



Planning for the April 8, 2024 Solar Eclipse

Jessica Stewart, Sr. Energy Meteorologist

Zach Ricciardulli, Forecast Model Analyst

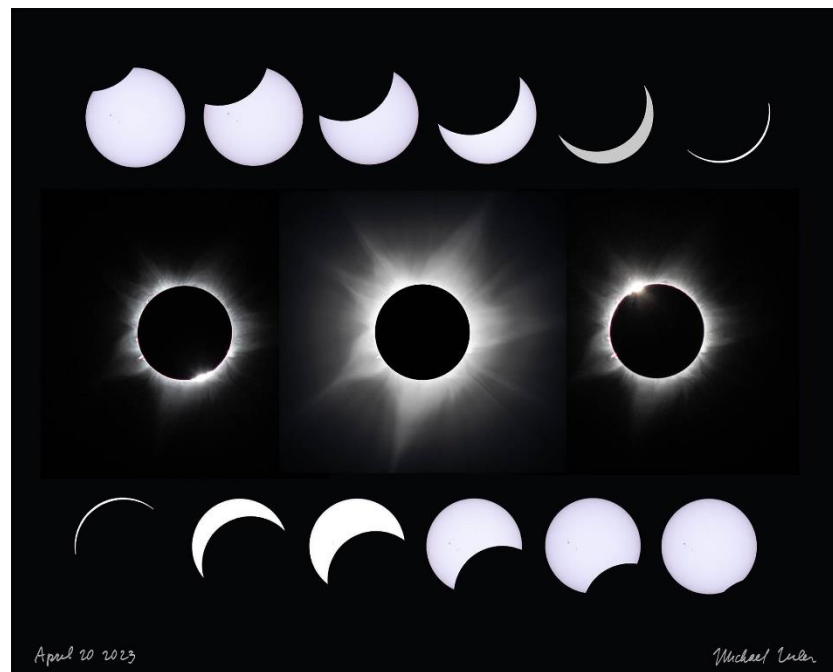
Lysha Matsunobu, Power Systems Forecast Specialist

Amber Motley, Director, Short-Term Forecasting

March 11, 2024

Agenda

- Eclipse overview
- CAISO impacts:
 - Grid-scale solar
 - Temperature, wind
 - BTM solar
 - Load
- WEIM impacts:
 - BTM and grid-scale solar
 - Load
- Real-time Operations planning
- Timeline

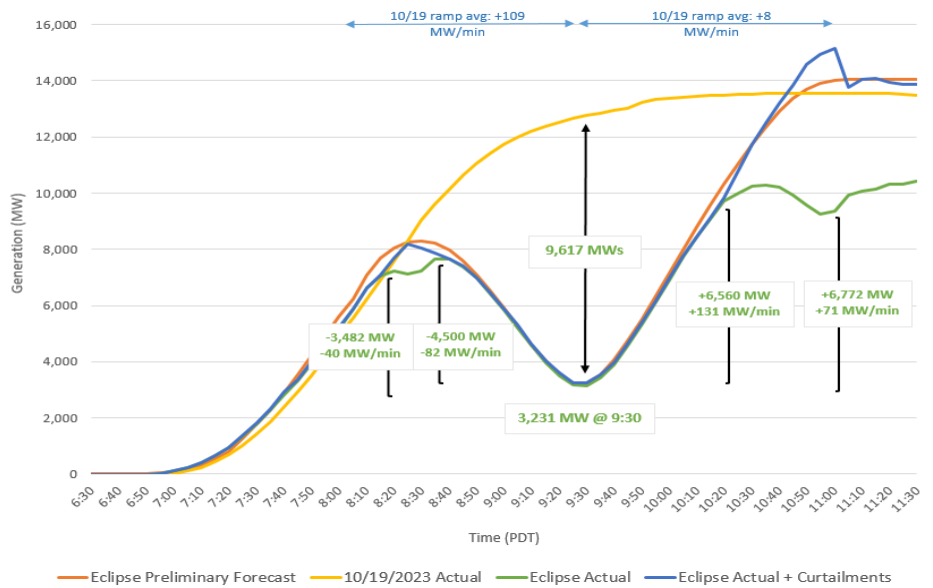


<https://www.greatamericaneclipse.com/april-8-2024>

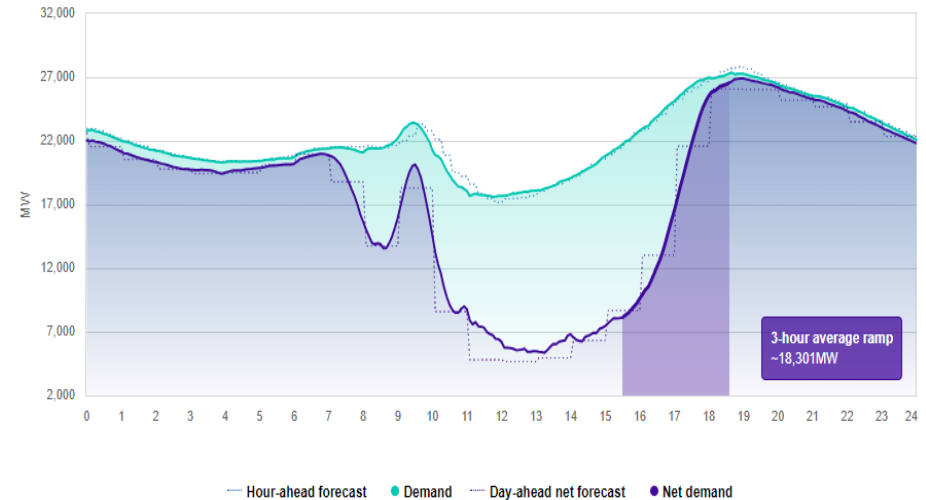
2023 Eclipse Impacts

CAISO Grid-scale solar

October 14, 2023 Eclipse Solar Production



Load



- Load:
 - 2,038 MW increase followed by a 5,738 MW decrease
- Net load:
 - 5,975 MW increase; 100 MW/min average ramp rate
 - 12,355 MW decrease; -118 MW/min average ramp rate

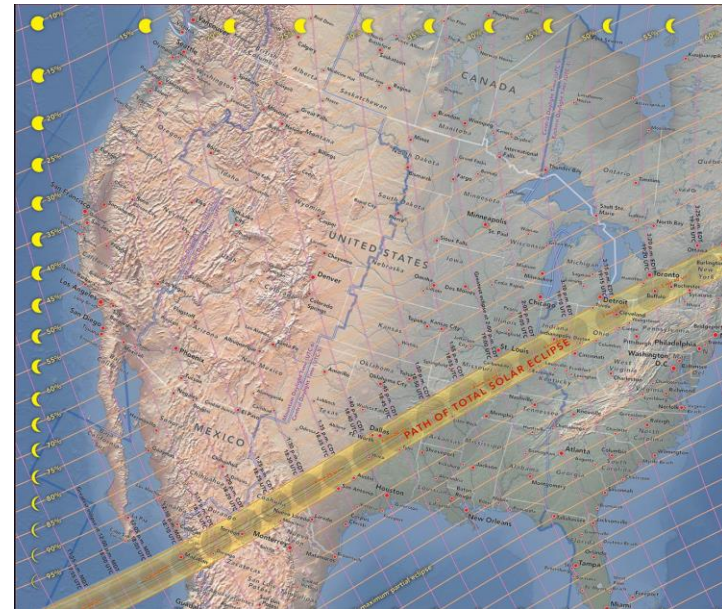
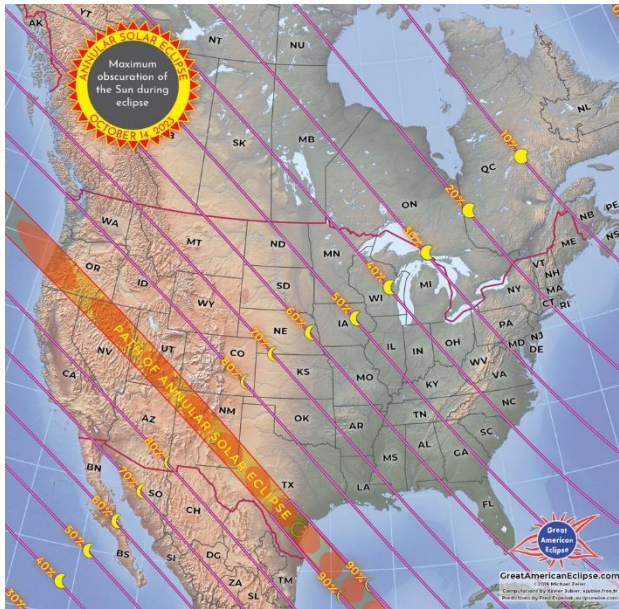
Eclipse Overview

- Monday, April 8
- Impacts California 10 a.m.-12:30 p.m.
- Impacts WEIM 10 a.m.-1 p.m.
- Total eclipse
- Largest impacts to CAISO BA and Desert SW WEIMs



<https://www.greatamericaneclipse.com/april-8-2024>

2023 vs. 2024 Eclipse

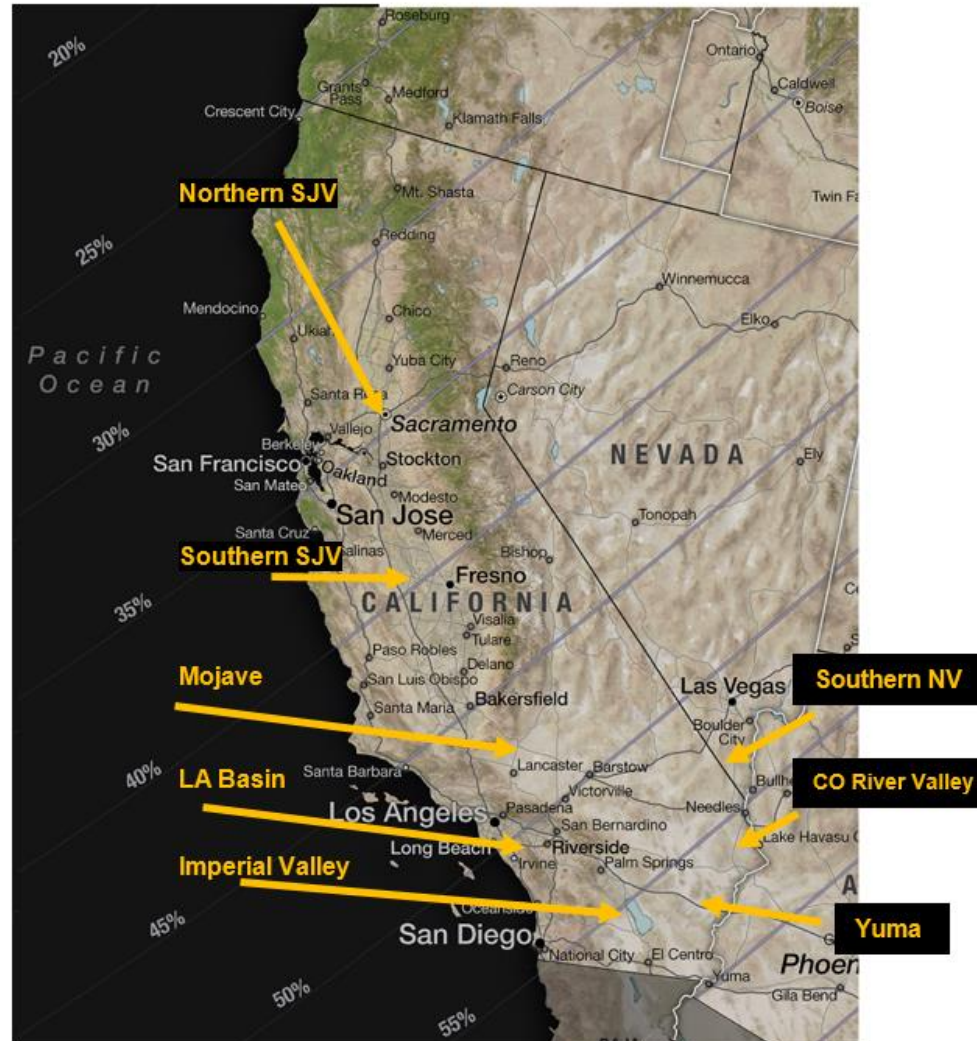


CAISO

WEIM

	Grid-scale solar (MW)	BTM solar (MW)	Storage resources (MW)	Grid-scale solar (MW)	BTM solar (MW)	Storage resources (MW)
2023	16,500	14,350	8,629	10,280	6,458	2,459
2024	18,530	15,770	11,854	12,150	6,903	2,729
Change	+2,030	+1,420	+3,225	+1,870	+445	+270

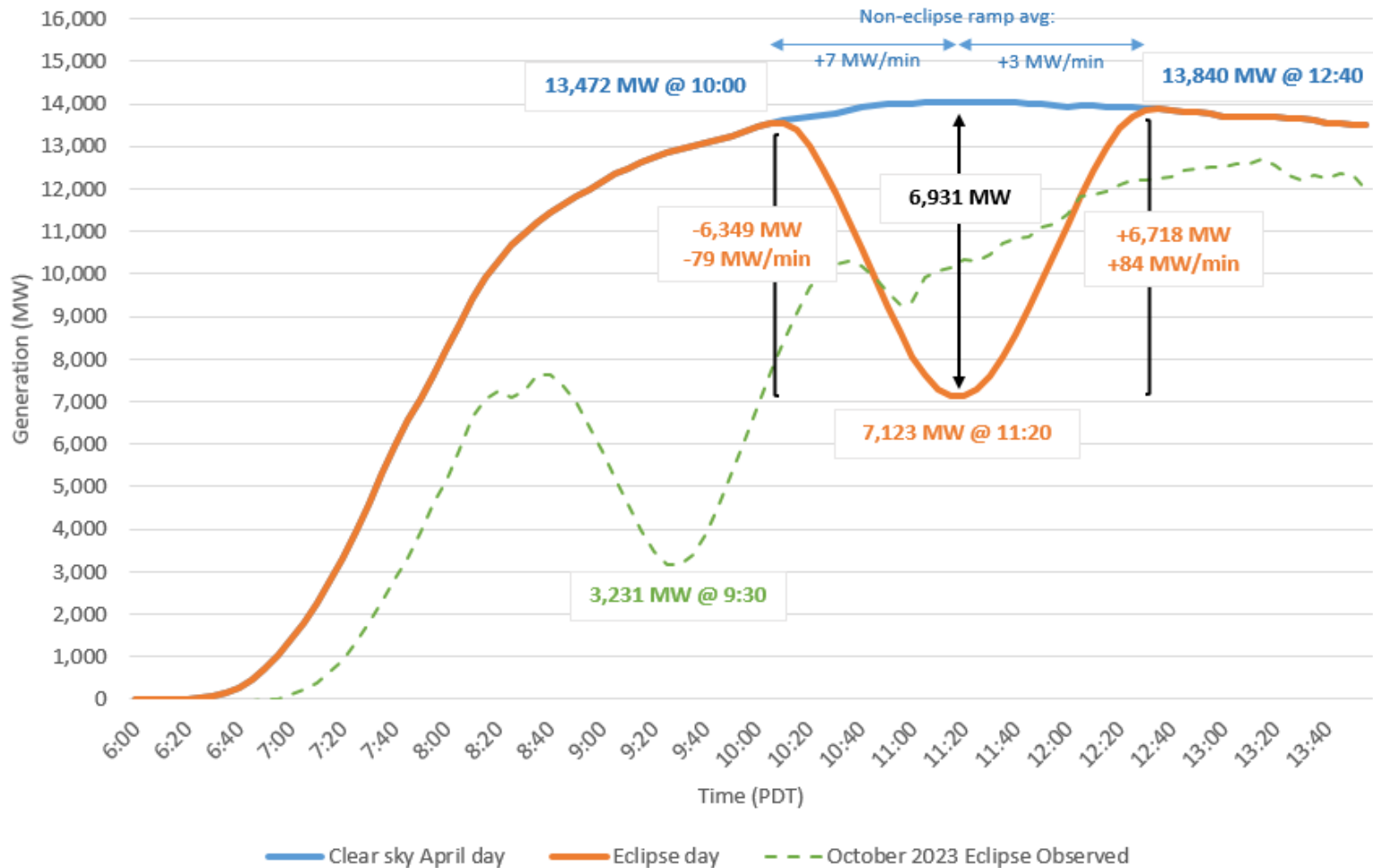
2024 Eclipse over California



<https://science.nasa.gov/eclipses/future-eclipses/eclipse-2024/where-when/>

System-wide forecast solar impact

April 8, 2024 Eclipse Solar Production Estimate



*Since assumption is clear sky results should be viewed as high impact scenario

Grid-Scale impact by region

Forecast Area	Eclipse Start Time (a.m.)	Eclipse Max Time (a.m.)	Eclipse End Time (a.m.)	Eclipse Max Obscuration	April 2024 Regional Capacity	Approx. Area Production at Eclipse Start		Approx. Area Production at Eclipse Max		Approx. Area Production at Eclipse End	
					MW	% of Capacity	MW	% of Capacity	MW	% of Capacity	MW
N. San Joaquin	10:16	11:15	12:18	34%	305	74%	227	51%	154	74%	225
S. San Joaquin	10:10	11:14	12:20	41%	4,905	74%	3,647	45%	2,215	74%	3,609
Mojave	10:08	11:14	12:23	48%	4,649	74%	3,455	40%	1,852	76%	3,529
LA Basin	10:06	11:13	12:24	51%	224	74%	167	38%	85	75%	169
Coachella/Imperial Valley	10:05	11:14	12:26	56%	2,635	74%	1,958	34%	897	75%	1,981
S. Nevada	10:11	11:19	12:30	52%	1,533	74%	1,139	37%	566	76%	1,163
Colorado River Valley	10:07	11:16	12:28	56%	2,874	74%	2,136	34%	968	76%	2,182
Yuma	10:08	11:18	12:31	58%	1,115	74%	828	32%	358	76%	846
SUM:							13,556		7,095		13,703

- Start: 10:05-10:16 a.m.
- Peak: 11:13-11:19 a.m. with generation at 32-51% of capacity
- Ends: 12:18-12:33 p.m.

Utilizing 2023 eclipse post analysis to determine impacts to temperature and wind during 2024 eclipse

Temperature

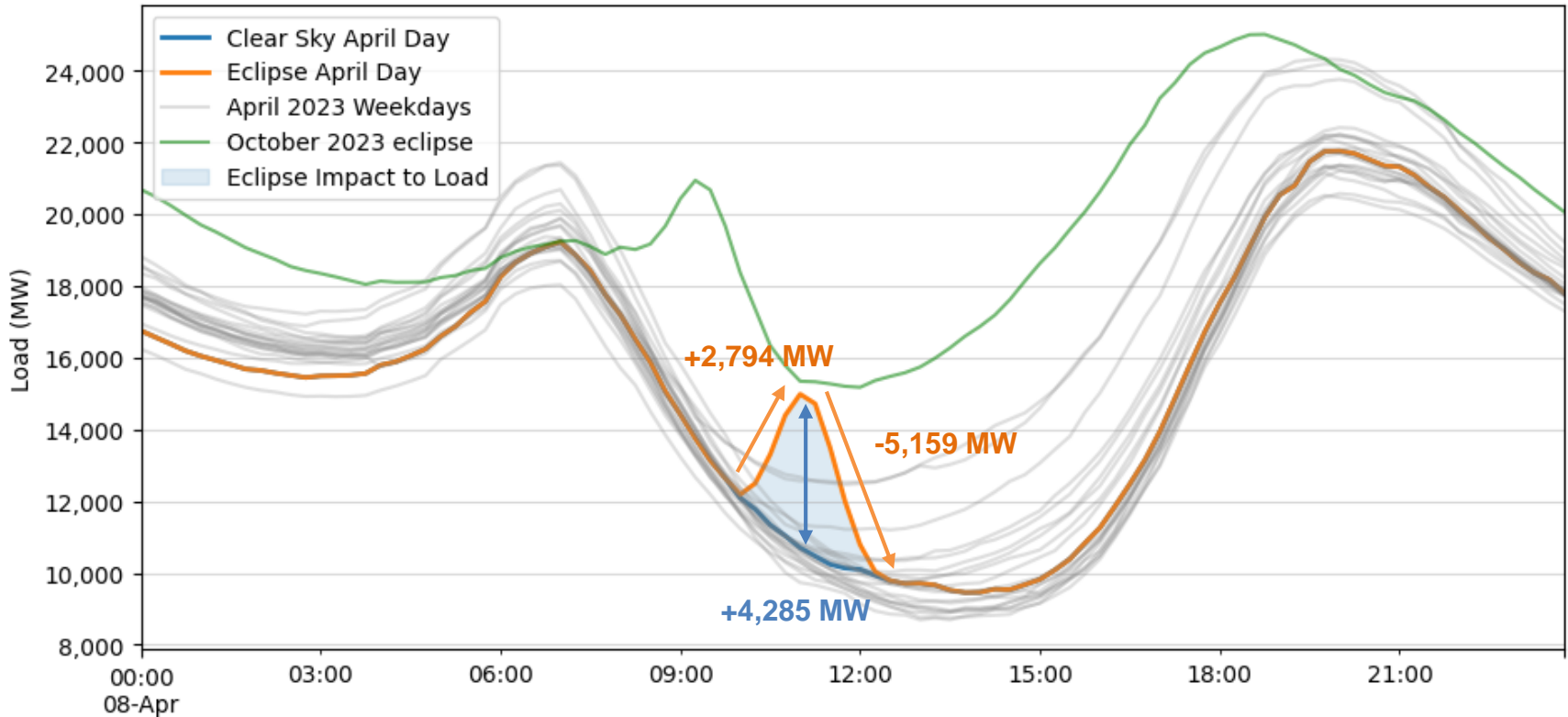
- Temperature impacts across California should be 3° F or less

2023 Obscuration level	2023 Observed temperature reduction (°F)
< 70%	3°
71-80%	5°
>80%	6°

Wind

- There are not expected to be wind generation impacts in the 2024 eclipse

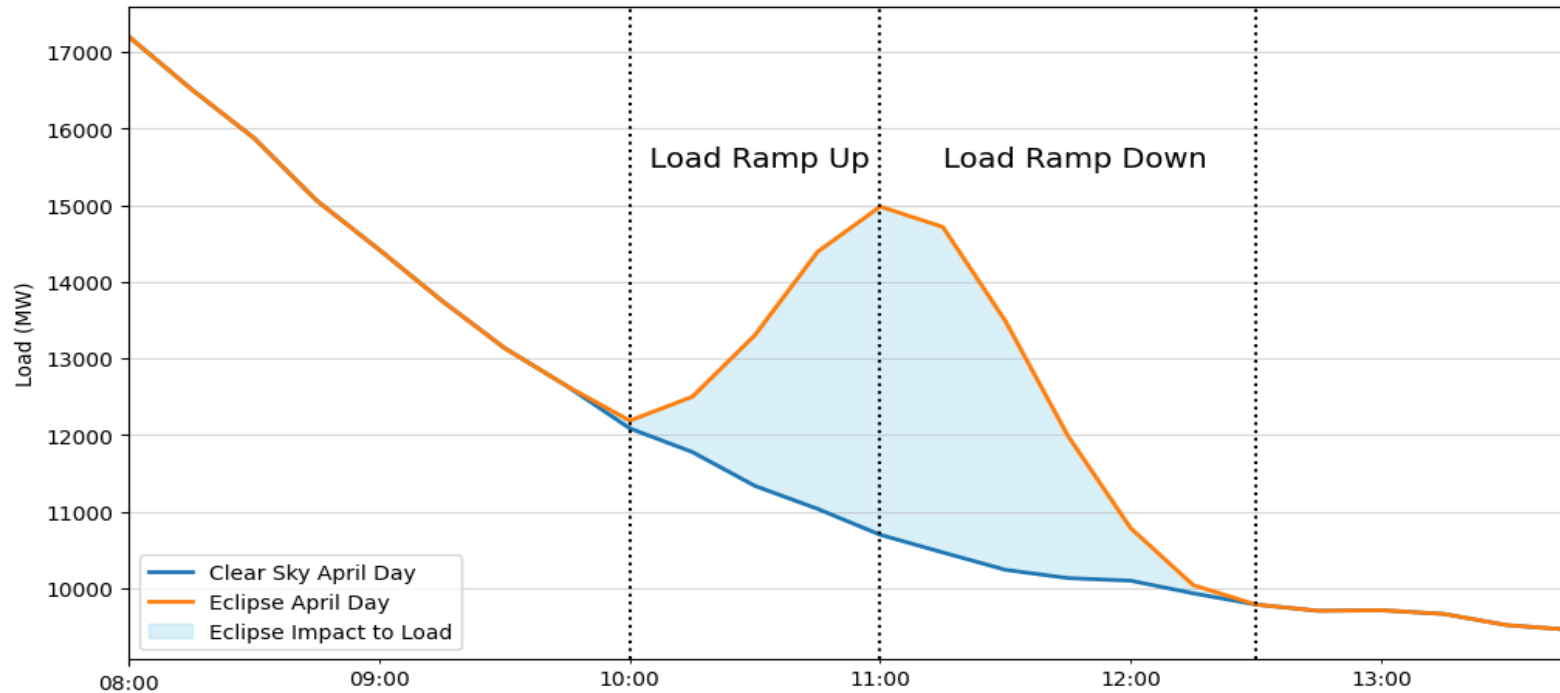
System-wide load impact (SCE, PG&E and SDG&E) will be similar to October 2023 Eclipse



	Load Start	Load Max	Load End	Total Up-Ramp (MW)	Total Down-Ramp (MW)
October 2023	19,023	21,061	15,323	2,038	-5,738
April 2024	12,189	14,983	9,788	2,794	-5,159

*Since assumption is clear sky results should be viewed as high impact scenario

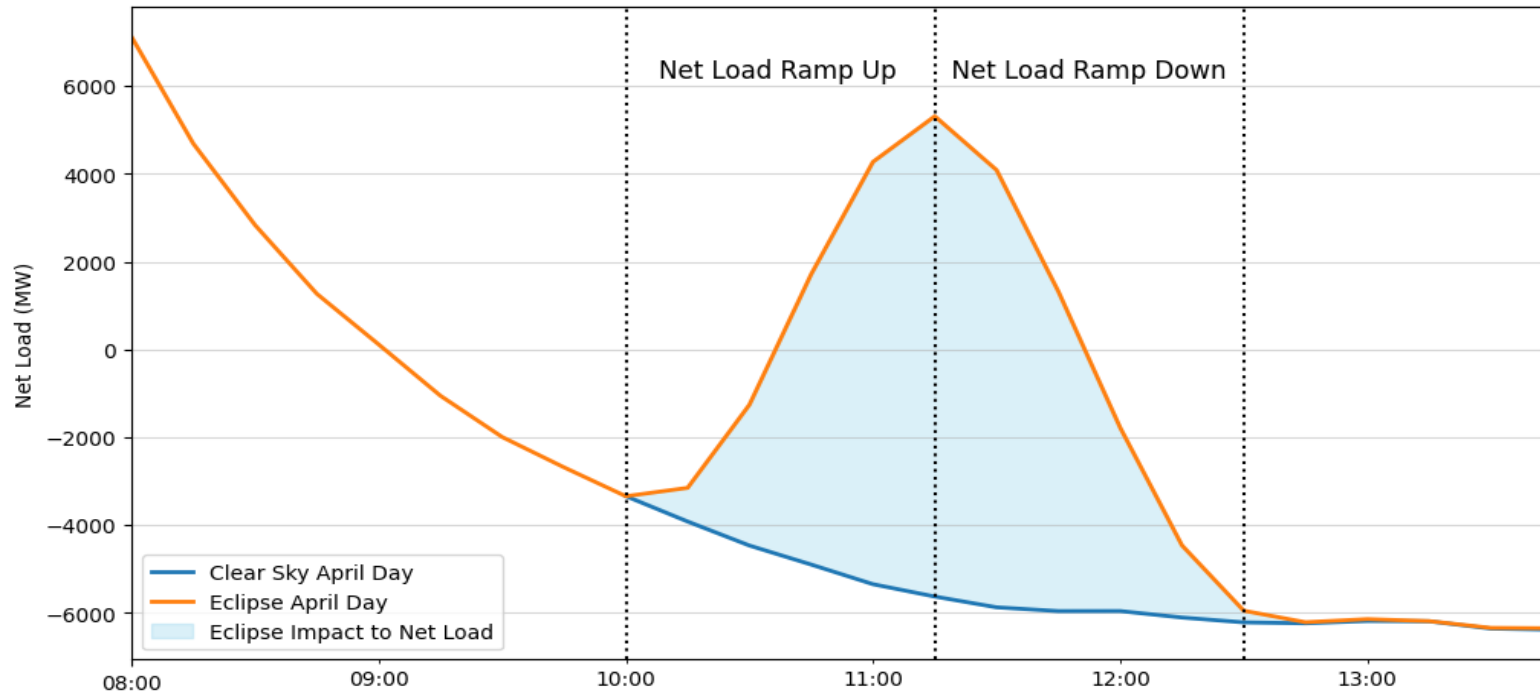
System-wide load impact



	Start	End	Load Start	Load End	Total Ramp (MW)	Average Ramp (MW/min)	Max Ramp (MW/min)	Typical Ramp (MW/min)
Ramp Up	10:00	11:00	12,189	14,983	2,794	47	72	-23
Ramp Down	11:00	12:30	14,983	9,788	5,159	-57	-100	-10.1

	Start	End	Load Start	Load End	Total Ramp (%)	Average 15 Min Ramp (%)	Max 15 Mn Ramp (%)	Typical 15 Min Ramp (%)
Ramp Up	10:00	11:00	12,189	14,983	22.9%	5.7%	8.7%	-2.9%
Ramp Down	11:00	12:30	14,983	9,788	-34.7%	-5.8%	-10.1%	-1.4%

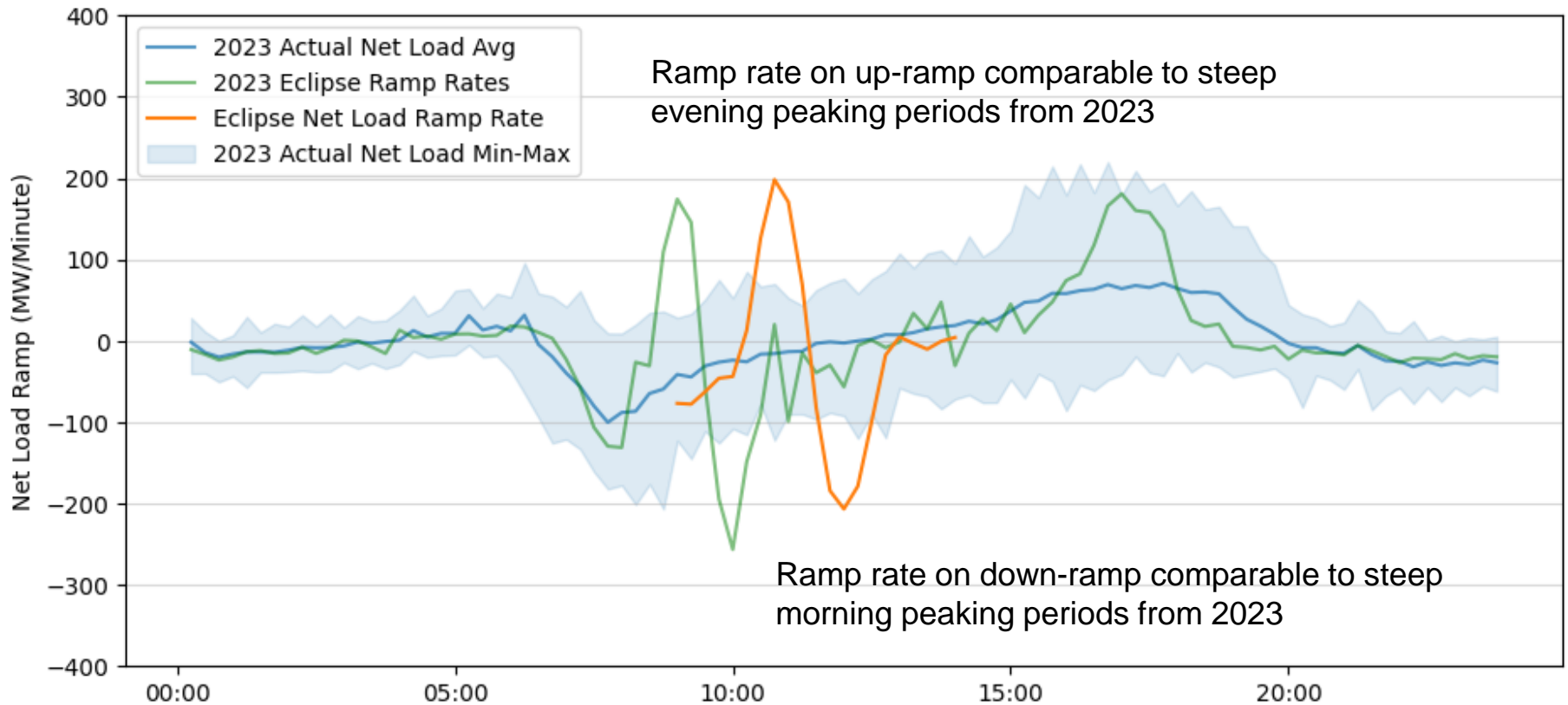
System-wide net load impact



	Start	End	Load Start	Load End	Total Ramp (MW)	Average Ramp (MW/min)	Max Ramp (MW/min)	Typical Ramp (MW/min)
Ramp Up	10:00	11:15	-3,344	5,311	8,655	115	198	-30
Ramp Down	11:15	12:30	5,311	-5,952	-11,263	-150	-206	-7.8

	Start	End	Load Start	Load End	Total Ramp (%)	Average 15 Min Ramp (%)	Max 15 Mn Ramp (%)	Typical 15 Min Ramp (%)
Ramp Up	10:00	11:15	-3,344	5,311	258.8%	51.8%	89.2%	-13.7%
Ramp Down	11:15	12:30	5,311	-5,952	-212.1%	-42.4%	-58.2%	-2.1%

System-wide eclipse net load ramping comparison



	Max Net Load Ramp Rate (MW/min)	Min Net Load Ramp Rate (MW/min)
October 2023	180	-267
April 2024	198	-206

Solar eclipse summary - CAISO

- Large scale solar ramps:
 - Loss of 6,438 MW from eclipse start to max (-92 MW/min)
 - Increase of 6,718 MW from eclipse max to end (+84 MW/min)
- Gross load ramps:
 - Increase of 2,794 MW from eclipse start to max (+47 MW/min)
 - Decrease of 5,159 MW from eclipse max to end (-57 MW/min)
- Net load ramps:
 - Increase of 8,655 MW from eclipse start to max (+115 MW/min)
 - Decrease of 11,263 MW from eclipse max to end (-150 MW/min)

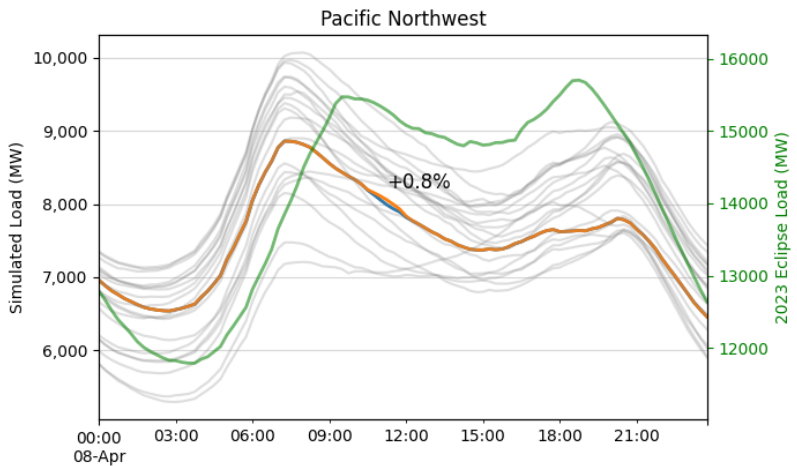
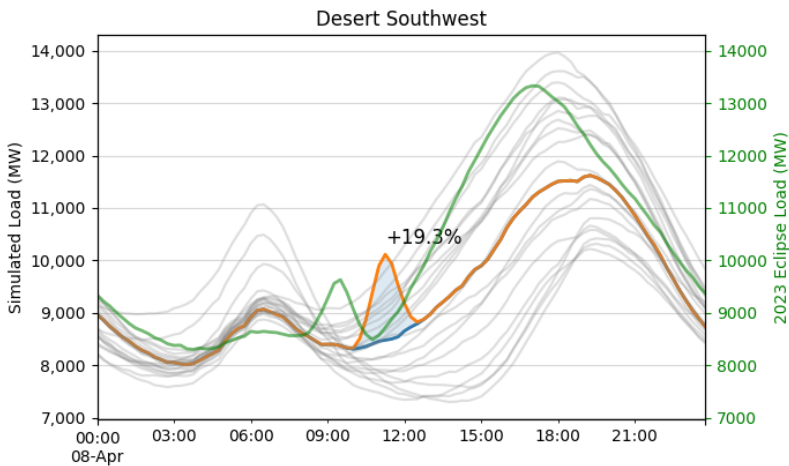
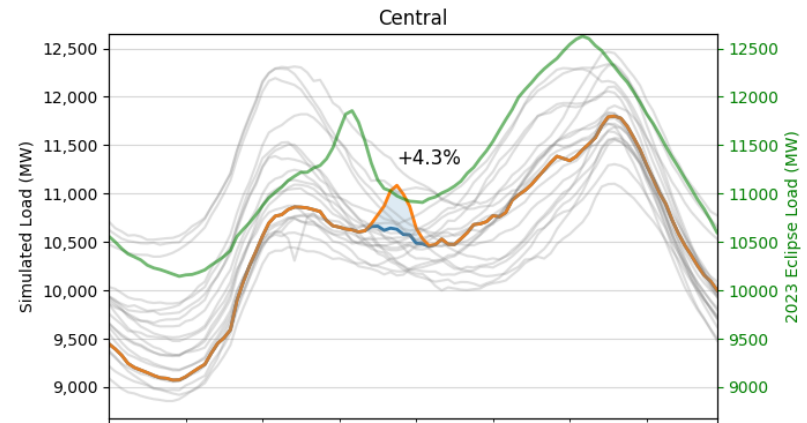
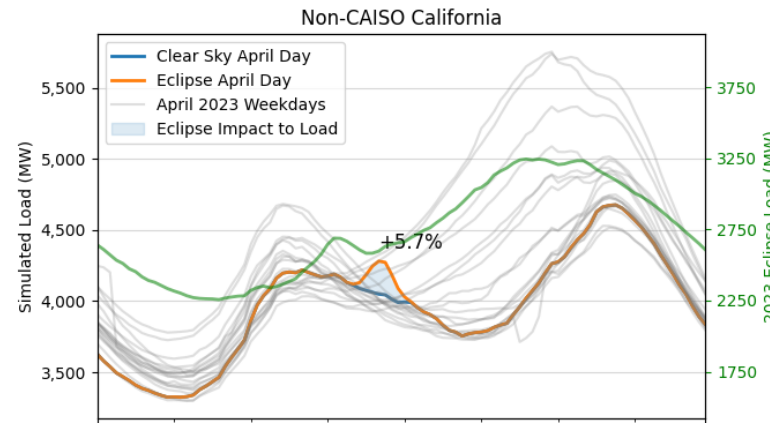
WEIM IMPACTS

WEIM BTM and grid-scale and BTM solar capacities

WEIM Region	Approx. Grid Connected Solar (MW)	Approx. Rooftop BTM Solar (MW)
California	1,561	1,016
Balancing Area of Northern CA (BANC)	407	347
Los Angeles Department of Water and Power (LADWP)	1,154	597
Turlock Irrigation District (TID)		72
Central	6,204	1,548
Idaho Power Company (IPCO)	473	126
Northwestern Energy (NWMET)	179	50
NV Energy (NVEP)	3,311	884
PacifiCorp East (PACE)	2,240	488
Desert Southwest	3,265	3,621
Arizona Public Service (AZPS)	1,109	1,886
El Paso Electric Company (EPE)	285	181
Public Service Company of New Mexico (PNM)	1,040	340
Salt River Project (SRP)	436	534
Tucson Electric Power (TEPC)	428	550
WAPA Desert Southwest Region (WALC)	67	130
Pacific Northwest	1,117	718
Avangrid (AVRN)	522	
Avista (AVA)	20	21
Bonneville Power Authority (BPA)	139	88
PacifiCorp West (PACW)	436	188
Portland General Electric (PGE)		179
Puget Sound Energy (PSE)		165
Seattle City Light (SCL)		60
Tacoma Power (TPWR)		17
WEIM Totals	12,150	6,903

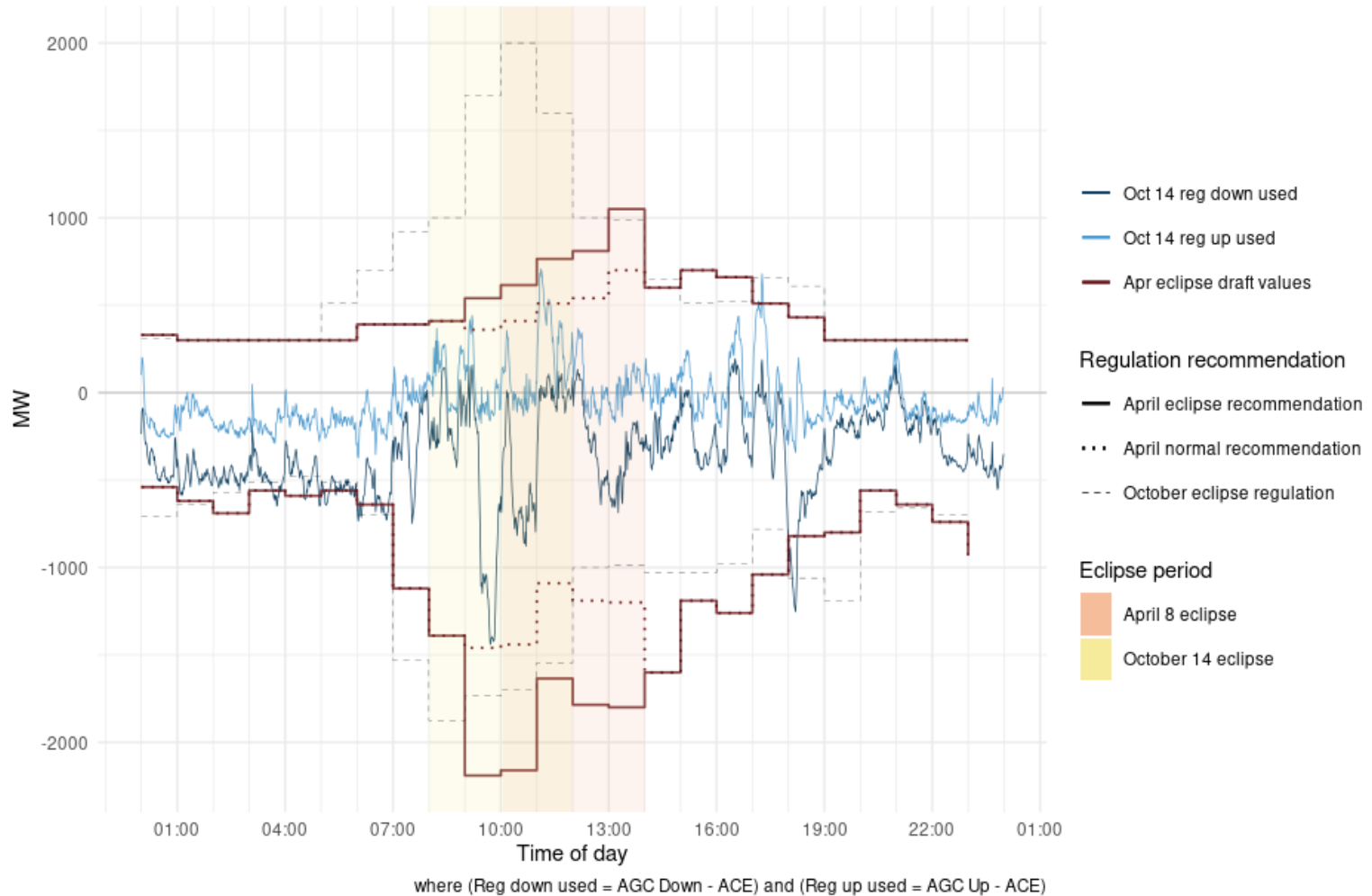
*Avangrid is a generation only WEIM and does not serve load

WEIM Regional Eclipse Load Impacts



WEIM Region	Approx Rooftop BTM Solar (MW)	Approx Rooftop BTM MW % Peak
California	1,016	6%
Central	1,536	4%
Desert Southwest	3,621	19%
Pacific Northwest	700	1%
WEIM Total	6,458	7%

Less regulation adjustment needed for April eclipse based on differences in eclipse impact and lessons learned from October





April 8, 2024 Solar Eclipse Planning - Real Time Operations

Brian Murray: Director, Real Time Operations

Cheri Pryor: Manager, Market Operations Coordination

Market mechanisms and processes to be utilized during the solar eclipse

Advanced Coordination		Day Ahead Activities	Real Time Activities
Internal market simulation	WECC/RC West Coordination	Importance of DA solar forecasting	Prohibit test energy
IOU coordination	Adjacent BA coordination	RUC net short	Management of state-of-charge*
Scheduling Coordinator (SC) interaction	Gas supply coordination	Management of state-of-charge*	Exceptional Dispatch*
Outage coordination	Assistance Energy Transfer (AET) Opt-in*	Exceptional Dispatch*	Flexible Ramp Product (FRP)
7 Day Ahead (DA) Outlook	Execution of 72-hour Reliability Unit Commitments (RUC)	Potential use of Flex Alert or Demand Response*	Use of WEIM transfer capability
Consider declaring restricted maintenance operations (RMO)*	Lessons learned from October 2023 eclipse	Resource Optimization	Solar resource operating instruction (OI) for CAISO BAA
Day +2 conference bridge	MNS Messaging	Post DA Conference Bridge	Additional CAISO Operators and support
Reserves procurement		Reserves & A/S procurement	ADS, MNS & Everbridge messaging
Post DA Conference bridge		MNS Messaging	

The CAISO Day Ahead Market normally uses hourly averages for load and resource values. This will dampen the impact of the eclipse.

Our renewable forecast service providers will be **producing a forecast accounting for the solar eclipse** that will automatically feed through the ISOs daily processes. The aggregate forecast for large scale solar will be available to the market participants, as well as public, through the OASIS applications.

Coordination in preparation for the solar eclipse

Entity	Items
RC West	<ul style="list-style-type: none">• Share Operational Plan• Discuss eclipse impact on BES & rooftop resources• Share market simulation results• Peak RC solar eclipse readiness call
Adjacent BA's	<ul style="list-style-type: none">• Review anticipated eclipse impact & Operational Plans
WEIM Participants	<ul style="list-style-type: none">• Discuss consistent policy for ETSR's during eclipse• No planned ETSR locks or significant limitations• Account for eclipse in energy schedule submittals
Gas companies	<ul style="list-style-type: none">• Gas burn results from market DA+3, DA+2, DA+1• Discuss any planned gas line work
IOU's	<ul style="list-style-type: none">• Anticipate eclipse impact & Operational plan• Send "Peak Day" messaging before and during the eclipse
Market Participants	<ul style="list-style-type: none">• Share anticipated eclipse impact & Operational Plan• Verify resources have adequate fuel• Request bids to keep resources flexible• Request they follow their DOT

CAISO MNS Messaging

Operations and Customer Services will develop pre-written MNS messaging that will be used during the event to externally communicate to SC's and Market Participants.

Timing	Topic	Message
Daily from 4/1 - 4/8	Pre Eclipse Message	This message is to serve as a reminder that the Solar Eclipse will take place April 8, 2024 from ~10:05 - 12:40 PDT. This is a unique event for the ISO BA, during which approximately 7,000 MW of solar generation will rapidly go away and then return within the span of less than 3 hours. Your cooperation and support throughout the event will help to ensure grid reliability. Please monitor MNS and ADS messaging to stay current with real time operations.
4/1 08:45	Eclipse readiness - timing of eclipse	This message is to serve as a reminder that the Solar Eclipse will take place April 8, 2024 from ~10:05 - 12:40 PDT. This is a unique event for the ISO BA, during which approximately 7,000 MW of solar generation will rapidly go away and then return within the span of less than 3 hours. Your cooperation and support throughout the event will help to ensure grid reliability. Please monitor MNS and ADS messaging to stay current with real time operations.
4/1 09:45	Ensure units are following DOTs	The Solar Eclipse will be starting shortly. From 10:05 through maximum obscuration at 11:20, the ISO anticipates the ramp down of solar generation in the ISO BA to occur. Participants are requested to follow all dispatch instructions and Dispatch Operating Targets (DOTs) and adhere to unit ramping capabilities as stated in the Master File. Your cooperation will help to ensure grid reliability for the duration of the event. Thank you.
4/1 11:20	Reminder to follow DOTs as solar units RAMP back up	The Solar Eclipse has reached maximum obscuration in the ISO BA. The ISO anticipates solar generation to ramp up through the end of the eclipse at 12:40. Participants are reminded to continue following all dispatch instructions and adhere to unit ramping capabilities as stated in the Master File. Thank you.
4/1 12:40	Eclipse event has ended	The Solar Eclipse Event has ended and system operations have returned to normal. Thank you for your cooperation and support during this unique event.

Timeline

Item	Date
IOU coordination discussions	March 12
WEIM Bi-weekly Ops Meeting	March 13
RC West Real-Time Working Group (RTWG) - Review of BA/TOP plans	March 19 bi-monthly RTWG meeting
RC West, adjacent RC coordination discussion	April 1
RC West webinar with RTWG members to verify system posture plans	April 5
TOP/BA – RC West and RC-RC Coordination day-of early morning conference calls confirming readiness	April 8 (03:00 PNW, 04:00 PSW, 06:00 RC/RC)

- Following Event: review solar eclipse and identify lessons learned

For reference

Visit user group webpage for more information:

<https://www.caiso.com/informed/Pages/MeetingsEvents/MiscellaneousStakeholderMeetings/Default.aspx>

Miscellaneous stakeholder meetings > Current Meetings

- If you have any questions, please contact isostakeholderaffairs@caiso.com

Save the Date: New Resource Implementation

We are planning to host the New Resource
Implementation Hybrid Stakeholder Meeting
Scheduled for Wednesday, **May 1, 2024**

Notice and in-person registration is coming soon!

Any questions ISOStakeholderaffairs@caiso.com

Save the Date: 2024 Stakeholder Symposium

- The California ISO Stakeholder Symposium to be held Oct. 29-30, 2024
- The Symposium will be held at the Safe Credit Union Convention Center in Sacramento, California
- Welcome reception for all attendees the evening of Oct. 29. Additional information, including event registration and sponsorship opportunities, will be provided in a future notice and on the ISO's website.

Welcome reception:	Stakeholder symposium:
Date: Oct. 29, 2024 Time: 5:30 p.m. - 7:30 p.m. Location: To be announced	Date: Oct. 30, 2024 Time: 8:00 a.m. - 4:30 p.m. Location: <u>Safe Credit Union Convention Center</u> , 1400 J St., Sacramento, CA 95814

Please contact Symposium Registration at symposiumreg@caiso.com with any questions.



California ISO

SAVE THE DATE

2024 STAKEHOLDER SYMPOSIUM

OCT. 30, 2024
SACRAMENTO, CA

Moderator: Elliot M...
Martin Adams, General Manager, Los Angeles DE
Stefan Bird, President & CEO, Pacific Power
Lisa A. Grow, President & CEO, Idaho Power
Steve Powell, President & CEO, Southern California
James Shelter, General Manager, Balancing Autho
Debra Smith, General Manager & CEO, Seattle C
Caroline Winn, CEO, San Diego Gas & Electric

