Slice of Day Workshops (D.21-07-014)

September 22, 2021

Together, Building a Better California

Desired Outcomes for Workshop #1

- **Review CPUC principles / evaluation criteria**
- **Refresher on slice-of-day concept**
- **Frame (all) issues that need to be addressed**

Principles / Evaluation Criteria

Common Task At Hand

Develop an appropriate RA program structure that delivers system reliability and can be implemented in the near-term

Main stakeholders:

- California Public Utilities Commission (CPUC)
- California Independent System Operator (CAISO)
- California Energy Commission (CEC)
- Suppliers
- Load Serving Entities (LSE)
- Consumer Advocates
- Environmental Organizations

CPUC Principles / Evaluation Criteria

As directed by the CPUC in D.21-07-014:

1. Balance a Reliable Electrical Grid with Minimizing Costs to Customers
2. Balance Addressing Hourly Energy Sufficiency with Advancing Environmental Goals
3. Balance Granularity in Meeting Hourly Needs with Simplicity and Transactability
4. Implementable in the Near-Term (2024)
5. To be durable and adaptable to a changing electric grid

Considerations

From D.21-07-014:

- Consider compatibility with existing Commission planning goals and programs, such as the Integrated Resource Plan and Renewables Portfolio Standard proceedings

- The proposed decision provided flexibility for consideration of aspects of the net load duration proposal alongside slice-of-day approach

- Workshops shall also cover the transactability of RA products, multi-day reliability event concerns, and alignment of RA compliance penalties and CAISO backstop procurement

Overview of “Slice-of-Day” Concept

Summary: Slice-of-Day Proposal

Key Objectives:

- Reforms the RA program to address **near-term** (net peak load) and **long-term** (reliability in all hours of day) **RA issues**
- Structures the RA program to recognize the **energy-limited nature** of the evolving resource mix
- Balance increases in administrative burden in some areas with decreases in administrative burden in other areas

Key Changes:

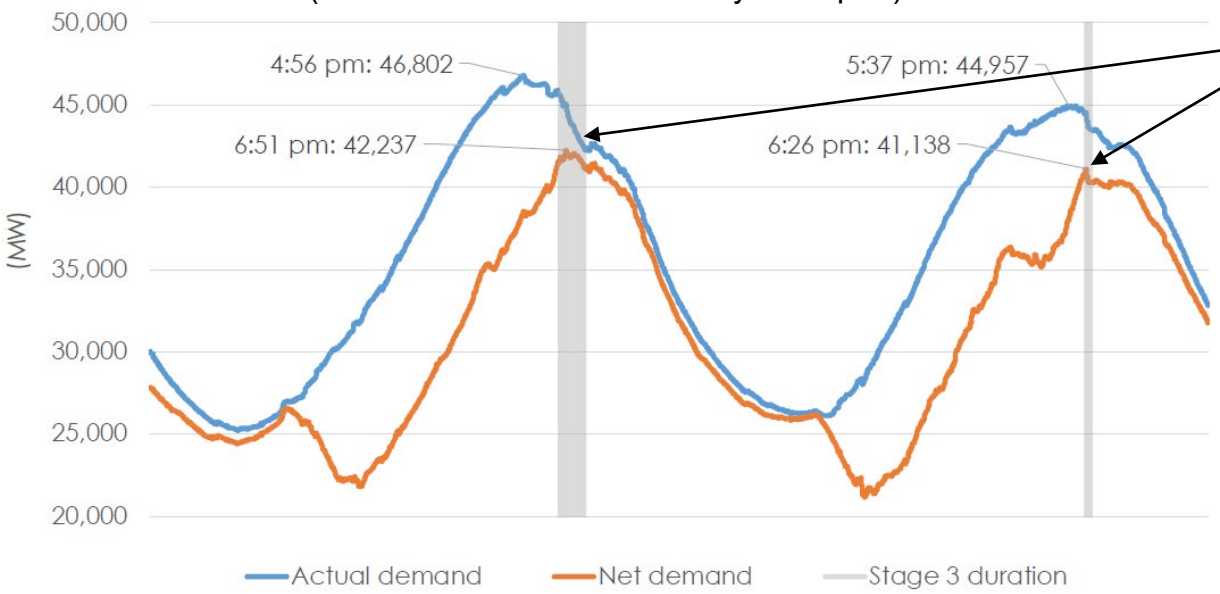
- **Multiple RA requirements over the course of the day**
- **Potentially seasonal requirements in lieu of monthly requirements**
- **Exceedance methodology for some resources**
- **Incorporates energy storage charging needs**

Background: Slice-of-Day Proposal

The RA program must evolve to address demand in all hours of the day

- California's RA program was designed to meet **gross peak demand**
  - But the resource mix is increasing its reliance on **energy-limited** resources
- The summer 2020 events highlighted the **challenges with the current approach**
  - Meeting **net peak demand** has become a growing concern
  - **Challenges in other hours** are likely in the future as large levels of energy storage are added

Actual Demand and Net Demand for August 14 and 15
(from Prelim Root-Cause Analysis Report)



Outages coincide with net peak demand

Prelim Root-Cause Analysis Report:
"Today, **the single critical period of peak demand is giving way to multiple critical periods during the day** including the net demand peak, which is the peak of load net of solar and wind generation resources." (p. 47)

Comparison: Slice-of-Day Proposal

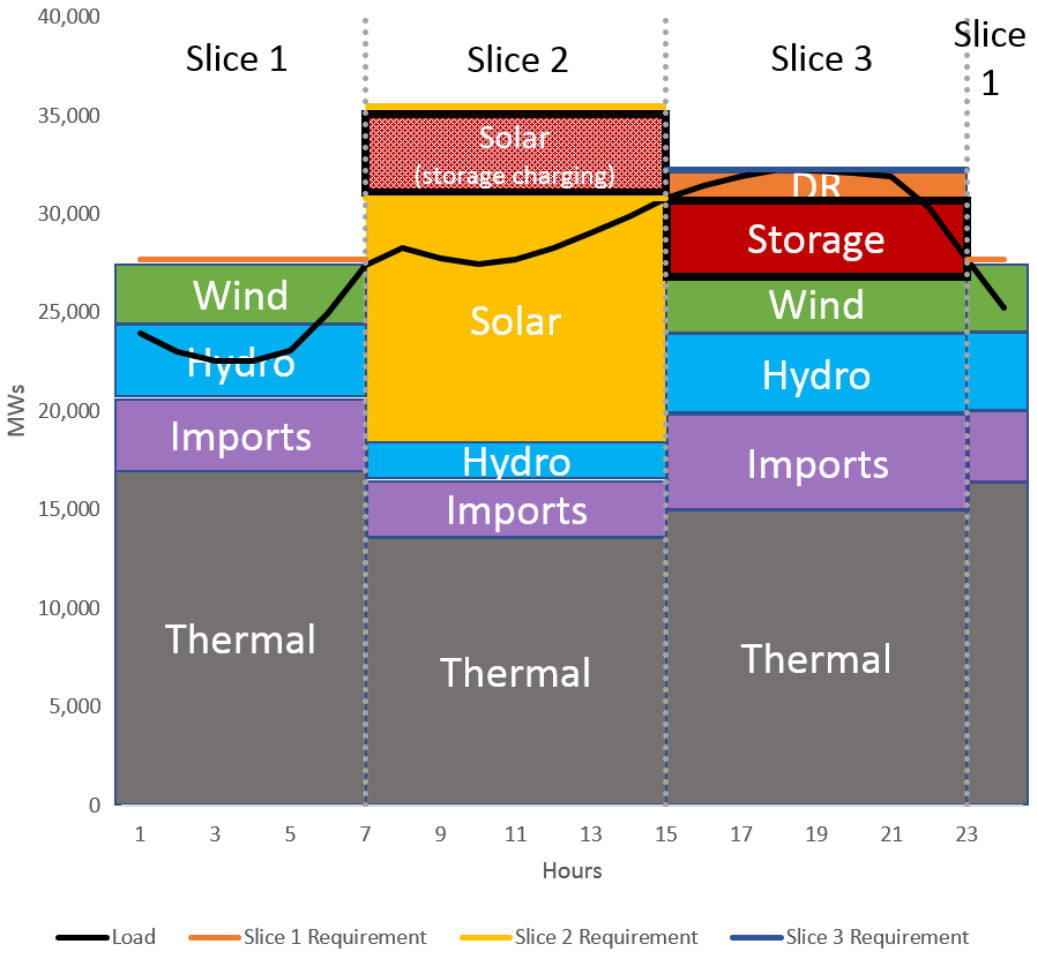
To address the changing resource mix, the proposal changes the RA requirement from a single peak period to multiple peak periods or "slices" across a 24-hour period

Summary of "Slice-of-Day" Changes Relative to Status Quo

#	Description	Today	"Slice-of-Day"
1	RA Showing Requirements	Gross peak hour; annual and monthly	Peak hour in each slice-of-day; potentially seasonal
2	Establishment and Allocation of Requirements	Top-down based on forecasted peak load	Top-down or bottoms-up based on forecasted peak load in each slice-of-day
3	Resource Counting	Resource/technology dependent (PMax, exceedance, ELCC)	Exceedance, depending on feasibility
4	Energy Market Obligation	24/7	24/7
5	RA Requirements Related to Energy Storage Charging	None	LSE is obligated to show capacity to meet charging needs

Example: Slice-of-Day Proposal

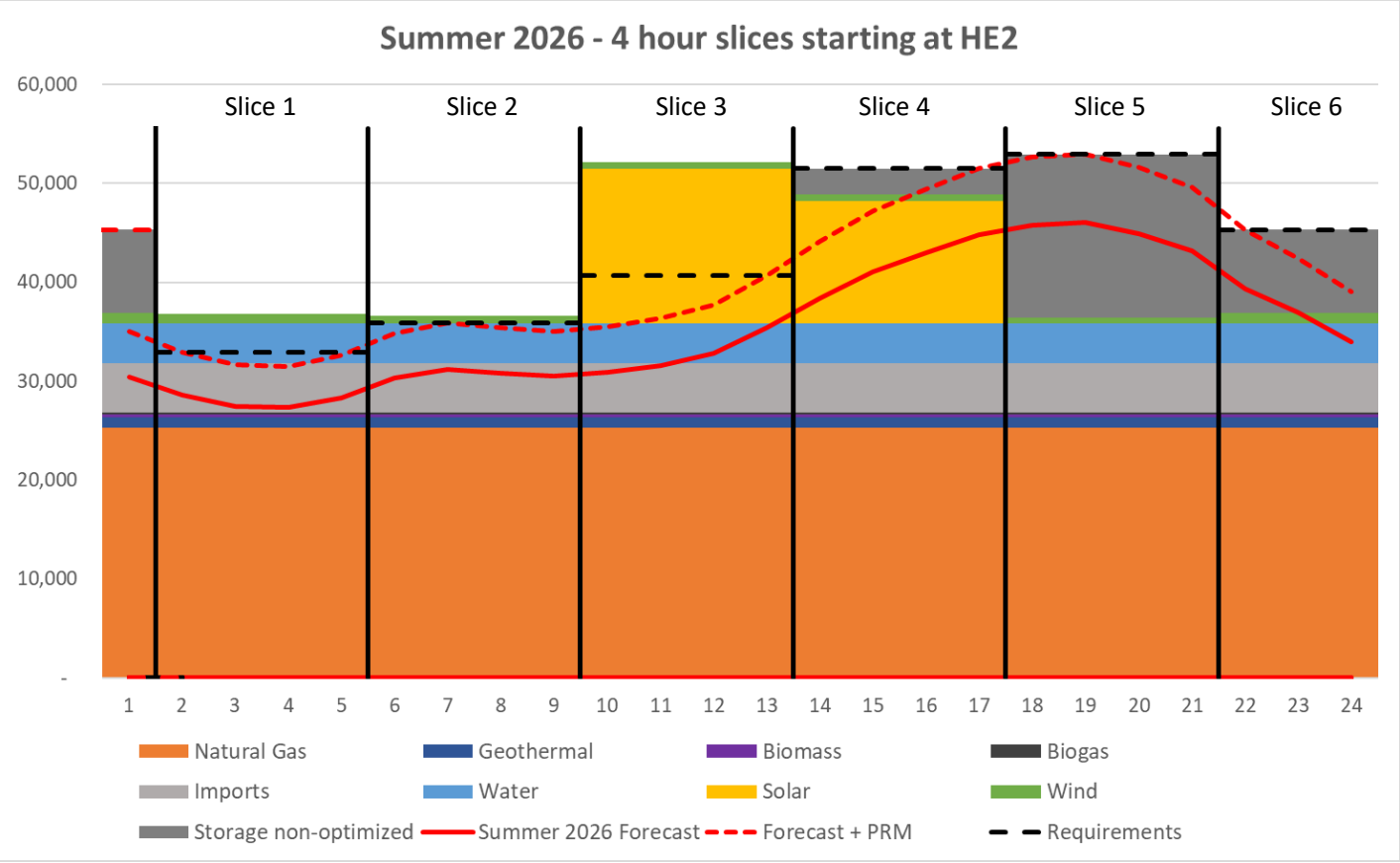
Illustrative RA Requirements and Resource Stack



- Resources would count for each slice-of-day based on the ability of the resource to produce during that period.
- Energy storage presents a unique operational characteristic in that it needs to charge to discharge.
  - There are different ways to handle this: a separate test could be performed or it could have a 'negative NQC' that would increase the LSE's requirement in one of the other slices.

More Detailed Slice-of-Day Proposal

- The following is a sample using June – September for summer based on the IEPR hourly forecast for 2026, with a 15% PRM.
- Resource values: Use 75% exceedance values for wind and solar based on 2018-2019 CAISO generation data; 2021 NQC data for other resources, with wind / solar additions based on the IRP preferred system plan, except storage, which is optimized for the need.



Key Issues

Introduction

- While we've discussed the key structure of the slice-of-day proposal, there are key implementation details and issues that need to be decided

- These details and issues present trade-offs where one approach may better address one of our principles, while a different approach supports a different principle

- Our plan for this workshop is to identifying these issues and trade-offs while the next workshop will present options or straw proposals

Key Issues and Trade Offs

Key Structural Elements

1. Forecast
2. Framework Based on Gross or Net Load
3. Seasons
4. Slices
5. Principles and Trade-Offs

Other Issues

6. Counting Rules (wind, solar, storage, hybrid, conventional)
7. Planning Reserve Margin (PRM)
8. LSE Allocations
9. RA Showings and Transactions
10. Multi-Day Reliability
11. Local and Flex

Key Structural Elements / Issues

1. Forecast

- PG&E started with the IEPR CAISO-level hourly load forecast as the basis for establishing requirements in a future framework.
- This is similar to how requirements are currently established
- There are several options for using this data:
  - Maximum values in a month for each hourly interval
  - Worst day in which the highest load day is identified and the hourly values are used from that day
  - Average value for each hourly interval
- Need to coordinate with IRP in terms of what they use / assume

1. Forecast

- The following shows the difference between the max value approach and the average approach for 2030
- Average value approach results in significantly lower values; would require a significantly higher planning reserve margin to address extreme heat days

HE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2%	2%	4%	3%	10%	9%	6%	7%	10%	6%	3%	2%
2	2%	2%	4%	3%	9%	9%	6%	7%	10%	5%	2%	2%
3	2%	2%	4%	3%	9%	8%	6%	7%	9%	5%	3%	3%
4	3%	3%	4%	3%	9%	9%	6%	7%	9%	6%	3%	4%
5	4%	3%	4%	4%	8%	10%	7%	8%	10%	7%	3%	4%
6	5%	4%	6%	5%	9%	11%	8%	10%	11%	8%	5%	6%
7	8%	7%	8%	8%	11%	12%	11%	11%	12%	8%	8%	9%
8	9%	11%	11%	9%	12%	15%	13%	13%	14%	9%	12%	11%
9	11%	12%	14%	13%	17%	19%	16%	17%	19%	12%	15%	13%
10	13%	12%	17%	17%	22%	23%	19%	20%	24%	16%	16%	15%
11	14%	13%	20%	22%	26%	27%	22%	23%	28%	21%	16%	16%
12	14%	13%	20%	25%	31%	30%	24%	25%	31%	25%	16%	16%
13	14%	13%	20%	29%	33%	32%	25%	26%	32%	28%	16%	15%
14	13%	13%	19%	30%	34%	32%	25%	26%	32%	29%	16%	14%
15	11%	13%	16%	29%	33%	31%	25%	24%	30%	28%	15%	12%
16	9%	11%	14%	26%	31%	29%	23%	23%	27%	25%	13%	9%
17	8%	11%	10%	22%	28%	26%	21%	20%	24%	21%	10%	8%
18	7%	8%	7%	17%	24%	23%	18%	17%	22%	17%	8%	8%
19	7%	6%	6%	13%	20%	21%	16%	16%	21%	16%	8%	8%
20	7%	6%	6%	12%	16%	18%	14%	14%	20%	14%	7%	8%
21	6%	6%	6%	11%	16%	16%	13%	12%	18%	13%	7%	8%
22	6%	6%	5%	9%	15%	15%	12%	11%	17%	11%	6%	8%
23	6%	6%	7%	9%	15%	14%	11%	10%	16%	10%	6%	7%
24	6%	5%	5%	6%	13%	12%	9%	8%	13%	8%	5%	7%

1. Forecast

- The following shows the difference between the max value approach and the worst day approach for 2030.
- There is very little variation in the summer months, but the winter months and March, in particular, have morning and mid-day values that deviate significantly.
- To be conservative, PG&E uses the max value approach in the following materials, although swapping out the max value forecast for the worst day approach is a simple change.

HE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0%	0%	3%	0%	0%	0%	0%	1%	1%	0%	1%	0%
2	0%	1%	3%	0%	0%	0%	0%	1%	1%	0%	0%	0%
3	0%	1%	2%	0%	0%	0%	0%	1%	1%	0%	0%	0%
4	0%	0%	2%	0%	0%	0%	0%	1%	0%	0%	0%	0%
5	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
6	0%	0%	1%	0%	0%	0%	0%	2%	0%	0%	1%	0%
7	0%	0%	1%	2%	1%	0%	0%	1%	0%	0%	1%	0%
8	0%	0%	2%	0%	0%	0%	0%	1%	0%	0%	5%	1%
9	1%	0%	6%	0%	0%	0%	0%	1%	0%	0%	7%	3%
10	4%	0%	10%	0%	0%	0%	0%	1%	0%	0%	6%	5%
11	5%	0%	13%	0%	0%	0%	0%	2%	0%	0%	5%	6%
12	4%	0%	13%	0%	0%	0%	0%	1%	0%	0%	3%	6%
13	5%	1%	11%	0%	0%	0%	0%	1%	0%	0%	1%	5%
14	4%	1%	10%	0%	0%	0%	0%	1%	0%	0%	0%	4%
15	2%	2%	7%	0%	0%	0%	0%	0%	0%	0%	0%	3%
16	0%	1%	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	0%	1%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%
18	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
19	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
21	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
22	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
23	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
24	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2. Gross or Net Load

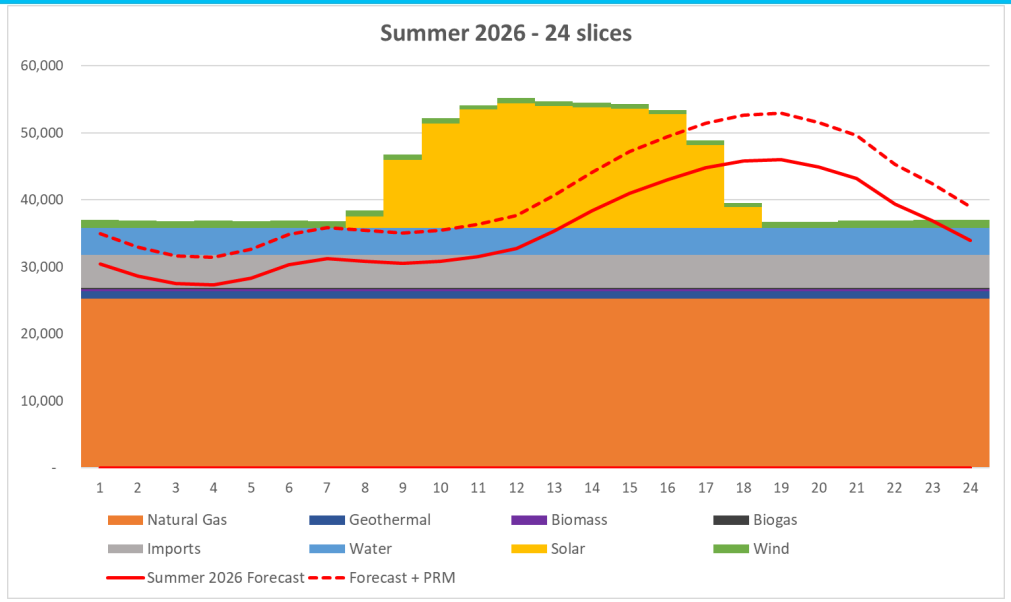
Should the load curve be on gross or net basis?

- Net would remove wind / solar from the load curve on an hourly basis
- Net matches variable resource contributions in each hour of production, thereby recognizing the contribution of those resources on an hourly basis

2. Gross or Net Load

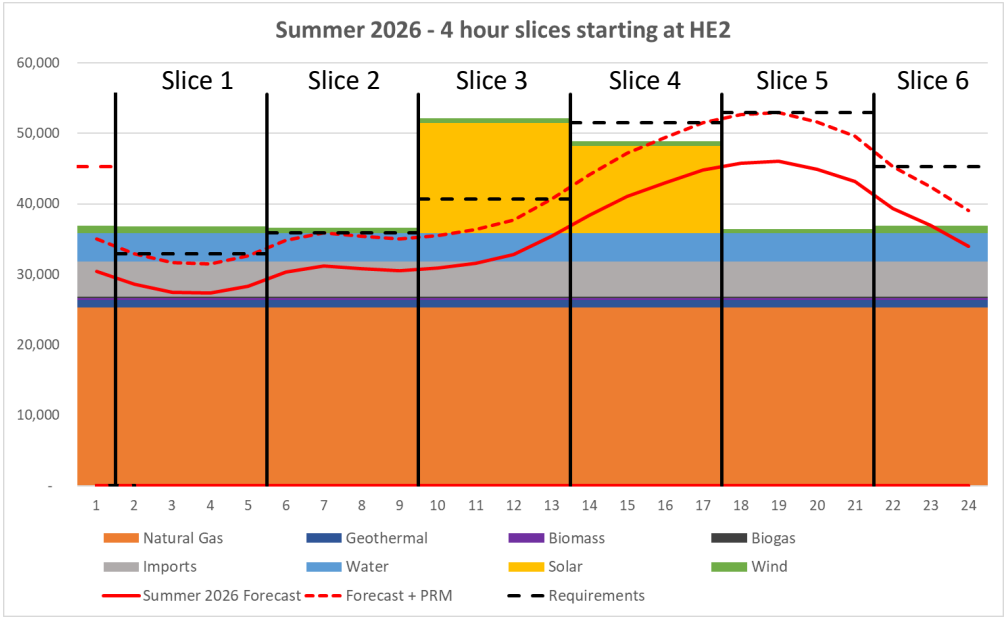
Solar and wind profiles on a gross basis

- Doesn't include slices
- Used to illustrate the hourly solar and wind values



Solar and wind in a 4-hour slice framework (gross)

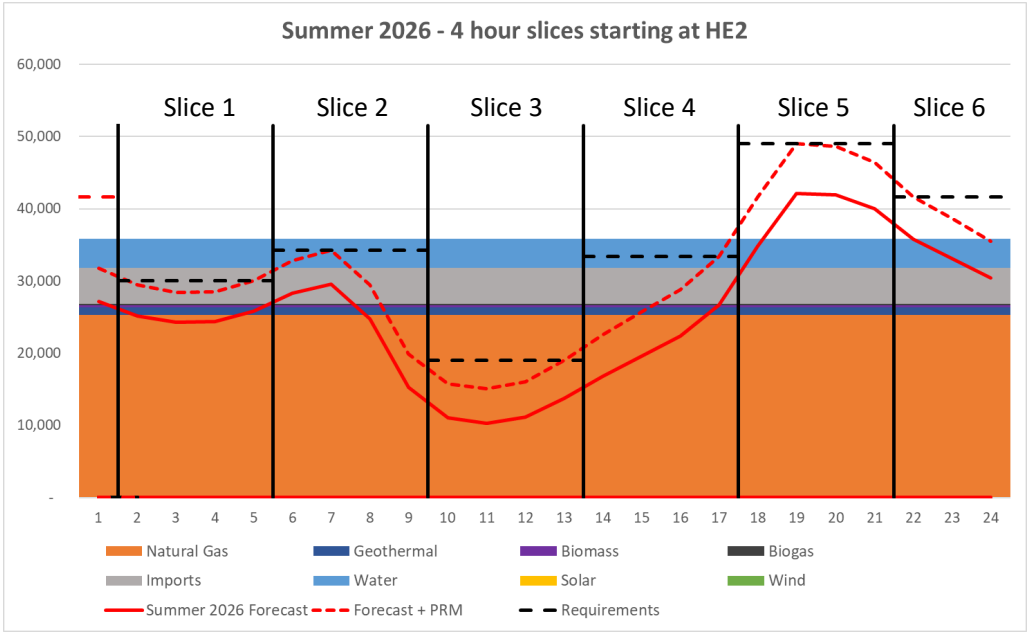
- Graph at right uses minimum resource value in the slice



2. Gross or Net Load

Net load basis

- On a net basis, the solar and wind is removed from the load forecast on an hourly basis
- This allows for use of longer slices than 1 hour while still accounting for the full capacity of solar and wind



3. Seasons

Background:

- PG&E proposed seasons in the 3B2 proposal to limit the increase to the showing requirements in a revised framework (and also due to the similarities in some months)
- There are several options for seasons:
  - 1 season, which would effectively be one annual showing
  - 12 seasons, which would effectively be a monthly showing
  - Some number of seasons in between

3. Seasons

Procurement requirement set under today's monthly framework

Gross load 2026 (MWs)

HE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	24,828	24,216	23,922	23,760	26,983	29,289	30,416	30,392	29,989	25,512	24,428	25,356
2	23,410	22,870	22,668	22,505	25,287	27,404	28,557	28,602	28,075	24,052	22,981	23,960
3	22,330	21,762	21,727	21,811	24,371	26,183	27,420	27,492	26,992	23,283	21,928	23,048
4	21,908	21,293	21,641	21,958	24,336	26,107	27,250	27,329	26,703	23,417	21,457	22,619
5	22,305	21,683	22,487	23,104	24,979	27,025	27,993	28,349	27,763	24,784	21,865	22,844
6	23,723	23,209	24,866	25,057	26,131	28,242	29,354	30,303	30,125	27,338	23,312	24,403
7	27,022	26,388	26,913	26,193	26,872	29,002	30,543	31,218	31,179	28,554	25,858	27,599
8	28,750	27,657	26,318	24,652	25,745	28,749	30,351	30,798	30,461	27,402	26,655	28,972
9	27,190	25,471	24,151	23,200	24,749	28,350	30,160	30,493	30,441	26,081	24,948	27,797
10	25,276	23,223	22,304	21,802	24,021	28,198	30,122	30,597	30,868	25,196	23,309	26,173
11	23,771	21,584	21,001	20,990	23,676	28,509	30,684	31,019	31,581	25,211	21,917	24,826
12	22,361	20,249	19,837	20,834	24,019	29,191	31,636	31,868	32,775	25,796	21,017	23,524
13	21,695	19,889	19,658	21,835	25,402	31,064	33,744	34,341	35,369	27,882	21,342	22,838
14	21,992	20,443	20,113	23,004	27,222	33,092	36,056	36,735	38,352	30,107	22,816	23,350
15	22,872	21,688	20,961	24,977	29,648	35,577	39,026	39,491	41,029	32,800	24,752	24,458
16	24,916	23,893	22,883	27,172	32,164	37,616	41,203	41,964	42,965	35,238	27,460	26,587
17	28,214	27,104	25,575	29,949	34,798	39,941	43,488	43,840	44,757	37,476	30,513	30,020
18	32,048	30,371	28,706	32,271	37,200	41,624	**44,640**	**45,029**	45,804	38,542	**32,876**	33,521
19	**32,983**	**32,218**	31,270	33,386	**37,739**	**41,958**	44,213	44,499	**46,011**	**38,760**	32,761	**34,140**
20	32,611	31,912	**31,385**	**34,127**	37,676	41,391	43,426	43,580	44,849	36,988	32,009	33,846
21	31,714	31,106	30,392	32,810	36,747	41,152	43,165	42,192	43,083	34,772	30,962	33,031
22	30,445	29,843	28,462	30,080	34,039	37,647	39,379	38,447	38,900	31,887	29,467	31,883
23	28,357	27,657	27,155	28,353	32,107	35,385	36,895	36,016	36,259	29,930	27,316	29,729
24	26,957	26,236	25,671	26,157	29,751	32,537	33,926	33,172	33,303	27,766	26,132	28,180

Bolded values currently set requirements for entire month

Total # showings: 12

3. Seasons

Procurement requirements set under a monthly slice-of-day

Gross load 2026 (MWs)

HE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	24,828	24,216	23,922	23,760	26,983	29,289	30,416	30,392	29,989	25,512	24,428	25,356
2	**23,410**	**22,870**	**22,668**	22,505	**25,287**	**27,404**	**28,557**	**28,602**	**28,075**	24,052	**22,981**	**23,960**
3	22,330	21,762	21,727	21,811	24,371	26,183	27,420	27,492	26,992	23,283	21,928	23,048
4	21,908	21,293	21,641	21,958	24,336	26,107	27,250	27,329	26,703	23,417	21,457	22,619
5	22,305	21,683	22,487	**23,104**	24,979	27,025	27,993	28,349	27,763	**24,784**	21,865	22,844
6	23,723	23,209	24,866	25,057	26,131	28,242	29,354	30,303	30,125	27,338	23,312	24,403
7	27,022	26,388	**26,913**	**26,193**	**26,872**	**29,002**	**30,543**	**31,218**	**31,179**	**28,554**	25,858	27,599
8	**28,750**	**27,657**	26,318	24,652	25,745	28,749	30,351	30,798	30,461	27,402	**26,655**	**28,972**
9	27,190	25,471	24,151	23,200	24,749	28,350	30,160	30,493	30,441	26,081	24,948	27,797
10	**25,276**	**23,223**	**22,304**	**21,802**	24,021	28,198	30,122	30,597	30,868	25,196	**23,309**	**26,173**
11	23,771	21,584	21,001	20,990	23,676	28,509	30,684	31,019	31,581	25,211	21,917	24,826
12	22,361	20,249	19,837	20,834	24,019	29,191	31,636	31,868	32,775	25,796	21,017	23,524
13	21,695	19,889	19,658	21,835	**25,402**	**31,064**	**33,744**	**34,341**	**35,369**	**27,882**	21,342	22,838
14	21,992	20,443	20,113	23,004	27,222	33,092	36,056	36,735	38,352	30,107	22,816	23,350
15	22,872	21,688	20,961	24,977	29,648	35,577	39,026	39,491	41,029	32,800	24,752	24,458
16	24,916	23,893	22,883	27,172	32,164	37,616	41,203	41,964	42,965	35,238	27,460	26,587
17	**28,214**	**27,104**	**25,575**	**29,949**	**34,798**	**39,941**	**43,488**	**43,840**	**44,757**	**37,476**	**30,513**	**30,020**
18	32,048	30,371	28,706	32,271	37,200	41,624	**44,640**	**45,029**	45,804	38,542	**32,876**	33,521
19	**32,983**	**32,218**	31,270	33,386	**37,739**	**41,958**	44,213	44,499	**46,011**	**38,760**	32,761	**34,140**
20	32,611	31,912	**31,385**	**34,127**	37,676	41,391	43,426	43,580	44,849	36,988	32,009	33,846
21	31,714	31,106	30,392	32,810	36,747	41,152	43,165	42,192	43,083	34,772	30,962	33,031
22	**30,445**	**29,843**	**28,462**	**30,080**	**34,039**	**37,647**	**39,379**	**38,447**	**38,900**	**31,887**	**29,467**	**31,883**
23	28,357	27,657	27,155	28,353	32,107	35,385	36,895	36,016	36,259	29,930	27,316	29,729
24	26,957	26,236	25,671	26,157	29,751	32,537	33,926	33,172	33,303	27,766	26,132	28,180

Bolded values would set requirement for that slice and month

Total # showings: 72

3. Seasons

Procurement requirements set under a seasonal slice-of-day

Gross load 2026 (MWs)

HE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	24,828	24,216	23,922	23,760	26,983	29,289	30,416	30,392	29,989	25,512	24,428	25,356
2	**23,410**	22,870	22,668	22,505	25,287	**27,404**	28,557	**28,602**	28,075	24,052	22,981	23,960
3	22,330	21,762	21,727	21,811	24,371	26,183	27,420	27,492	26,992	23,283	21,928	23,048
4	21,908	21,293	21,641	21,958	24,336	26,107	27,250	27,329	26,703	23,417	21,457	22,619
5	22,305	21,683	22,487	23,104	24,979	27,025	27,993	28,349	27,763	**24,784**	21,865	22,844
6	23,723	23,209	24,866	25,057	26,131	28,242	29,354	30,303	30,125	27,338	23,312	24,403
7	27,022	26,388	26,913	26,193	26,872	**29,002**	30,543	**31,218**	31,179	28,554	25,858	27,599
8	**28,750**	27,657	26,318	24,652	25,745	28,749	30,351	30,798	30,461	27,402	26,655	**28,972**
9	27,190	25,471	24,151	23,200	24,749	28,350	30,160	30,493	30,441	26,081	24,948	27,797
10	**25,276**	23,223	22,304	21,802	24,021	28,198	30,122	30,597	30,868	25,196	23,309	26,173
11	23,771	21,584	21,001	20,990	23,676	28,509	30,684	31,019	31,581	25,211	21,917	24,826
12	22,361	20,249	19,837	20,834	24,019	29,191	31,636	31,868	32,775	25,796	21,017	23,524
13	21,695	19,889	19,658	21,835	25,402	**31,064**	33,744	34,341	**35,369**	**27,882**	21,342	22,838
14	21,992	20,443	20,113	23,004	27,222	33,092	36,056	36,735	38,352	30,107	22,816	23,350
15	22,872	21,688	20,961	24,977	29,648	35,577	39,026	39,491	41,029	32,800	24,752	24,458
16	24,916	23,893	22,883	27,172	32,164	37,616	41,203	41,964	42,965	35,238	27,460	26,587
17	**28,214**	27,104	25,575	29,949	34,798	**39,941**	43,488	43,840	**44,757**	**37,476**	30,513	30,020
18	32,048	30,371	28,706	32,271	37,200	41,624	44,640	45,029	45,804	38,542	32,876	33,521
19	**32,983**	32,218	31,270	33,386	37,739	**41,958**	44,213	44,499	**46,011**	**38,760**	32,761	34,140
20	32,611	31,912	31,385	34,127	37,676	41,391	43,426	43,580	44,849	36,988	32,009	33,846
21	31,714	31,106	30,392	32,810	36,747	41,152	43,165	42,192	43,083	34,772	30,962	33,031
22	**30,445**	29,843	28,462	30,080	34,039	**37,647**	**39,379**	38,447	38,900	**31,887**	29,467	31,883
23	28,357	27,657	27,155	28,353	32,107	35,385	36,895	36,016	36,259	29,930	27,316	29,729
24	26,957	26,236	25,671	26,157	29,751	32,537	33,926	33,172	33,303	27,766	26,132	28,180

Bolded values would set requirement for that slice and season

Total # showings: 24

3. Seasons

Procurement requirements set under a net load seasonal slice-of-day

Net load 2026 (using PSP solar / wind data); peak hour in bold

HE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	24,257	22,904	22,517	19,819	22,231	24,424	25,553	25,892	27,186	24,278	23,891	24,680
2	**22,797**	21,618	21,360	18,512	20,946	22,831	23,917	24,371	25,171	22,920	22,441	23,253
3	21,746	20,466	20,438	18,230	20,127	21,500	23,333	23,361	24,234	22,269	21,418	22,342
4	21,283	20,073	20,304	18,521	20,291	21,657	23,499	23,408	24,376	22,352	20,985	21,892
5	21,665	20,611	21,198	19,742	21,190	**23,071**	24,749	24,876	**25,784**	**23,767**	21,446	22,152
6	23,133	22,305	23,721	22,122	22,666	**24,521**	26,535	27,046	28,306	26,277	22,813	23,729
7	26,448	25,491	25,846	23,514	21,974	22,544	26,757	27,955	**29,544**	**27,612**	25,249	26,936
8	**26,693**	23,389	23,304	17,397	14,219	14,609	20,851	21,977	24,709	24,791	22,074	26,494
9	20,028	14,278	14,280	8,338	8,345	8,670	14,794	14,344	15,300	15,122	14,530	21,040
10	**14,688**	9,316	8,193	4,207	5,232	6,382	11,013	10,517	11,080	8,848	9,008	**17,356**
11	11,375	6,219	4,740	1,716	3,390	5,437	10,136	9,260	10,324	6,889	6,727	14,963
12	9,336	4,655	3,554	793	3,258	5,542	9,904	9,380	11,131	6,443	5,676	12,423
13	8,914	4,602	3,090	1,714	4,423	**7,034**	12,339	11,744	**13,742**	9,023	6,597	11,584
14	9,525	6,010	4,162	3,497	6,765	8,990	14,494	14,159	16,808	11,427	8,812	12,946
15	12,873	7,823	6,346	5,726	8,753	11,515	17,419	16,872	19,609	14,356	13,240	16,172
16	19,157	12,902	10,743	8,803	11,693	14,074	20,115	19,789	22,320	17,632	21,307	22,145
17	**26,793**	21,617	16,861	12,483	15,873	**17,395**	23,291	23,177	**26,690**	24,438	**29,528**	29,091
18	31,508	28,541	25,785	18,758	20,439	21,481	26,991	28,021	34,494	34,794	32,440	32,924
19	**32,403**	30,810	29,661	26,659	27,453	28,236	32,367	34,884	**42,128**	**37,924**	32,306	33,459
20	31,963	30,138	29,854	30,716	32,660	34,812	37,455	38,612	41,952	36,100	31,502	33,111
21	31,091	29,514	28,878	29,017	31,944	**36,353**	38,357	37,209	39,964	33,719	30,460	32,236
22	**29,837**	28,156	26,777	26,239	28,813	**32,765**	34,482	33,414	**35,765**	30,801	28,926	**31,073**
23	27,723	26,059	25,588	24,808	26,927	30,324	32,071	31,132	33,143	28,738	26,731	28,918
24	26,363	24,673	24,325	22,647	24,739	27,406	29,134	28,542	30,389	26,619	25,524	27,459

Under net load, variation in each season and slice is different

4. Slices

Background:

- PG&E proposed slices in the 3B2 proposal to account for capacity needs in all hours, but also limit the increase to the showing requirements in a revised framework
- There are several options for slices:
  - 3 8-hour slices
  - 4 6-hour slices
  - 6 4-hour slices
  - 8 3-hour slices
  - 12 2-hour slices
  - 24 1-hour slices
  - Different size slices
  - Heterogenous slice definition across seasons
- PG&E presented six 4-hour slices in the February workshop, as a 4-hour slice is consistent with the existing RA framework (what a resource can output for 4 hours) and would result in a manageable increase in showing requirements

4. Slices

Two parameters for selecting slices:

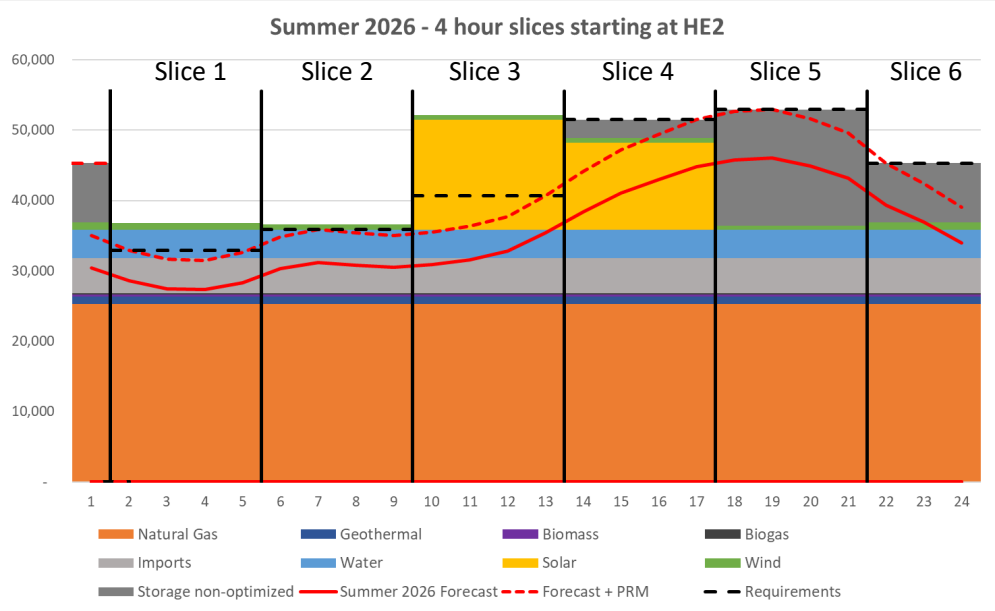
1. Size of the slice
2. Start of the slice

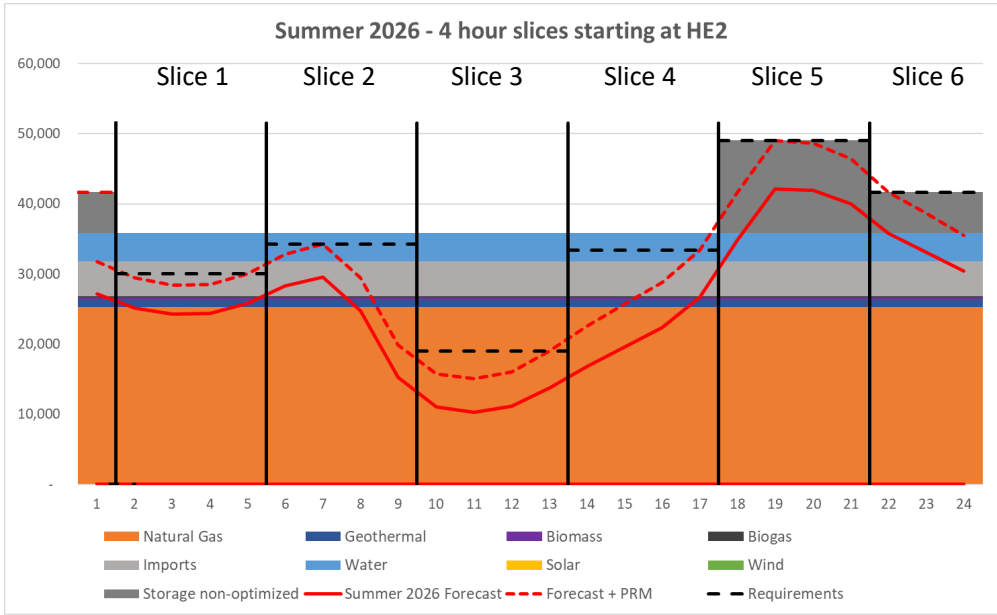
4-hour slices on a gross basis

- Potential 4-hour structure illustrates how resources would fit into this structure

4-hour slices on a net basis

- A net basis accounts for much of the variation within the slices





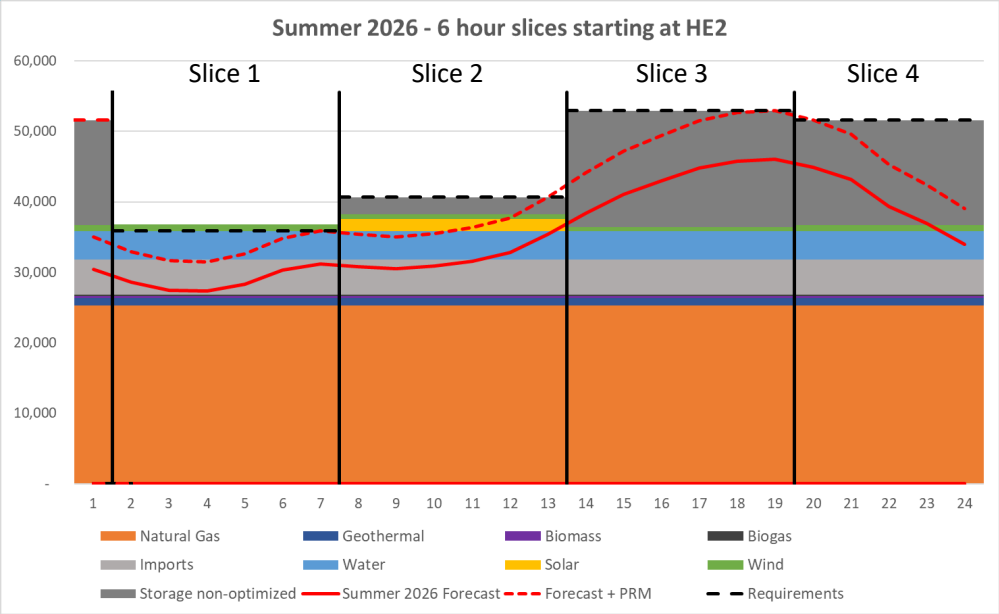
4. Slices

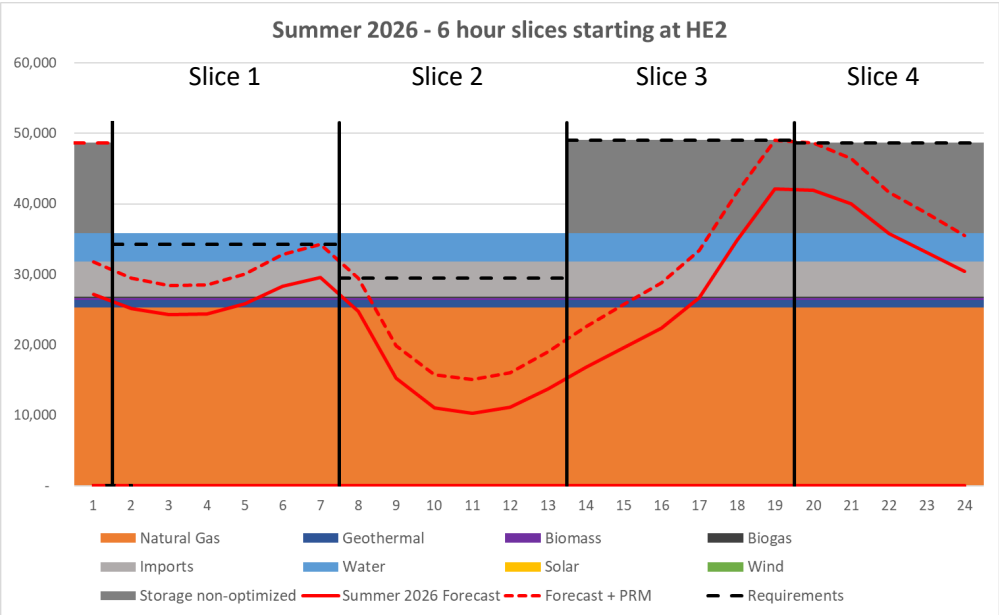
6-hour slices on a gross basis

- Illustrates the importance of considering solar / wind when selecting slices

6-hour slices on a net basis

- Solar and wind are fully accounted for by using net
- The increased slice size increases storage requirement





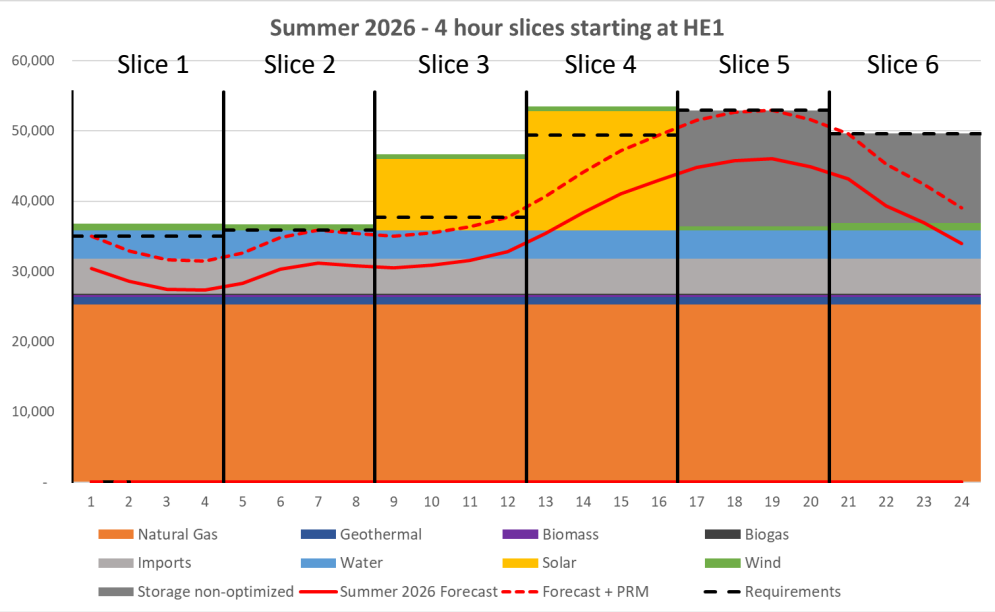
4. Slices

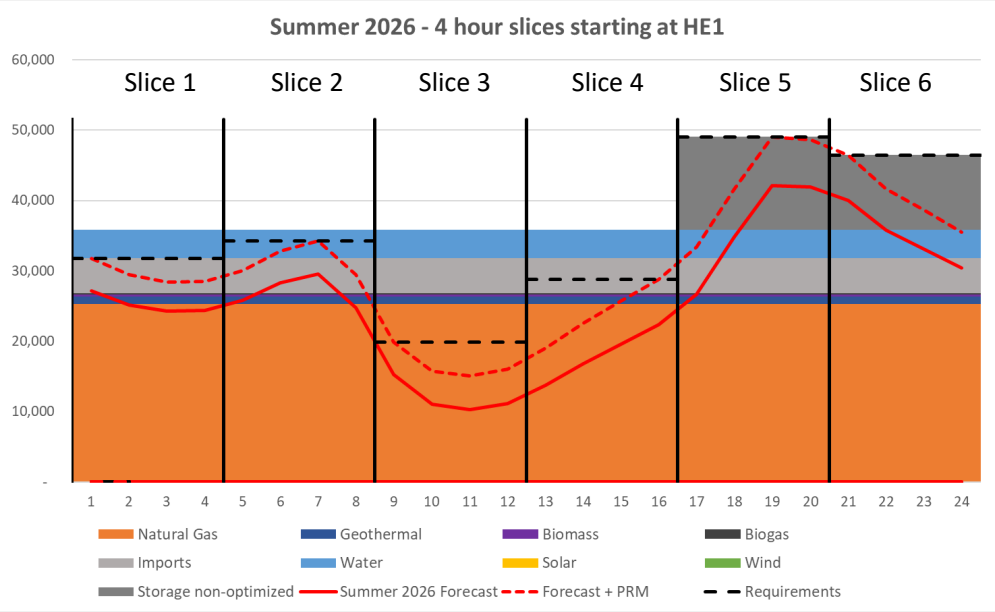
4-hour slices on a gross basis w/ different start hour

- Moving the start of the slices by even one hour can significantly impact results

4-hour slices on a net basis w/ different start hour

- Solar and wind are fully accounted for by using net
- However, different start hour increases storage requirement due to less optimal coverage of the peak hours





5. Principles and Trade-Offs

Discussion of principles as they relate to seasons and slices

- Each season and slice approach has trade-offs
- How do we balance these according to the principles?
- Principles:
  - Balance a Reliable Electrical Grid with Minimizing Costs to Customers
  - Balance Addressing Hourly Energy Sufficiency with Advancing Environmental Goals
  - Balance Granularity in Meeting Hourly Needs with Simplicity and Transactability
  - Implementable in the Near-Term (2024)
  - To be durable and adaptable to a changing electric grid

Other Issues

6. Wind and Solar Accounting

How should wind and solar profiles be developed?

- ELCC develops a single value for these resources and therefore a different approach is needed to incorporate the hourly values we just explored
- PG&E proposed moving to an exceedance approach for wind and solar to enable use of the full resource profiles in an hourly capacity framework
  - This is similar to how resource profiles are developed in IRP

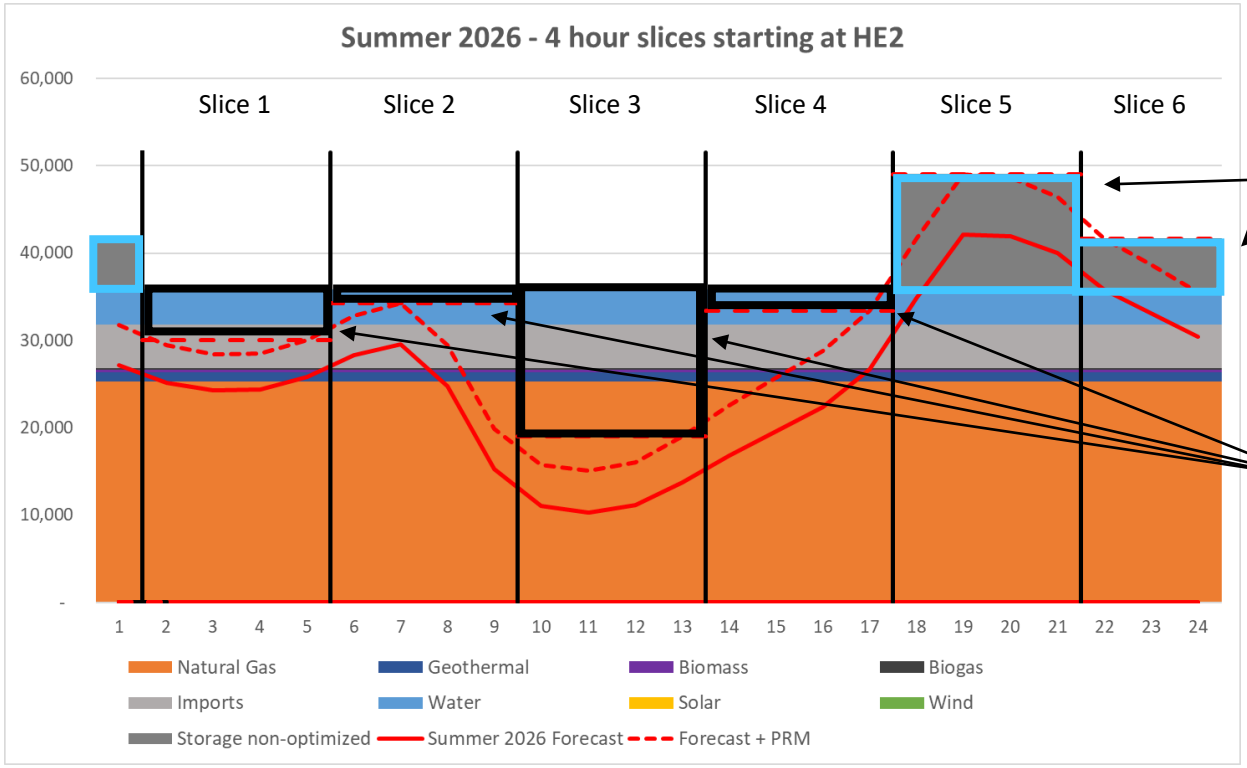
What exceedance level should be used?

- One way to address this issue is studying it in conjunction with the loss of load analysis happening in the IRP

6. Storage Accounting

Considerations for accounting for charging needs

- PG&E proposed a framework in which LSEs that have storage would need to show sufficient capacity in other slices to charge the storage
- Charging requirements for shown storage needs to be addressed in other slices



Storage shown in slices 5 and 6:

- ~20 GWs
- Losses: 20%

Total required capacity for charging:

- 24 GWs

6. Hybrid Accounting

How do we treat hybrids?

- Current hybrid framework
  - Uses monthly solar production estimates to determine the portion of the solar needed for charging
  - If sufficient solar exists to fully charge the storage, the storage gets a QC equal to its nameplate
  - Any excess solar receives ELCC treatment
- Similar approach could be applied in slice-of-day
  - If sufficient solar exists to charge the storage, the storage gets full value
  - Hybrid storage could have a special classification as storage that doesn't need additional charging capacity
  - The remainder of the solar would receive an hourly exceedance profile
    - Initially the profile could use a predetermined profile, but could transition to a resource-specific exceedance profile

6. Conventional Resource Accounting

Approaches for conventional resources

- Problems with exceedance for these resources
- Check proposal on what we said

UCAP

- Could be incorporated into the accounting for these resources
- To be addressed in future workshops (#3, #4, #9)

7. Planning Reserve Margin

How do we determine the PRM?

- IRP has a workstream looking at this in conjunction with loss of load analysis
  - Likely need to coordinate with that effort to formulate recommendations on the PRM for future RA framework
- Depends on how resource accounting is done
  - Forced outage rate
  - Exceedance level for variable resources
- Depends on load forecast approach (1 in 2, 1 in 5, etc.)

Is the PRM the same for each season and slice?

- PRM is currently set on gross peak
- How we determine what is needed in other hours?
- Should different PRMs be assigned for each season and slice?

8. LSE Allocations

Will be discussed in future workshops (#5 and #6)

Top Down

- Current program uses a top-down approach in which system requirements are determined first and LSE requirements are allocated based on contribution to the gross load peak
- Does this work if we change the solar and wind accounting to something that is more resource-specific?
    - Could the solar / wind profiles be somewhat generalized to reduce administrative burden?

Bottoms Up

- Starts at the LSE level and then aggregates load profiles up to the system level
- May need to use this approach in a net load framework unless solar and wind profiles are limited

9. RA Showings and Transactions

Trade-offs

- Additional showings facilitates precision in matching load and resource mix
- Fewer showings is simpler and minimizes administrative burden
- Balancing complexity and ability to transact

10. Multi-day reliability

How do we plan for long heat events that extend beyond a 24-hour period in a framework based on a 24-hour view?

- Exceedance and UCAP somewhat captures impacts of extreme events
- One area to coordinate with the IRP, potentially in a loss of load study
- Forecasting approach (1 in 2, 1 in 5, etc.) could also capture some of these impacts

11. CPUC Penalties and CAISO Backstop

How do CPUC penalties and CAISO backstop work in slice-of-day?

- Are CPUC penalties constant across slices and seasons?
- If there are many slices and seasons, how does the structure change, if at all?
- How would the CAISO determine deficiencies that require backstop procurement?

12. Local and Flex

How does the slice-of-day interact with local and flexible requirements?

- CAISO sets these requirements; both are under redesign at the CAISO
- Capacity procured to meet local requirements could be translated into meeting slice-of-day system requirements
- Slice-of-day mitigates need to focus on flexible requirements by requiring multi-hour availability