

## Case Study: California ISO – “Keeping the Lights On” for Millions Every Day with WeatherBug Streamer

Keeping the power flowing reliably in California is largely the job of the [California Independent System Operator \(California ISO\)](#). Twenty-eight million people – 75 percent of all Californians -- receive their energy through the California ISO.

To keep the power flowing, the California ISO relies on [WeatherBug Streamer™](#) for live, neighborhood level weather observations for unprecedented accuracy and precision.

### ***The Situation:***

Electricity can't be stored. It is used within hundreds of milliseconds of being produced. Need for electricity spikes when the weather changes – a temperature drop has people running to turn up the thermostat – causing a surge in energy usage. If the energy surge happens without warning the demand can exceed the supply. In worst case scenarios, brownouts and blackouts occur.

Wind flows in a fairly regular pattern around high and low pressure systems. Fog often lies off the coast of California. When the Marine Layer of fog lifts the temperatures rise rapidly. People crank up their air conditioners and the demand for electricity rises by 2 million watts.<sup>1</sup> (The average household uses about 20,000 to 30,000 watts a day.) This is why accurate weather forecasting is so critical to keeping the power supply humming.

In the years before WeatherBug, everyone relied upon weather information from approximately 1200 airport-based weather stations nationwide that updated hourly. Consequently, one could not track rapid changes in weather.

Before joining California ISO as Director of Grid Operations, Jim McIntosh used to watch the U.S. flag outside his former office window in San Francisco to help him predict what the weather was going to do. Since changes in wind direction meant a change in the weather and the marine layer that impacts the Bay Area, Jim knew that when the flag changed direction, it meant a potentially quick change to Bay Area loads and generation requirements. Jim's staff would use the change in wind direction indicated by the flag's movement to keep the proper balance by responding with additional generation units.

When Jim first came to California ISO as the Director of Scheduling, he would call San Francisco to check what the flag was doing.

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<sup>1</sup> A watt is the rate of energy transfer equivalent to one [ampere](#) under an electrical pressure of one volt.

## ***The Background:***

We take electrical power for granted. It is just “there,” like the air we breathe. It is only during a power failure, when you walk into a dark room, flip the light switch and nothing happens that you realize how important power is in your daily life. Behind the scenes, is a sophisticated network of technology and talent that “keep the lights on” for millions everyday.

Power runs through electricity generation stations throughout the United States, interconnected in a system called power grids. In California the grid is the responsibility of the California Independent System Operator (California ISO).

California’s restructured electricity industry is complex, with traditional utilities, private generating companies and state agencies each with different roles and responsibilities. The California ISO, a not-for-profit public benefit corporation, is one link in this chain, but an important link. The ISO is the impartial operator of the state’s wholesale power grid. It maintains the reliability and directs the electron traffic on the transmission superhighway that connects energy suppliers with the utilities serving 28 million Californians, 75 percent of the entire state of California.

The California ISO doesn’t generate any power. It is a clearinghouse for energy transactions. It moves power from where it is, to where it needs to be.

The California ISO manages more than 25,520 circuit-miles of power lines, supplying power in bulk to local power companies. Experts monitor the distribution of power and reroute electricity from areas of low demand to areas of high demand. Often there are automatic switches that direct the routing of power to where it is needed.



(Pictured left: the California ISO Control Room).

From the high voltage transmission lines, power goes to regional and neighborhood substations. There, the electricity is stepped down from high voltage to a current that be used in homes and offices.

High or unbalanced demands for power can develop suddenly, usually due to rapid changes in the weather. If these swift changes aren’t expected, the surges can upset the smooth distribution of electricity in the grid. Supply must meet demand or the result can be a blackout in one section of a grid, or even ripple throughout the whole grid, sequentially shutting down one section after another. Once large sections of a grid are shut down, it may be difficult or impossible to restore power from neighboring grids. In periods of high demand, such as summer, often those nearby grids also are under stress and may not have spare power.

Jim McIntosh and his team at the California ISO control center are responsible for ensuring that they balance the supply of power, the loads (customers) demanding that power and the transmission line capacity, so that their system is in a state where no single fault can cause it to fail.

Jim's team has sophisticated computer systems, with backups, which issue alarms when there are faults on the transmission or generation system. They also have power flow modeling tools which let them analyze what is currently happening on their network, predict whether any parts of it may be overloaded and predict what the worst possible failure left is so that they can change the power generation, load or transmission to prevent a failure if that accident happens. For weather prediction, Jim's team uses multiple weather forecasting sources. Prior to WeatherBug Streamer, these resources updated hourly – leaving large gaps of time for weather to change unnoticed by Grid Operations.

The California ISO needed a weather monitoring tool that would give operators live, streaming weather and alert them to rapidly changing weather conditions from within the actual neighborhoods they serviced.

### ***The Solution:***



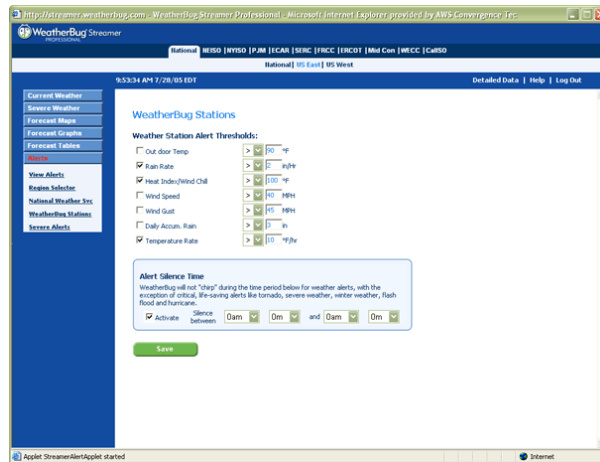
Jim McIntosh no longer checks the flag to see which way the wind is blowing. These days he relies on WeatherBug. Now, the California ISO can precisely assess the impact of current and rapidly changing weather conditions via monitors in the Control Room. They can determine when and where to redirect power flow to meet the increased demand where the change occurs – in real time.

With its exclusive network of more than 8,000 [WeatherBug Tracking Stations™](#) and more than 1,000 [WeatherBug Cameras™](#) throughout the U.S., the Windows-based weather tool is like no other. It delivers up-to-the-second, customizable views of weather data including current weather and wind conditions, local radar, current weather contour, satellite, lightning strikes, live camera views and forecast updates.

Jim's California ISO WeatherBug Tracking Station™ provides his team with live, site-specific weather information. The station records 27 live weather measurements, including various wind data, temperature, relative humidity, heat index, precipitation, barometric pressure, dew point, and more.

The WeatherBug Station™ reports back to the WeatherBug™ Network through the Internet. To manage and interpret all this data, Jim uses WeatherBug Streamer™, an online Microsoft Windows-based application that provides instantaneous, integrated streaming weather information to Jim's desktop. This gives Jim and his team "live", neighborhood level data with far greater granularity and relevancy than any previous weather tool.

The California ISO uses the program to set alarms and alerts based on their criteria. Whether these reports are from the National Weather Service (NWS) or prompted by customized California ISO parameters, Jim and his team receive a visual and audio alert of weather conditions that can impact energy usage.



These threshold alerts are viewed on multiple displays in the California ISO control center, where it is monitored 24 hours a day, 7 days a week.

With WeatherBug Streamer the California ISO can set up to 23 customized warnings, including: alerts for storms, tornadoes, floods, cyclones (hurricanes), lightning, hail, precipitation, non-precipitation, marine warnings and advisories, fire weather and civil emergency severe warnings.

Even more alert thresholds can be set for low and high temperatures, heat index, average and current wind speeds, wind chill, wind gusts, rain rate and daily accumulation of rain. This combination of historical data and personalized, up-to-the-second reports introduces an unprecedented level of precision to the tracking and analysis of weather.



WeatherBug Streamer also lets them observe and interpret up to five layers of weather data on the same map, such as humidity and heat index. This enables the California ISO to monitor potentially dangerous weather, such as lightning or a tornado. For greater precision, they pan and zoom selected maps of roads and counties, integrating their own custom layer data, such as the fog in San Francisco Bay, hospitals or other data. Being able to view such conditions helps ensure that no single fault can cause the system to fail.

For optimal coverage, Grid Operations can access readings from any of the nearly 500 WeatherBug Tracking Stations throughout California, including 336 schools, museums, stadiums, TV stations and more.

Jim McIntosh noted, "WeatherBug actually linked to additional buoys to get us better information relative to the marine layer."<sup>2</sup>

### ***The Outcome:***

Instead of looking out his window to see if the flag has shifted direction, Jim McIntosh and his team now watch a big screen displaying wind speed on the coast, temperature differentials, radar and (as Jim puts it) "other visual stuff". Visuals show change in wind direction.

"We use WeatherBug Streamer to enhance our forecasting of the weather and the corresponding demand for electricity that nature brings," said Jim. "With the ability to assess the weather instantly and accurately, we can prepare and respond to our customers' demands with greater speed and efficiency. This product improves our ability to maintain grid reliability in California.

The California ISO takes a pulse of the power grid every four seconds to ensure there are enough electrons flowing to meet the demand for power. To truly know the demands on the grid, the California ISO operations team must know how the weather is changing second by second.

WeatherBug owns and operates the world's largest weather network and so can deliver live, truly local weather content. Today the California ISO uses these live weather conditions at a neighborhood level. This detailed data gives them near-instant warning of severe weather alerts or dramatic changes in weather conditions – increased wind speed, for instance – in enough time to shift power to a needed area – or even increase power rapidly.

"Weather and heat are the most significant factors to keep power flowing smoothly in California on a day to day basis," said Jim McIntosh, Director of Grid Operations at the California ISO. "We now have critical weather information available, anywhere, any time, to help maintain reliability of the Grid."

Today, instead of looking out his window to see which way the flag is blowing to determine if a cold front is on the way, Jim McIntosh, Director of Grid Operations, and his team watch large display screens updating weather information up-to-the-second, with live neighborhood-local weather conditions from 600 WeatherBug weather tracking stations located throughout the state of California.

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<sup>2</sup> WeatherBug linked to NWS buoys and fed the data to WeatherBug Streamer.

The California Independent System Operator (California ISO) supplies power to over 28 million people (75 percent of the state). The California ISO manages 25,526 circuit miles of transmission lines ensuring that power flows throughout California. Rapid changes in weather can create unexpected demands on the power grid – resulting in power outages. The California ISO relies on WeatherBug, the leading provider up-to-the-second, live neighborhood-local weather conditions from over 500 WeatherBug Tracking Stations and nearly 100 WeatherBug Cameras in the California for up to the second, reliable weather forecasts to keep the power flowing.

### **About WeatherBug**

WeatherBug ([weatherbug.com](http://weatherbug.com)) ensures that individuals, schools, businesses and government agencies receive the most precise live weather information, the most relevant weather reports, and the earliest weather warnings to safeguard property, lives and to plan with confidence. With 8,000 WeatherBug Tracking Stations and over 1,000 cameras primarily based at neighborhood schools and public safety facilities across the U.S., WeatherBug maintains the largest exclusive weather network in the world. The live, local weather conditions are delivered to millions of consumers via the Internet and mobile devices, more than 100 state and local government agencies including the National Weather Service, and to broadcast television stations (KSBW-TV the NBC affiliate on California's Central Coast and KPIX-TV, the CBS affiliate in San Francisco). California businesses and schools also use WeatherBug. WeatherBug's data is unique as it is the only live, neighborhood weather available anywhere. WeatherBug is a brand of AWS Convergence Technologies, Inc. ([www.aws.com](http://www.aws.com)).