Slice-of-Day Workshops on Resource Counting

November 3, 2021

Together, Building a Better California

Safety

Earthquake

Know the safest places to drop, cover, and hold, such as under sturdy desks and tables.

Fire

Know your exits, escape routes, and evacuation plan. If safe to do so, use your compliant fire extinguisher. Exit the house and call 911.

Active Shooter

Get out, hide out, take out, and call 911.

Medical Emergency

Know who can perform first aid and CPR. Call 911 if you're alone or share your location with the call leader to send help. If you have an AED, ensure you and others in your household know where it's located and how to use it.

Psychological Safety

- ✓ We care for each other.
- ✓ Look out for one another.
- ✓ Create a safe space for all.
- ✓ Welcome new ideas from everyone.
- ✓ Practice self-care.

Ergonomics

- ✓ Practice ***30/30*** (every 30 minutes, move & stretch for 30 seconds).
- ✓ Ensure proper ergonomics.

COVID-19

- ✓ Wash hands frequently
- ✓ Wear a mask when required
- ✓ Get vaccinated if you are able to
- ✓ Follow current CAL-OSHA regulations and local county health orders.

PG&E's Desired Outcomes for Workshop #4

1. Clarify role of Slice of Day framework in planning and operations

2. Introduce resource counting proposals for specific resource types

3. Introduce options for establishing exceedance values for solar & wind resources

Commission-Adopted Principles

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

PG&E's Key Objectives for Resource Counting

1. Provide a reasonable measurement of a resource's ability to create energy in particular times of the day

2. Simplify resource counting rules

3. Use resource counting rules to inform the design of the slice-of-day framework

Planning vs. Operations

Role of RA capacity in planning v. operations

- The RA program is intended to be a planning effort to ensure sufficient capacity is available to operate the grid reliably in all hours.

- Three specific categories to consider:

  - QC value: what value is a resource assigned in a particular hour or slice for a month or season;

  - Resource filing: how the resource is shown or used towards the RA requirements;

  - Market dispatch of the resource: what is the must-offer-obligation for the resource, when does it generate / charge / discharge, etc.;

Planning

Operations

Current RA Counting Rules

Resource Type	Current Approach	September 2022 Net Qualifying Capacity (NQC)
Dispatchable[1]	PMax	29,940
Storage	PMax measured over a 4-hour output	1,500
Solar	Effective load carrying capability (ELCC)	1,730
Wind	Effective load carrying capability (ELCC)	890
Hybrid/Co-located	Renewable resource's energy to charge storage + excess energy at ELCC	-
Non-dispatchable[1]	Average generation output during measurement hours (HE17-21) from previous 3-years	1,320
Storage-Based Hydroelectric	Monthly exceedance based on market bids from previous 10-years	6,190
Imports	Contracted amount	4,000-6,000
Demand Response	Load impact protocols	1,200

[1] Includes biogas, biomass, geothermal, thermal, hydroelectric, waste-to-power

PG&E Proposal: "Dispatchable" Resources

PG&E Proposal

PG&E proposes that dispatchable resources be counted using a PMax methodology while accounting for ambient temperature conditions

- Given that thermal resource's output is generally impacted by ambient temperature conditions, it is reasonable to account for these conditions when establishing the QC value.
- Maintaining a similar counting methodology reduces complexity and administrative burden.

PG&E Proposal Parameters

PG&E proposes the following parameters for dispatchable resource counting:

- Use rolling 3 years of data as basis for determining ambient derates for each dispatchable resource
    - Weight all years equally
- Calculate maximum ambient derate over the duration of each slice (if slices are larger than 1 hour) within each season or month

PG&E Proposal: Standalone Energy Storage

PG&E Proposal

PG&E proposes that standalone energy storage resources be counted by measuring the full capacity output of the storage resource.

- The full output will be measured over the determined slice duration subject to the interconnection limit
    - Example: A 100MW (400MWh) storage resource could count for 100MW across 4 hours or 40MW across 10 hours
- The full output provides a reasonable and accurate measurement of a standalone energy storage resource's ability to dispatch energy in a particular time of day
- Maintaining a similar counting methodology reduces complexity and administrative burden
- LSEs need to show sufficient capacity to charge the storage
- There should not be limitations to showing in multiple slices throughout the day if the resource is operationally capable and/or willing to charge and discharge multiple times
    - A storage resource may be operationally capable of charging and discharging within the same hour or slice, but it doesn't make sense from a planning perspective

PG&E Proposal: Solar & Wind

PG&E Proposal

PG&E recommends an exceedance-based methodology for solar and wind under the new RA framework.

PG&E Proposal Parameters

PG&E proposes the following parameters for solar & wind resource counting:

- Use rolling 5 years of data as a basis for determining resource value through exceedance level
    - Weight all years equally
- For existing resources with 5 years of data, exceedance could be applied at a resource or some aggregated level (e.g., geographic location or technology type)
- New resources without 5 years of data would be assigned a value based on an average of resources with similar technology types and geography
- PG&E believes that the exceedance level should remain constant across all hours (e.g., some hours should not have a 50% exceedance level while others have a 75% exceedance level)
    - A variable exceedance level creates additional complexity (e.g., How often are levels updated? Are hours changing every year?)

Determining Exceedance Level

How do we determine the appropriate exceedance level?

PG&E has explored a peak load day approach to determine the exceedance level for solar and wind

Peak Load Day:

- Identifies the peak load day in each month during the historical period in question and assesses how the solar / wind resources performed during that day (averaging data across years if multiple years are included)
- Build exceedance profiles at various levels (e.g., 50%, 60%, 75%)
- Compare the peak load day performance to the exceedance production at each level and select the exceedance level that best matches the peak load day profile

Exceedance Analysis - Solar

- Tables below show the difference between the exceedance production at each level and peak load day production (data is for 2015-2020)
- 50% level overvalues solar in summer months, 75% exceedance level undervalues solar for almost all hours, 60% level may strike a reasonable balance.

50% Exceedance vs. Avg Worst Day

	Hour Ending																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	0	0	0	0	0	0	0	27	340	580	769	1,047	1,162	1,188	1,002	626	120	-3	0	0	0	0	0	0
Feb	0	0	0	0	0	0	-17	-24	-60	-125	-136	-256	-188	-193	8	-75	165	10	-3	-3	-4	-4	-4	-4
Mar	-2	-2	0	0	0	0	-197	-880	-506	-100	101	140	244	137	-145	147	496	942	267	0	0	0	0	0
Apr	0	0	0	0	0	0	-211	-1,024	-1,321	-1,000	-867	-768	-804	-981	-1,206	-1,245	-950	-994	-635	-155	-51	-4	0	0
May	0	0	0	0	0	-1	-260	-223	-243	-367	-198	-179	-107	-230	-195	-95	-79	115	-61	-116	-4	0	0	0
Jun	0	0	0	0	0	-3	244	613	741	683	706	695	760	915	1,024	1,104	1,203	1,089	671	128	-15	-9	0	0
Jul	0	0	0	0	0	0	21	92	250	421	567	888	770	778	851	1,049	1,059	865	428	91	-5	-5	-6	-6
Aug	-2	-2	-2	-2	-2	-1	8	353	779	854	774	850	683	737	888	1,007	973	814	236	22	-15	-15	-15	-15
Sep	-1	-2	-2	-1	-1	0	-47	-167	230	555	598	688	709	696	798	841	352	-329	-394	-49	-12	-2	-1	-1
Oct	-1	-1	-1	-1	-1	-1	-4	-80	149	328	346	612	610	674	698	807	402	-176	-44	-13	-7	0	0	0
Nov	0	0	0	0	0	0	-40	-127	-249	-260	-358	-179	-85	147	-149	-469	-488	-116	-1	0	0	0	0	0
Dec	-1	-1	-1	-1	-1	-1	-8	-216	-420	-380	-388	-257	-73	-274	-126	-17	-8	-3	-2	-2	-3	-2	0	0

75% Exceedance vs. Avg Worst Day

	Hour Ending																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	0	0	0	0	0	0	0	-204	-676	-823	-806	-506	-385	-320	-397	-256	-103	-3	0	0	0	0	0	0
Feb	0	0	0	0	0	0	-46	-518	-1,104	-1,297	-1,386	-1,515	-1,326	-1,327	-1,253	-1,198	-569	-61	-3	-3	-4	-4	-4	-4
Mar	-2	-2	0	0	0	0	-197	-1,296	-1,800	-1,831	-1,624	-1,647	-1,612	-1,591	-1,413	-1,241	-648	-742	-241	0	0	0	0	0
Apr	0	0	0	0	0	0	-308	-1,748	-2,824	-3,087	-3,081	-3,115	-3,010	-2,995	-3,024	-2,924	-2,722	-2,323	-1,120	-191	-51	-4	0	0
May	0	0	0	0	0	-1	-604	-1,844	-2,227	-2,370	-2,466	-2,333	-2,448	-2,420	-2,346	-2,260	-2,061	-1,779	-1,185	-224	-4	0	0	0
Jun	0	0	0	0	0	-4	-421	-1,572	-2,008	-2,313	-2,328	-2,482	-2,371	-2,248	-2,079	-1,952	-1,738	-1,576	-1,067	-205	-15	-9	0	0
Jul	0	0	0	0	0	0	-203	-881	-1,536	-1,649	-1,547	-1,480	-1,549	-1,480	-1,268	-1,122	-944	-837	-370	-124	-5	-5	-6	-6
Aug	-2	-2	-2	-2	-2	-1	-64	-530	-1,275	-1,460	-1,508	-1,533	-1,592	-1,538	-1,347	-1,016	-1,042	-678	-424	-81	-15	-15	-15	-15
Sep	-1	-2	-2	-1	-1	0	-66	-659	-1,301	-1,365	-1,351	-1,332	-1,097	-1,074	-1,053	-1,013	-1,115	-1,124	-607	-49	-12	-2	-1	-1
Oct	-1	-1	-1	-1	-1	-1	-4	-320	-979	-1,660	-1,368	-1,167	-1,104	-950	-993	-1,090	-1,165	-604	-74	-13	-7	0	0	0
Nov	0	0	0	0	0	0	-99	-761	-1,408	-1,665	-1,720	-1,519	-1,423	-1,186	-1,350	-1,162	-615	-116	-1	0	0	0	0	0
Dec	-1	-1	-1	-1	-1	-1	-8	-482	-1,286	-1,615	-1,639	-1,495	-1,326	-1,401	-1,405	-802	-102	-3	-2	-2	-3	-2	0	0

60% Exceedance vs. Avg Worst Day

	Hour Ending																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	0	0	0	0	0	0	0	-64	-218	-211	-1	150	292	368	297	232	22	-3	0	0	0	0	0	0
Feb	0	0	0	0	0	0	-31	-218	-544	-507	-488	-564	-485	-403	-349	-392	-56	-22	-3	-3	-4	-4	-4	-4
Mar	-2	-2	0	0	0	0	-197	-1,070	-1,197	-1,091	-987	-921	-904	-949	-938	-558	87	481	150	0	0	0	0	0
Apr	0	0	0	0	0	0	-255	-1,360	-2,061	-1,933	-1,872	-1,930	-1,680	-1,847	-1,901	-2,034	-1,880	-1,682	-853	-170	-51	-4	0	0
May	0	0	0	0	0	-1	-379	-1,042	-1,160	-1,455	-1,147	-1,064	-996	-979	-1,273	-1,207	-1,329	-1,171	-634	-160	-4	0	0	0
Jun	0	0	0	0	0	-4	111	147	53	-42	-41	38	439	692	557	620	635	545	338	-18	-15	-9	0	0
Jul	0	0	0	0	0	0	-35	-360	-550	-310	-81	88	42	118	320	419	441	121	105	30	-5	-5	-6	-6
Aug	-2	-2	-2	-2	-2	-1	-28	-98	-196	-45	274	363	274	258	307	239	198	93	66	-23	-15	-15	-15	-15
Sep	-1	-2	-2	-1	-1	0	-57	-295	-513	-319	-192	-87	65	-53	-4	-301	-404	-563	-484	-49	-12	-2	-1	-1
Oct	-1	-1	-1	-1	-1	-1	-4	-224	-193	-249	-123	65	48	48	167	-10	-64	-364	-58	-13	-7	0	0	0
Nov	0	0	0	0	0	0	-59	-367	-774	-756	-612	-414	-354	-252	-675	-747	-552	-116	-1	0	0	0	0	0
Dec	-1	-1	-1	-1	-1	-1	-8	-303	-840	-930	-996	-783	-702	-711	-683	-341	-37	-3	-2	-2	-3	-2	0	0

Exceedance Analysis – Wind

- Tables below show the difference between the exceedance production at each level and peak load day production (data is for 2015-2020)
- 50% level overvalues wind in most seasons, while 75% slightly undervalues it across most months/hours. 70% exceedance level may strike a reasonable level.

50% Exceedance vs. Avg Worst Day

Hour Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	-541	-569	-594	-534	-587	-545	-499	-499	-446	-518	-445	-465	-500	-602	-551	-520	-593	-711	-571	-568	-567	-515	-487	-532
Feb	-806	-712	-627	-602	-531	-609	-609	-588	-627	-859	-838	-801	-953	-847	-661	-477	-323	-214	-82	-36	175	43	30	-37
Mar	686	510	623	481	455	437	392	259	190	127	16	-4	9	-32	-98	111	225	362	357	410	327	346	190	279
Apr	246	317	408	457	554	714	810	903	799	824	671	770	804	892	1,032	1,237	1,323	1,321	1,317	1,229	1,163	1,149	1,015	1,048
May	94	20	41	105	216	150	242	387	517	634	521	481	562	577	740	592	632	431	419	350	184	152	186	145
Jun	1,160	1,212	1,274	1,152	1,170	1,170	1,104	967	872	857	767	692	688	736	769	776	608	620	653	654	366	265	329	348
Jul	191	208	96	-64	22	9	35	84	221	353	365	379	361	405	417	336	150	273	323	283	199	235	149	89
Aug	342	345	237	332	395	527	475	500	475	457	369	330	363	475	536	627	719	611	494	561	641	590	507	354
Sep	586	527	556	543	523	533	584	556	507	351	310	244	233	306	421	487	462	367	293	390	356	307	256	217
Oct	364	305	171	154	167	134	17	-35	-28	0	-46	-105	-103	-31	105	194	263	484	496	585	667	621	600	523
Nov	289	252	245	251	218	221	200	149	112	86	120	146	145	114	149	124	30	56	16	3	33	26	-57	-151
Dec	-828	-767	-618	-563	-405	-384	-318	-144	-61	-175	-255	-323	-339	-232	-129	-13	40	48	105	75	101	131	154	78

75% Exceedance vs. Avg Worst Day

Hour Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	-765	-798	-819	-776	-832	-769	-732	-733	-681	-734	-647	-681	-725	-811	-794	-751	-819	-948	-800	-829	-772	-719	-697	-765
Feb	-1,337	-1,240	-1,173	-1,140	-985	-974	-974	-943	-1,011	-1,186	-1,237	-1,219	-1,382	-1,352	-1,176	-1,024	-877	-744	-738	-656	-522	-567	-586	-574
Mar	-168	-240	-147	-302	-296	-289	-248	-238	-284	-362	-430	-346	-356	-557	-798	-722	-658	-548	-454	-535	-670	-663	-687	-622
Apr	-647	-689	-609	-461	-298	-28	67	126	117	102	147	128	98	129	142	64	331	386	325	457	505	472	352	235
May	-567	-659	-617	-472	-417	-443	-334	-192	-158	-18	-90	-109	-167	-184	-125	-168	-94	-123	-121	-254	-461	-551	-580	-577
Jun	571	600	633	543	528	507	444	418	328	214	221	182	117	58	-9	-40	-151	-130	58	91	-159	-246	-304	-243
Jul	-403	-386	-410	-497	-509	-500	-411	-340	-238	-69	-18	57	105	77	23	-80	-252	-190	-166	-255	-334	-339	-394	-523
Aug	-196	-216	-245	-183	-86	31	80	142	124	67	44	39	50	106	79	121	107	24	-26	53	88	81	-35	-229
Sep	-209	-228	-230	-167	-129	-108	-118	-96	-55	-24	-57	-104	-50	6	15	-46	-92	-270	-325	-459	-451	-461	-456	-512
Oct	-257	-289	-328	-334	-264	-261	-298	-306	-312	-311	-349	-396	-384	-291	-243	-182	-127	-61	-58	-30	40	55	9	-19
Nov	13	-15	-13	-10	-3	10	-7	-30	-49	-71	-79	-64	-54	-48	-30	-79	-177	-202	-258	-270	-228	-256	-318	-390
Dec	-1,057	-1,060	-996	-853	-717	-646	-558	-422	-385	-484	-557	-628	-663	-595	-475	-366	-284	-237	-186	-172	-229	-221	-215	-198

70% Exceedance vs. Avg Worst Day

Hour Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	-728	-737	-781	-747	-788	-733	-681	-671	-637	-686	-607	-649	-691	-772	-770	-727	-786	-925	-771	-784	-743	-694	-674	-718
Feb	-1,213	-1,213	-1,107	-1,084	-931	-885	-902	-899	-949	-1,162	-1,198	-1,171	-1,333	-1,233	-1,089	-873	-745	-659	-685	-599	-441	-482	-544	-485
Mar	-30	-128	-23	-137	-149	-105	-153	-168	-220	-294	-360	-307	-262	-458	-687	-605	-480	-448	-295	-317	-526	-529	-547	-476
Apr	-465	-548	-367	-305	-165	16	184	231	190	206	247	206	207	223	281	404	502	653	590	648	617	647	418	343
May	-421	-529	-490	-378	-293	-341	-232	-124	14	100	31	5	3	-94	72	-7	55	4	21	-134	-319	-327	-344	-336
Jun	702	772	789	734	731	684	577	516	451	342	325	258	207	175	113	90	54	91	174	231	-34	-129	-143	-94
Jul	-286	-260	-320	-407	-399	-398	-339	-287	-136	-20	50	129	163	120	87	6	-186	-78	-67	-176	-251	-217	-308	-383
Aug	-84	-63	-163	-92	19	135	155	215	184	162	106	111	114	166	143	231	201	118	67	150	206	218	95	-88
Sep	-49	-28	-43	-41	17	21	-6	34	50	20	-34	-21	12	80	105	58	-20	-201	-224	-289	-306	-317	-384	-416
Oct	-151	-209	-272	-237	-188	-205	-234	-261	-293	-289	-299	-350	-342	-250	-208	-140	-63	11	13	47	95	131	115	56
Nov	36	22	28	14	34	36	24	-5	-21	-37	-46	-27	-34	-29	-13	-66	-152	-169	-232	-228	-194	-216	-282	-332
Dec	-1,022	-1,034	-972	-823	-672	-614	-521	-381	-368	-455	-534	-615	-630	-570	-444	-330	-233	-188	-131	-145	-198	-187	-178	-168

PG&E Proposal: Hybrid and Co-located

PG&E Proposal:

If generation component is solar or wind and has charging restrictions:

- PG&E proposes a similar framework to existing counting rules with a slight modification.
- If the solar or wind resource has sufficient energy to fully charge the battery then the QC of the storage is given its full RA value (Full Output).
  - Any remaining expected daily production is then converted back to a capacity value and an exceedance value is applied.
  - Exceedance value likely should be resource-specific given that there won't be a standard charging profile across resources

PG&E Proposal: Storage-Based Hydro

PG&E Proposal:

- PG&E proposes no methodology changes to the recently adopted exceedance-based methodology for storage-based hydro resources for the slice-of-day framework (to enable slice or hourly values)
- The existing framework includes 10 years of hydro bid data, calculates a 50% exceedance and a 90% exceedance and weights them at 80% and 20% respectively
- This was done to provide a greater weight to poor hydro years
- While the existing methodology currently produces a peak value, it could be adapted to produce values for slices or every hour (for a 24-slice framework)

PG&E Proposal: Non-Dispatchable

Resource Types:

- Biogas
- Biomass
- Geothermal
- Thermal
- Hydroelectric
- Waste-to-power

PG&E Proposal:

- PG&E proposes no methodology changes to the current methodology for Non-Dispatchable resources in the slice-of-day framework (to enable slice or hourly values)

- The current methodology could be adapted by applying the existing monthly NQC values for non-dispatchable resources to each slice or hour

PG&E Proposal: Imports

PG&E Proposal:

- If an import resource is non-resource-specific, then there may be no need to change the existing counting rules based on contracted amount
- If an import resource is resource-specific (e.g., wind or solar) then the updated counting rules can be applied (e.g., exceedance)
- Note: Import/contracting hours may not align with determined slices, at least at first, and may need to be considered in a final framework
    - Imports transact under 3 products:
        1. All hours; or
        2. High load hours (HE7-22); or
        3. Low load hours (HE1-6 and HE23-24)
    - If we set slices that don't align with the traditional import products, there is a chance that imports will not be able to be counted in certain slices

Demand Response

Two issues to consider for demand response:

1. How is the resource shown?
2. How is the value determined?

Showing Approach:

Showings should be aligned with the slice length and tariff requirements / program design

- For example, a program that is available for five hours, should only be shown for at most 5 hours, but would only be shown for four hours in a 4-hour slice design

Value:

An ELCC or LIP approach could be used, but defer to the stakeholder processes underway at the CEC on which of these approaches is best

- Incorporating the determination of the DR value into the RA Reform effort would duplicate efforts underway at the CEC
- We plan to reach out to CEC staff to engage with them on considering RA reform efforts in that workstream

Multi-Day Reliability

Issue:

- Slice-of-day framework ensures reliability across a 24-hour period
- Questions have been raised about ensuring reliability across multiple days
- For instance, if the resource mix includes a significant percentage of resources that can't produce across several consecutive days, reliability could be at risk in the latter days of a multi-day reliability event
- Two resource types that potentially present issues of this nature are hydro and demand response
    - Hydro: The exceedance approach for hydro should capture the diminishing water availability in later summer and fall months; this is also not a growing resource and therefore makes up a fairly static portion of the resource mix
    - Demand Response: Coordination across the RA reform efforts and the CEC's working group is likely needed to determine if multi-day reliability is accounted for in the final valuation methodology. If it isn't, other methods may need to be explored, e.g. maintaining a DR cap