

BUILDING A SUSTAINABLE ENERGY FUTURE

2014-2016 STRATEGIC PLAN



MESSAGE

FROM THE GOVERNING BOARD

New technologies promise to improve the ways we use and produce electricity, and how we manage our resources to reduce greenhouse gas emissions. Larger amounts of variable energy resources and increasingly decentralized generation require changes to how we manage the grid. We see these developments as opportunities that can help lead California and the West to a reliable and sustainable energy future.

The ISO's core function remains constant: to efficiently manage a highly-reliable electric grid in a non-discriminatory way, using markets to provide consumers with the best value from our transmission and generation resources. As we join this core function with environmental policy goals, we see an important role for the ISO in three key areas:

- 1) evolving market structures to encourage the participation of new clean energy resources, including demand response and storage
- 2) ensuring that the resource fleet has the capability and flexibility to reliably meet electricity needs of our homes and businesses
- 3) taking a leadership role both within the state and throughout the West to ensure we use our collective infrastructure investments to their fullest potential on behalf of our ratepayers, the public and the future

THOSE OF US ENTRUSTED WITH PROVIDING ELECTRIC SERVICE SHARE THE SAME CHALLENGES, FROM **KEEPING OUR CRITICAL INFRASTRUCTURE SECURE** TO CREATING OPPORTUNITIES TO

California imports 25% of its electricity and our grid is interconnected with all or portions of 13 other states in the West. Regional markets and broader sharing of infrastructure can better manage the costs and diversify the impacts of moving to greater reliance on clean energy resources. The West now has a tremendous opportunity to collaborate for the betterment of us all. We believe the ISO can facilitate this collaboration by hosting a new market for optimizing the use of generation resources in real-time, working closely with neighboring balancing authorities to find opportunities to share resources and leading efforts to integrate growing renewables on the system. We stand ready to work with other jurisdictions to refine market rules and adapt ISO governance to facilitate widespread participation in the energy imbalance market.

LEVERAGE NEW TECHNOLOGIES, LIKE SMART DEVICES IN OUR HOMES AND ELECTRIC VEHICLES ON OUR ROADS. WE DO THIS WHILE **BEING CAREFUL STEWARDS OF OUR RESOURCES** AS WE LOOK TO MODERNIZE OUR TRANSMISSION GRID.

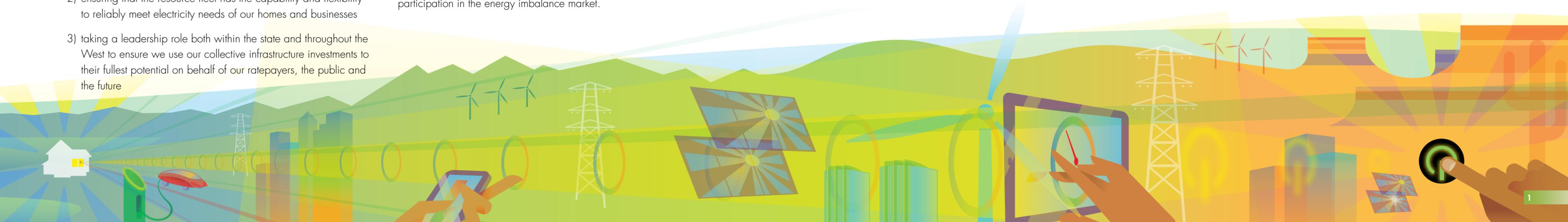
The goals identified in this plan outline a direction for evolving electric service to be more secure and sustainable—to better contend with the impact of fires, droughts and less predictable weather patterns and manage increasingly risky long-term infrastructure investments. As micro grids, distributed generation, fuel cells and storage become increasingly viable and more widely deployed, the ways we supply electricity may

be quite different in a few years. This strategic plan positions the ISO to meet future challenges while leveraging innovation and leadership.

We are honored to be part of an organization determined to make a real difference in ensuring a bright, sustainable future for California and the West.



Bob Foster, Chair Angelina Galiteva Ash Bhagwat Richard Maullin David Olsen



WINDS OF CHANGE

MOVING FROM A CENTRALIZED GRID TO A DECENTRALIZED NETWORK

Our electric grid is experiencing a historic transformation brought on by far-reaching environmental policies, regulatory changes, economics, consumer demands and the availability of advanced technologies.

Concerns about the environment — from air and water quality to greenhouse gas emissions and changing weather patterns — have led to changes in how business is done, not just in California or the United States, but around much of the world. In the energy sector, electricity generation dependent on fossil-fueled plants is shifting to more variable renewable energy sources. Higher temperatures, increasing wildfires and the reduced snow pack are affecting how electricity is created, stored, transmitted and used.

The ISO is uniquely positioned to help transform our electric grid in an environmentally responsible way. California has led the country in innovative and ambitious environmental regulations, from the renewable portfolio standard to our new cap-and-trade market for greenhouse gas emissions. These regulations shape the type of resources we can count on for our electric supply as well as the operating characteristics that we need to meet demand.

Electricity consumers also have new roles to play. From a structure that did not allow much engagement in their personal energy management, consumers now have new tools and technologies that enable them to manage their own energy use and even produce electricity. In combination, distributed generation resources such as rooftop solar, fuel cells, electric vehicles and advances in energy storage have the potential to revolutionize the power grid.

These key drivers are fundamentally changing the grid from a centralized, “one-way” distribution system, to a “two-way” decentralized network.

OUR CHALLENGE

California policy goals and the climate change imperatives are driving generation portfolios toward cleaner and renewable resources. By 2015, we project that nearly 25 percent of California load will be served by renewable resources, compared to just 17 percent in 2010. In 2012 alone, over 670 megawatts of new solar generation were connected to the ISO grid, enough to power over 500,000 homes.

This is just the beginning; advancements in new technologies and products promise to change the way energy is generated, transmitted, stored and how consumers make decisions about their energy use. The role of consumers will also change as technologies evolve and provide a greater ability for consumers to shape our electric system with the devices they use and the decisions they make about their energy use. This presents an opportunity for the ISO to provide its perspective on how these changes will impact the system and formulate a plan that not only encourages this innovation, but enables its success by ensuring a reliable and sustainable grid.

Integrating the 33 percent or more renewable energy portfolio creates challenges and opportunities for California, including ensuring that the electric system has sufficient flexible capacity to address the added variability of increasing amounts of renewable resources. At the same time that electrical energy from conventional gas-fired resources is being displaced by intermittent renewable resources, California and the West will need even more of this flexible

WHAT THIS MEANS FOR CONSUMERS...

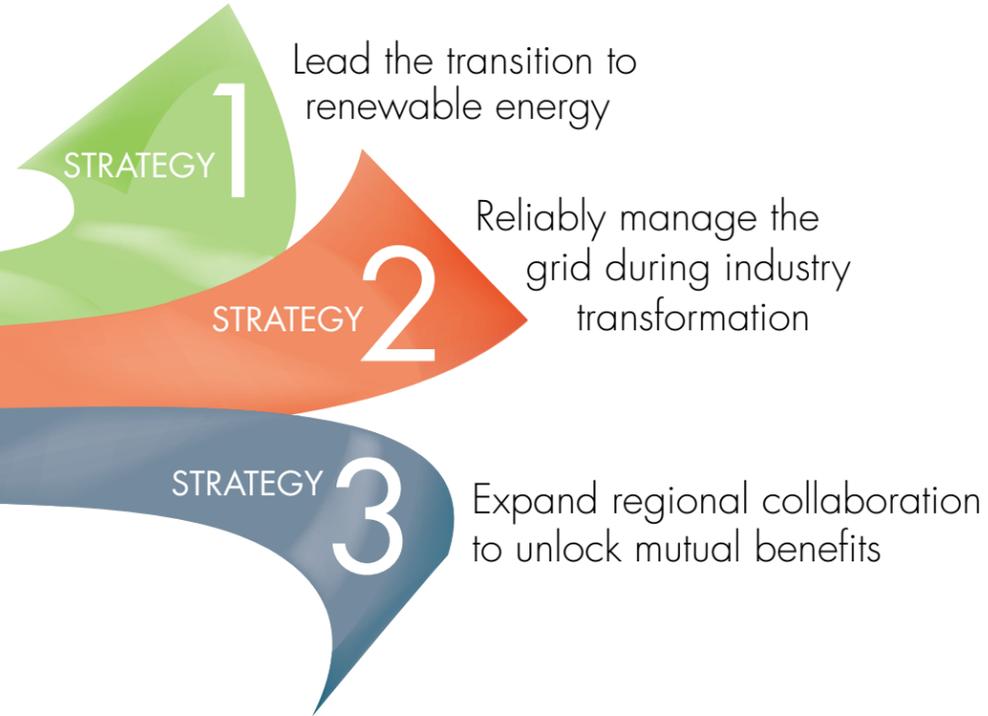
Everyone reading this strategic plan is a consumer that has a personal interest in how the electricity industry evolves — as a source of reliable and affordable service that also minimizes the environmental impact of power production.

capacity to maintain grid reliability. Thus, we must have the means to retain economically viable, efficient and flexible resources — including demand response, energy efficiency and generation — to pair with the output variability of renewable resources. The ISO has looked carefully at what our electricity demand will be in the coming years and created a “net load” profile that allows us to plan for the range and characteristics of flexibility we will need on the system to keep a stable supply of electricity

to match demand at the lowest possible cost to consumers. The challenge of operating the system with more output from wind and solar resources is compounded by the looming retirement or replacement of the generation provided today by nearly 12,000 MW of coastal gas-fired generation to protect marine resources and the permanent loss of approximately 2,200 MW of generation previously provided by the San Onofre Nuclear Generating Station.

OUR STRATEGY – LEADERSHIP, RELIABILITY, COLLABORATION

With continued focus on the organization’s operating principles, the ISO will respond to the changes before it with three broad strategic efforts over the next three years and beyond.



Ensuring reliability throughout this evolving modernization of the electric system requires a combination of policy, process and technology-driven solutions. We will work closely with federal, regional and state agencies to develop a long-term strategy that ensures reliable operation throughout all areas of the grid and encourages advancements towards a cleaner electric grid. Among this group of agencies, the ISO is uniquely positioned to provide independent analysis and perspective on system needs and costs associated with operating a more resilient and capable electric system. The ISO will also work with local agencies and market participants to educate consumers about new opportunities for their role in energy use and production.

San Onofre Nuclear Generating Station

On June 7, 2013, Southern California Edison announced the permanent shut-down of the San Onofre Nuclear Generating Station. This generation had served about 1.4 million consumers in Southern California. When the plant first went off line in early 2012, the ISO started analyzing how it would run the grid and address local reliability issues without this large resource. The ISO anticipated the possibility of a longer-term closure and has already taken steps to mitigate its impact, including the following:

- installing new equipment in Huntington Beach that will provide essential support for more electricity to flow into the region

- adding new support at three Southern California substations to bolster the transmission capability to homes and businesses in the area
- upgrading transmission facilities to make them more robust
- using Flex Alerts and available demand response programs to conserve energy during times of high demand

Over the next three years, the ISO will focus on taking steps to begin critical infrastructure additions to mitigate for this generation loss, as well as ensure that contingency solutions have been planned in case preferred alternatives do not materialize.

PURPOSE

LEAD THE WAY TO TOMORROW’S ENERGY NETWORK

OPERATING PRINCIPLES

FOR THE BENEFIT OF OUR CUSTOMERS, WE:

- ATTRACT, DEVELOP AND RETAIN A HIGHLY SKILLED WORKFORCE
- OPERATE THE GRID RELIABLY AND EFFICIENTLY
- PROVIDE FAIR AND OPEN TRANSMISSION ACCESS
- PROMOTE ENVIRONMENTAL STEWARDSHIP
- FACILITATE EFFECTIVE MARKETS AND PROMOTE INFRASTRUCTURE DEVELOPMENT
- PROVIDE TIMELY AND ACCURATE INFORMATION

STRATEGY 1: LEAD THE TRANSITION TO RENEWABLE ENERGY

Increasing the amount of renewable generation on the grid and advancing programs to incentivize demand response and energy efficiency will bring the state closer to its environmental policy goals. This transition to a greener grid also presents new challenges. As more distributed generation is installed, electric vehicles become more prevalent and consumers begin to use smart technologies to more efficiently manage their energy use, it becomes increasingly difficult for the ISO to forecast supply and demand to maintain overall grid reliability. Over the next three years the ISO will focus on the following initiatives lead the transition to a smarter, cleaner, more reliable and secure energy future:

- Create new market opportunities for new clean energy resources, energy efficiency and demand response, while working with the California Public Utilities Commission and California Energy Commission to coordinate procurement mechanisms so financial incentives for new technologies are aligned.
- Facilitate timely development of generator interconnection projects.
- Collaborate on an integrated agency road map that can drive innovation, investment and jobs in ways that also minimize environmental impacts.
- Encourage advanced technologies that provide instantaneous visibility and automated response to grid conditions.
- Advocate for increased price transparency to enable consumers to make smarter choices about their energy use.
- Invest in technology to advance the ISO's ability to forecast electricity supply and demand, and predict the impact of weather and changing usage patterns on them.
- Enable the wide deployment of new technologies by conducting pilot projects to explore the integration of flexible storage, demand response, distributed generation and electric vehicles.



The ISO's demand response initiative is one example of our efforts to expand opportunities for new technologies and products. Bringing these technologies into our market is critical to our goal of minimizing the impact of our energy infrastructure on the environment. To date, California has lagged behind other areas of the nation in developing these resources and it is clear we need to change the way we procure, define and deploy these resources. The changes will require close collaboration between the ISO and the California Public Utilities Commission.

WHAT THIS MEANS FOR CONSUMERS...

Increased price transparency and time of use rates, together with home energy management systems and appliances that automatically respond to electricity prices can enable consumers to take advantage of lower energy costs when demand is low and to supply electricity at other times. This interaction with the grid is known as demand response.



Vehicle-to-grid pilot projects

The Department of Defense plans to spend \$20 million on a fleet of electric vehicles with a unique capability to export their own power. The Los Angeles Air Force Base and the Naval Air Weapons Station located in China Lake, California, will be the first two federal facilities to implement this vehicle-to-grid program. By replacing over 100 gas and diesel-powered vehicles with electric vehicles, the fleet will not only be cleaner but will also send energy back into the grid when they are sitting idle.

As vehicles with this capability become more common, the ability for them to serve as a fast-acting grid-balancing resource, both in terms of managing charging and as a resource capable of providing two-way energy flow, gives the ISO additional flexibility in managing grid reliability.

STRATEGY 2: RELIABLY MANAGE THE GRID DURING INDUSTRY TRANSFORMATION

The ISO has identified the need for very specific operational capabilities needed in real-time to allow electric supply to keep up with demand and also reduce production during over-supply conditions. At this point, however, there is no effective mechanism looking out two to three years to procure these flexible capabilities. To ensure that efficient resources are available to meet the changing system needs, the ISO will:

- Coordinate compliance with the state's once-through cooling policy and local reliability requirements.
- Work with the California Public Utilities Commission to develop market-based solutions that:
 - enhance the Commission's existing long-term procurement and resource adequacy programs to ensure availability and financial viability of flexible resources
 - provide backstop capacity for reliability
 - facilitate procurement of preferred resources in line with the state's loading order
- Advocate for critical policy changes that will facilitate renewable integration, such as time-of-use rates.
- Work cooperatively to streamline generation interconnections on both the distribution and transmission systems.
- Support resiliency of the grid by protecting against known threats and preparing to recover quickly from unforeseen events that threaten the grid.

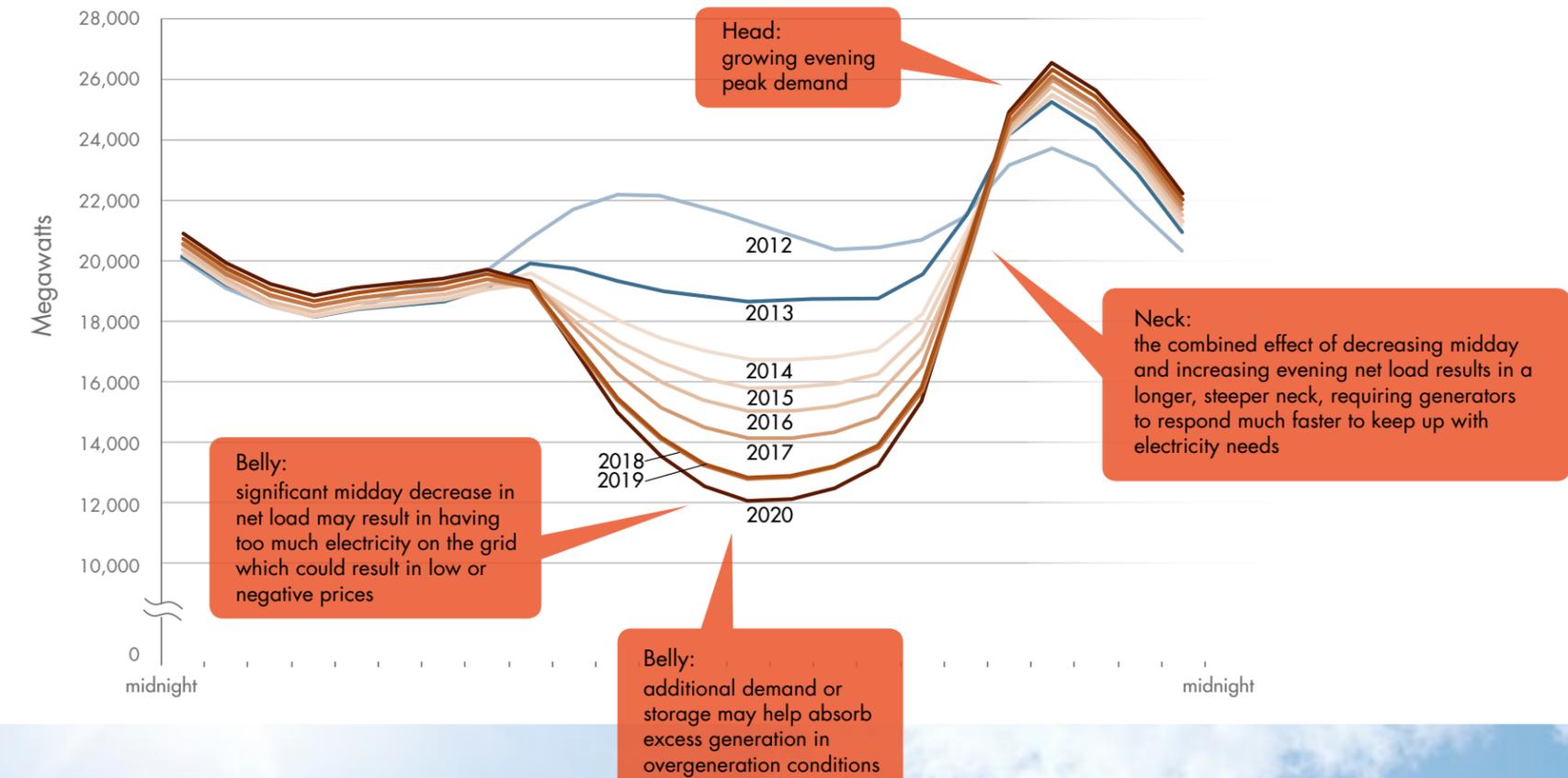
WHAT THIS MEANS FOR CONSUMERS...

Consumers depend on electricity being available when they need it. The ISO is working to ensure that the evolving generation mix and energy-management technologies continue to deliver highly reliable service.

Flexible capabilities

The ISO has identified a growing need for operational flexibility as more of our energy is produced by clean, renewable-fueled generation that is, by nature, variable. Solar power is available only during daylight hours and wind power generates only when the wind blows. The ISO developed what is now known as the duck chart, named after the shape of the curve that demonstrates how the California electric system is likely to evolve as more energy is produced by renewables.

The ISO balances the system, matching supply and demand in real time by adjusting generation to meet load. The duck chart illustrates the "net load," which is the actual demand on the system minus variable generation production. The ISO uses forecasts for what electricity demand will be to determine the generation characteristics needed to balance the net load.



STRATEGY 3: EXPAND REGIONAL COLLABORATION TO UNLOCK MUTUAL BENEFITS

Two years ago, the ISO identified the need for more regional collaboration as a key strategy to help manage resources and our infrastructure efficiently and cost-effectively. We are now offering to provide our existing real-time energy imbalance market, which has been in effect since 2009, as a service to other balancing authorities. The ISO is currently working with stakeholders to develop policies that will provide this service to PacifiCorp, with the potential to expand the operation to other utilities. The energy imbalance market automates optimal generation dispatch, on a five-minute basis. When the system goes into operation in 2014, the ISO and PacifiCorp are confident of being able to demonstrate that the energy imbalance market reduces costs and emissions. This is a tremendous opportunity and a challenge that the ISO will meet by engaging in partnerships across the region.

To achieve our strategy for enhanced regional collaboration over the next three years, the ISO will:

- Provide a platform for an energy imbalance market in the West that facilitates more efficient, reliable and cost-effective grid operations and renewable integration.
- Develop new market mechanisms to bring online resources offering the operational flexibility we need to orchestrate the increasingly complicated electricity network in California and the West.

WHAT THIS MEANS FOR CONSUMERS...

California's electric grid is interconnected with our neighbors throughout the western region. Electricity moves without regard to state or international borders, so the whole region benefits if we can take advantage of our geographic and resource diversity. The ISO is doing this through an "energy imbalance market" that will determine the lowest-cost way to meet our electricity needs.

- Work with interested balancing authorities on studies that uncover potential value in greater collaboration.
- Explore opportunities for deeper collaboration and partnership with other regional players to improve the reliability, efficiency and security of electric service to our respective customers.
- Engage others in the western region to accelerate and demonstrate potential new technologies.
- Stimulate higher levels of renewable power generation in the West.

Implementation of FERC Order 764, 15-minute scheduling

When California imports electricity from neighboring states, the electricity is "scheduled" into California so we know how much is coming and whether the transmission lines can handle the volume. Historically, these schedules have occurred hourly. Moving to 15-minute scheduling increases the operational flexibility of the grid and reduces the cost of integrating renewable resources, including those imported from other regions.

■ **PacifiCorp**, the first participant in the energy imbalance market, has nearly 10,600 MW of generation that serves more than 1.7 million customers in the West. PacifiCorp operates as Pacific Power in Oregon, Washington and California, and as Rocky Mountain Power in Utah, Wyoming and Idaho. The energy imbalance market with PacifiCorp will launch in 2014.

■ In January 2013, the ISO welcomed the first out-of-state transmission owner, **Valley Electric Association**, as a full participating member. Based in Pahrump, Nevada, the Valley Electric service territory borders California's Mono and Inyo counties and extends into California near Bishop. Valley Electric adds 347 miles of transmission lines, 120 MW of load and approximately 17,000 customers.

■ **Merced Irrigation District** plans to become a participating generator owner in 2014 and a participating transmission owner within the next few years. This would add flexible capacity to the system as well as resolve future transmission limitations for Merced.

ALIGNING OUR STRATEGY WITH OUR PRIORITIES

Underpinning the ISO's three core strategies is our continued commitment to strengthening the depth and versatility of our team of leading-edge experts, engineers, economists, grid operators, policy analysts and other staff. We will leverage technology to improve efficiency and upgrade the effectiveness of our daily business processes.

The strategic plan will anchor and focus our overall performance management framework in the years ahead and define the capabilities we need to accomplish them. Our organization strives to be as reliable and versatile as the electricity we ensure for the customers we serve.

- STRATEGY 1 Lead the transition to renewable energy
- STRATEGY 2 Maintain reliability during industry transformation
- STRATEGY 3 Lead regional collaboration

RELIABILITY	SUSTAINABILITY	EFFICIENCY	RESILIENCY
Electricity when you need it	A cleaner, greener and more agile grid	Competitive prices, new technologies and policies that encourage efficiency and minimize costs	A more resilient, less vulnerable grid
Ensure reliability while integrating more diverse and less predictable variable resources	Create new market opportunities for clean energy resources and programs	Advocate for increased price transparency to enable consumers to make smarter choices about their energy use	Invest in technology to advance forecasting of electricity supply and demand, and the impact of weather and changing usage patterns
Develop appropriate financial support to keep needed plants online	Support flexible resources in order to successfully deploy renewable resources	Improve price transparency to incentivize the demand at the right time	Protect against known threats and prepare to recover quickly from unforeseen events
Develop market mechanisms to bring online resources offering operational flexibility	Stimulate higher levels of renewable power generation in the West	Develop an energy imbalance market in the West that facilitates more cost-effective grid operations and renewable integration	Explore opportunities for collaboration with regional players to improve the security of electric service

“OUR GOAL IS TO FOSTER AND ENABLE NEW TECHNOLOGIES TO MODERNIZE AND GREEN THE ELECTRIC GRID. THE ENTIRE ISO IS COMMITTED TO ADVANCING THE ORGANIZATION TOWARD A SUSTAINABLE ENERGY FUTURE.”

STEVE BERBERICH, CEO
CALIFORNIA ISO

UNDERSTANDING THE ISO

Electricity must be produced at the same instant it is consumed, requiring constant balancing of supply and demand. In order for that to happen, there must be an electrical grid connecting the generators (supply) to the end-users (demand). Grid reliability is a term used to characterize both the balance of supply and demand, as well as the integrity of the electric grid. It is a 24-hour-a-day job requiring ISO operators to assess the status of the transmission system at all times. The ISO operates two fully-functioning control centers, with the main headquarters in Folsom and a second control center in Alhambra. The two control centers work as redundant systems protecting grid operations. The Folsom headquarters houses one of the most modern control centers in the world.

Transmission lines have a maximum amount of energy they can transfer. Transmission dispatchers monitor grid conditions to avoid exceeding any operating limits. Maintenance outages, fires and other natural disturbances can cause transmission lines to be temporarily taken out of service in particular areas. Dispatchers then monitor power flow on the other paths remaining in service in order to assure these remain within operating limits to serve the demand.

Transmission dispatchers monitor the transmission infrastructure upon which electricity travels from generation to consumer.

Workstations for operators are surrounded by screens linking them to the Energy Management System and market systems with information relevant to their role in the control center.

A communications console provides a direct link to other operations centers, generating plants, and switching centers to enable immediate routine and emergency communications.

An 80' by 6.5' video wall provides overall situational awareness and a "big picture" of real-time grid and market conditions.

Forecasted energy use for the current day and the actual use are updated on this display hourly. This information helps grid operators predict when generation resources will need to power up or down to match demand.

Generation dispatchers are responsible for controlling generation and balancing supply and demand.

System frequency is a key measure of electric system operation—electric equipment can be damaged if the frequency is too high or low.

System frequency operates at 60 hertz. This frequency is a continuously changing variable determined by the balance between consumer demand and total generation. If demand and generation fall out of balance the frequency changes. The ISO monitors system frequency and adjusts generator output to maintain this frequency.

The shift supervisor oversees operations for the entire shift and makes crucial operating decisions.

The interchange scheduler coordinates transfers of energy to or from the ISO and other areas in the western interconnection.

These displays show which renewable resources are generating power and how much. Weather data is especially important to the renewable dispatcher; as wind and solar generation is dependent on when the wind is blowing or the sun shining.

The renewable dispatcher monitors renewable generation within the ISO area and coordinates the changes in renewable generation with the generation dispatchers.

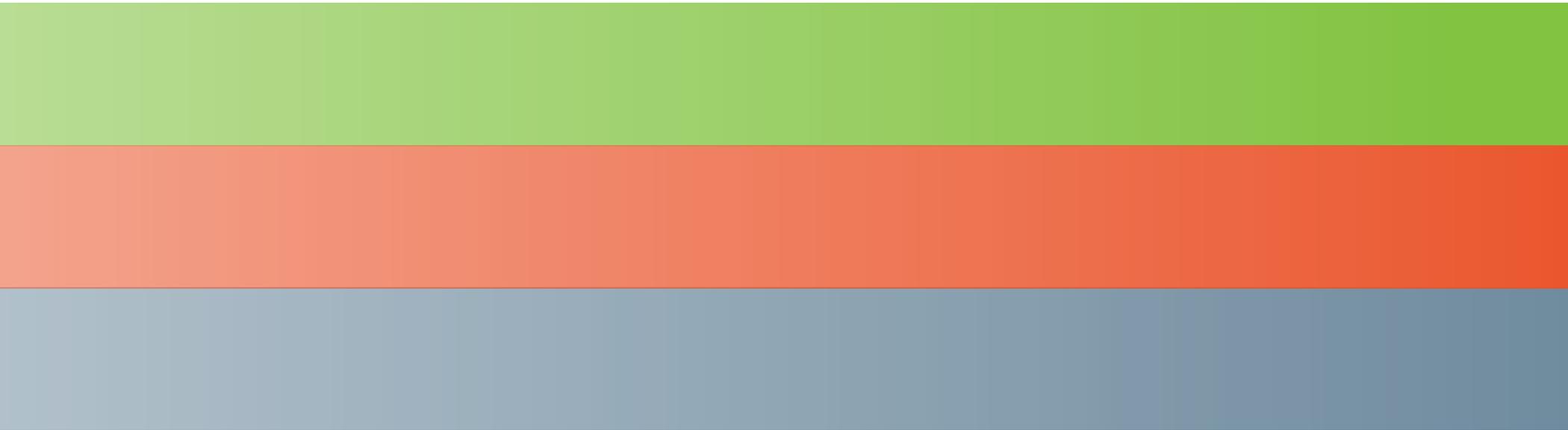
Market operators monitor market systems to ensure adequate resources are made available and that the market is functioning properly.

The ISO market assures open, competitive access to the electric grid and provides the needed energy ensuring reliability in our balancing area.



CONTROL ROOM





California ISO

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