

Solar eclipse

On Saturday, October 14, the moon will cross between the earth and the sun, creating an annular solar eclipse visible for about three hours that morning across the western United States. The eclipse will cast a 136-mile-wide shadow in its path of annularity that will cross through eight states from Oregon to Texas and including California.

While eclipses are fascinating to astronomers and everyday viewers, when the moon obscures the sun from 8 a.m. to 11 a.m. on October 14, the California ISO will be busy managing a drop in solar production and a fast restart of generators.

The ISO started planning for the event in July to mitigate the effects of the loss of solar generation and keep the system operating reliably.

Here are some frequently asked questions about the upcoming eclipse:

Is this a total solar eclipse?

No. This is an annular eclipse which means the moon will only partially block the sun. It's estimated that throughout the RC West footprint, the sun's obscuration will range from 54-90 percent during the event, including eight states seeing 89-90% of sun coverage through the path of annularity.

Why is this event any different than past solar eclipses?

The last solar eclipse visible in North America was a total eclipse in 2017, and the 2023 eclipse is expected to be more impactful because of the rise of solar generation. In 2017, there was about 10,000 megawatts (MW) of installed capacity of commercially operational grid-connected photovoltaic (PV) solar on the ISO system, and about 5,800 MW of behind-the-meter rooftop solar. Since then, grid-scale PV solar has grown to more than 16,500 MW of installed capacity, and there is now 14,350 MW of rooftop solar in the ISO balancing authority (BA).

The west's electricity systems are also more interconnected today than in 2017, which requires analysis and planning on a broader scope. The ISO's real-time Western Energy Imbalance Market (WEIM) had four participants during the last eclipse. There are now 21 balancing authorities in 11 western states in the WEIM. Within those entities, grid-scale solar has grown from 866 MW in 2017 to 10,280 MW. Behind-the-meter solar has increased from 738 MW to 6,458 MW.

In addition to the growth in WEIM entities and solar resources, the ISO has also begun to offer reliability coordination (RC) services through RC West. To get the most benefit while minimizing risk, coordination and preparation across utilities is required throughout the RC West and WEIM footprints as well as the ISO balancing area. Impacts will be felt across all of the WEIM and RC West at various times and magnitudes, so WEIM and RC West entities can utilize these connections and relationships to maintain reliable operations, collaborate and optimize resources throughout 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 8:05 a.m. on October 14, reaching maximum impact at 9:30 a.m. before returning to normal operations at 11 a.m. The grid will not only experience a sharp reduction in solar supply, but a simultaneous pull for more electricity caused by drop in rooftop solar generation. The change in grid-scale solar production will be most dramatic through the eclipse's waning, when 10,801 MW is expected to come back online at roughly 120 MW per minute.

Has the ISO planned for the solar eclipse?

The ISO has been preparing for the effects of the solar eclipse for three 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 September 5 with an open stakeholder call sharing the results of the 2023 October Eclipse Technical Bulletin that we published on August 31.

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 online quickly, 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.

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 flexible 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 October 13, 2022 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.

To learn about the ISO activities in preparation for the eclipse, [view our Solar Eclipse Technical Bulletin](#).

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. Partially cloudy sky is the hardest weather 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. Due to the predictability of the event, it makes it easier for ISO grid operators to manage the larger ramps due to the eclipse.

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 table below shows that 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.

WEIM Region	Approx. grid connected solar (MW)	Approx. rooftop behind-the-meter solar (MW)
California	1,561	953
Balancing Area of Northern CA (BANC)	407	335
Los Angeles Department of Water and Power (LADWP)	1,154	564
Turlock Irrigation District (TID)		55
Central	4,807	1,453
Idaho Power Company (IPCO)	473	116
Northwestern Energy (NWMT)	178	38
NV Energy (NVEP)	2,471	835
PacifiCorp East (PACE)	1,685	464
Desert Southwest	2,851	3,402
Arizona Public Service (AZPS)	794	1,761
El Paso Electric Company (EPE)	285	170
Public Service Company of New Mexico (PNM)	841	340
Salt River Project (SRP)	436	497
Tucson Electric Power (TEPC)	428	503
WAPA Desert Southwest Region (WALC)	67	130
Pacific Northwest	1,061	650
Avangrid (AVRN)	522	
Avista (AVA)	20	21
Bonneville Power Authority (BPA)	138	88
PacifiCorp West (PACW)	381	173
Portland General Electric (PGE)		161
Puget Sound Energy (PSE)		149
Seattle City Light (SCL)		44
Tacoma Power (TPVWR)		15
WEIM Totals	10,280	6,458

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.

What did the ISO learn from the total solar eclipse in 2017?

Yes, but each eclipse has unique qualities, such as the geographical path and totality of coverage, the proximity to generation, and weather. Because of good planning in the 2017 event, the ISO was able to maintain grid reliability through the three-hour eclipse. Staff also studied the 2017 total solar eclipse and conducted a Lessons Learned report, which the ISO plans to complete again after the October 2023 eclipse.

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.flexalert.org) to learn more about Flex Alerts, 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.

When is the next eclipse that will impact the western United States?

A total solar eclipse will occur on Monday, April 8, 2024 with the path of totality passing from Maine to Texas. While no states in the ISO, WEIM or RC footprints will be impacted by totality, obscurations will range from 89% in southeast New Mexico to 16% in northwest Washington. The ISO will begin preparing for this eclipse in early 2024.

How do I view the eclipse safely?

[How to safely view the eclipse \(nasa.gov\)](https://www.nasa.gov).