

Low Carbon Grid and Regionalization

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October 5, 2017

Agenda

- What is a low carbon grid, and why do we need it?
- What does a low carbon grid require?
- What does regionalization mean?
 - A little history
 - Independent System Operators
 - CAISO, and why its different
- Why do ISOs produce lower costs?
- What are the other benefits?

A few acronyms:

- ISO = Independent System Operator
- CAISO = California ISO
- FERC = Federal Energy Regulatory Commission

What is a Low Carbon Grid?

An electrical network that runs on renewable energy using automation to operate optimally and at lowest cost

- The West has most of the ingredients
 - Ample ***solar, wind, geothermal and distributed resources***
 - ***Legacy large scale hydro***
 - Large, high voltage ***transmission system***
- Recent technology developments now make that dream ***affordable***
 - Solar and wind keep getting cheaper
 - Distributed storage prices (batteries) have fallen even more
 - Independent system operators can integrate lots of renewables at less cost

Why a Low Carbon Grid?

Environmental Benefits:

- Climate change is upon us (see the new documentary, [Chasing Coral](#))
- It also reduces *criteria pollutants* because we stop burning things

Cost Containment:




- It is *feasible at reasonable cost*

Job Creation:

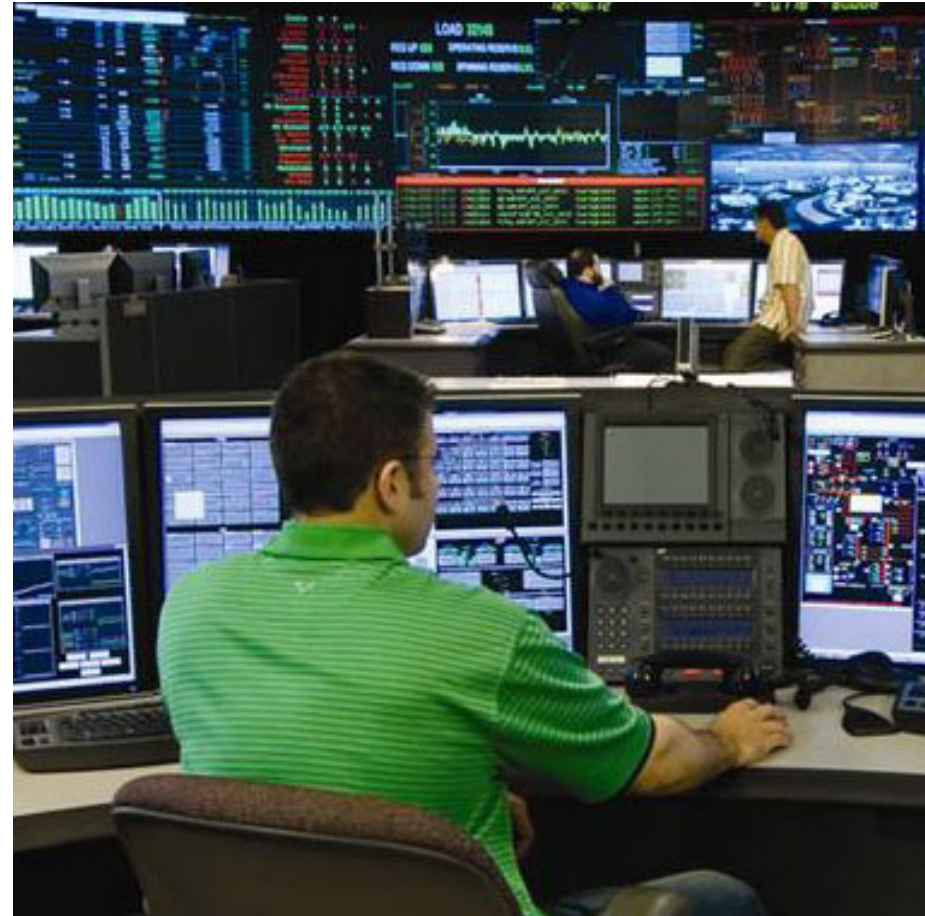
- California *leads the world* in the two main ingredients: digital technology and clean energy technology
- The transformation will drive jobs across the sector

IT IS A MORAL ISSUE

Key Components to a Low Carbon Grid

- Accurate and timely ***tracking of carbon emissions***, enabling carbon regulation
- ***Diversity*** of geography, technology, weather and time zone. 
- ***Centralized grid operator*** to optimize such a diverse portfolio 
- Transparency around the ***impacts*** of generators on ***communities*** 

What Is Regionalization?



What is “Regionalization”

The addition of non-member utilities to the CAISO, to give it more diversity, and thereby lower the cost of managing large amounts of renewables.

A Little History

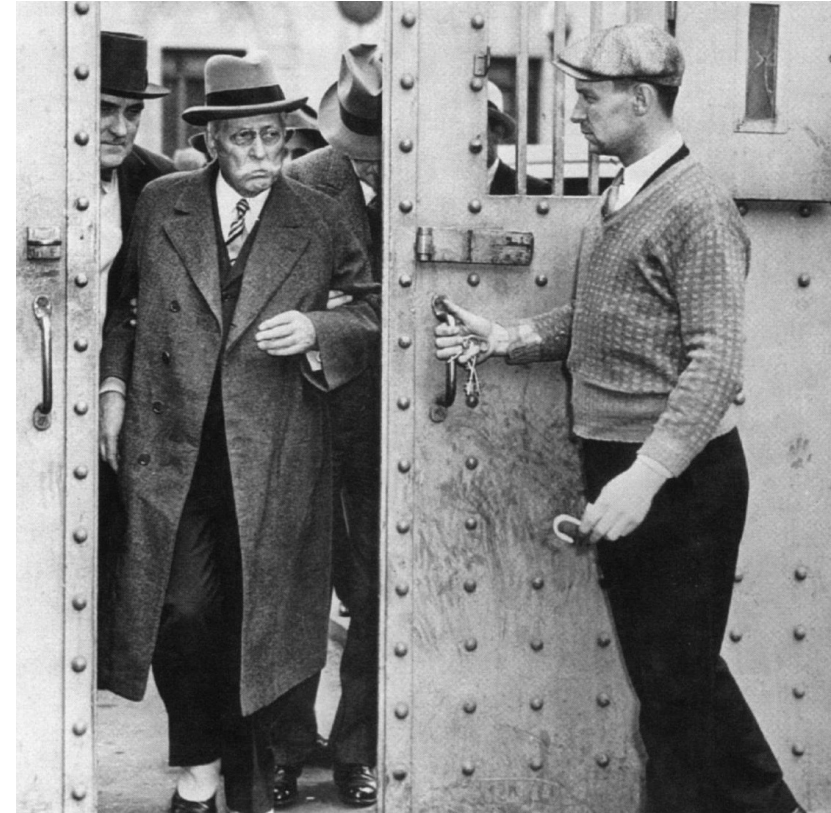
1800s Initially, each town got a power plant and wires to distribute

1900s Cities eventually regulated prices, safety, and rights of way


1911 State regulation unlocked economies of scale

1935 Federal regulation filled jurisdictional gaps

1942 – Feds require utilities to interconnect to fuel the war effort



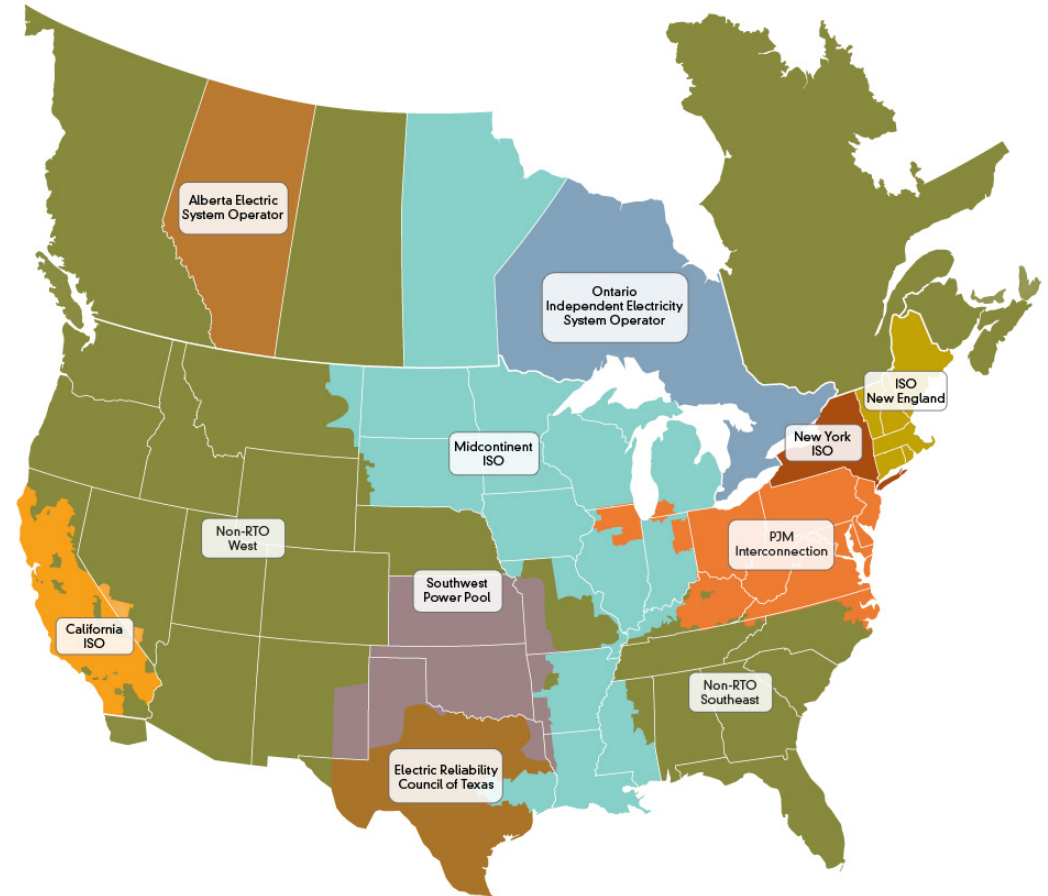
Federal Regulation of Utilities

- Federal Power Act (1920, amended 1935)
- Established “bright line” of federal jurisdiction:
 - Transmission
 - Wholesale markets
- Created the Federal Power Commission (now FERC) 
- States retained jurisdiction over retail markets, and therefore retained the bulk of the oversight responsibilities
- Operated under this system until the 1990s

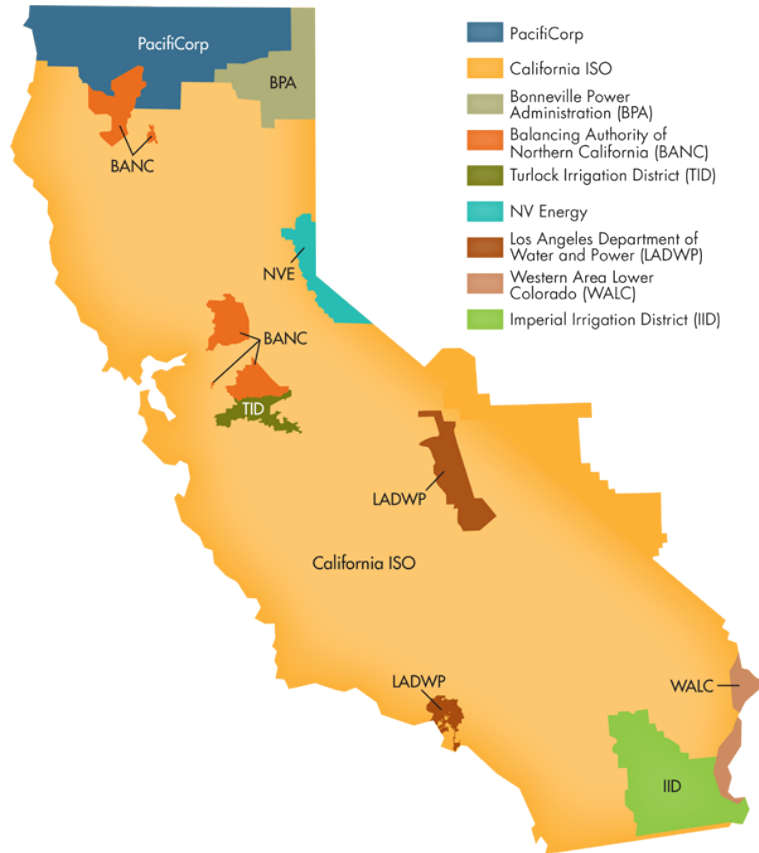
FERC Creates Independent System Operator



- Goal: **reduce the market power** of the big utilities for the benefit of the consumers
- Non-profit corporation responsible for wholesale operations
 - Dispatch and Reliability
 - Planning
 - Operating markets



California Independent System Operator



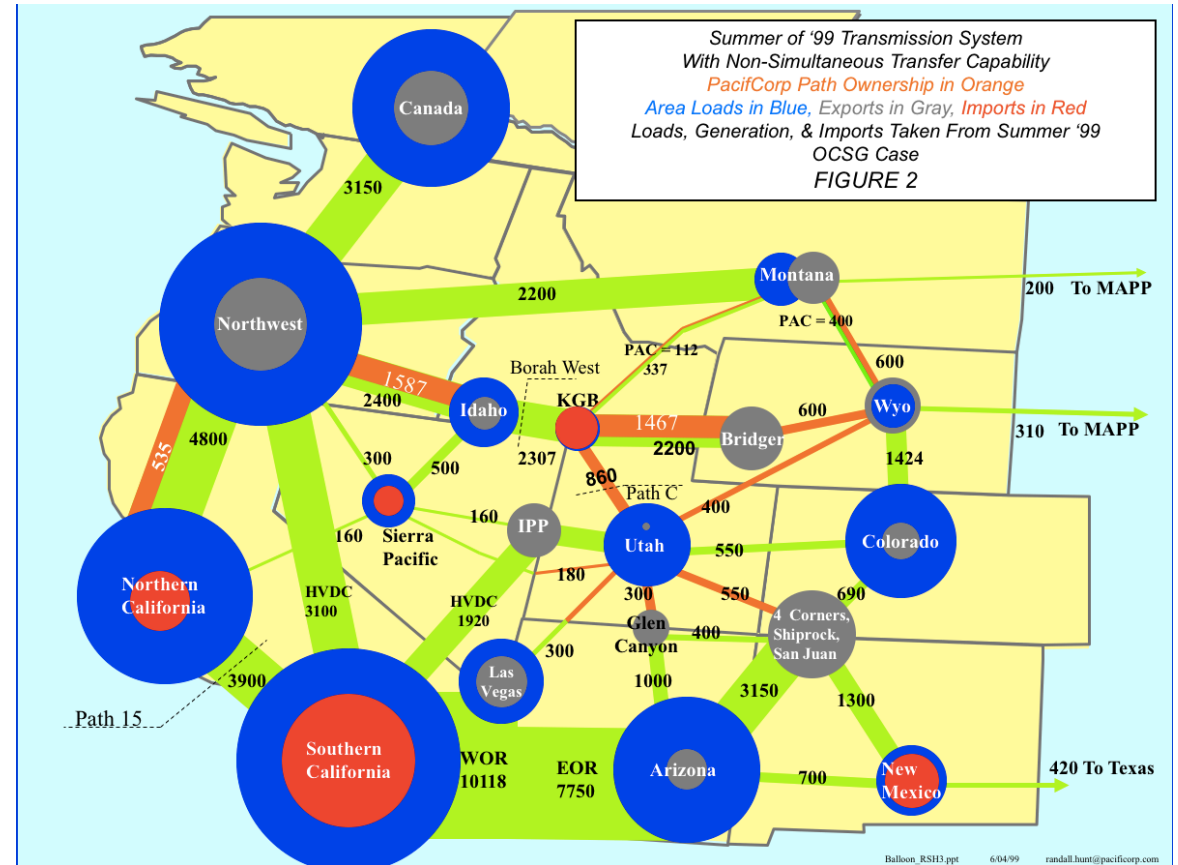
- 70% of California ratepayers
- Operates:
 - Physical transmission system
 - Markets for electricity and related services
- Does not include Los Angeles or Sacramento
- One small out-of-state member
- Independent board appointed by the Governor
- State-of-the art technology

The Western System Today



- Blue circles indicate size of demand
- Red circles import
- Grey circles export
- Synchronously connected but market disconnected

California ISO operates within the legacy system



Renewables and ISOs



- ISOs intended to address market power and improve efficiency
- As wind became significant, big differences emerged between ISOs and stand-alone utilities:
 - ISO's have much lower costs of "integrating" renewables
 - ISO fast markets provide solutions to variability



ISO Analogy: Lyft



ISO






- Share power plants and transmission
- Savings:
 - Don't need to build as many plants and lines
 - Fast dispatch and markets allows adjustments for variation
 - Lower prices due to competition


Lyft

- Share somebody else's car
- Savings:
 - Don't need to buy a car
 - Fewer cars
 - More timely dispatch
 - Competition drives down prices

Challenges to Low Carbon Grid

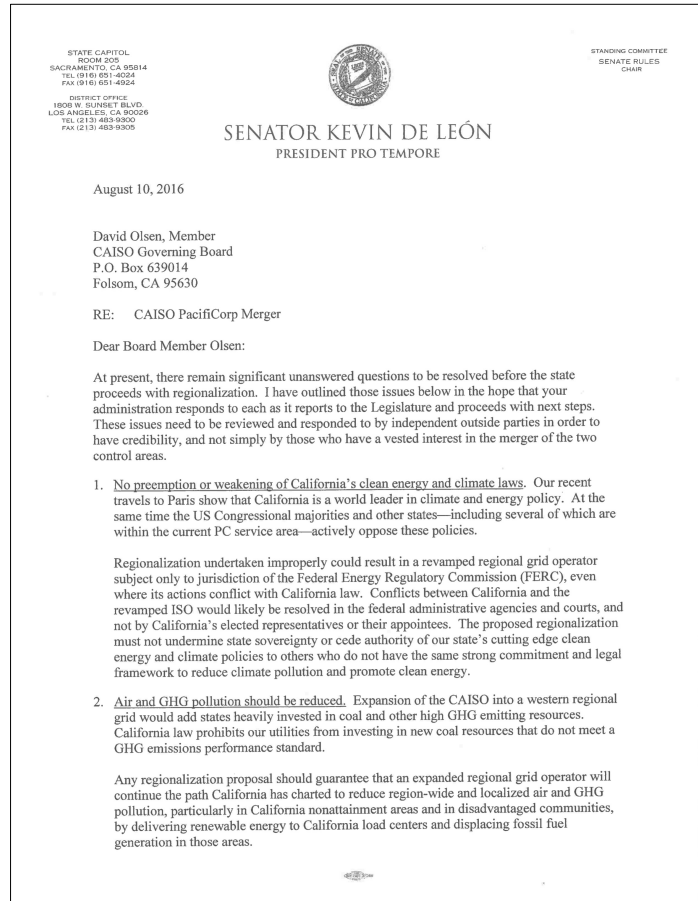
- Complexity
- Concern for state environmental regulation 
- Distraction of PacifiCorp's earlier foray 
- Other political priorities 

Seizing the Opportunity

- **California** can benefit by taking in new out-of-state members
 - Improve diversity (weather, geography, transmission): the more options available to run the system, the cheaper the cost
 - Spread fixed costs over more consumers
- **Other states** benefit, too
 - Cheaper to join an existing ISO than starting from scratch 
 - Access to modern, automated markets to lower costs
- **Entire west** gets a higher ceiling on amount of renewables that can be integrated, and therefore can increase and accelerate fossil fuel retirements

Appendix

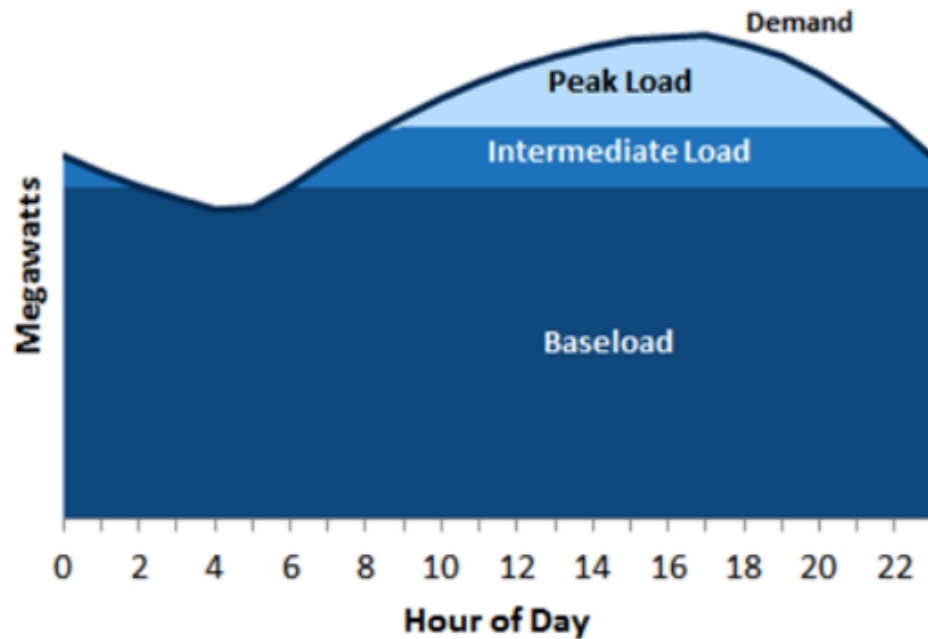
KdL's 2016 Letter



- No weakening of environmental laws
- Pollution reduced
- RPS protected
- Lower consumer costs
- Transparency and access
- Support transportation electrification
- Promote growth and jobs

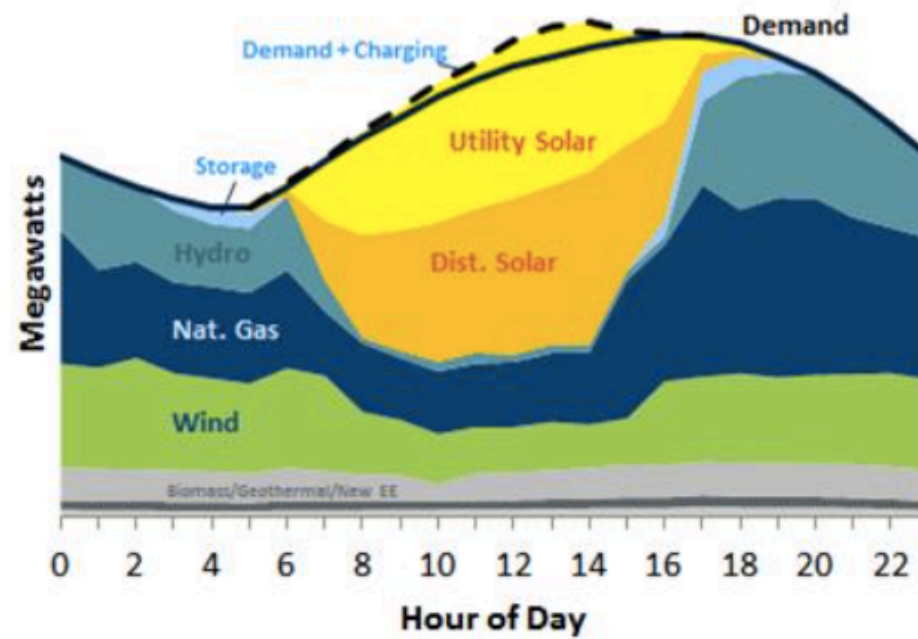
The Nature of Power Supply Has Changed

Electricity Demand and Supply Mix in Traditional Planning



Source: The Brattle Group.

Electricity Demand and Supply Mix with High Renewable Generation



Source: The Brattle Group.