

## MANAGING AN EVOLVING GRID

### Transitioning to a low carbon future

*California leads the nation in the transition to clean, environmentally sustainable electricity generation, and is already on track to meet its goal of 33 percent of its energy coming from renewable sources by 2020. Now, the state has set its sights even higher, by establishing that 50 percent of its electrical needs be met by renewable energy by 2030, which is one of the most ambitious clean energy goals in the U.S.*

Getting half of California's electricity from renewable sources isn't just a groundbreaking vision; it's required to support reducing carbon emissions that leads to climate change. As more renewable energy comes on line, grid operators are at the forefront of making sure the rising amount of clean energy is incorporated into the power mix, while providing reliable electricity to customers.

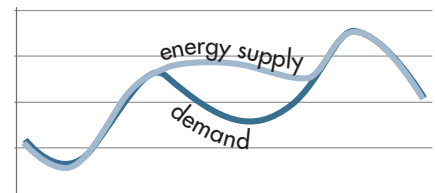
The California Independent System Operator (ISO) is leading the nation, if not the world, in integrating clean electricity into its power grid, bringing together industry leaders to explore new methods and technology, and leveraging a sophisticated energy marketplace to support innovative grid management solutions.

### When supply outpaces demand

Electricity at this time has to be used the instant it is produced. This means ISO grid operators work every minute, every day to balance electricity demand and supply flowing on high-voltage transmission lines.

Energy production can outpace demand during certain times of the day, throwing supply and demand off balance. This condition is called "over-supply" and it is a central challenge to optimizing renewable energy into the green grid of the future.

The ISO supports incorporating higher levels of renewable energy through several in-house stakeholder initiatives, active participation in relevant state energy agency proceedings, enhancing coordination capabilities with neighboring and regional grid operators, and encouraging the development of innovative technologies.

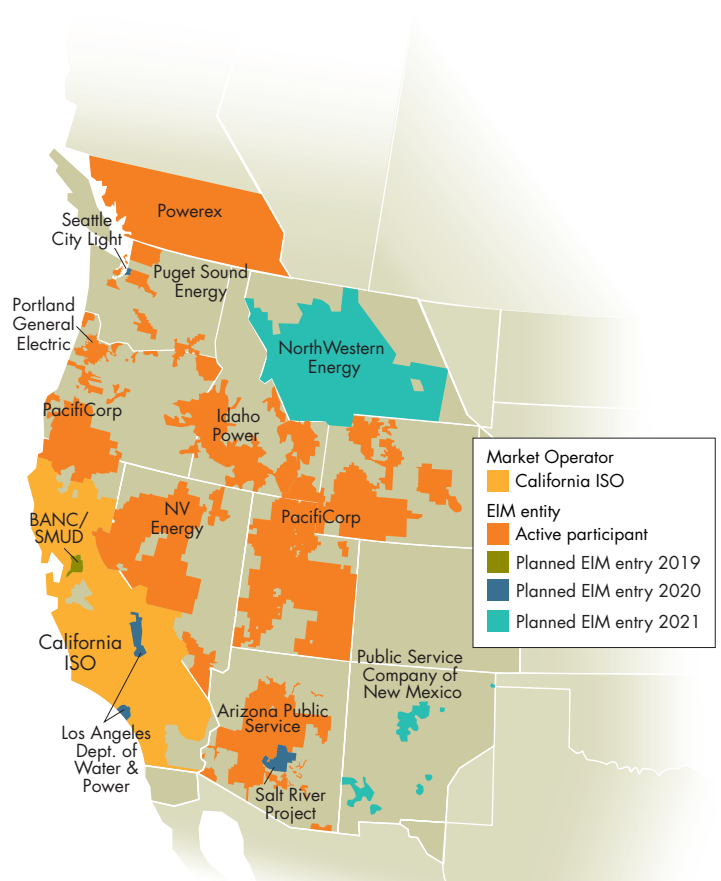


### Renewables and reliability

The ISO adopted grid operational improvements on May 1, 2014 that shortened the timeframe between creating a renewable generation forecast and the actual output. This gives a more accurate picture of the renewable energy expected, so other resources can be dispatched to meet demand.

The ISO and PacifiCorp launched the western Energy Imbalance Market on November 1, 2014 to balance energy supply with demand in real time and across six western states.

This new real time market allows grid operators to find and move energy across a larger geographic area – and different time zones – allowing for more flexibility in scheduling and dispatching. The market enables solar energy produced at noon in California to serve afternoon demand in Utah. Likewise, evening winds in Wyoming can produce power to help meet peak demand in California in late afternoons. Analysis shows the market is producing significant benefits as originally intended. The EIM operates solely in real time, and will soon get new participants. NV Energy in Nevada began participating in the market in December 2015 while Washington-based Puget Sound Energy and Arizona Public Service Co. began operation in 2016. Portland General Electric began operation in fall 2017 with Idaho Power and Powerex entering in 2018. Balancing Area of Northern California/Sacramento Municipal Utilities District will start on April 1, 2019. Phoenix-based Salt River Project, Seattle City Light and Los Angeles Department of Water and Power join in 2020, followed by Public Service Company of New Mexico and NorthWestern Energy in 2021. The EIM currently serves consumers in eight western states and about 55 percent of the imbalance load in the West.



Expanding the ISO balancing area would create opportunities to schedule use of lower cost renewable and excess energy to meet fluctuations in demand across a larger region. The ISO completed a series of studies on the impact of such expansion as mandated by California Senate Bill 350 in 2016, which were submitted to the governor. The regional approach has been supported by federal and state energy officials, and environmental leaders throughout the West.

## Maximizing use of renewables

In addition to a regional market approach, the ISO and state energy agencies are exploring other solutions to using renewable power to its fullest potential. Those solutions include the following:

- increasing energy storage, energy efficiency and demand response systems so that energy users can reduce use when the grid is low on supply;
- offering time-of-use rates that better match energy production times and are an incentive to reduce energy use;
- integrating electric vehicles and encouraging owners to charge when supply is high; and
- improving flexibility of power plants.

Excess supply presents opportunities to develop improvements to the marketplace. The ISO, with a proven track record of integrating renewable resources, is now at the forefront of solving contemporary issues of a cleaner power supply.

For more information on this topic and the ISO, please visit [www.caiso.com](http://www.caiso.com) > Going green.

California Independent System Operator