California ISO

Draft 2024 Flexible Capacity Needs and Availability Assessment Hours Technical Study

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Objective

Discuss the assumptions, methodology, and draft results of the monthly flexible capacity requirement and Availability Assessment Hours Technical Study.

Specifically

Calculating monthly flexible capacity requirements for all LRAs within the ISO footprint for RA compliance year 2024 and advisory requirements for compliance years 2025 and 2026

Agenda / Overview

Time	Topic	Presenter
10:00 – 10:05	Welcome, housekeeping reminders	Yelena Kopylov-Alford
10:05 – 10:35	Background Process review - Expected build out from all LSEs (CPUC jurisdictional and non-jurisdictional) - Load, wind and solar profiles - Load error correction methodology (slides 16-19) - Calculate three-hour net load upward ramps - Add the larger of either the spinning reserve portion of contingency reserves or the most severe contingency - Calculate monthly Flexible Capacity requirement	Clyde Loutan Jessica Stewart Clyde Loutan
10:35 – 10:55	Preliminary Results (slides 32-41)	Hong Zhou
10:55 – 11:10	Overview of methodology used for system/local availability assessment hours (slides 42-54) 2024 availability assessment hours 2025-2026 draft availability assessment hours	Jessica Stewart
11:10 – 11:15	Next Steps	Jessica Stewart

Each LSE Scheduling Coordinator shall make a year-ahead and month-ahead showing of flexible capacity for each month of the compliance year

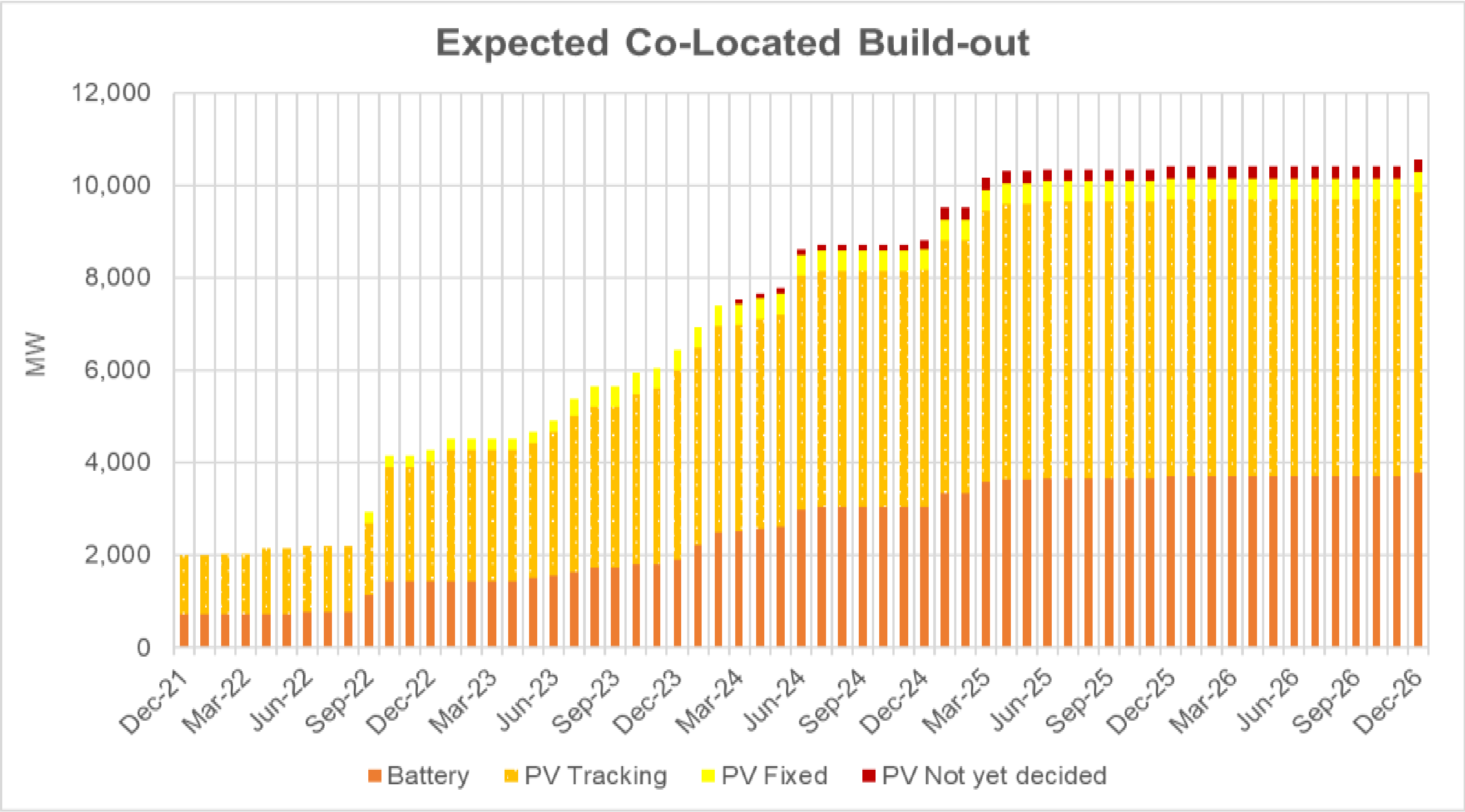
Resource Adequacy (RA)

- Ensure LSEs contract for adequate capacity to meet expected flexible capacity needs
- Year ahead: LSEs need to secure a minimum of 90% of the next years monthly needs
- Month ahead: LSEs need to secure adequate net qualified capacity to serve their peak load including a planning reserve margin and flexible capacity to address largest three-hour net load ramps plus contingency reserves
- All resources participating in the ISO markets under an RA contract will have an RA must-offer-obligation
- Required to submit economic bids into the ISO's real-time market consistent with the category of flexible capacity

The ISO used the following data to determine the flexible capacity needs

- CEC's IEPR demand forecast for 2024 through 2026
- LSE SCs updated renewable build-out for 2022 through 2026
- The Analysis of Flex Capacity Needs included:
  - Existing VERs capacity
  - Expected installed capacity by technology and expected operating date (e.g. Solar thermal, solar PV tracking, solar PV non-tracking, estimate of behind-the-meter solar PV, co-located and renewable components of hybrids) for all variable energy resources under contract
  - Operational date or expected on-line date
  - Dynamically scheduled resources located outside ISO's BAA

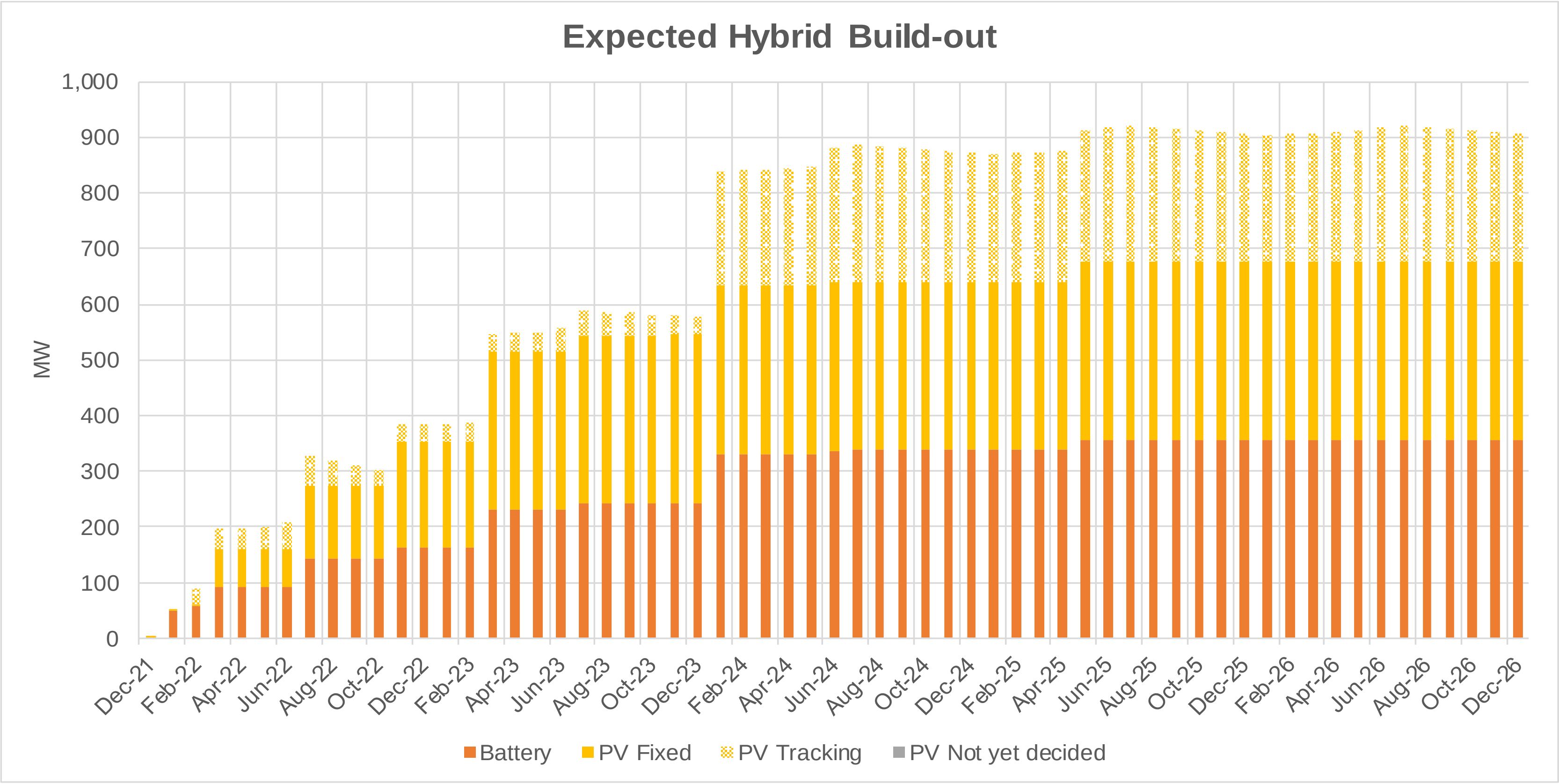
Expected co-located renewable buildout through December 2026 based on LSE's submittal



Co-Located resources were included in the flexible needs assessment

For more details on hybrid and co-located resources, visit the stakeholder page: https://stakeholdercenter.caiso.com/StakeholderInitiatives/Hybrid-resources

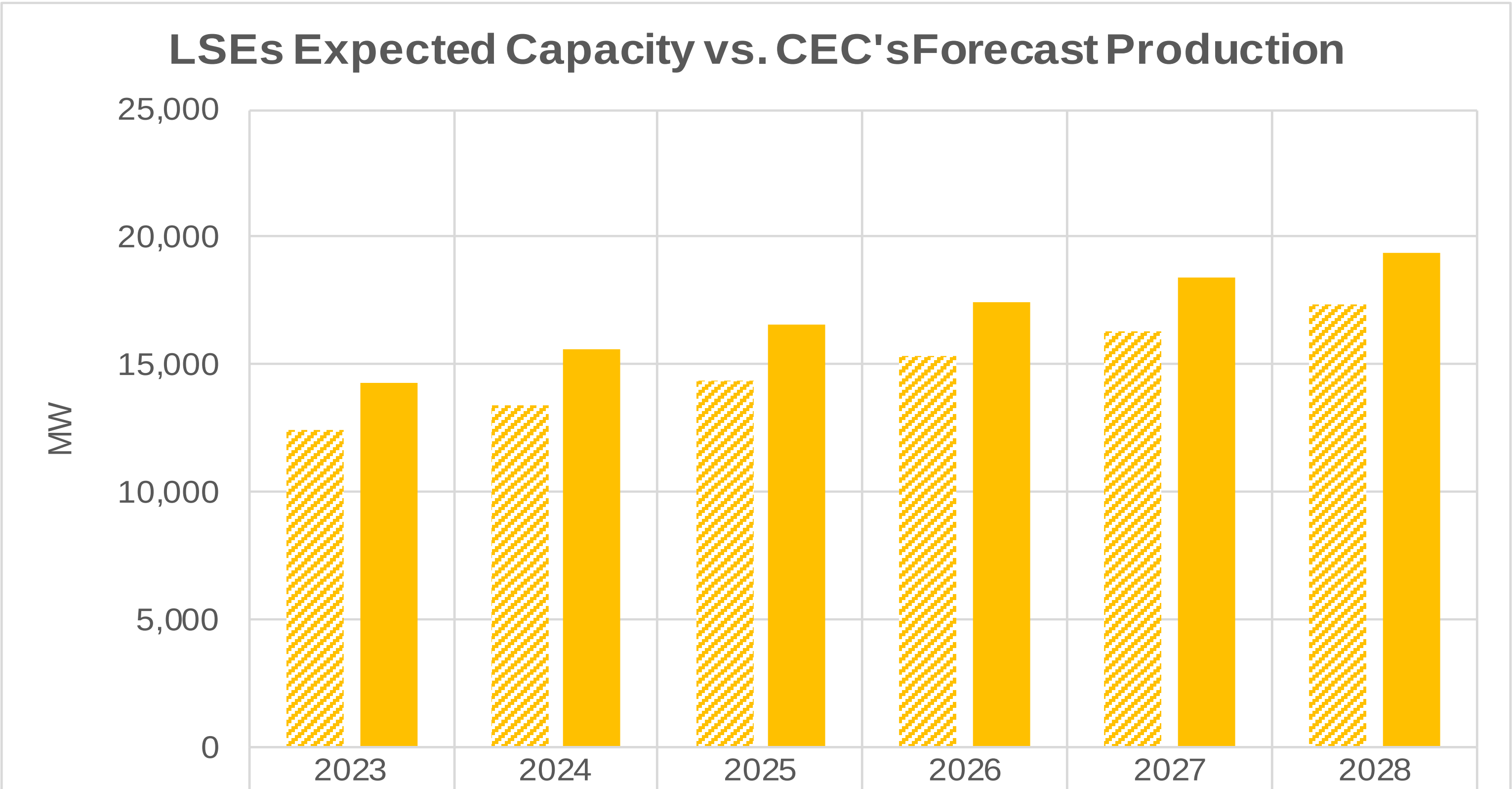
Expected hybrid renewable buildout through December 2026 based on LSE's submittal



Hybrid resources were included in the flexible needs assessment

For more details on hybrid and co-located resources, visit the stakeholder page: https://stakeholdercenter.caiso.com/StakeholderInitiatives/Hybrid-resources

Expected LSEs rooftop solar PV capacity vs. CEC's estimated production



	2023	2024	2025	2026	2027	2028
CEC Fct.	12,429	13,395	14,339	15,323	16,340	17,375
LSEs Cap	14,312	15,565	16,580	17,483	18,380	19,408

Summary of LSEs submittal showing the expected capacity at the end of each year

Resource Type	Existing 2022	Expected 2023	Expected 2024
ISO Solar PV	14,389	16,534	17,879
ISO Solar Thermal	860	858	858
ISO Wind	4,492	4,641	4,912
Co-Located Resources (Wind)	0	0	0
Co-Located Resources (Solar)	2,850	4,551	5,755
Hybrid Resources (Wind)	0	0	0
Hybrid Resources (Solar)	221	336	534
Total Variable Energy Resource Capacity within the ISO	***22,812***	***26,920***	***29,937***
Cumulative Non ISO Wind/Solar Resources that's Dynamically Scheduled into the ISO	1,884	1,986	1,991
Total Internal and Dynamically Scheduled VERs in Flexible Capacity Needs Assessment	***24,696***	***28,906***	***31,928***
Incremental New VERs Additions Each Year (Included in Flexible Capacity Needs Assessment)		***4,210***	***3,022***
Maximum behind-the-meter Solar PV Production in the CEC's Forecast		12,429	13,395
Cumulative behind-the-meter Solar PV Capacity reported by LSEs	13,249	14,312	15,565

The ISO flexibility capacity assessment is based on current LSE's RPS build-out data

- Uses the most current data available for renewable build-out obtained from all LSE SCs
  - The SC for each *LSE* in the CAISO BAA [to identify] each *wind and solar resource*… that is owned, in whole or in part, by the LSE, or under contractual commitment to the LSE or the Load-following MSS LSE, for all or a portion of its capacity

- For new renewable installation, scale 2022 actual production data based on the expected installed capacity in subsequent years

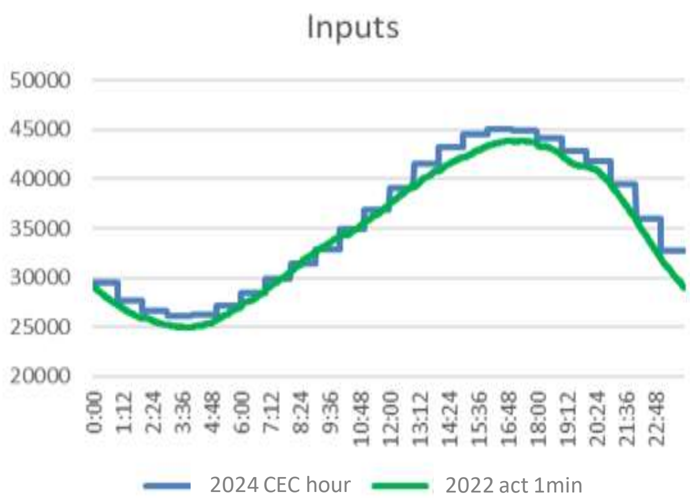
- Generate net-load profiles for 2024 through 2026
  - Generate load profiles for 2024 through 2026
  - Generate solar profiles for 2024 through 2026
  - Generate wind profiles for 2024 through 2026

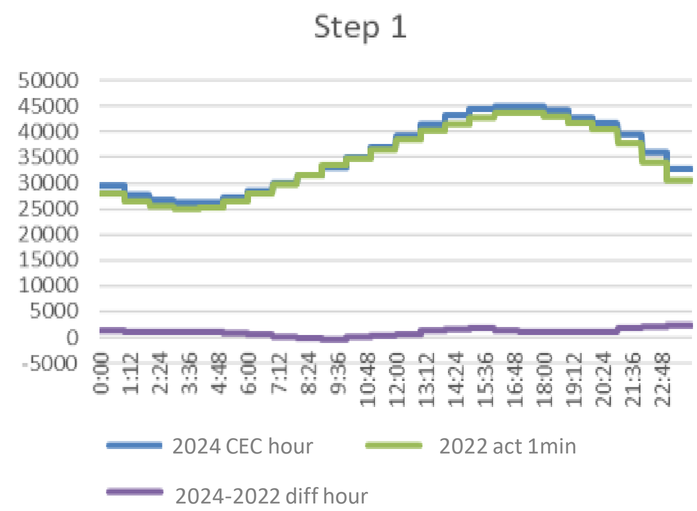
The ISO will use the CEC's 1-in-2 IEPR forecast to develop the monthly flexible capacity

- CEC IEPR Load Forecast
  - https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2022-integrated-energy-policy-report-update-2
  - Title of File: "CED 2022 Hourly Forecast – CAISO – Planning Scenario"
    - CAISO will be using Managed Net Load (column V) within the spreadsheet
      - **Managed Net Load (col V)** = Baseline Net Load (col U)
        + AAEE (Col Q) + AAFS (Col R)
      - Baseline Net Load (col U) = Baseline Consumption (col N)
        - BTM PV (col N)
        - BTM Storage Res (col O)
        - BTM Storage NonRes (col P)
      - Baseline Consumption (col N) = unadjusted consumption (col E)
        + Pumping (col F)
        + climate change (col H)
        + light EV (col I)
        + medium heavy EV (col J)
        + TOU impacts (col K)
        + other adjustments (col L)

Building expected one-minute load profile requires actual 2022 hourly and one-minute data and CEC's hourly forecast

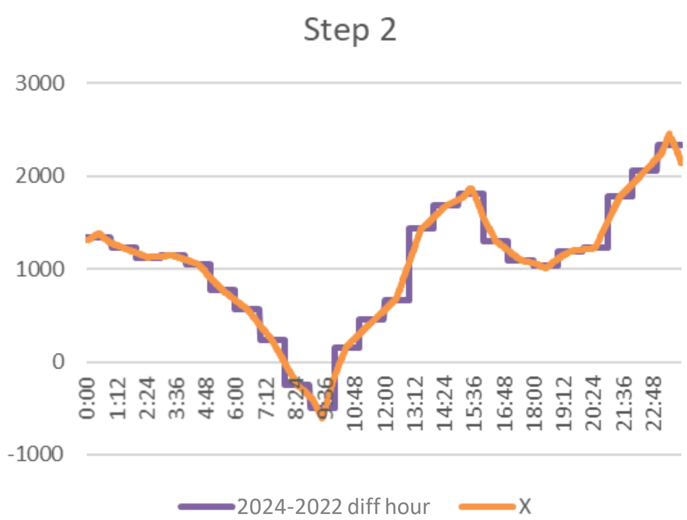
Using the 2024 CEC hourly forecast and the 2022 1-min actuals, we will create the estimated 2024 1-min forecast

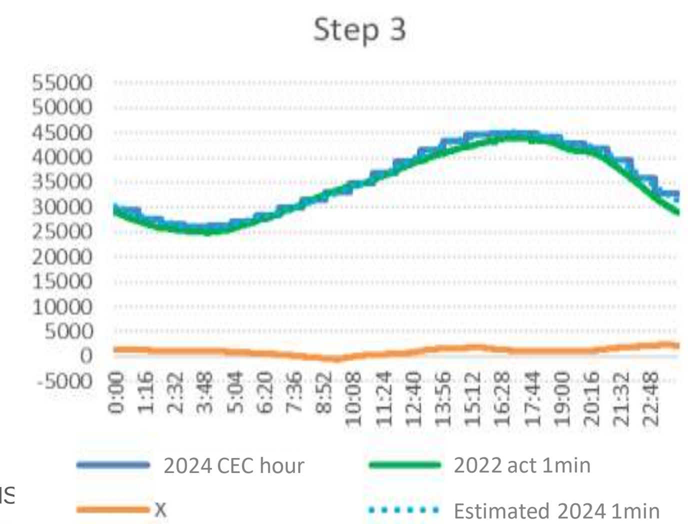




Take the hourly average of the 1-min data and find the difference between the hourly 2022 actuals and 2024 forecast

Smooth the hourly 2024-2022 difference from Step 1 to a 1-min granularity





Add the 1-min data from Step 1 to the 2022 1-min actuals to get a smoothed 2024 forecast

Hourly load forecast to one-minute load forecast

- Used 2022 actual one-minute load data to build one-minute load profiles for subsequent years
- Scaled the hourly CEC load forecast value of each hour into one-minute forecast data using a smoothing equation looking at the differences between the forecasted year and the 2022 one-minute actuals.

2024 Load One-Minute Forecast

- **$2024\ L_{CECfcst\_1\text{-}min} = 2022\ L_{Act\_1\text{-}min} + X$**
  - **Where X = Interpolated 1-min profile from the difference**

    $(2024\ L_{CECfcst\_hourly} - 2022\ L_{actual\_hourly})$

2025 Load One-Minute Forecast

- **$2025\ L_{CECfcst\_1\text{-}min} = 2022\ L_{Act\_1\text{-}min} + X$**
  - **Where X = Interpolated 1-min profile from the difference**

    $(2025\ L_{CECfcst\_hourly} - 2022\ L_{actual\_hourly})$

*See slide 8 for more graphs showing steps to calculate

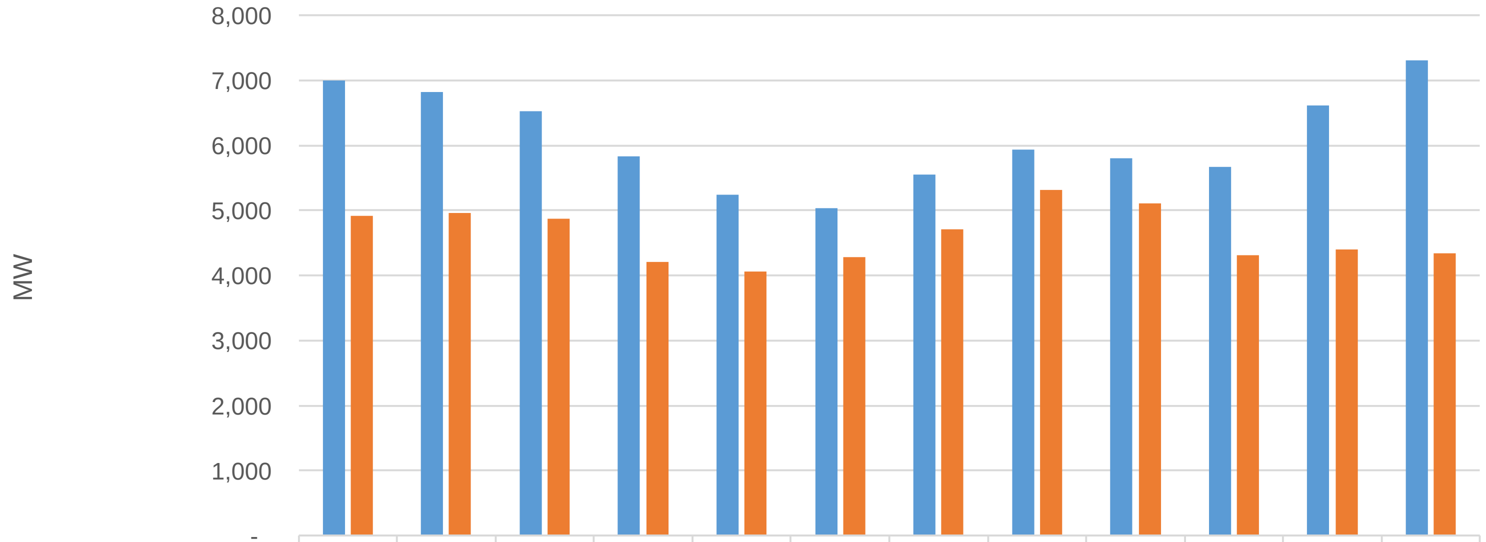
A load error correction coefficient was applied to the one-minute load forecast

- For the 2024 study, the ISO has included a load error correction factor of to the CEC IEPR one-minute load forecast
- This was calculated by:
  - Comparing the averaged ISO load ramp for 2021-2022 to the 2021 and 2022 2 year lagged IEPR forecast
    - i.e. the 2019 forecast for 2021 and the 2020 forecast for 2022 as these were the forecasts used for the 2021 and 2022 flexible capacity analyses
  - Finding the average load ramp error for each month, then taking the average across all months
- Found that the three-hour IEPR load ramp forecast was over-forecast by an average of 24.3% across 2021 and 2022

A load error correction coefficient was applied to the one-minute load forecast

- A load correction coefficient of .757 was calculated
  - The annually averaged load ramp error between the 2021-2022 ISO actuals and IEPR forecast

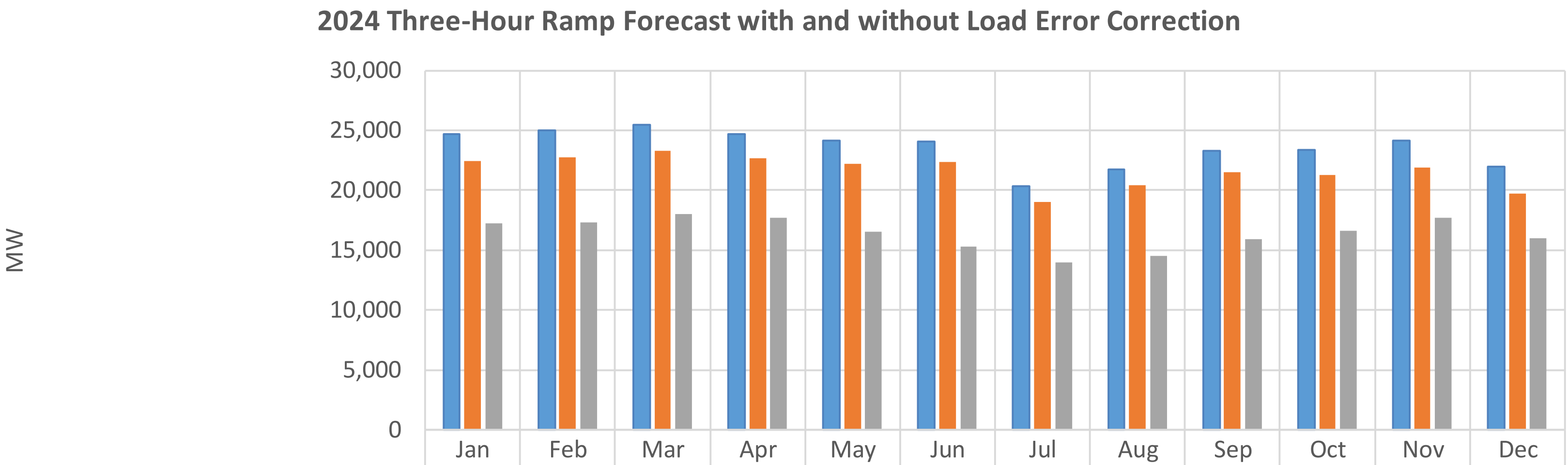
CEC Forecast vs ISO Actual Maximum Three-Hour Load Ramp: 2021 and 2022 Average



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CEC Load Ramp Forecast	6,994	6,818	6,533	5,830	5,236	5,039	5,546	5,935	5,797	5,666	6,613	7,308
CAISO Load Ramp Actual	4,922	4,957	4,870	4,203	4,064	4,287	4,705	5,314	5,109	4,308	4,406	4,346

Without the load error correction, the net load ramps for 2024-2026 were overstated

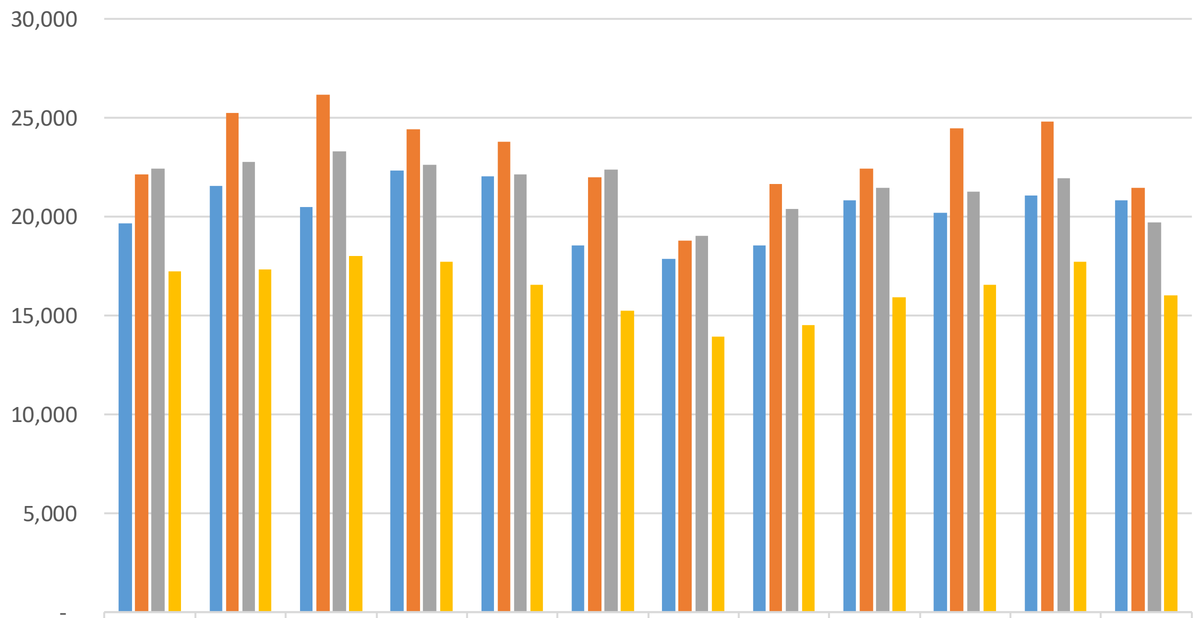
- Error correction was only applied to the one-minute load forecast used to calculate the three-hour ramp forecast for 2024-2026
  - It was **not** applied to the monthly peak in the flexible capacity calculation or for determining MOO or AAH



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3-Hr Ramp Traditional Methodology	24,680	24,981	25,465	24,701	24,161	24,102	20,347	21,716	23,324	23,395	24,151	21,988
3-Hr Ramp Error Correction	22,432	22,775	23,296	22,632	22,163	22,390	19,031	20,384	21,467	21,272	21,924	19,699
Actual 2022 3-Hr Ramp	17,255	17,342	18,030	17,710	16,559	15,265	13,938	14,520	15,935	16,578	17,717	16,001

Updated methodology using load error correction reduces forecast compared to preliminary forecast

Change in 2024 Three-Hour Net Load Ramp Forecast Over Time



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021 Forecast for 2024 Using 2020 Data	19,687	21,573	20,511	22,309	22,029	18,536	17,882	18,565	20,815	20,206	21,092	20,808
2022 Forecast for 2024 Using 2021 Data	22,163	25,224	26,179	24,396	23,786	21,990	18,777	21,633	22,439	24,450	24,825	21,460
2023 Forecast for 2024 using 2022 Data	22,432	22,775	23,296	22,632	22,163	22,390	19,031	20,384	21,467	21,272	21,924	19,699
2022 Actuals	17,255	17,342	18,030	17,710	16,559	15,265	13,938	14,520	15,935	16,578	17,717	16,001

Net-load is a NERC accepted metric[1] for evaluating additional flexibility needs to accommodate VERs

- Net load is defined as load minus wind and solar power production
- Net load variability increases as more and more wind and solar resources are integrated into the system
- The monthly three-hour flexible capacity need equates to the largest upward change in net load when looking across a rolling three-hour evaluation window
- The ISO dispatches flexible resources (including renewable resources with energy bids) to meet net load

1 NERC Special Report
Flexibility Requirements and Metrics for Variable Generation: Implications for System Planning Studies, August 2010. https://www.nerc.com/files/IVGTF_Task_1_4_Final.pdf

The flexible capacity methodology is expected to provide the ISO with sufficient flexible capacity

Methodology

Flexible Req_{MTHy} = $Max[(3RR_{HRx})_{MTHy}] + Max(MSSC, 3.5\%*E(PL_{MTHy})) + \varepsilon$

Where:

$Max[(3RR_{HRx})_{MTHy}]$ = Largest three-hour contiguous ramp starting in hour x for month y

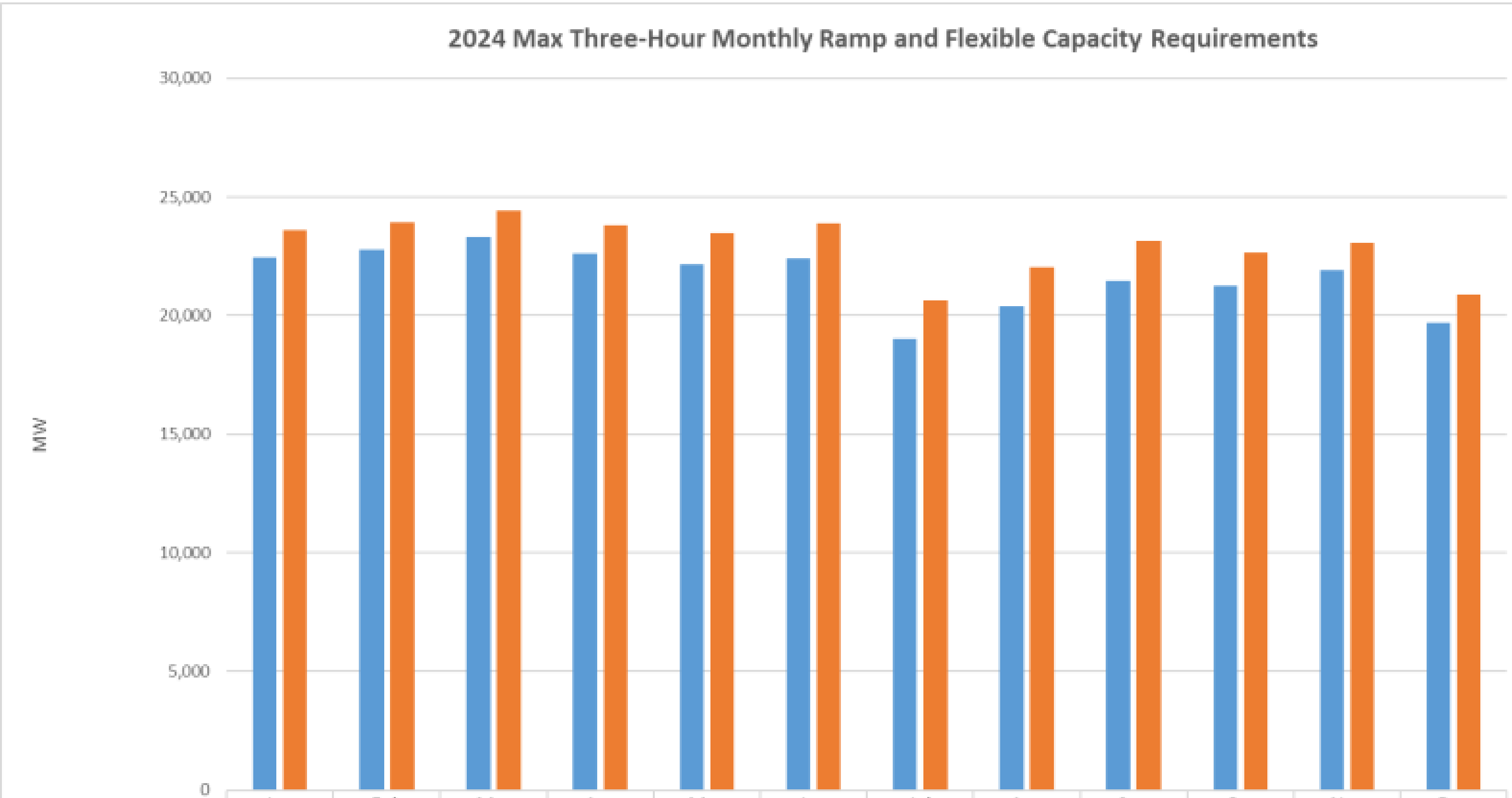
E(PL) = Expected peak load

MTH_y = Month $_y$

MSSC = Most Severe Single Contingency

ε = Annually adjustable error term to account for load forecast errors and variability. ε is currently set at zero

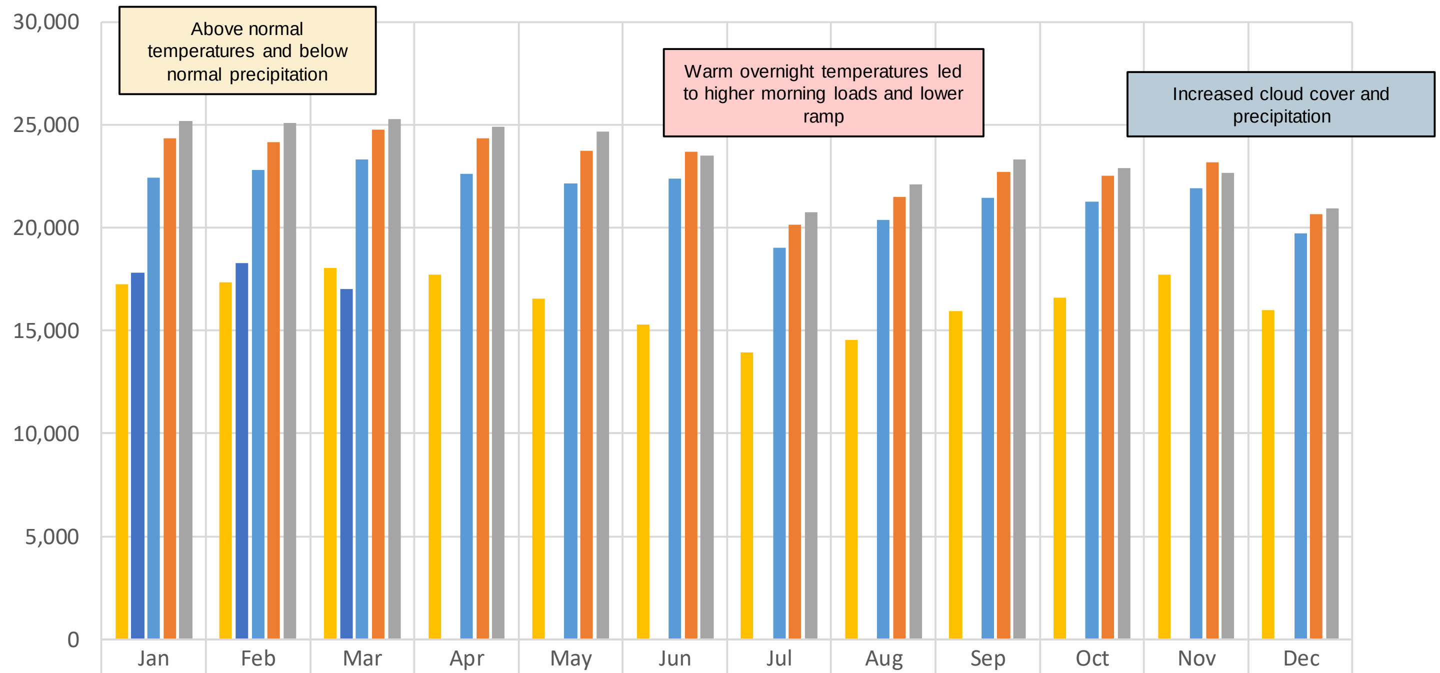
Monthly Three-Hour upward ramps and total flexible capacity requirements for 2024



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2024 3-Hr Ramp	22,432	22,775	23,296	22,632	22,163	22,390	19,031	20,384	21,467	21,272	21,924	19,699
2024 Flex Capacity	23,583	23,925	24,446	23,817	23,485	23,897	20,651	22,018	23,135	22,655	23,081	20,900

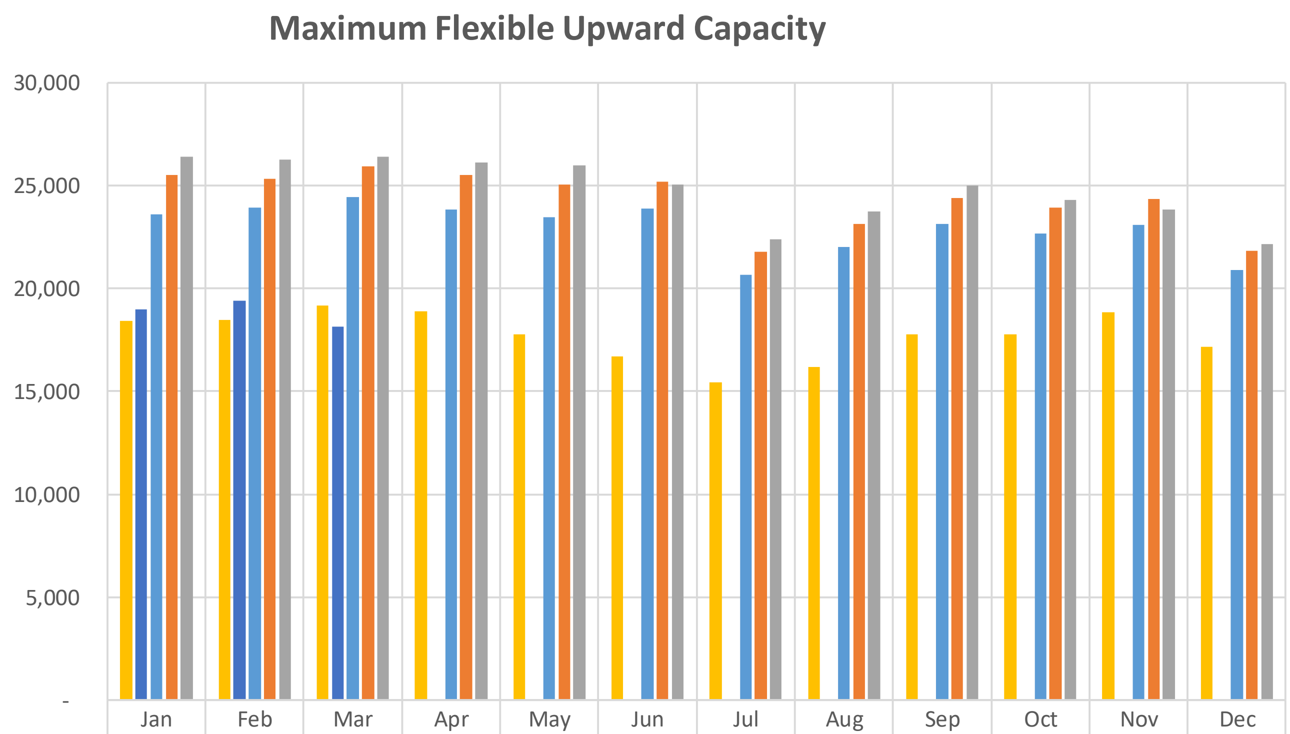
Expected maximum monthly three-hour upward ramps vs. 2022 and 2023 actuals

Maximum Monthly Three-Hour Upward Ramps



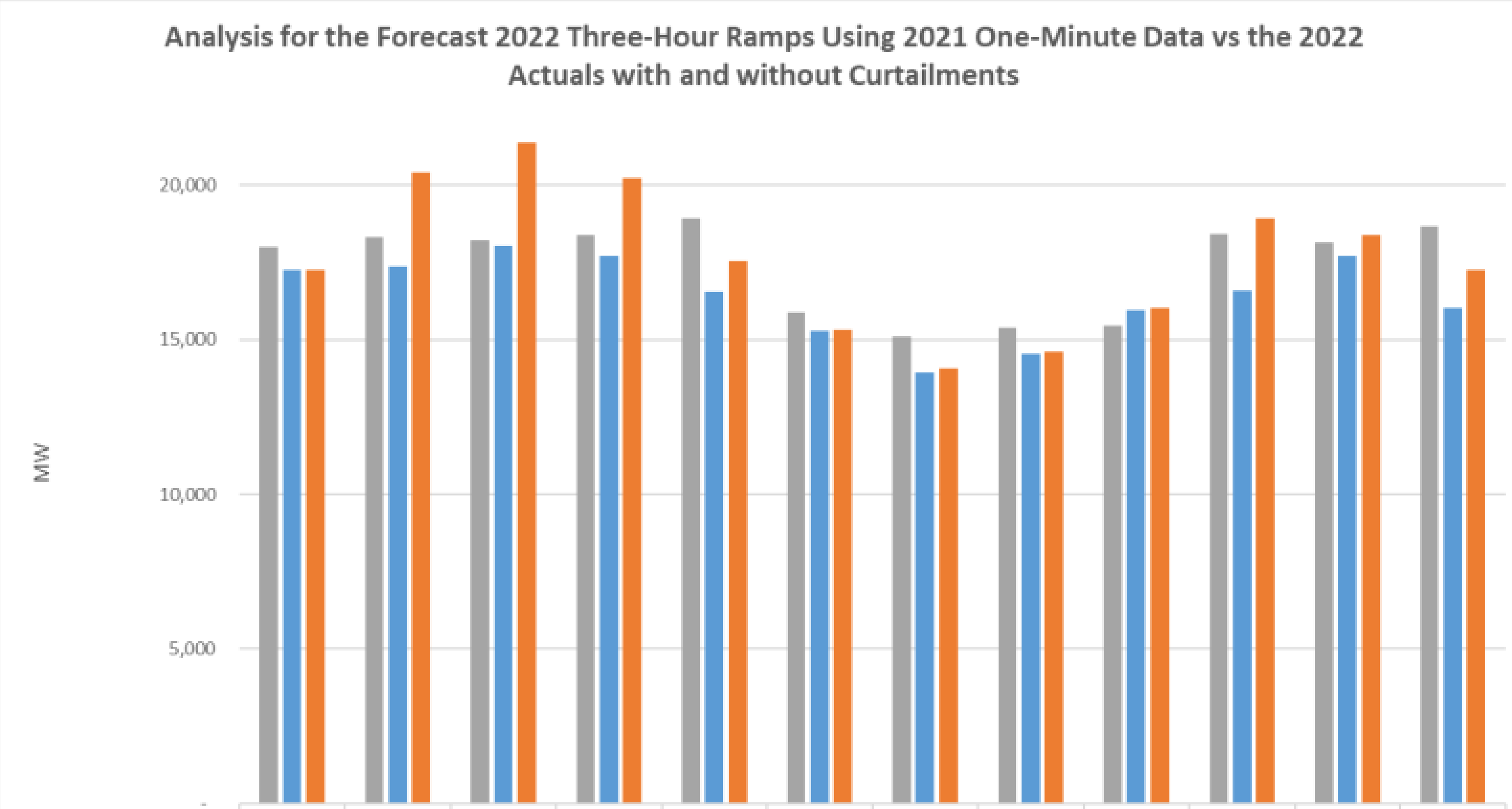
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2022 Actuals	17,255	17,342	18,030	17,710	16,559	15,265	13,938	14,520	15,935	16,578	17,717	16,001
2023 Actuals	17,821	18,261	17,003									
2024 3-Hr Ramp Fcst	22,432	22,775	23,296	22,632	22,163	22,390	19,031	20,384	21,467	21,272	21,924	19,699
2025 3-Hr Ramp Fcst	24,352	24,171	24,767	24,340	23,714	23,670	20,163	21,502	22,719	22,515	23,156	20,638
2026 3-Hr Ramp Fcst	25,197	25,101	25,255	24,909	24,648	23,506	20,747	22,096	23,292	22,889	22,648	20,940

Actual maximum monthly flexible capacity for 2021 and 2022 vs. forecast flexible capacity for 2023 through 2025



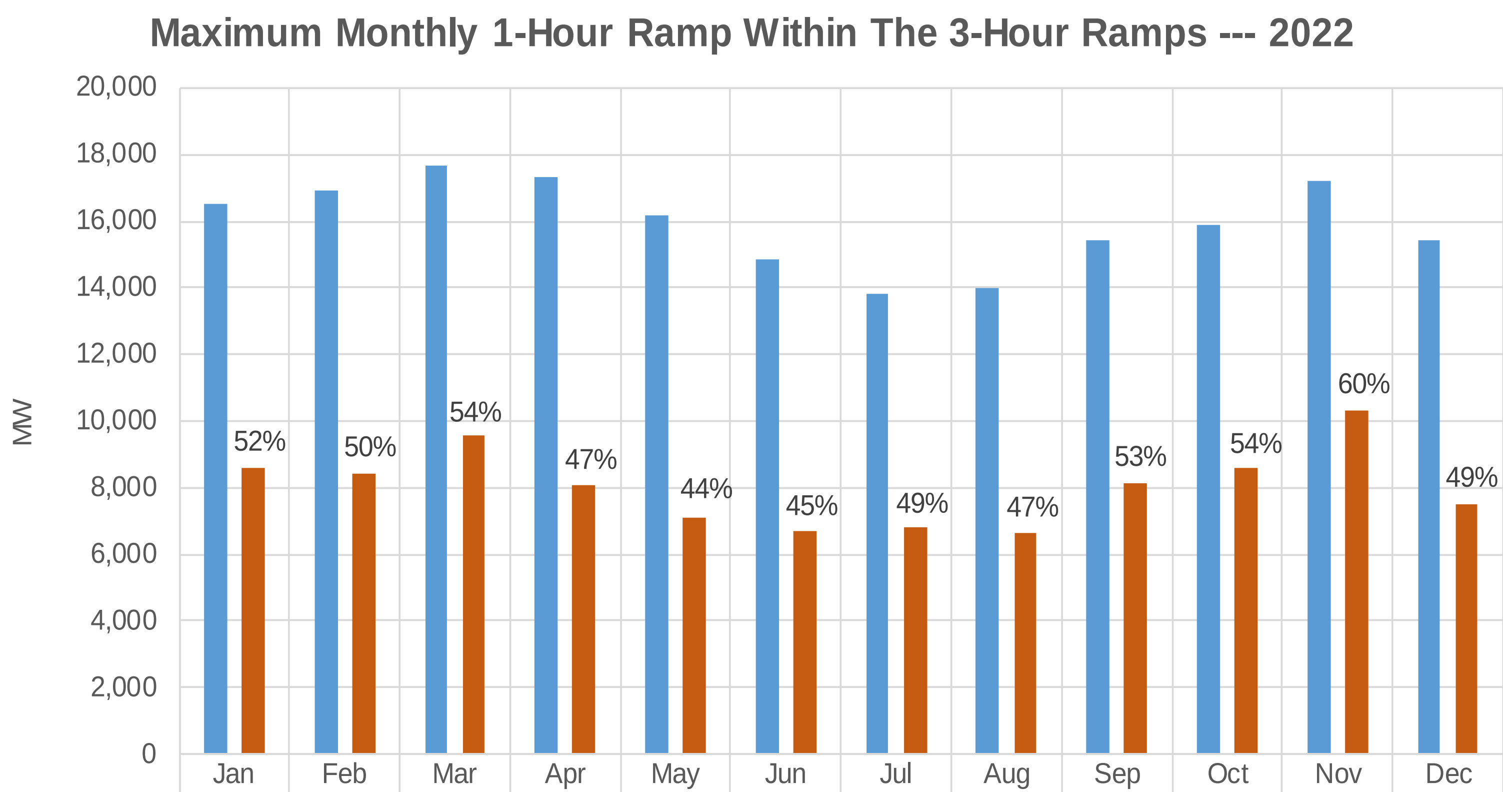
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2022 Actual Flex Capacity	18,405	18,492	19,180	18,882	17,762	16,724	15,420	16,178	17,757	17,795	18,867	17,151
2023 Actual Flex Capacity	18,971	19,411	18,153									
2024 Fcst Flex Capacity	23,583	23,925	24,446	23,817	23,485	23,897	20,651	22,018	23,135	22,655	23,081	20,900
2025 Fcst Flex Capacity	25,519	25,321	25,917	25,539	25,052	25,194	21,794	23,150	24,405	23,918	24,329	21,855
2026 FcstFlex Capacity	26,383	26,251	26,405	26,126	26,002	25,044	22,394	23,763	24,995	24,308	23,833	22,170

2020 forecast of 2022 three-hour ramps vs. actual with/without curtailments



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2022 Forecast	17,990	18,294	18,212	18,377	18,911	15,863	15,085	15,382	15,429	18,400	18,150	18,669
2022 Actual	17,255	17,342	18,030	17,710	16,559	15,265	13,938	14,520	15,935	16,578	17,717	16,001
2022 Actual + Curtail	17,260	20,402	21,358	20,233	17,524	15,302	14,076	14,604	15,994	18,918	18,382	17,266

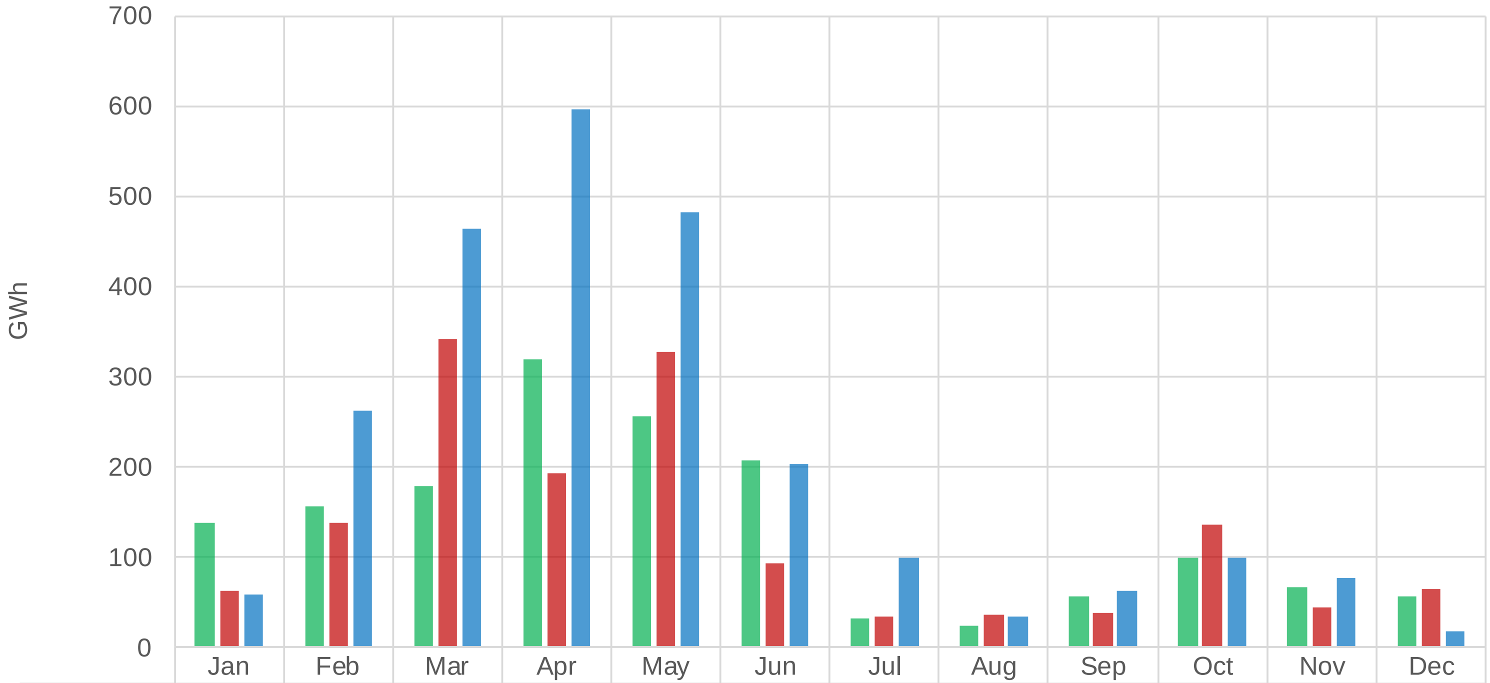
3-hour upward ramps can be more than 50% of the daily peak demand, indicating the need for faster ramping resources



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3-Hr Ramp	16,517	16,947	17,660	17,298	16,146	14,879	13,837	14,012	15,447	15,909	17,219	15,431
1-Hr Ramp	8,601	8,433	9,551	8,056	7,104	6,671	6,819	6,627	8,145	8,609	10,324	7,520

2020, 2021 & 2022: Higher levels of curtailments typically occur during the spring months

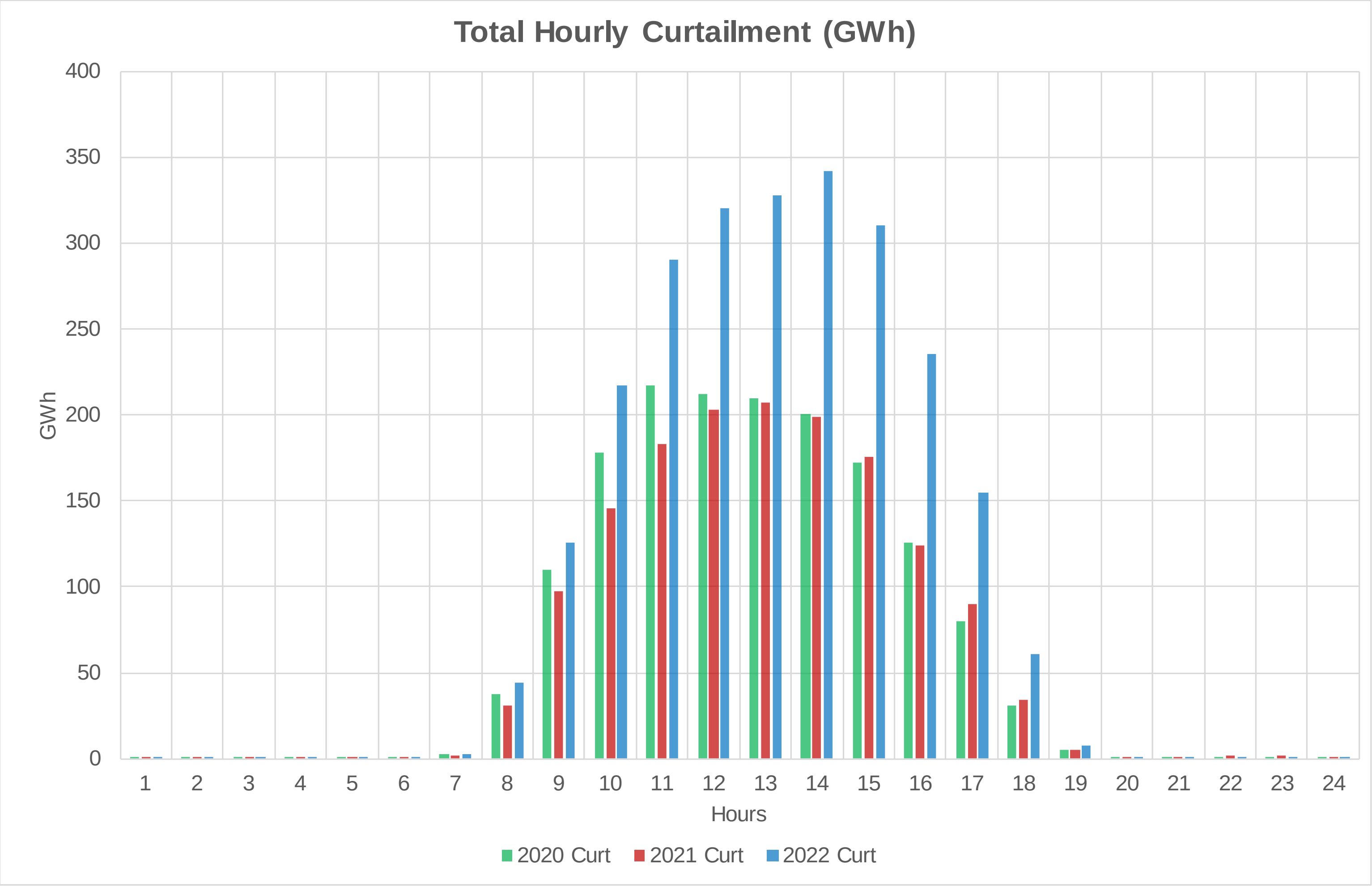
Monthly Curtailment (GWh)



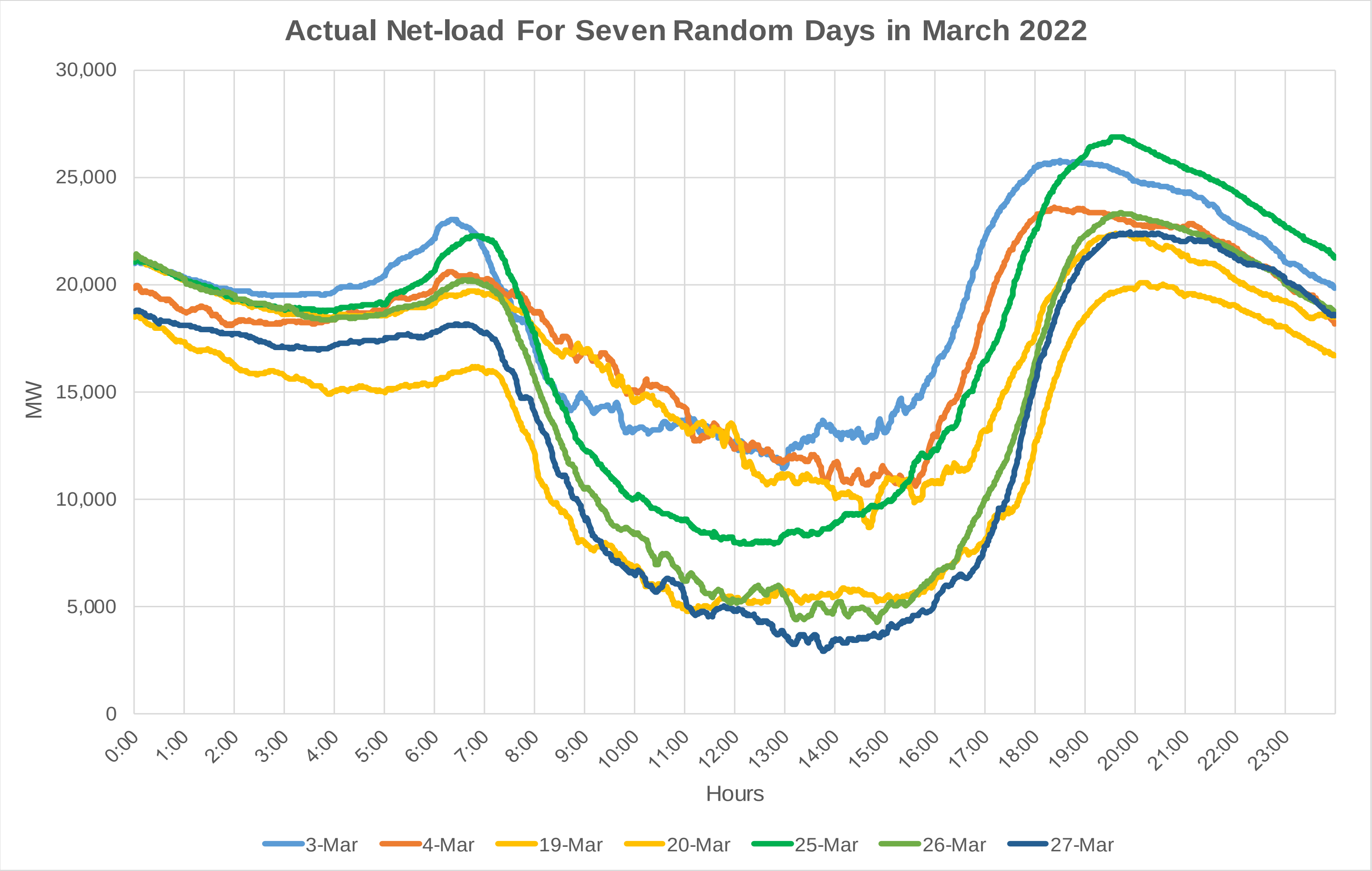
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020 Curt	138	157	179	318	255	206	31	23	57	99	67	56
2021 Curt	62	138	342	193	328	92	34	37	37	136	43	63
2022 Curt.	57	262	463	596	482	202	99	34	62	100	76	17

2020 Curt 2021 Curt 2022 Curt.

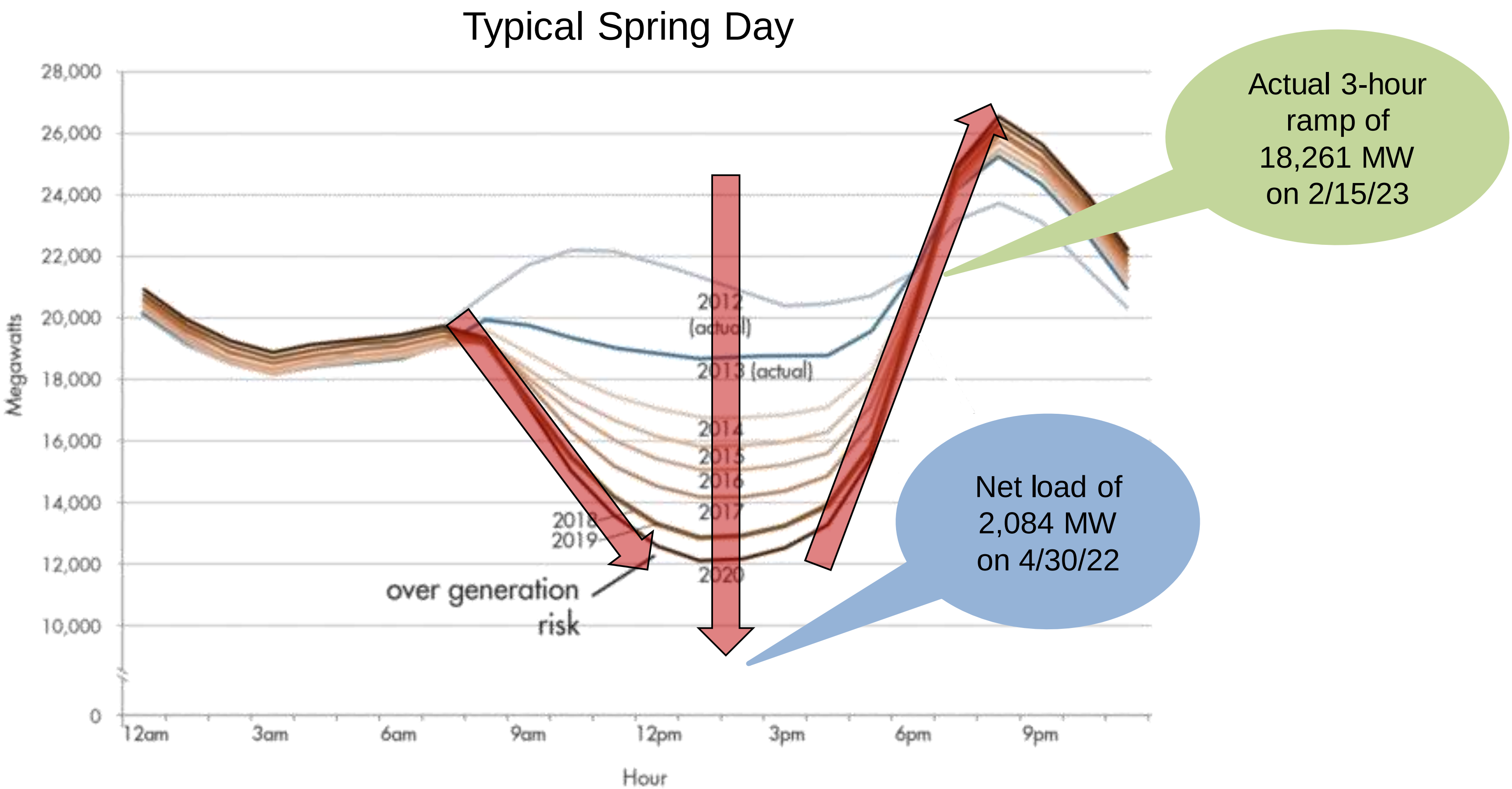
2020, 2021 & 2022: Higher levels of curtailments typically occur between sunrise and sunset



Example of actual net-load variability for seven random days in March 2022

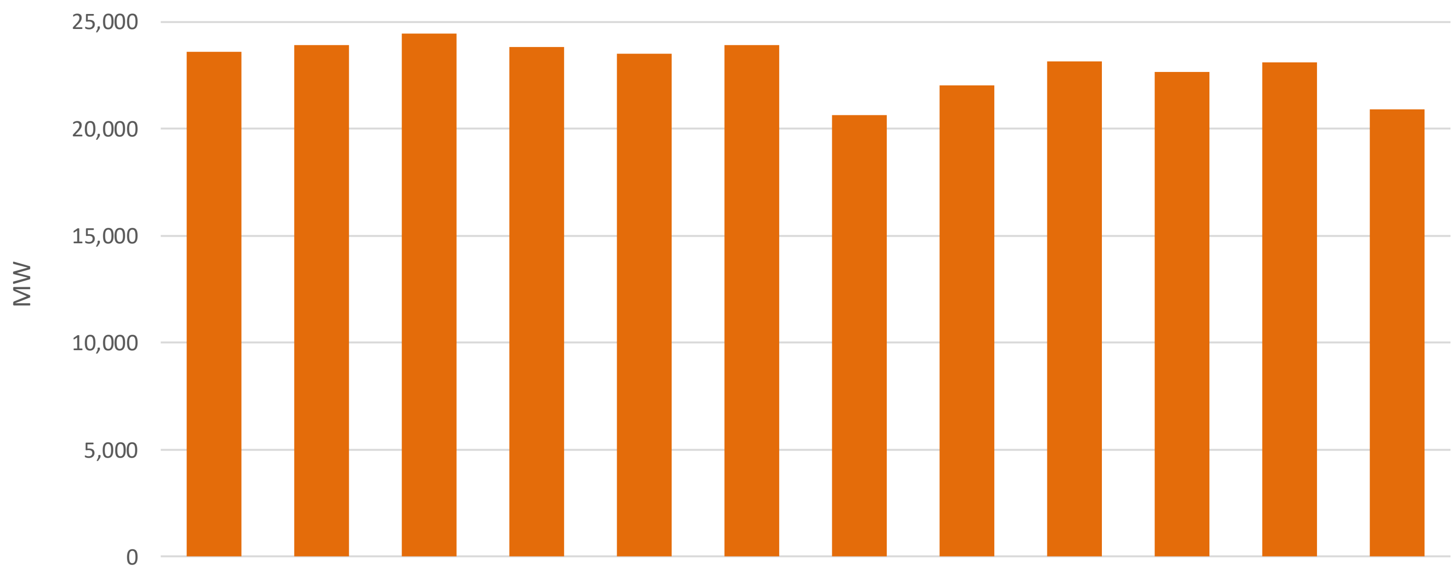


The actual net load and 3-hour ramps are years ahead of the ISO's original estimate primarily due to under forecasting rooftop solar PV installation



Forecasted monthly 2024 ISO system-wide flexible capacity needs

Forecasted monthly 2024 ISO system-wide flexible capacity needs*



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
flexneed	23,583	23,925	24,446	23,817	23,485	23,897	20,651	22,018	23,135	22,655	23,081	20,900

$$*\text{Flexibility Requirement}_{MTHy} = \text{Max}[(3RR_{HRx})_{MTHy}] + \text{Max}(MSSC,\ 3.5\%*E(PL_{MTHy})) + \varepsilon$$

Preliminary Results

Hong Zhou
Lead Market Development Analyst, Short-Term Forecasting

Jessica Stewart
Senior Energy Meteorologist, Short-Term Forecasting

Components of the flexible capacity needs

Month	Load contribution 2024	Wind contribution 2024	Solar contribution 2024	Total percent 2024
January	29.42%	-3.49%	-67.09%	100%
February	30.17%	0.78%	-70.61%	100%
March	25.39%	-0.94%	-73.68%	100%
April	28.49%	2.89%	-74.41%	100%
May	28.10%	-4.22%	-67.68%	100%
June	23.82%	-4.53%	-71.65%	100%
July	18.95%	4.58%	-85.64%	100%
August	20.35%	0.37%	-80.02%	100%
September	18.11%	-3.20%	-78.69%	100%
October	30.50%	-0.23%	-69.27%	100%
November	31.65%	-0.70%	-67.65%	100%
December	33.82%	-0.80%	-65.38%	100%

Δ Load – Δ Wind – Δ Solar = 100

Flexible capacity categories allow a wide variety of resources to provide flexible capacity

- Category 1 (Base Flexibility): Operational needs determined by the magnitude of the largest three-hour secondary net load ramp
- Category 2 (Peak Flexibility): Operational need determined by the difference between 95 percent of the maximum three-hour net load ramp and the largest three-hour secondary net load ramp
- Category 3 (Super-Peak Flexibility): Operational need determined by five percent of the maximum three-hour net load ramp of the month

Seasonal breakout of flexible capacity needs

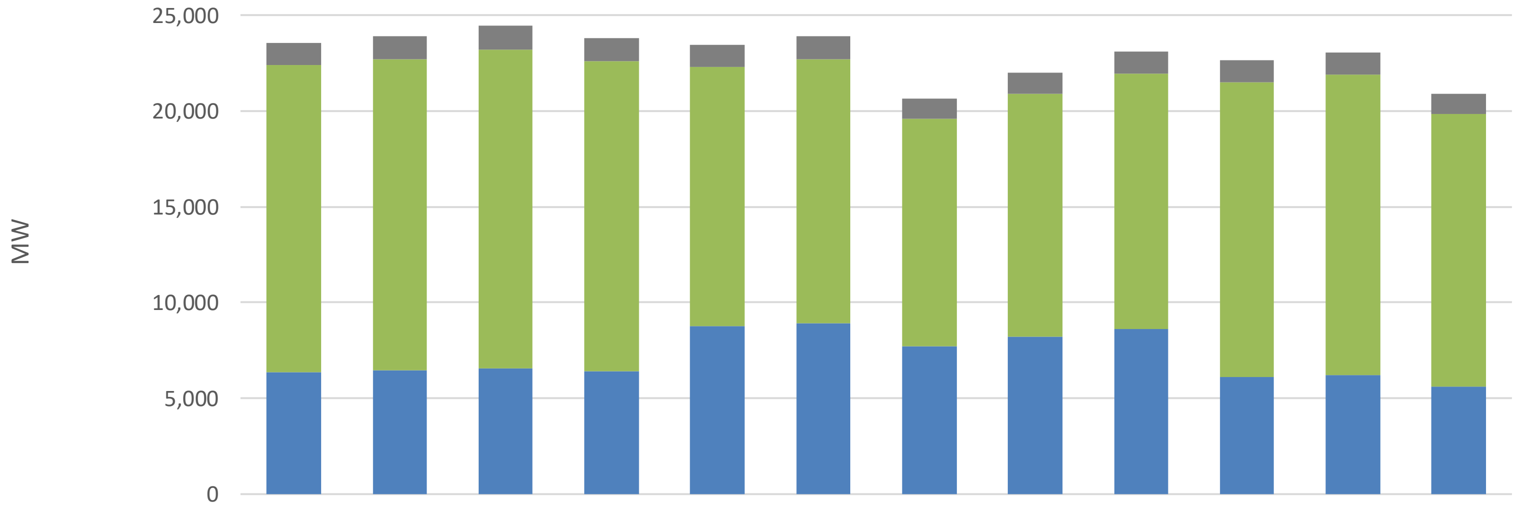
	Actual Contributions			Seasonal Contribution		
	Unadjusted			Adjusted		
Month	Base Flexibility	Peak Flexibility	Super-Peak Flexibility	Base Flexibility	Peak Flexibility	Super-Peak Flexibility
January	28%	67%	5%	27%	68%	5%
February	21%	74%	5%	27%	68%	5%
March	29%	66%	5%	27%	68%	5%
April	31%	64%	5%	27%	68%	5%
May	28%	67%	5%	37%	58%	5%
June	36%	59%	5%	37%	58%	5%
July	41%	54%	5%	37%	58%	5%
August	44%	51%	5%	37%	58%	5%
September	37%	58%	5%	37%	58%	5%
October	28%	67%	5%	27%	68%	5%
November	23%	72%	5%	27%	68%	5%
December	27%	68%	5%	27%	68%	5%

Increased weighting observed in Peak Category

Month	2021	2022	2023	2024
January	57.30%	55.06%	62.74%	68.11%
February	57.30%	55.06%	62.74%	68.11%
March	57.30%	55.06%	62.74%	68.11%
April	57.30%	55.06%	62.74%	68.11%
May	45.62%	45.39%	49.28%	57.75%
June	45.62%	45.39%	49.28%	57.75%
July	45.62%	45.39%	49.28%	57.75%
August	45.62%	45.39%	49.28%	57.75%
September	45.62%	45.39%	49.28%	57.75%
October	57.30%	55.06%	62.74%	68.11%
November	57.30%	55.06%	62.74%	68.11%
December	57.30%	55.06%	62.74%	68.11%

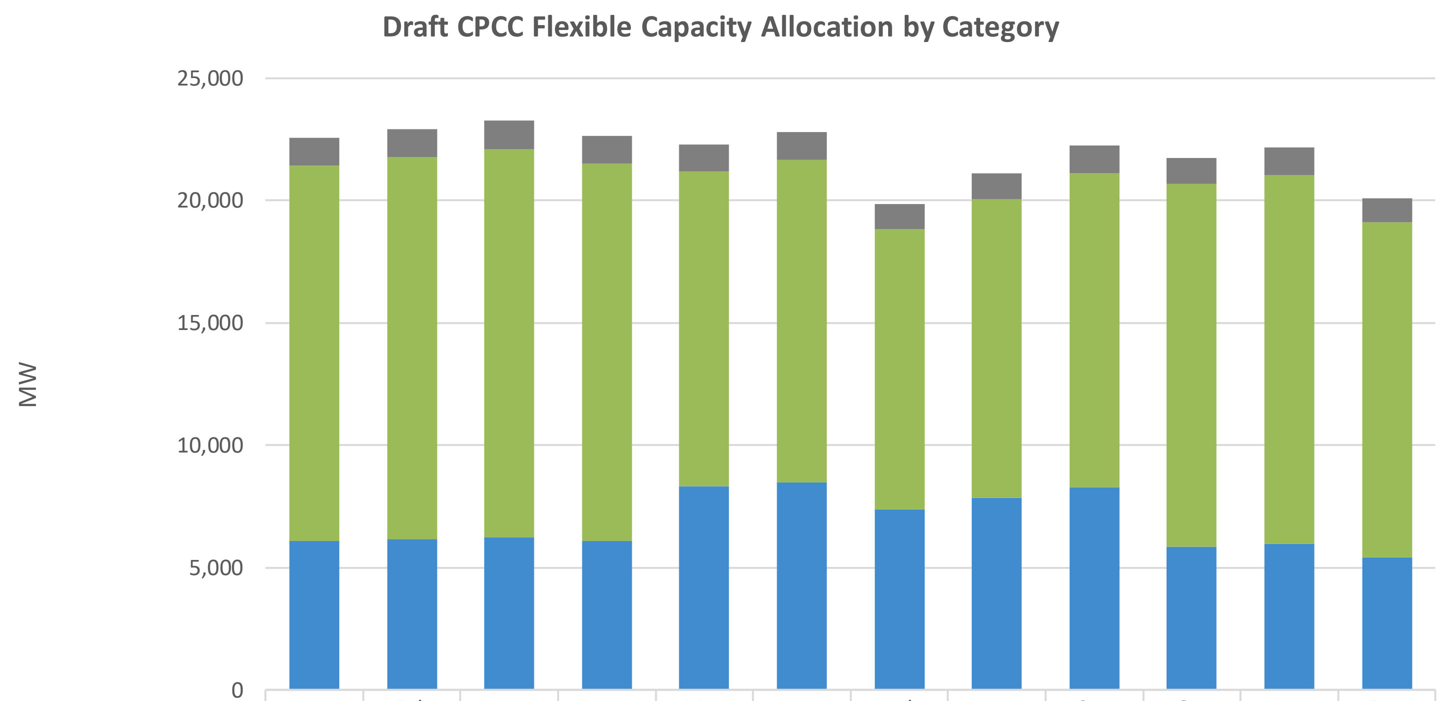
Total flexible capacity needed in each category – seasonally adjusted

Total Flexible Capacity Needed in Each Category - Adjusted



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Super-Peak Flexibility	1,179	1,196	1,222	1,191	1,174	1,195	1,033	1,101	1,157	1,133	1,154	1,045
Peak Flexibility	16,062	16,296	16,650	16,222	13,564	13,802	11,927	12,716	13,361	15,430	15,720	14,235
Base Flexibility	6,341	6,434	6,574	6,404	8,747	8,901	7,692	8,201	8,617	6,092	6,206	5,620

CPUC jurisdictional flexible capacity allocation - by flexible capacity category



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Super-Peak Flexibility	1,128	1,145	1,162	1,132	1,115	1,139	992	1,054	1,111	1,087	1107	1005
Peak Flexibility	15,361	15,604	15,833	15,422	12,875	13,154	11,456	12,179	12,837	14,811	15083	13685
Base Flexiblity	6,065	6,160	6,251	6,089	8,303	8,483	7,388	7,854	8,278	5,847	5955	5403

Start time of three-hour net load ramp to evaluate seasonal must offer obligations

	Three Hour Net Load Ramp Start Hour				
Month	**HE14**	**HE15**	**HE16**	**HE17**	**HE18**
January	4	27			
February		22	6		
March		2	15	14	
April				29	1
May				30	1
June				26	4
July			2	29	
August		1	7	23	
September		1	25	4	
October		10	21		
November	10	19	1		
December	4	27			

Seasonal must-offer obligations for peak and super-peak flexible capacity

- Recommended must-offer obligation hours in hour ending

	Jan	Feb	Mar	Apr	Mar	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HE15-HE19	x	X									x	X
HE16-HE20									x	x		
HE17-HE21			x	x	x	x	x	x				

Review of preliminary assessment results

- Flexible Capacity need is largest in January through June
  - Flexible capacity makes up a greater percentage of resource adequacy needs during the off-peak months
  - Increase almost exclusively caused by three-hour ramp, not increase in peak load
- Peak category has heavier weight this year
- The CEC IEPR hourly demand forecast, growth of behind-the-meter solar PV, and PV contributes to the larger flexible capacity requirements
- Using the ISO flexible capacity contribution calculation majority of three-hour net load ramps are attributable to CPUC jurisdictional LSEs
- The Peak and Super-Peak MOO hours have not changed from the 2022 study (information below is in Hour Ending)
  - November through February: HE 15- HE 19 (2:00 p.m. to 7:00 p.m.)
  - March through August: HE 17 – HE 21 (4:00 p.m. to 9:00 p.m.)
  - September through October: HE 16- HE 20 (3:00 p.m. to 8:00 p.m.)

AVAILABILITY ASSESSMENT HOURS

Availability assessment hours: Background and purpose

- Concept originally developed as part of the ISO standard capacity product (SCP)
  - Maintained as part of Reliability Service Initiative – Phase 1 (i.e. RA Availability Incentive Mechanism, or RAAIM)
- Determine the hours of greatest need to maximize the effectiveness of the availability incentive structure
  - Resources are rewarded for availability during hours of greatest need
  - Hours determined annually by ISO and published in the BPM
    - See section 40.9 of the ISO Tariff

Methodology overview of system/local availability assessment hours

- Used CEC IEPR data described in previous slides to obtain:
  - Hourly Average Load
    - By Hour, by month
    - Years 2022-2026
  - No adjustments made to CEC IEPR for AAH analysis

- Calculated:
  - Top 5% of Load Hours within each month using an hourly load distribution
  - Years 2024 – 2026

- Last year the ISO proposed the addition of Spring season

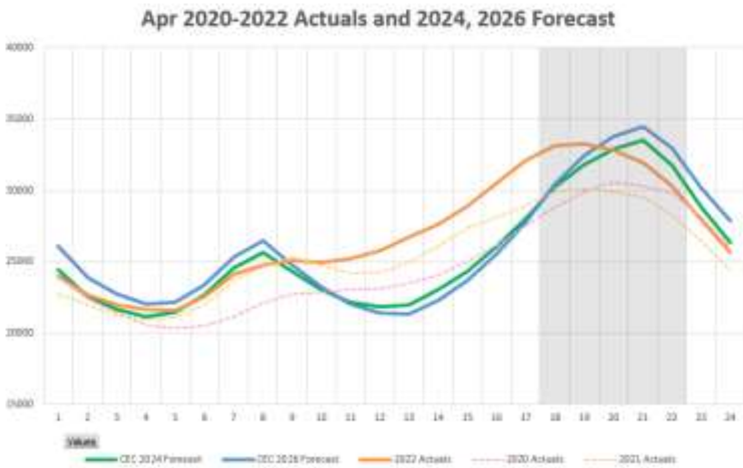
The ISO proposes adding May to the spring AAH season

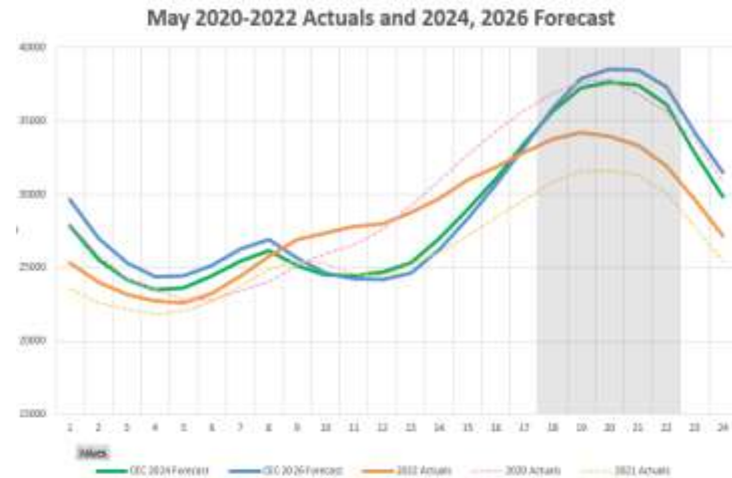
- Last year the ISO proposed the addition of a spring season with AAH hour-ending 18-22
- Load actuals still support the months of March and April having a later top 5% of load hours, with the addition of May

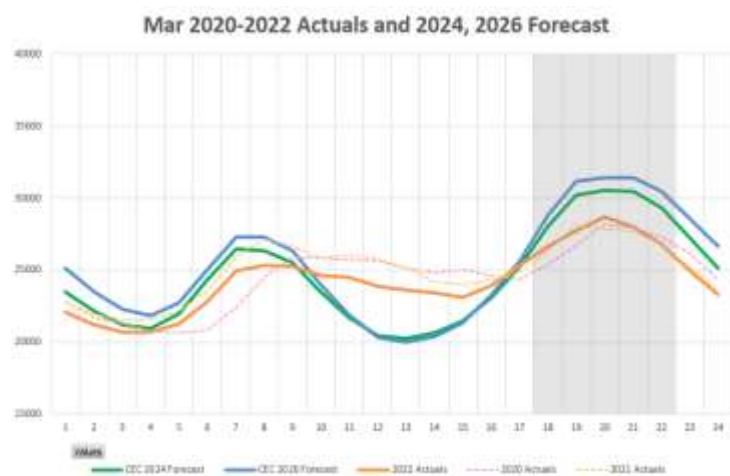
MONTH / Hour	7	8	9	10	11	13	14	15	16	17	18	19	20	21	22	23
Jan											10	***18***	7	2		
Feb	2	2									2	***17***	6	3	1	
Mar											2	12	***16***	5	2	
Apr							1	2	2	2	3	4	***8***	***8***	4	2
May							1	1	2	3	4	6	***8***	***8***	3	1
Jun									4	7	***8***	7	7	3		
Jul								1	3	5	9	***10***	6	3		
Aug									3	6	***13***	10	3	2		
Sep						1	2	3	***6***	***6***	***6***	5	4	3		
Oct									4	6	***9***	***9***	8	1		
Nov				1	1						***13***	***13***	8			
Dec		1	1								***11***	***11***	7	5	1	
Grand Total	**2**	**3**	**1**	**1**	**1**	**1**	**4**	**7**	**24**	**35**	**90**	**122**	**88**	**43**	**11**	**3**

Month	Season
Jan	winter
Feb	winter
Mar	spring
Apr	spring
May	spring
Jun	summer
Jul	summer
Aug	summer
Sep	summer
Oct	summer
Nov	winter
Dec	winter

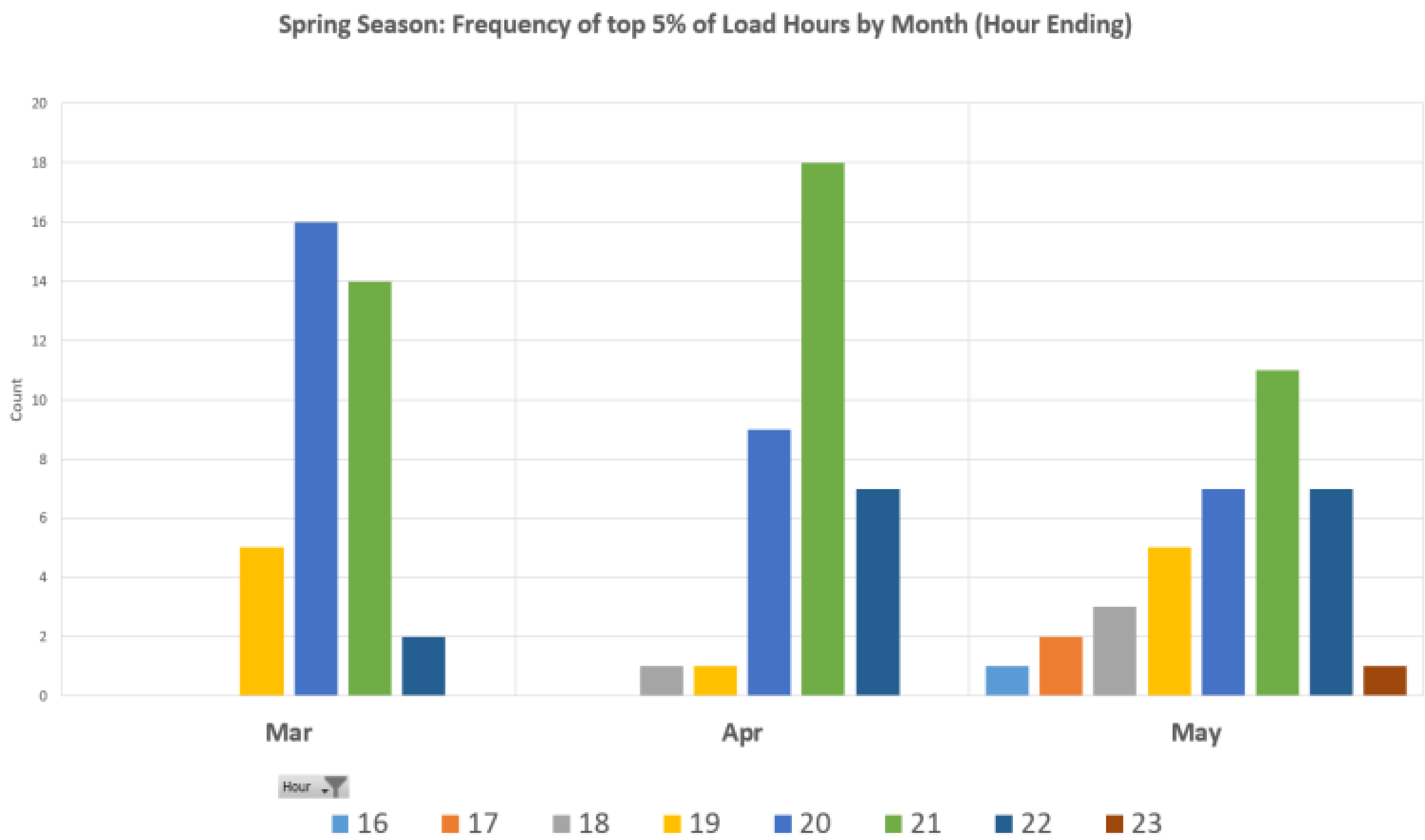
CEC forecast and previous actuals still indicate a shift in top load hours for March and April, as well as May



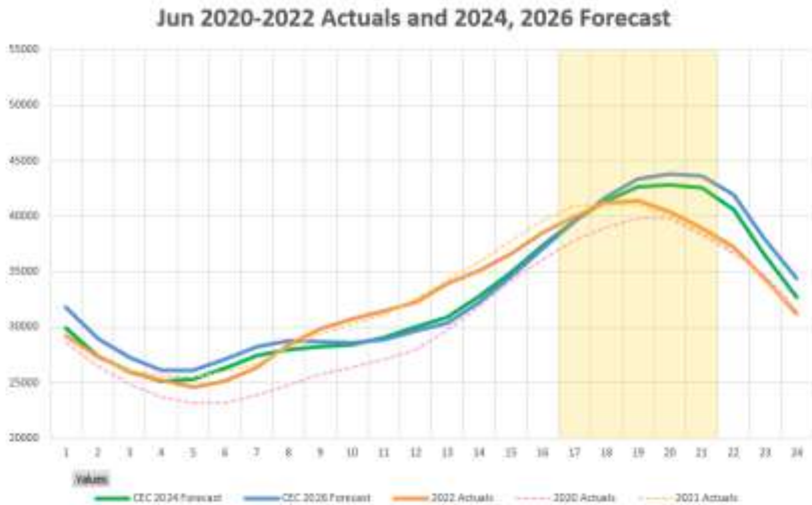


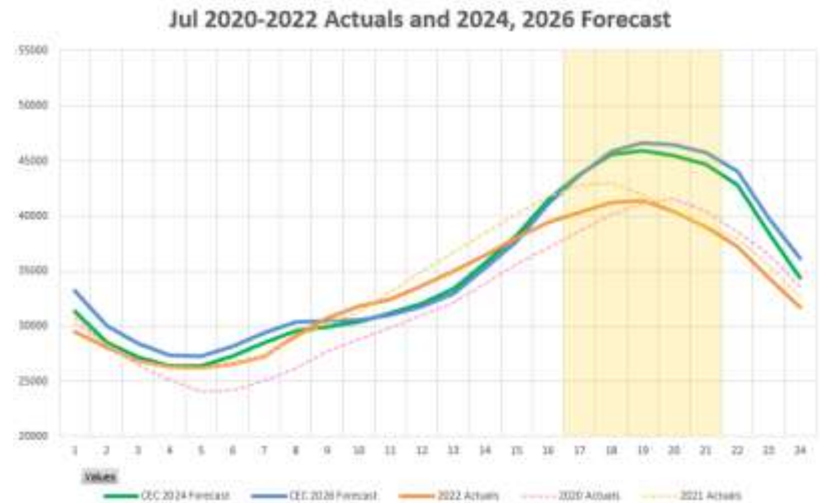


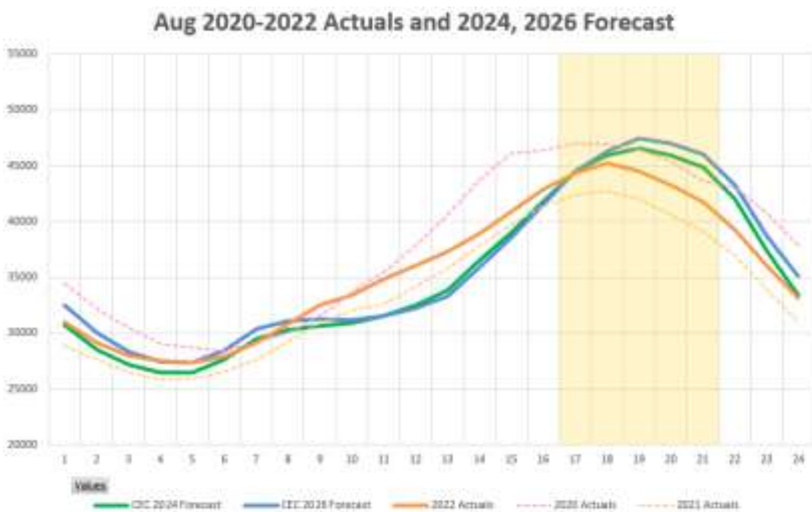
Spring Season
2024 top 5% of load hours (HE)

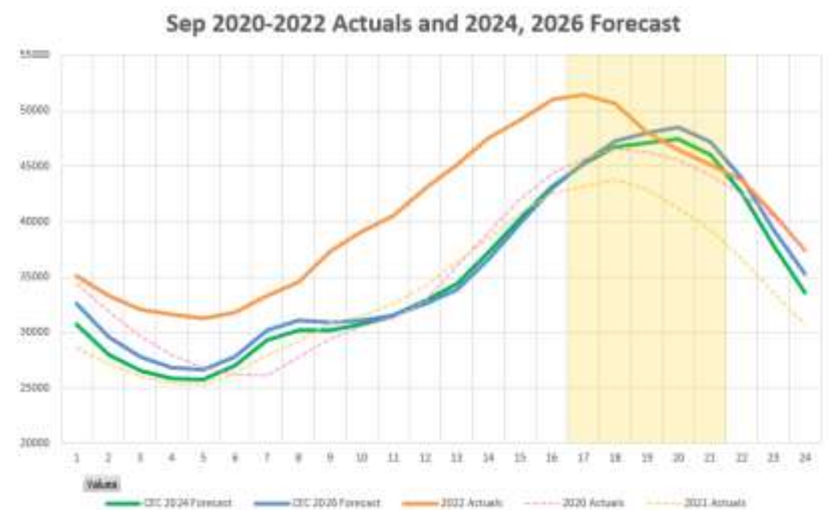


Summer seasonal load shapes and proposed AAH

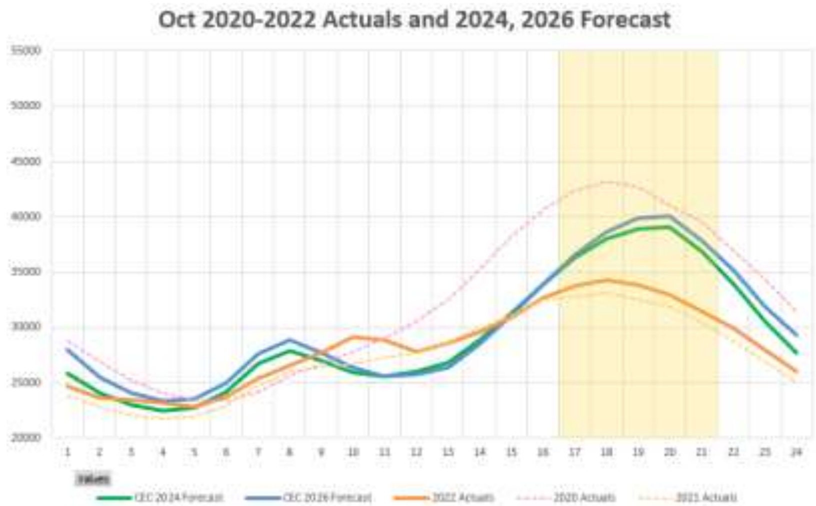




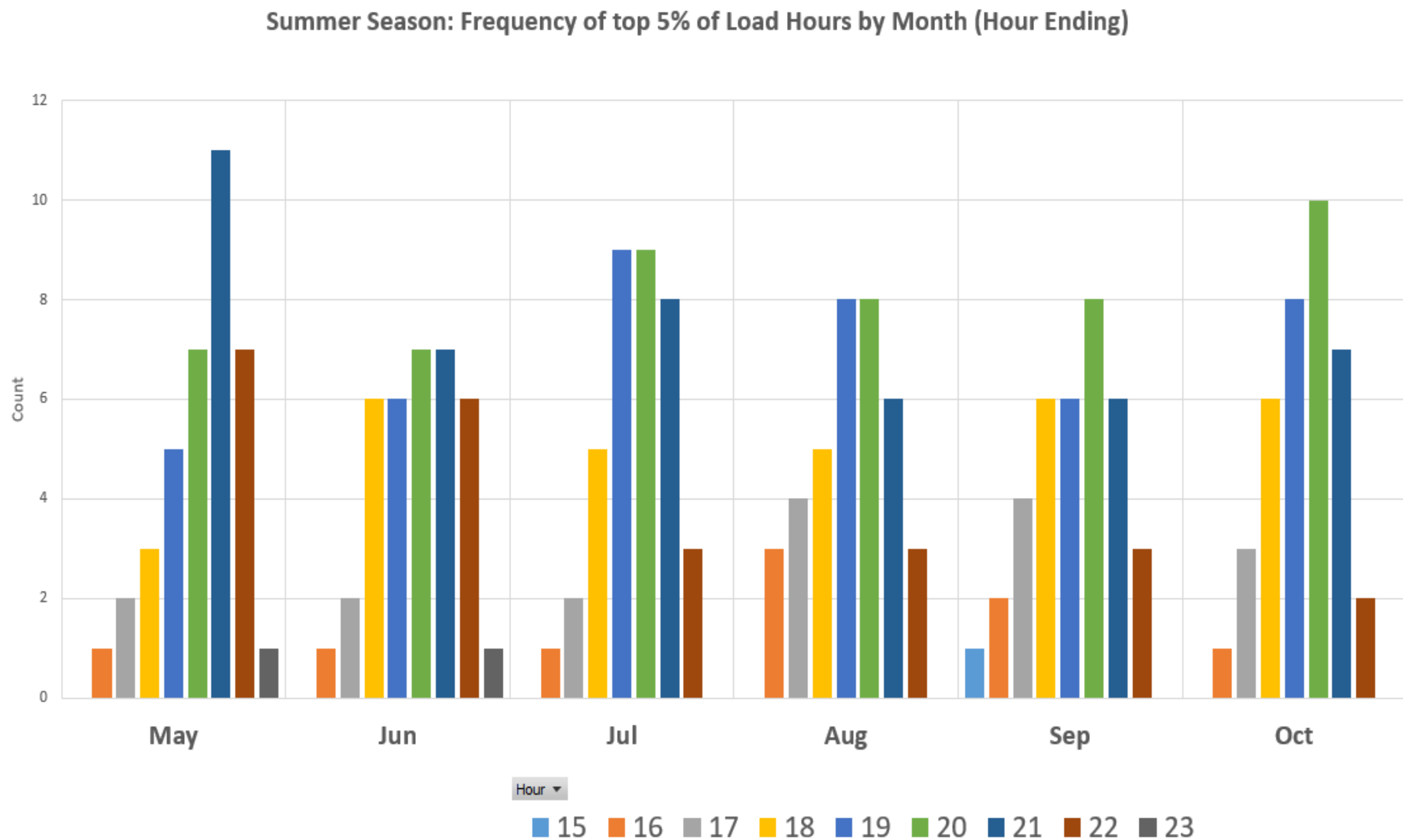




Summer seasonal load shapes and proposed AAH cont.

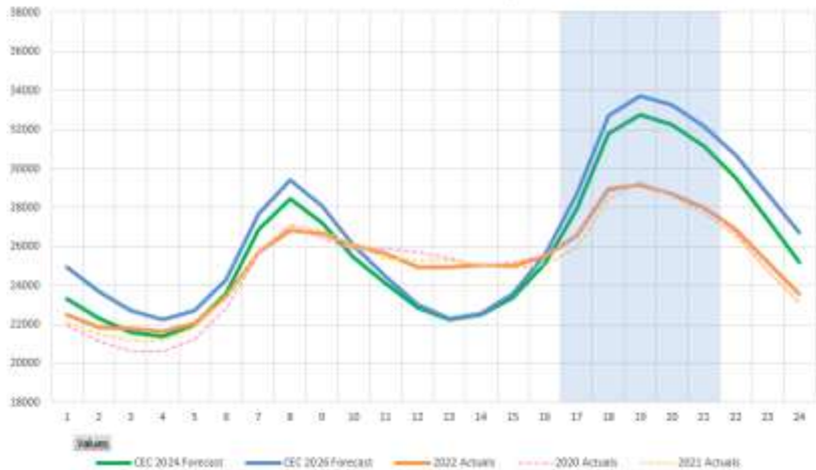


Summer Season
2024 top 5% of load hours (in HE)

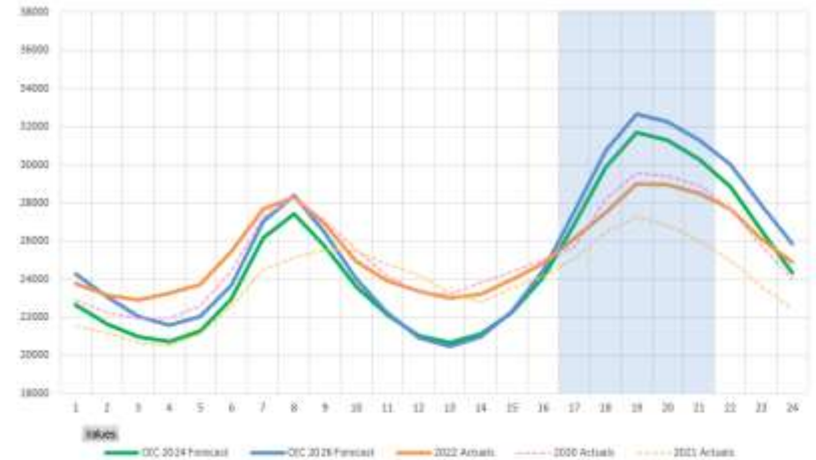


Winter seasonal load shapes and proposed AAH

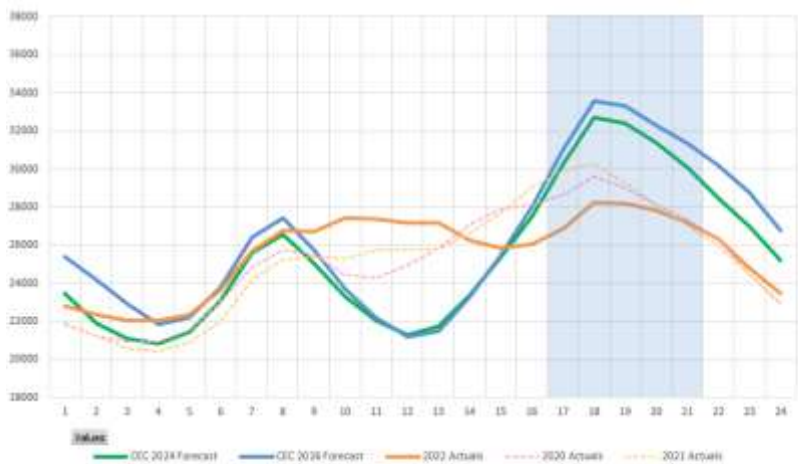
Jan 2020-2022 Actuals and 2024, 2026 Forecast



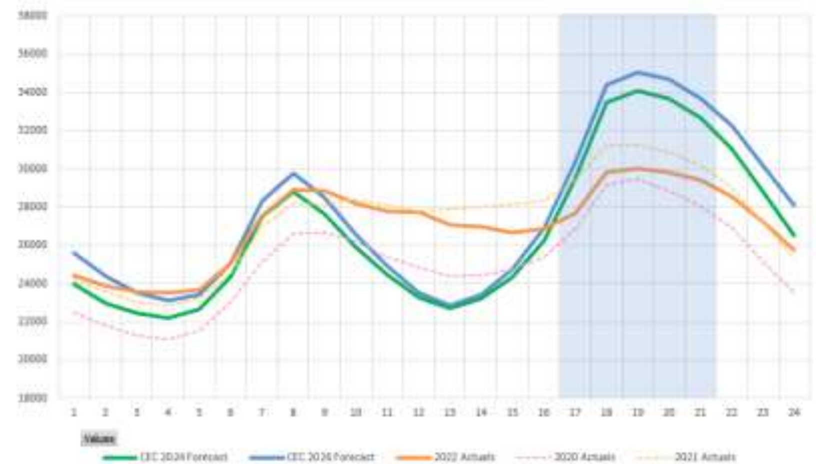
Feb 2020-2022 Actuals and 2024, 2026 Forecast



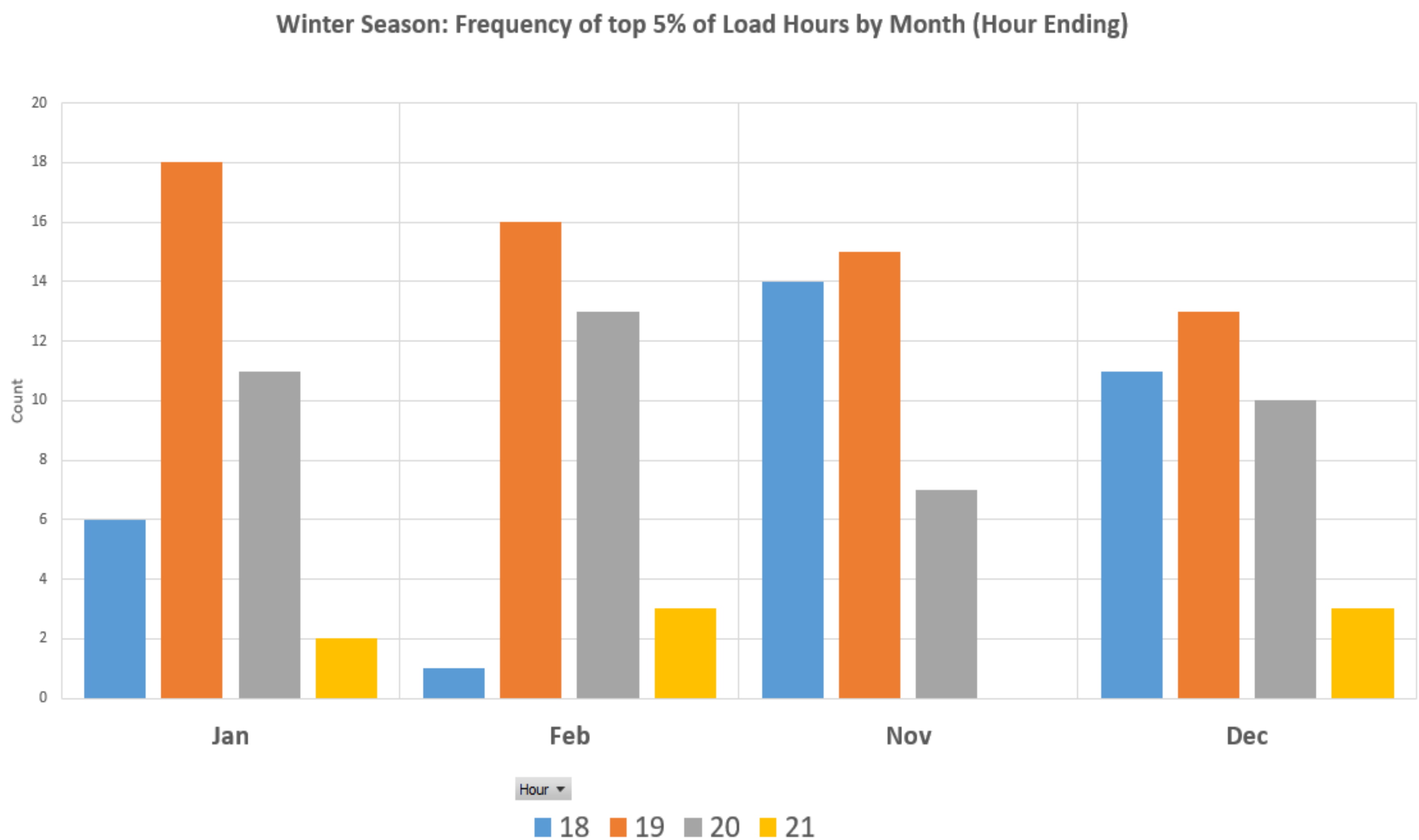
Nov 2020-2022 Actuals and 2024, 2026 Forecast



Dec 2020-2022 Actuals and 2024, 2026 Forecast



Winter Season
2024 top 5% of load hours (HE)



Availability assessment hours draft recommendation

Winter and Summer Season Draft Recommendation

Jan-Feb, Nov-Dec; Jun-Oct (also includes May for 2023)

Year	Start	End
2023 (Final)	HE 17	HE 21
2024 (Draft)	HE 17	HE 21
2025 (Estimate)	HE 17	HE 21
2026 (Estimate)	HE 17	HE 21

Spring Season Draft Recommendation

Mar-Apr for 2023; Mar-May for 2024-2026

Year	Start	End
2023 (Final)	HE 18	HE 22
2024 (Draft)	HE 18	HE 22
2025 (Estimate)	HE 18	HE 22
2026 (Estimate)	HE 18	HE 22

Reliability Requirements; Section 7 – BPM Updates Needed

<u>2024 System and Local Resource Adequacy Availability Assessment Hours</u>

Analysis employed: Top 5% of load hours using average hourly load

<u>Spring: March 1 – May 31</u>

Availability Assessment Hours: 5pm – 10pm (HE18 – HE22)

<u>Summer: June 1 - October 31</u>

Availability Assessment Hours: 4pm – 9pm (HE17 – HE21)

<u>Winter: November 1 - February 28</u>

Availability Assessment Hours: 4pm – 9pm (HE17 – HE21)

<u>2024 Flexible Resource Adequacy Availability Assessment Hours and must offer obligation hours</u>

Flexible RA Capacity Type	Category Designation	Required Bidding Hours	Required Bidding Days
January – February November – December			
Base Ramping	Category 1	5:00am to 10:00pm (HE6-HE22)	All days
Peak Ramping	Category 2	2:00pm to 7:00pm (HE15-HE19)	All days
Super-Peak Ramping	Category 3	2:00pm to 7:00pm (HE15-HE19)	Non-Holiday Weekdays*
March – August			
Base Ramping	Category 1	5:00am to 10:00pm (HE6-HE22)	All days
Peak Ramping	Category 2	4:00pm to 9:00pm (HE17-HE21)	All days
Super-Peak Ramping	Category 3	4:00pm to 9:00pm (HE17-HE21)	Non-Holiday Weekdays*
September – October			
Base Ramping	Category 1	5:00am to 10:00pm (HE6-HE22)	All days
Peak Ramping	Category 2	3:00pm to 8:00pm (HE16-HE20)	All days
Super-Peak Ramping	Category 3	3:00pm to 8:00pm (HE16-HE20)	Non-Holiday Weekdays*

Next steps

Please use the stakeholder Commenting Tool to submit comments by May 10, 2023

- Published Draft Flexible Capacity Needs Assessment and Draft AAH for 2024 on April 24, 2023

- Publish Final Flexible Capacity Needs Assessment and AAH for 2024 on May 17th, 2023

Flexible Capacity Needs Assessment – 2024 Stakeholder page

Questions

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  http://www.caiso.com/about/Pages/Blog/default.aspx.

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April 13, 2023
Inside the California ISO, Operations

ISO forecasters honored for work on probabilistic solar forecasting

Two California ISO forecasters, Amber Motley and Rebecca Webb, have won a 2022 EPRI Technology Transfer Award for their work examining how probabilistic solar forecasts could be used to support the successful integration of solar power.

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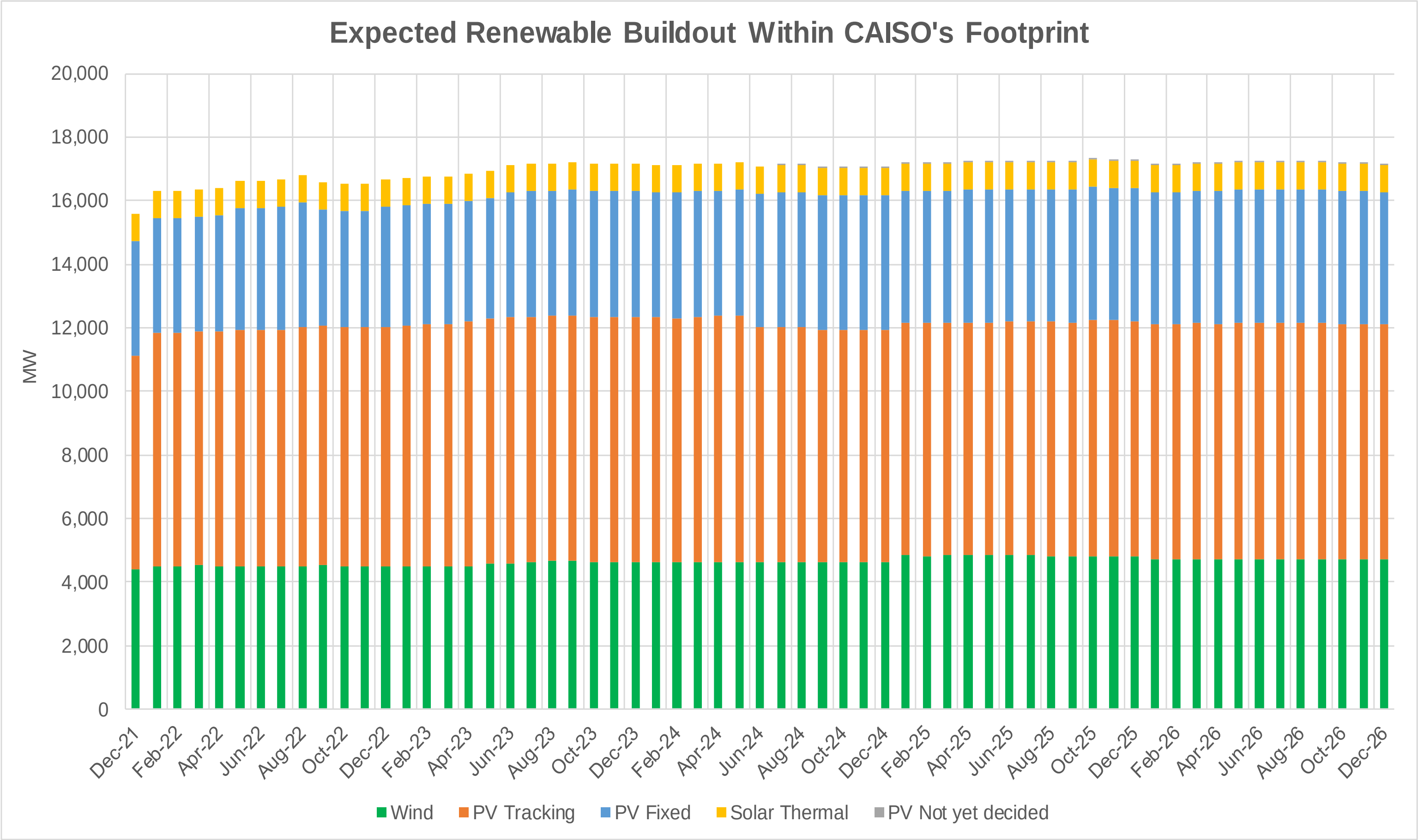
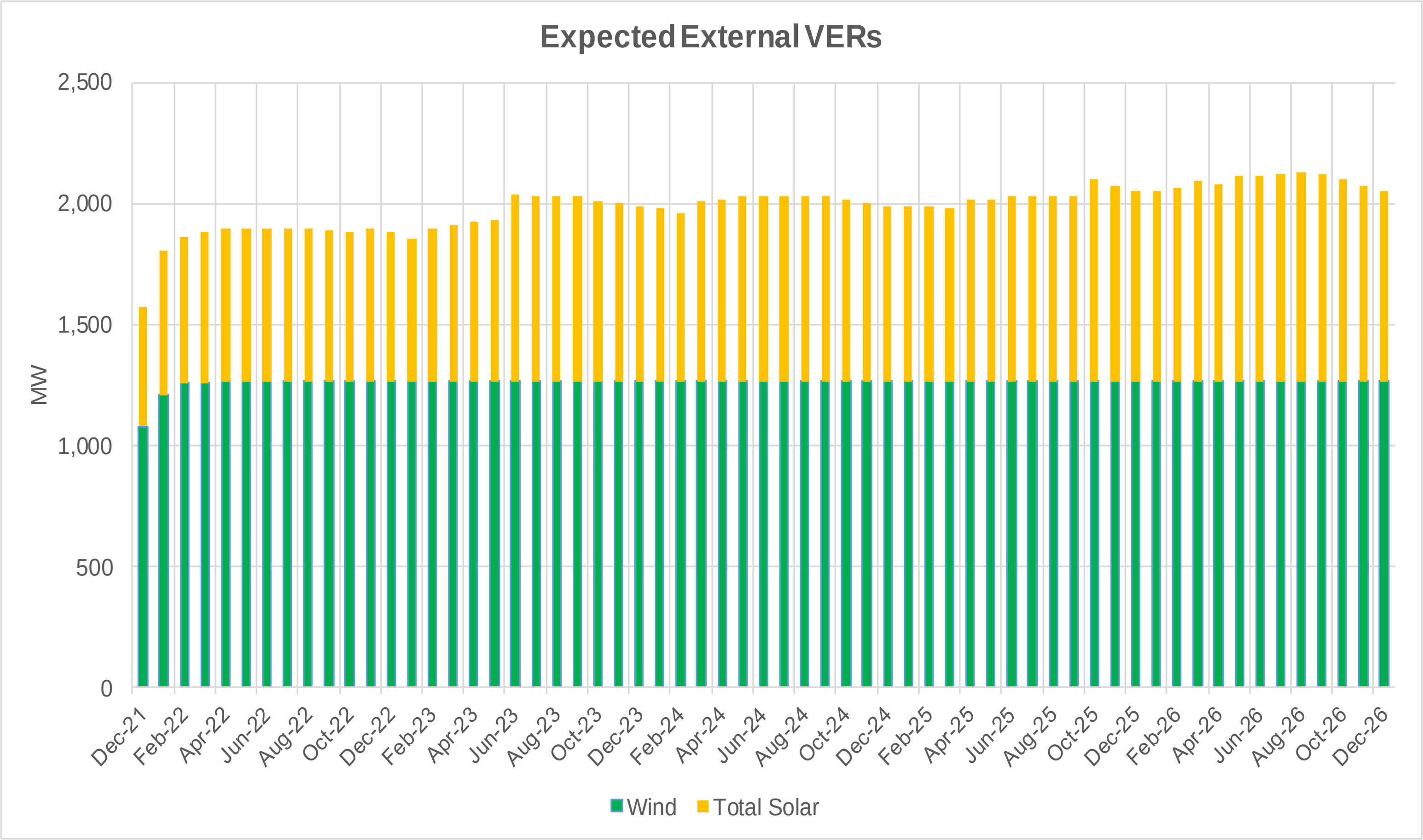
Appendix

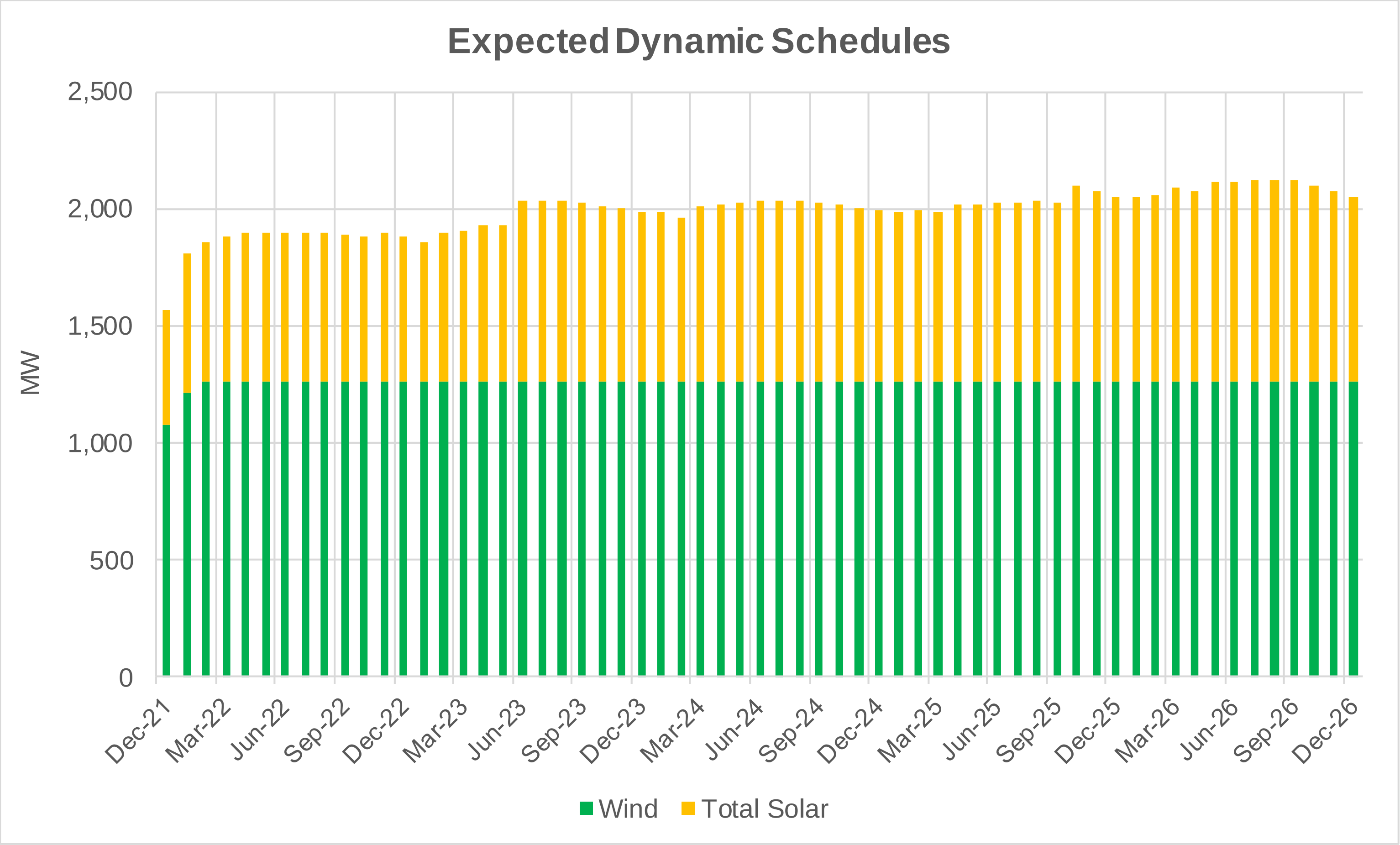
Expected renewable buildout through December 2026 based on LSE’s submittal



Expected wind/solar resources located outside the ISO which are contracted by LSE within the ISO

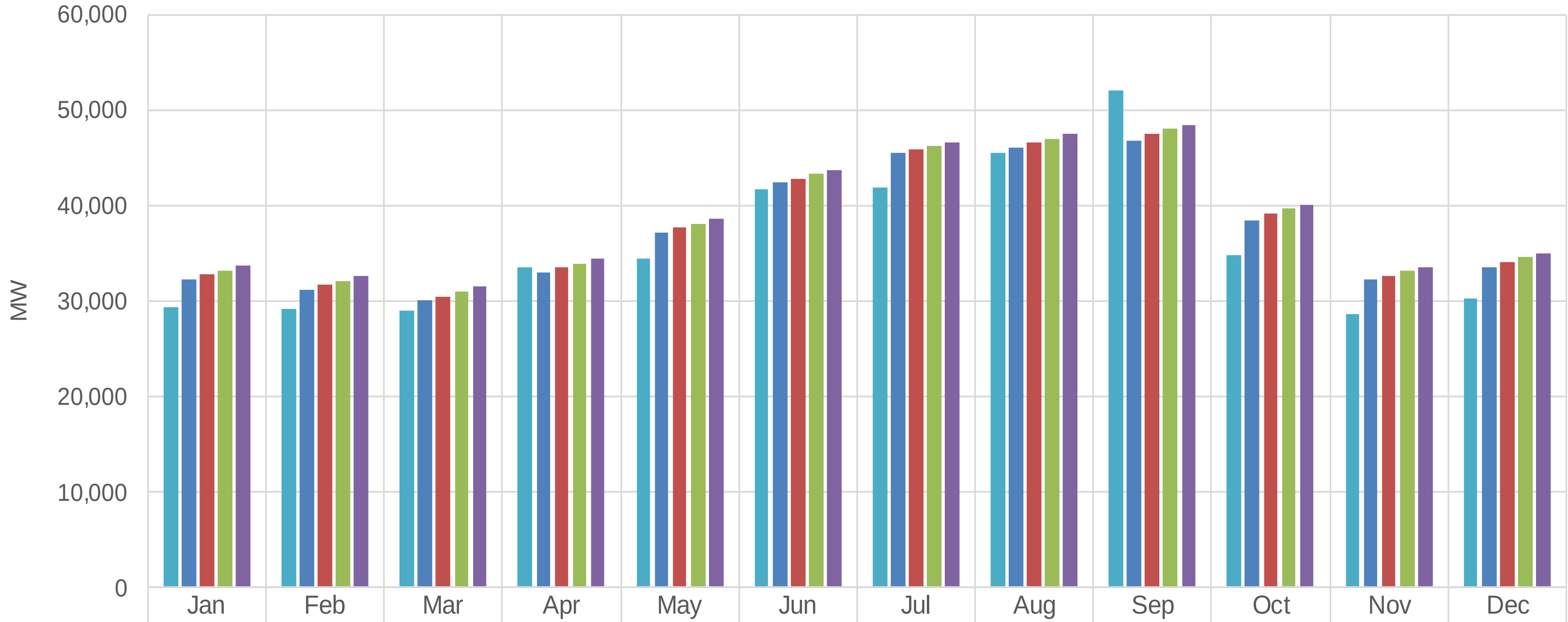


Expected dynamically scheduled wind/solar resources from external resources shown in the previous slide



CEC’s (1-in-2) ISO monthly coincident peak forecast

CEC's Maximum Monthly Forecast vs. 2022 Actual



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2022 Act.	29,402	29,222	28,961	33,486	34,382	41,680	41,841	45,488	52,055	34,764	28,555	30,265
2023 Fct.	32,221	31,178	30,021	32,996	37,121	42,354	45,510	46,074	46,829	38,497	32,216	33,561
2024 Fct.	32,749	31,689	30,518	33,532	37,679	42,791	45,938	46,569	47,475	39,078	32,705	34,108
2025 Fct.	33,200	32,157	30,966	33,963	38,133	43,311	46,300	46,951	47,987	39,634	33,147	34,585
2026 Fct.	33,727	32,670	31,458	34,478	38,567	43,774	46,669	47,449	48,487	40,080	33,562	35,077

2022 Act. 2023 Fct. 2024 Fct. 2025 Fct. 2026 Fct.