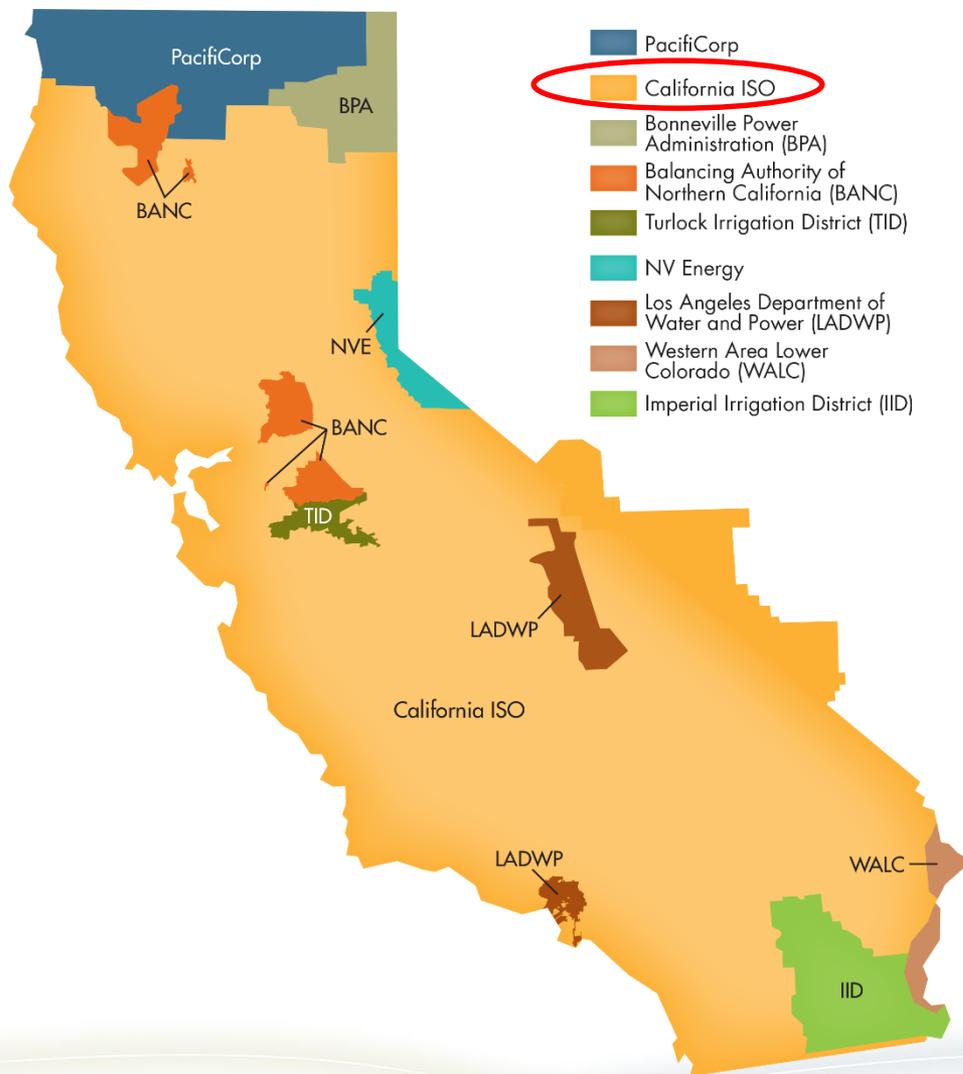


**FERC approves the ISO tariff**

# ISO Market Participants



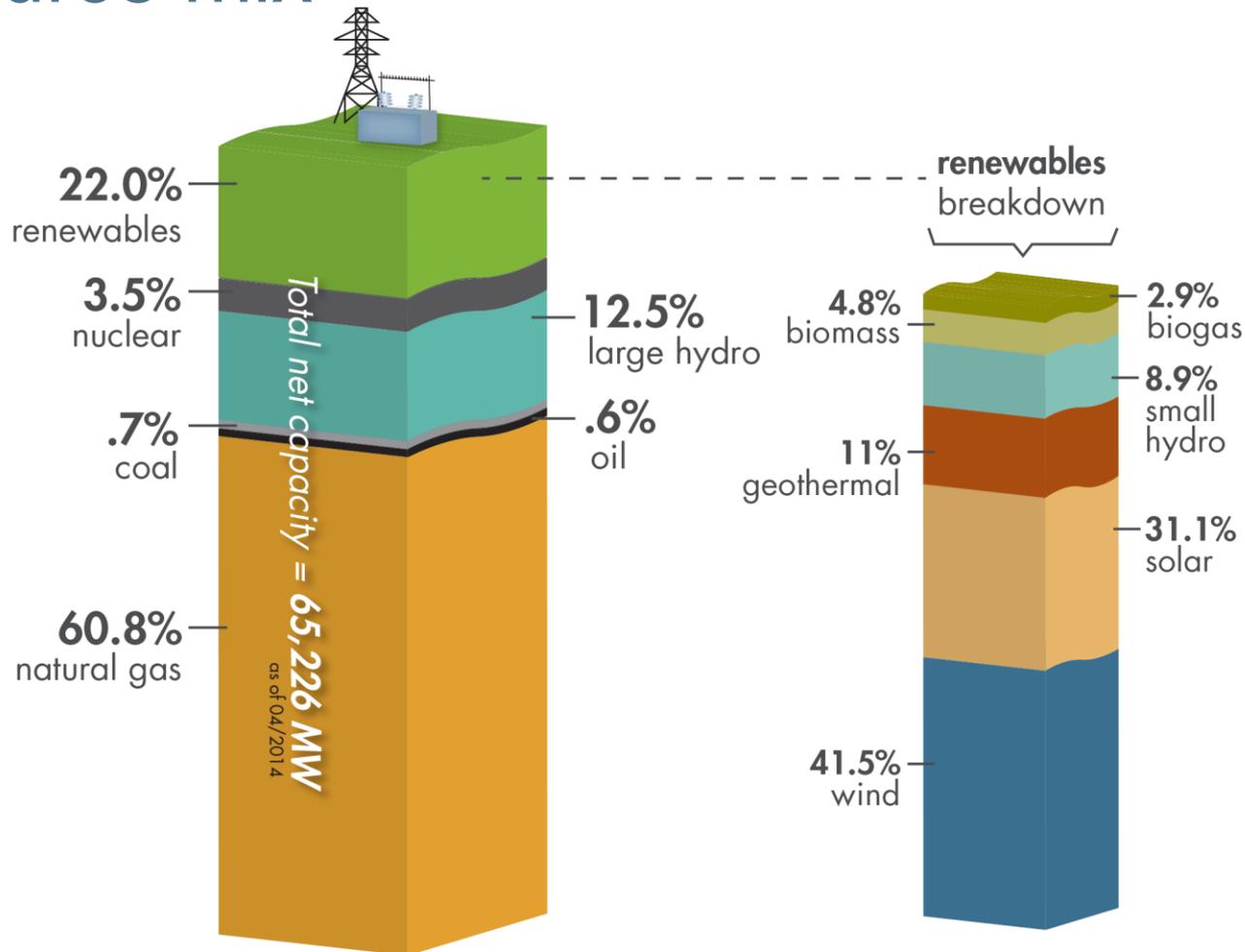
# California ISO by the numbers



The California ISO manages the flow of electricity for about 80 percent of California and a small portion of Nevada, which encompasses all of the investor-owned utility territories and some municipal utility service areas.

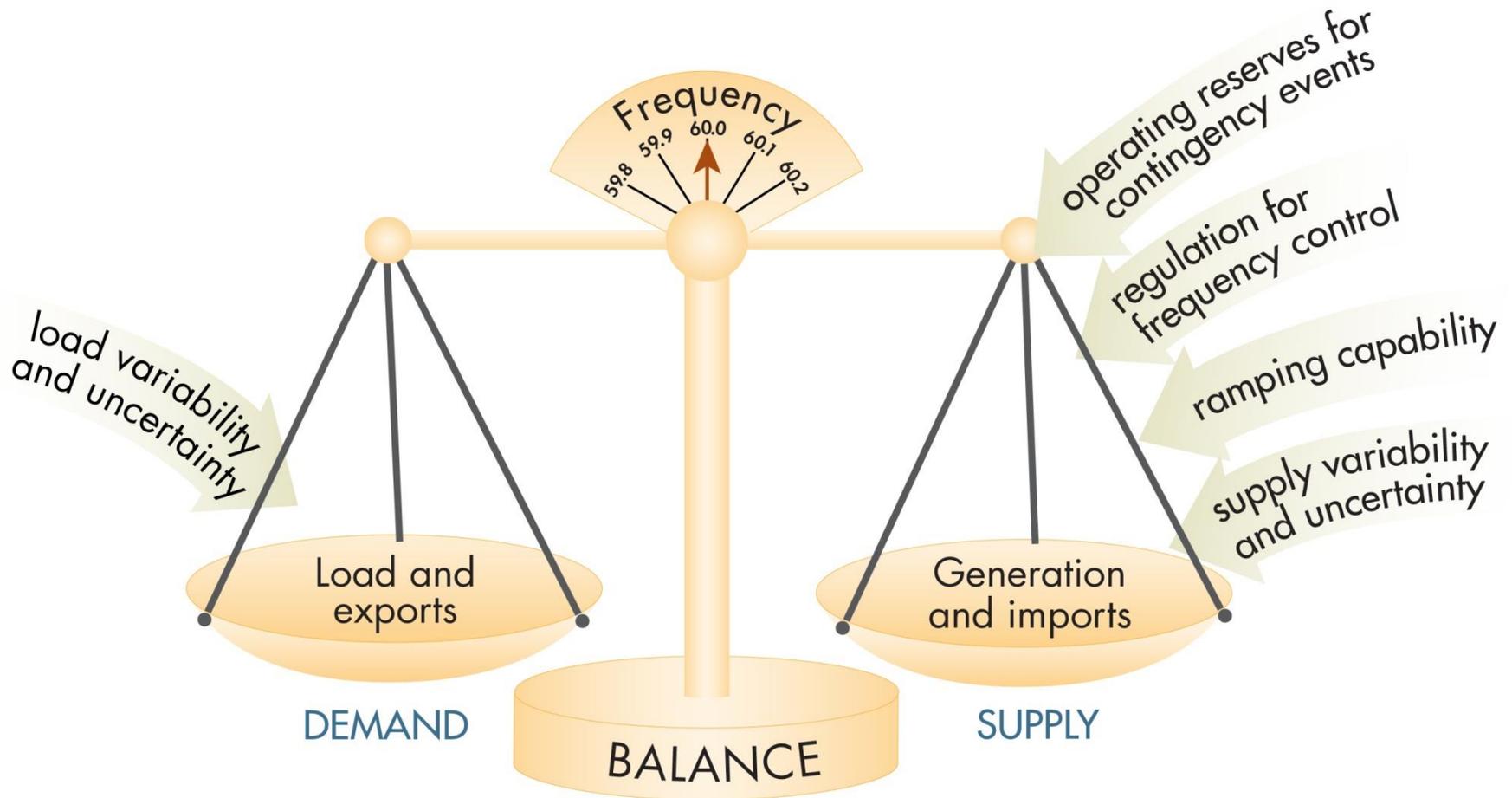
- **65,000** MW of power plant capacity (net dependable capacity)
- **50,270** MW record peak demand (July 24, 2006)
- **27,000** market transactions per day
- **26,000** circuit-miles of transmission lines
- **30 million** people served

# Resource mix



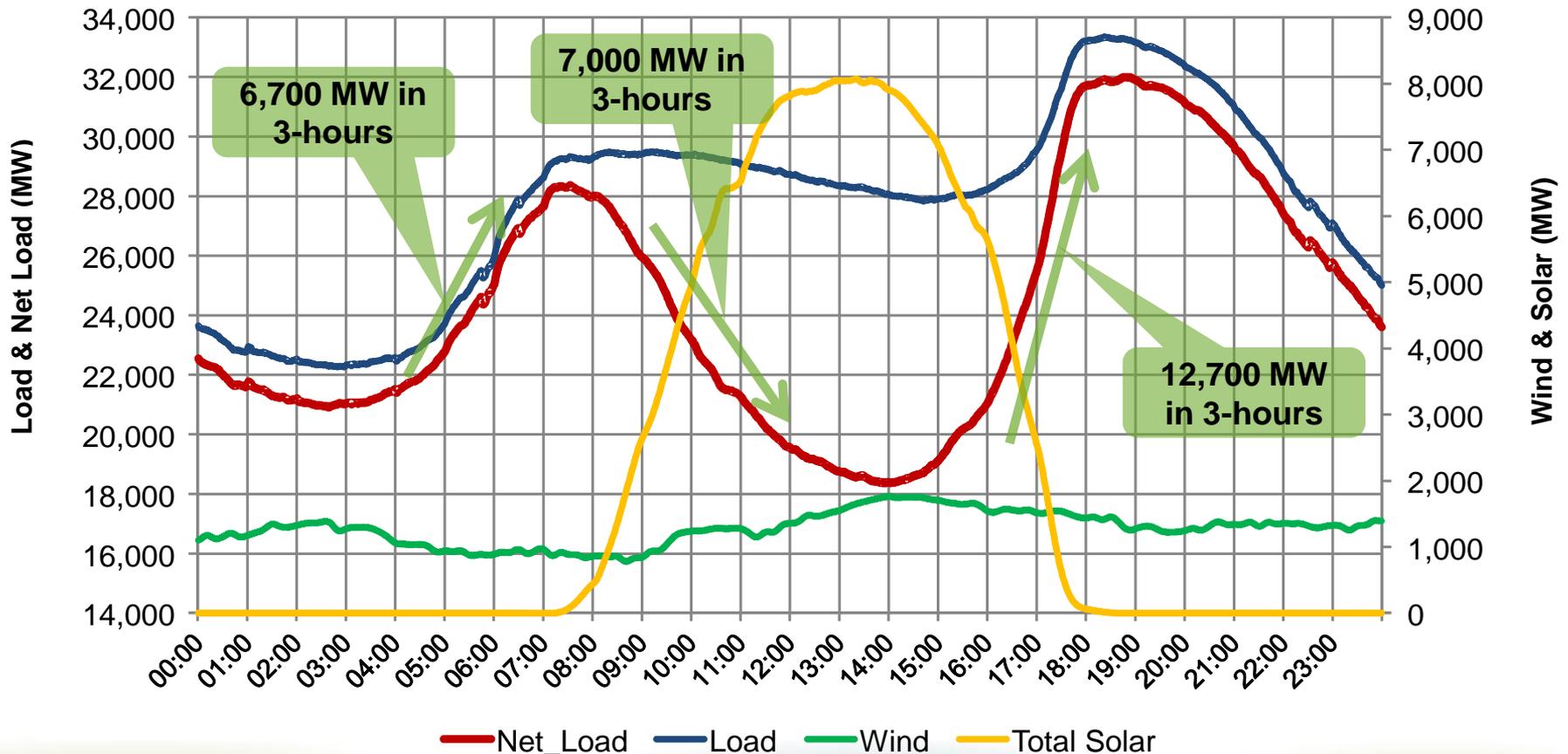
**17,486 MW = Maximum import capacity for the ISO**

Electricity is produced, delivered, and consumed at the speed of light while balance must be maintained



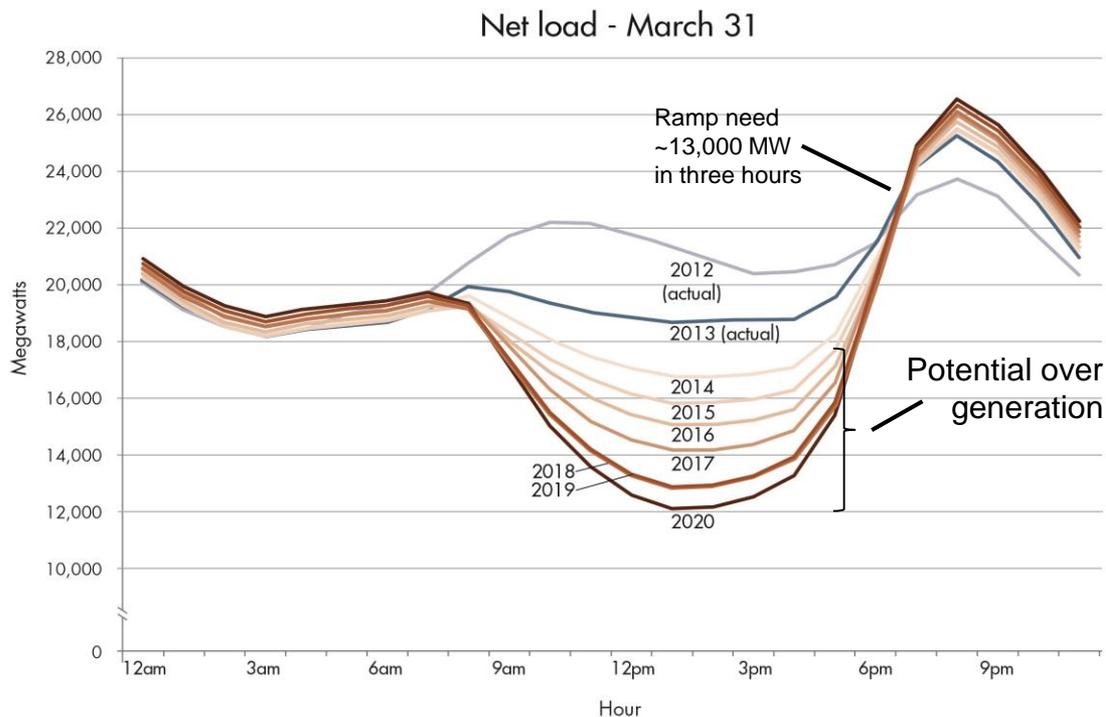
# Flexible resources needed to balance the net load demand curve

Load, Wind & Solar Profiles — Base Scenario  
January 2020



Net Load = Load - Wind - Solar

# Non-Flexible resources create overgeneration conditions and potential for RPS curtailment



Reliability depends on having resources with flexible capabilities to follow the net load curve

Non-summer months — net load pattern changes significantly starting 2014

Overgen may lead to curtailment because of dispatch limitations on some resources, such as

- geothermal
- nuclear
- small hydro
- combined heat and power

Operational requirements include

- minimum gas necessary to provide ramping
- necessary ancillary services
- load following

All Time Wind/Solar Peaks		
	MW	Time
Wind	4,769	04/12/14 17:48
Solar	6,038	04/28/15 13:36

# Looking forward opportunities and solutions

Deepening regional coordination – EIM

Enabling distributed energy resources

Increase storage and demand response

Enable economic dispatch of renewables

Target energy efficiency

Retrofit existing power plants

Decarbonize transportation fuels – cars & trucks

Align time-of-use-rates with system conditions



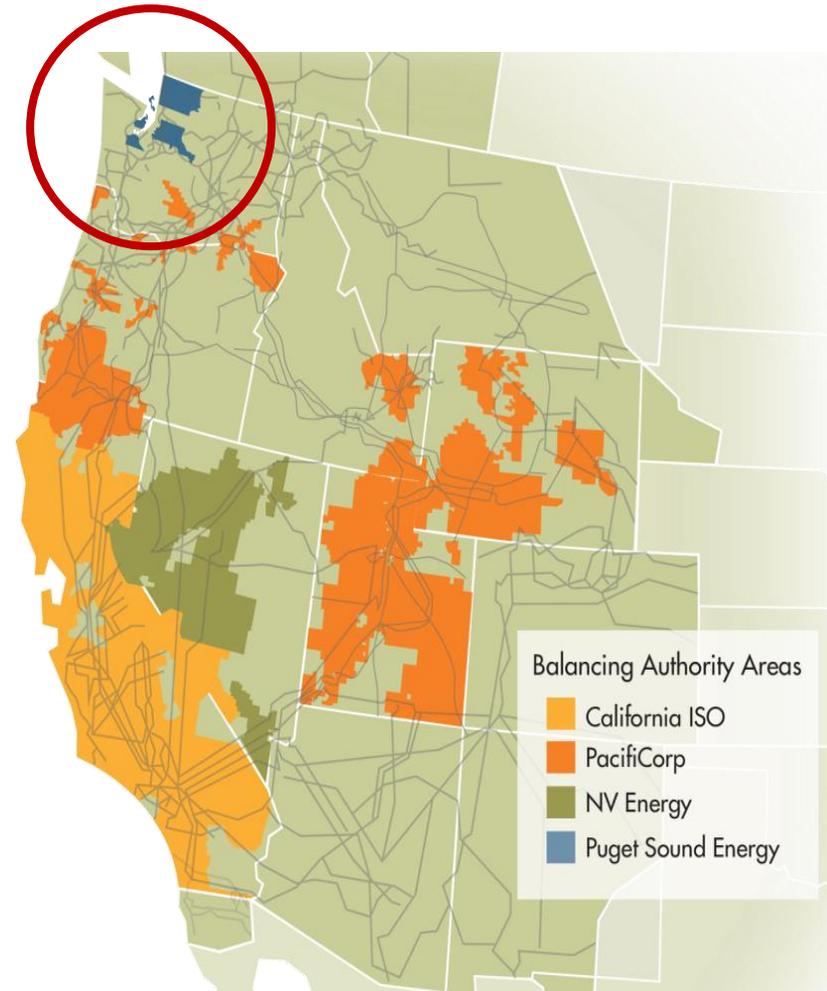
# Energy imbalance market balancing authority areas

Facilitates integration of renewables and enhances reliability by sharing diverse resources across a larger geographical area

Neighboring BAs have partnered with the ISO to develop a real-time energy imbalance market

- **PacifiCorp was activated on October 1, 2014**
- **NV Energy activation scheduled for October 2015**
- **Puget Sound Energy scheduled for October 2016**

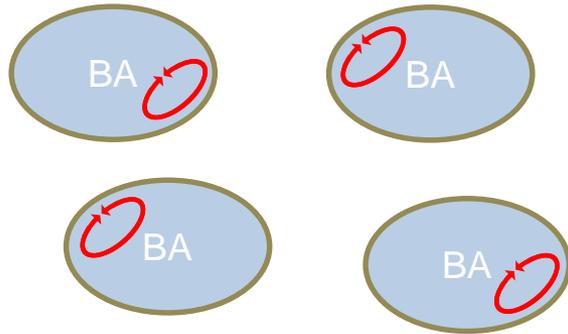
**PacifiCorp's is exploring full participation as an ISO PTO, which provides additional benefits of improved overall efficiency**



# Today versus energy imbalance market

Today:

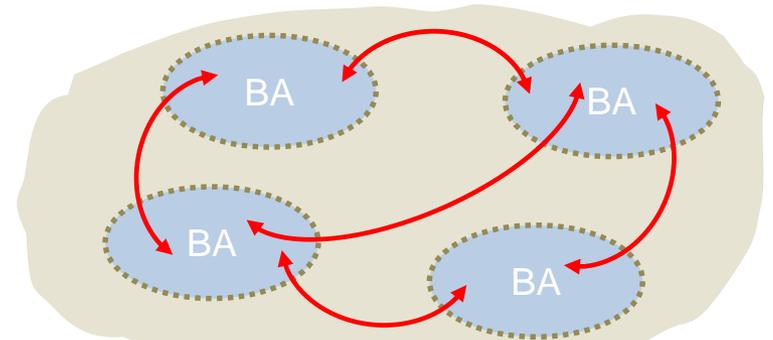
Each BA must balance loads and resources within its borders



- limited pool of balancing resources
- inflexibility
- high levels of reserves
- economic inefficiencies
- increased costs to integrate wind/solar

In an EIM:

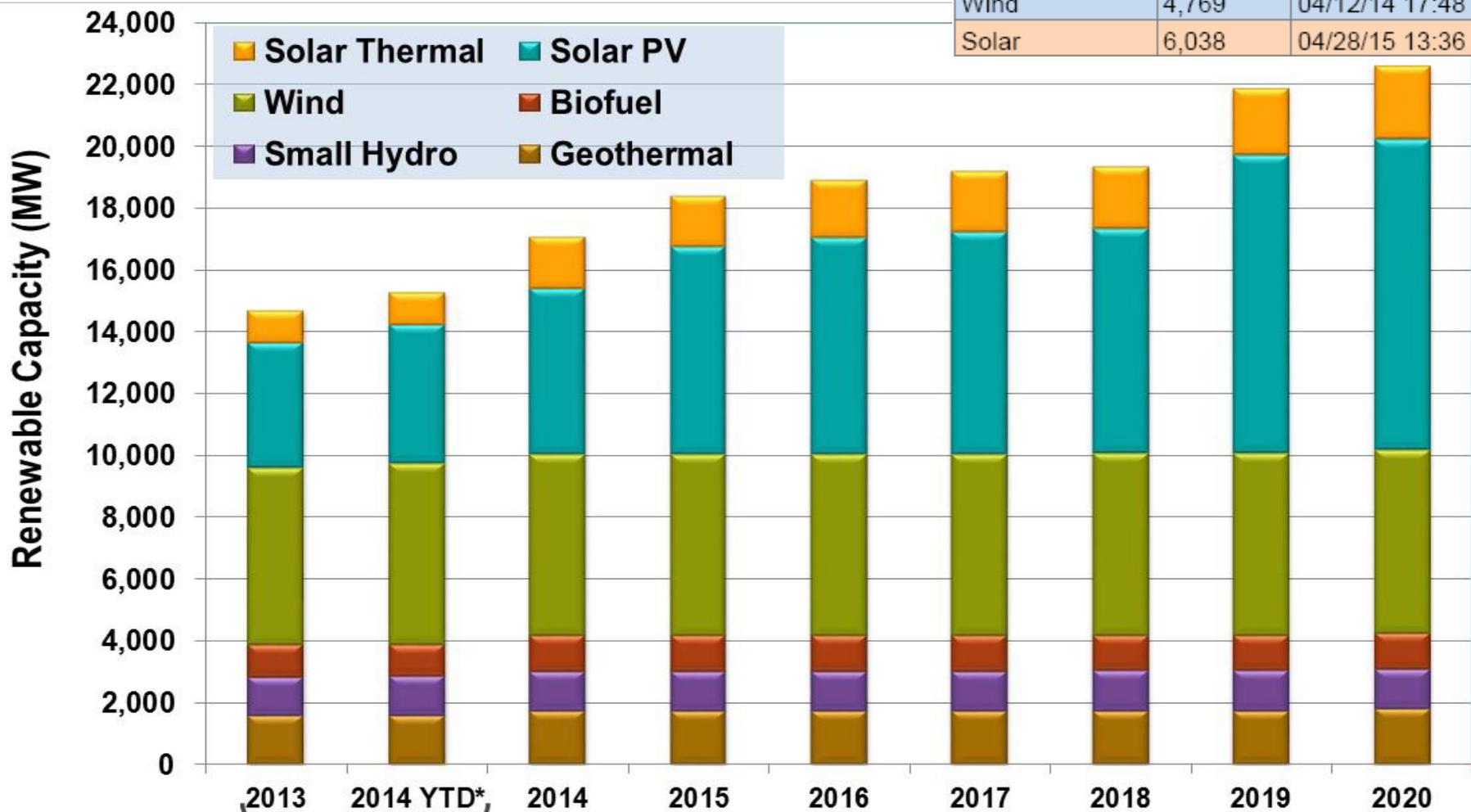
The market dispatches resources across BAs to balance energy



- diversity of balancing resources
- increased flexibility – capacity, ramping
- decreased flexible reserves
- more economically efficient
- decreased integration cost – wind/solar
- brings down costs by allowing access to a wider pool of resources
- leverages existing ISO real-time market

# Solar generation doubles between now and 2020

All Time Wind/Solar Peaks		
	MW	Time
Wind	4,769	04/12/14 17:48
Solar	6,038	04/28/15 13:36



(Existing generation)

\*All online resources are included in the 2014 YTD amounts, including those yet to achieve full commercial operation.

# California energy and environmental policies drive renewable integration and transmission needs

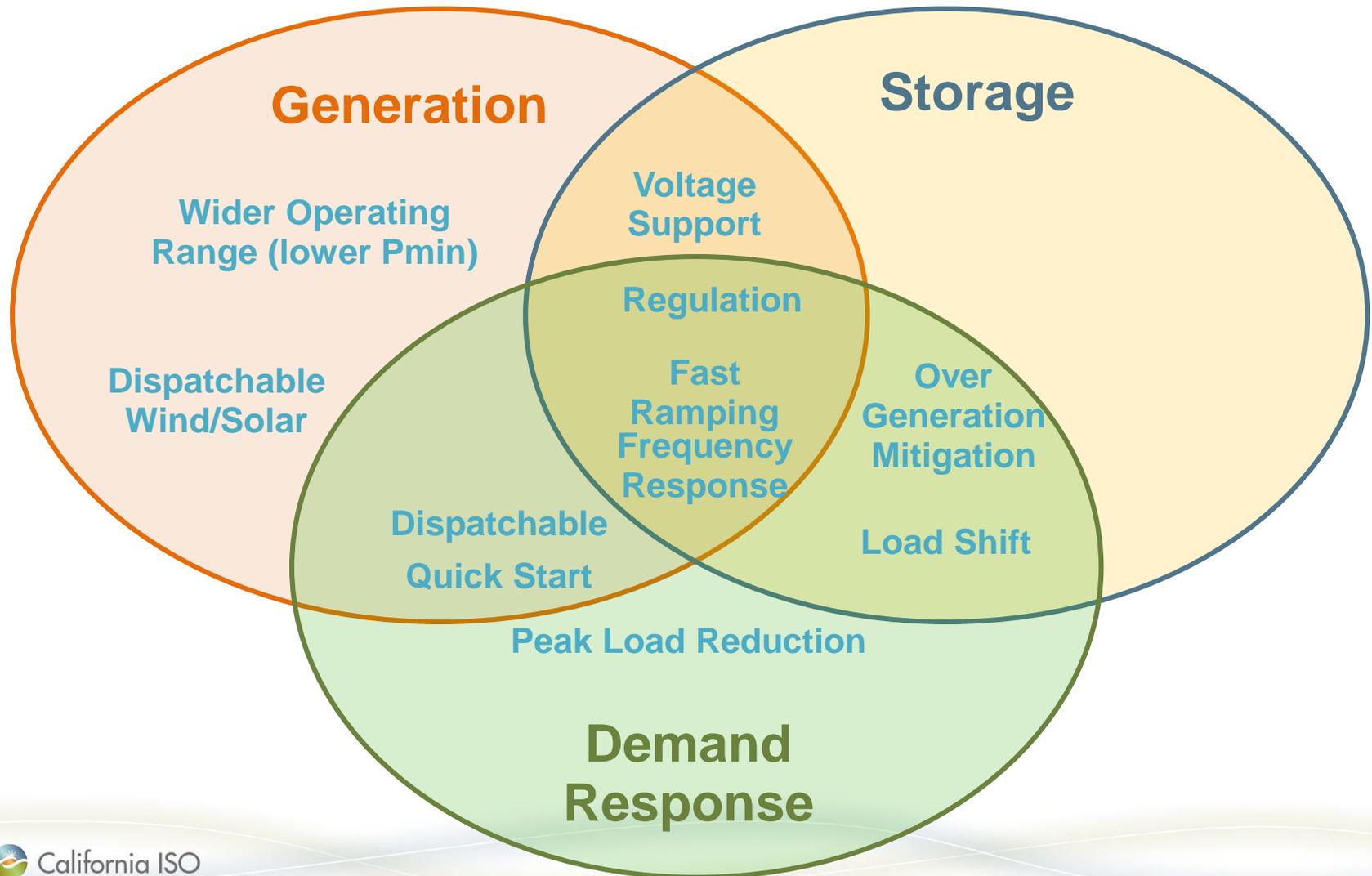
- Greenhouse gas reductions to 1990 levels by 2020
- 33% of load served by renewable generation by 2020
- 12,000 MW of distributed generation by 2020
- Ban on use of once-through cooling in coastal power plants

## Governor Brown's 2030 goals:

- 50% renewables
- 50% reduction petroleum use — cars & trucks
- double the energy efficiency of existing buildings
- make heating fuels cleaner

**Need to strike a balance between system reliability, renewables and reasonable cost**

# All of these including improved regional coordination for meeting operational challenges beyond 2020



# State of the art energy control room



Get a real time view of supply and demand, renewable energy production, emergency notifications and requests for energy conservation  
<http://www.caiso.com/Pages/TodaysOutlook.aspx>



This information is also available on our *free* smart phone app, *ISO Today*

<http://www.caiso.com/Pages/ISOToday.aspx>