

Solar eclipse

On Monday, April 8, the moon will cross between the Earth and the sun, creating a total solar eclipse for the southern and eastern US, with a partial eclipse occurring for about three hours across the West. The eclipse will cast a 115-mile-wide shadow in its path of totality as it crosses 14 states from Texas to Maine.

The last solar eclipse visible in North America was an annular eclipse in 2023; however the last total eclipse that passed through the United States was in 2017. The path of maximum solar obscuration will not pass through any western states.

The ISO started preparing for the event in February to mitigate the effects of the loss of solar generation. We published the [April 2024 Solar Eclipse Technical Bulletin](#) and [presentation](#) on March 6 on the impacts and plans for operating the grid reliably during the eclipse.

Here are some frequently asked questions about the upcoming eclipse:

Will California see a total eclipse from this event?

No. New Mexico will see the largest sun obscuration of 89% during the event, while California's solar obscuration will range from 25% in the northwestern corner of the state to 59% in the southeastern corner. States from Texas to Maine will see a total eclipse lasting about 4 minutes, which is almost double the length of the 2017 eclipse totality. This differs from the October 2023 eclipse, which had the path of annularity with over 90% solar obscuration pass through eight states across the West, including northeast California.

Why is this event any different than past solar eclipses?

For the ISO and many of the Western Energy Imbalance Market (WEIM) entities, the solar obscuration rates are lower than what was experienced in the 2023 eclipse, but similar impacts to system load and net system load are expected.

In 2023, there were about 16,500 megawatts (MW) of installed capacity of commercially operational grid-connected photovoltaic (PV) solar on the ISO system, and about 14,350 MW of behind-the-meter (BTM) rooftop solar. In less than six months, grid-scale PV solar has grown to more than 18,500 MW of installed capacity. There is now 15,770 MW of rooftop solar in the ISO balancing authority (BA), but because the sun will not be obscured as much, impacts across the ISO BA to grid-scale and rooftop solar will be less than in October 2023.

The ISO's real-time WEIM has 21 balancing authorities in 11 western states. Within those entities, grid-scale solar increased from 10,280 MW in October 2023 to 12,150 MW in February 2024. BTM rooftop solar has increased from 6,458 to 6,903 MW in the same period.

The ISO also offers reliability coordination (RC) services through RC West. Coordination and preparation across utilities throughout the RC West and WEIM footprints as well as the ISO balancing area will be important. Impacts will be felt across the West at various times and magnitudes, so WEIM and RC West entities will utilize these connections and relationships to maintain reliable operations, collaborate and optimize resources during the eclipse.

How does the solar eclipse impact California?

The eclipse will start to affect the ISO's grid-scale solar generation and load at 10:05 a.m. PT on April 8, reaching maximum impact at 11 a.m. PT for load and 11:20 a.m. PT for grid-scale solar before returning to normal operations at 12:40 p.m. PT. The grid will not only experience a sharp reduction in solar supply, but a simultaneous pull for more electricity caused by a drop in rooftop solar generation. The change in grid-scale solar production will be most dramatic through the eclipse's waning when 6,718 MW is expected to come back online at roughly 84 MW per minute.

Has the ISO planned for the solar eclipse?

The ISO has been preparing for the effects of the solar eclipse for two months including close coordination with stakeholders, utilities and generators in its market, as well as WEIM entities and RC West participants. This coordination kicked off on March 11 with an [open stakeholder call](#) sharing the details of the technical bulletin.

What specific challenges is the ISO planning for?

In addition to the loss of solar production, the ISO is preparing for a rapid decrease and then increase in solar generation, known as ramp rates, during the eclipse, which can stress the system. When the solar plants come back, they come back online in a fast ramp, which can cause oversupply conditions and frequency management issues. To manage the solar ramps, the ISO has done extensive outreach to scheduling coordinators and market participants to emphasize the importance of following dispatch operating targets (DOTs) in real time. This emphasis is particularly important for solar and battery resources. This will ensure the generation fleet changes are managed in a controlled manner.

Has the ISO learned any lessons from the October 2023 eclipse that they plan to take into consideration for April?

Yes, but each eclipse has unique qualities, such as the geographical path and totality of coverage, and weather. Because of good planning in the 2023 event, the ISO was able to maintain grid reliability through the three-hour eclipse. The ISO and WEIM did not experience significant problems but learned ways to improve for April's event, including enhancements in load forecasting, regulation requirements, and automatic generation control (AGC). A complete analysis of the renewable, load, and market performance during the October 2023 eclipse can be found [here](#).

What steps are being taken to mitigate generation shortages during the eclipse?

The ISO is coordinating with the gas companies, utilities, and generators within its footprint in advance to procure additional regulation and reserve capacity to help manage rapid loss and return of solar generation during the eclipse. The ISO also plans to use quick ramping energy, including battery storage, hydropower and natural gas plants. The transfer capability among WEIM participants, which will be affected by the eclipse at slightly different times and magnitudes of impact than the ISO, will allow for additional flexibility. The ISO used weather assumptions from April 2023 to model demand, plan for supply, and map ramp rates on the day of the eclipse. The forecasting models assume full sun, no extraordinary consumer conservation, and higher obscuration rates in the northern part of California, along with a corresponding loss of rooftop solar generation.

How will the ISO maintain grid reliability and stability?

While the eclipse will present some challenges, the advantage is that it is a known and predictable event. Losses of solar generation are not uncommon, so ISO grid operators will balance demand and supply much as they do on days with cloud cover or rain. A partially cloudy sky is the hardest condition to prepare for, due to the rapid increase and decrease in solar generation. In the case of the eclipse, however, operators know when it will occur and have an identified path and expected impacts.

Will there be electric service outages because of the eclipse?

The ISO doesn't anticipate any eclipse-related service outages. We will ramp up generation to compensate for lost solar production, and there is plenty of capacity to meet need. The predictability of the event will make it easier for ISO grid operators to manage the more intense ramps.

How will the WEIM be impacted?

Eclipse impacts across the WEIM footprint will vary depending on proximity to the eclipse path and levels of installed grid-scale and BTM solar capacity. The Desert Southwest has the most installed BTM solar while the Central WEIM region has the most grid-scale solar when it comes to total capacity. The ISO will communicate with WEIM entities to ensure eclipse impacts are appropriately factored into operational forecasts leading up to and through the eclipse event.

The Central and Desert Southwest regional loads are forecast to increase by 4.3% and 19.3% during the upcoming April 2024 eclipse ramp-up period, respectively. During the October 2023 eclipse, these regions saw 5.2% and 12.9% increases during the eclipse ramp-up period.

Will alternative sources be turned on during the eclipse, and then turned off once conditions return to normal?

The ISO will have resources committed to offset solar production, and then reduce generation when the solar plants come online immediately after the eclipse. The ISO power grid, along with its partner balancing authorities in other western states and parts of Mexico and Canada, is required by federal regulations to carry enough reserves to effectively manage the system. The expected loss of solar energy will be optimized in the market dispatch, and the market will commit and dispatch the amount needed to stabilize the system.

How can consumers help?

The ISO predicts the typical consumer will not notice the grid management challenges and balancing strategies and that the market will work efficiently the day of the eclipse. However, if there are unforeseen circumstances, such as generation or transmission outages, the ISO can call a Flex Alert, which is a voluntary call to consumers for conservation. [Visit FlexAlert.org](https://www.caiso.com/flexalert) to learn more and to sign up for notifications.

How will my solar photo-voltaic system be affected?

Homeowners and businesses will see production on their solar PV systems lowered, and solar thermal systems will not heat as much water. As with any time that solar generation is reduced, the electrical grid will make up for the drop-off.