Mapping Criteria Alignment

Land-use and Environmental Criteria alignment: Solar

- Summary of criteria alignment for mapped solar resources by resource region.
  - For "other land-use criteria" and "environmental criteria", category reflects highest flag out of the multiple criteria in that category.

2039	Core Land-use Screen					Other Land-use Criteria					Environmental Criteria				
Solar Mapping (MWs)	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues
Northern California	565	230	400		Telsa	683	512			Fire threat/Cropland	428	767	-	-	Connectivity/ Irreplaceability
Southern PG&E	5,044	2,465	-	-	Midway and Gates	4,932	2,577	-	-	Parcelization/Cropland index	6,735	774	-	-	All ACE
Greater Tehachapi	2,564	1,815	-	-	Windhub	-	-	-	4,374	Parcelizatiion/Some Fire Threat	2,564	1,815	-	-	All ACE/ Wetlands at Windhhub
Greater Kramer	1,016	350	644		Kramer	280	994	-	736	Parcelization	1,016	994	-	-	Connectivity / Wetlands
Riverside	-	1,395	-	1,114	Red bluff / CR	-	-	1,114	1,395	Cropland Index	1,395	1,114	-	-	Wetlands/ All ACE
Arizona	4,100	-	-	-		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
Southern Nevada	2,540	300	-	-	El Dorado	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
Greater Imperial	182	-	-	-		-	182	-	-	Fire threat	182	-	-	-	
Total MWs:	16,011	6,555	1,044	1,114		5,895	4,265	1,114	6,505		12,320	5,464	-	-	

Land-use and Environmental Criteria alignment: Solar

2039	Core Land-use Screen					Other Land-use Criteria					Environmental Criteria				
Solar Mapping	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues
Northern California	565	230	400		Telsa	683	512			Fire threat/Cropland	428	767	-	-	Connectivity/ Irreplaceability
Southern PG&E	5,044	2,465	-	-	Midway and Gates	4,932	2,577	-	-	Parcelization/Cropland index	6,735	774	-	-	All ACE
Greater Tehachapi	2,564	1,815	-	-	Windhub	-	-	-	4,374	Parcelizatiion/Some Fire Threat	2,564	1,815	-	-	All ACE/ Wetlands at Windhhub
Greater Kramer	1,016	350	644		Kramer	280	994	-	736	Parcelization	1,016	994	-	-	Connectivity / Wetlands
Riverside	-	1,395	-	1,114	Red blufff/ CR	-	-	1,114	1,395	Cropland Index	1,395	1,114	-	-	Wetlands/ All ACE
Arizona	4,100	-	-	-		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
Southern Nevada	2,540	300	-	-	El Dorado	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
Greater Imperial	182	-	-	-		-	182	-	-	Fire threat	182	-	-	-	
Total:	16,011	6,555	1,044	1,114		5,895	4,265	1,114	6,505		12,320	5,464	-	-	

- Generally good alignment with criteria for solar resources, with some key exceptions:
  - **High parcelization for Tehachapi solar**: Staff view this as not a major issue warranting remapping. Known issue that has not seriously limited recent development in the area.
  - **High Cropland utilization for Riverside solar**: Solar mapped to both Red bluff and Colorado River (CR) have high non-compliance. Red bluff is an artifact of only a tiny amount of farmland, but CR does have significant amount of farmland and may warrant remapping.
  - **Level-3 alignments for various criteria:** Staff may potential remapping some of the resources at these substations if overall improvements can be found.

Land-use and Environmental Criteria alignment: Solar

2039	Core Land-use Screen					Other Land-use Criteria					Environmental Criteria				
Solar Mapping	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues
Northern California	565	230	400		Telsa	683	512			Fire threat/Cropland	428	767	-	-	Connectivity/ Irreplaceability
Southern PG&E	5,044	2,465	-	-	Midway and Gates	4,932	2,577	-	-	Parcelization/Cropl and index	6,735	774	-	-	All ACE
Greater Tehachapi	2,564	1,815	-	-	Windhub	-	-	-	4,374	Parcelizatiion/Som e Fire Threat	2,564	1,815	-	-	All ACE/ Wetlands at Windhhub
Greater Kramer	1,016	350	644		Kramer	280	994	-	736	Parcelization	1,016	994	-	-	Connectivity / Wetlands
Riverside	-	1,395	-	1,114	Red blufff/ CR	-	-	1,114	1,395	Cropland Index	1,395	1,114	-	-	Wetlands/ All ACE
Arizona	4,100	-	-	-		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
Southern Nevada	2,540	300	-	-	El Dorado	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
Greater Imperial	182	-	-	-		-	182	-	-	Fire threat	182	-	-	-	
Total:	16,011	6,555	1,044	1,114		5,895	4,265	1,114	6,505		12,320	5,464	-	-	

- **High non-compliance with Core land-use Screen:**
  - **Red bluff**: Significantly exceeds amount of low implication land, warrants potential remapping of generic resources.
  - **Kramer:** High utilization of low implication within 15 mi radius, warrants either extending radius to 20 miles or some remapping.
- **Level-3 compliances with Core land-use Screen:** Several substations with large MWs of resources mapped too them – Windhub, Midway, and Gates – could have some resources remapped to improve compliance.
- **Alternative mapping locations:** Southern PG&E and southern Nevada areas have several substations with low potential implications and high amounts of commercial interests.

Land-use and environmental criteria alignment: In-state Wind

- Summary of criteria alignment for mapped in-state wind resources by resource region.
  - Only other land-use criteria apply for wind analysis is fire threat.
  - Does not include in-state wind resources mapped to Baja California, MX.

2039	Core Land-use Screen					Other Land-use Criteria					Environmental Criteria				
Wind Mapping (MWs)	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues
Northern California	433	-	1,545	901	Multiple Subs	1,538	-	-	1,341	Fire Threat	1,203	370	200	1,106	Multiple Criteria
Southern PG&E	300	-	-	350	Multiple Subs	575	-	-	75	Fire Threat	300	-	75	275	Multiple Criteria
Greater Tehachapi	314	500	-	-	Whirlwind	124	500	-	190	Fire Threat	814	-	-	-	
Greater Kramer	200	300	-	150	Proposed Sub	650	-	-	-		500	150	-	-	Intactness
Riverside	-	-	-	499	Devers/El Casco	-	-	-	499	Fire Threat	-	-	200	399	Multiple Criteria
Southern Nevada	1,500	410	-	-	Sloan Canyon	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
Greater Imperial	60	-	-	500	Proposed Sub	-	60	-	500	Fire Threat	60	500	-	-	Multiple Criteria
Total MWs:	2,807	1,210	1,545	2,400		2,887	560	-	2,605		2,877	1,020	475	1,780	

Land-use and environmental criteria alignment: In-state Wind

2039	Core Land-use Screen					Other Land-use Criteria					Environmental Criteria				
Wind Mapping	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues
Northern California	433	-	1,545	901	Multiple Subs	1,538	-	-	1,341	Fire Threat	1,203	370	200	1,106	Multiple Criteria
Southern PG&E	300	-	-	350	Multiple Subs	575	-	-	75	Fire Threat	300	-	75	275	Multiple Criteria
Greater Tehachapi	314	500	-	-	Whirlwind	124	500	-	190	Fire Threat	814	-	-	-	
Greater Kramer	200	300	-	150	Proposed Sub	650	-	-	-		500	150	-	-	Intactness
Riverside	-	-	-	499	Devers/El Casco	-	-	-	499	Fire Threat	-	-	200	399	Multiple Criteria
Southern Nevada	1,500	410	-	-	Sloan Canyon	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
Greater Imperial	60	-	-	500	Proposed Sub	-	60	-	500	Fire Threat	60	500	-	-	Multiple Criteria
Total:	2,807	1,210	1,545	2,400		2,887	560	-	2,605		2,877	1,020	475	1,780	

- Significant non-alignment with land-use and environmental mapping criteria across several areas.
  - Roughly half of the mapped MWs analyze have level-4 or -5 alignments with criteria.
- Several substations with level-5 alignment have little or no wind resource potential, even high potential implications.
  - Potential misalignment of base resource potential given identified commercial interest at substations.

Land-use and environmental criteria alignment: In-state Wind

2039	Core Land-use Screen					Other Land-use Criteria					Environmental Criteria				
Wind Mapping	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues
Northern California	433	-	1,545	901	Multiple Subs	1,538	-	-	1,341	Fire Threat	1,203	370	200	1,106	Multiple Criteria
Southern PG&E	300	-	-	350	Multiple Subs	575	-	-	75	Fire Threat	300	-	75	275	Multiple Criteria
Greater Tehachapi	314	500	-	-	Whirlwind	124	500	-	190	Fire Threat	814	-	-	-	
Greater Kramer	200	300	-	150	Proposed Sub	650	-	-	-		500	150	-	-	Intactness
Riverside	-	-	-	499	Devers/El Casco	-	-	-	499	Fire Threat	-	-	200	399	Multiple Criteria
Southern Nevada	1,500	410	-	-	Sloan Canyon	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
Greater Imperial	60	-	-	500	Proposed Sub	-	60	-	500	Fire Threat	60	500	-	-	Multiple Criteria
Total:	2,807	1,210	1,545	2,400		2,887	560	-	2,605		2,877	1,020	475	1,780	

- Re-mapping options:
  - Staff are considering implementing additional criteria analysis using a lower capacity factor threshold at locations with commercial interest.
    - Not relaxing the environmental criteria but attempting to better capture potential locations given relative coarseness of underlying base resource potential data.
  - IRP staff are still reviewing ruling comment & reply feedback that included comments that IRP assumptions overestimate wind potentials in certain areas that RESOLVE selects.

Land-use and environmental criteria alignment: Geothermal

- Summary of criteria alignment for mapped geothermal resources within California, summarized by geothermal area.
  - Generally, good alignment for geothermal resources.
  - In remapping, staff may consider relocating additional resources to these in-state areas given identified transmission criteria issues for out-of-state locations.

2039	Core Land-use Screen					Other Land-use Criteria					Environmental Criteria				
Geo. Mapping (MWs)	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues	1 or 2	3	4	5	Main issues
Gesyers	124	-	-	-		-	-	-	124	Fire Threat	-	124	-	-	All ACE
Salton Sea	740	-	-	-		740	-	-	-		740	-	-	-	
East Brawley	50	-	-	-		50	-	-	-		50	-	-	-	
Total (MW):	914	-	-	-		790	-	-	124		790	124	-	-	

Community environmental impacts criteria

- Table to the right shows the number of mapped resources in non-attainment zones, near existing gas plants, and proximity to disadvantaged communities.
- Further mapping may seek to align resources with gas plants selected to not be retained through the gas not retained mapping process.

	In Air Quality Non-attainment Zones		Interconnecting to Substation < 1 mi from Gas Plant		In or near Disadvantaged Communities	
CAISO Study Area	Renewable (MW)	Storage (MW)	Renewable (MW)	Storage (MW)	Renewable (MW)	Storage (MW)
PG&E North of Greater Bay	433	88	796	208	347	38
PG&E Greater Bay	1,228	820	217	906	1,198	670
PG&E Fresno	6,392	2,551	1,311	509	3,185	1,276
PG&E Kern	4,630	2,365	182	50	2,471	1,182
SCE Northern	4,617	2,015	2,245	654	1,894	575
SCE Metro	14	2,793	-	1,130	7	1,397
SCE North of Lugo	2,152	650	683	170	1,282	295
East of Pisgah	-	-	1,400	500	-	-
SCE Eastern	1,689	145	399	45	200	-
SDG&E	3,382	651	2,532	92	50	-
Total:	**24,537**	**12,079**	**9,764**	**4,264**	**10,633**	**5,433**

Biomass proximity to disadvantaged communities	>5 mi from a DAC	<5 miles from a DAC	in a DAC
Biomass/gas (MWs)	**126**	**20**	**17**

- Initial mapping resulted in about 40 MW of biomass mapped to substations in or near a disadvantaged community.
- Staff will be seeking to remap the generic biomass to better alternatives. ~17 MW of these resources are in-development resources and cannot be remapped.

Commercial interest criteria analysis – Solar & Battery

- Significantly more solar and storage in the CAISO interconnection queue than selected in the portfolio.
  - Portfolio resources amounts are comparable to the amounts of higher confidence CI in the queue.
  - Commercial interest is not always optimal located when assessing environmental and transmission criteria as well.

All Values in Nameplate MWs	Resources in Full CAISO Queue (8/8/23)		Resources in CAISO Queue (8/8/23) — Excluding already online, contracted, and in-development resources				Cluster 15 Interconnection Requests
Resource Type	Total Resources	Has TPD	Total Resources	Executed IA	Has TPD	In Near-term Interconenction List	Total Resources*
Battery	106,422	29,020	92,926	18,056	15,924	16,382	155,804
LDES	4,300	1,465	4,100	500	1,265	-	1,067
Solar	60,594	10,164	47,511	14,407	3,091	13,466	75,951
Onshore Wind	5,795	928	5,262	1,992	631	1,125	3,611
Offshore Wind	7,518	1,000	7,518	1,029	1,000	162	12,500
Geothermal	53	-	32	-	-	-	-
Total:	**184,682**	**42,577**	**157,349**	**35,984**	**21,911**	**31,135**	**248,933**

*incomplete inclusion of all projects in list

Commercial interest criteria analysis – Solar & Battery

- Table (below) shows number of substations by region that have criteria-flagged differences between resources mapped and commercial interest for solar and battery mapped resources in the 2039 portfolio.
- Only two solar and two battery locations have no corresponding commercial interest.
- Remapping of the four substations with no commercial interest is a staff priority.
  - Resources at the 34 substation that exceed the amount of higher confidence commercial interest may be remapped to some of the 107 substations with more higher confidence commercial interest if it would improve alignment with the other criteria.

2039 Mapping Results	Resources Mapped exceeds Commercial Interest				Commercial Interest exceeds Mapped Resources			
	Solar		Battery		Solar		Battery	
Number of Substations by Area	No CI	Exceeds Higher Confidence CI	No CI	Exceeds Higher Confidence CI	More higher confidence CI	More total CI	More higher confidence CI	More total CI
PG&E North of Greater Bay	0	0	0	0	3	15	15	21
PG&E Greater Bay	0	0	1	0	0	6	16	31
PG&E Fresno	1	7	1	2	1	17	6	26
PG&E Kern	0	3	0	2	4	8	7	14
SCE Northern Area	1	2	0	1	3	3	11	7
SCE Metro	0	1	0	3	2	5	0	21
SCE North of Lugo	0	4	0	3	1	4	4	7
East of Pisgah	0	1	0	2	2	9	3	12
SCE Eastern	0	0	0	1	6	7	8	8
SDG&E	0	0	0	2	3	3	12	16
Total	**2**	**18**	**2**	**16**	**25**	**77**	**82**	**163**

Commercial interest criteria analysis – In-state Wind

- Overall, more instate wind in portfolio than identified in interconnection queues.
- Mapped wind resources at several stations exceed the identified commercial interest.
  - Seven substation, with 1.4 GW mapped, have no commercial interest.
  - Three substations have significantly more resources mapped than commercial interest.
- Few mapping alternatives to better alignment with commercial interest.-
- Only three substations have more low confidence interest than resource mapped.
  - Devers (Riverside Area): Additional interest from Cluster 15
  - Metcalf (Greater Bay Area): Interest from Cluster 15
  - East County (Baja California Area): Additional interest in current CAISO queue.

	2039 Mapped (MWS)	Total Commercial Intrest	Executed IA (CAISO, WDTs)	All Queue (CAISO, WDTs)	Cluster 15 Applications	NVEP Queue
PG&E North of Greater Bay	2,104	1,662	208	338	100	1,015
PG&E Greater Bay	875	1,187	787	-	400	-
PG&E Fresno	265	264	64	-	200	-
PG&E Kern	285	210	-	210	-	-
SCE Northern Area	814	324	124	-	200	-
SCE Metro	-	-	-	-	-	-
SCE North of Lugo	650	462	-	362	100	-
East of Pisgah	1,910	1,410	310	-	800	300
SCE Eastern	599	998	90	308	600	-
SDG&E	2,860	3,163	463	2,700	-	-
Total:	**10,362**	**9,679**	**2,046**	**3,918**	**2,400**	**1,315**

Commercial interest criteria analysis – Geothermal & LDES

- Geothermal resources generally align with identified commercial interest.
  - Very little within the CAISO queue
  - Roughly 1 GW of interests in both the Imperial area and in Nevada based on IID's and NVEP's queues, respectively.
- LDES resources are mapped to two locations corresponding to identified commercial development interests.
  - ~480 MW at Whirlwind in the Tehachapi area: aligns with a A-CAES project identified in the CAISO queue and partially contracted with by LSEs.
  - ~500 MW at Sycamore Canyon in the San Diego area: aligns with project underdevelopment that has received some state funding support.

Geothermal Commercial Interest					
Location	**Queue**	**Total MWs**	**No. of Projects**	**Avg. Project Size**	**Mapped Amount (2039)**
California	CAISO	53	1	53	**124**
Imperial	IID	921	7	132	**790**
Nevada	NEVP	1,007	21	48	**740**
Utah	N./A.	-	-	-	**76**

Alignment with Previous TPP – Northern CA

- Key criteria issues across the whole mapped portfolio:
  - **Less solar and storage in portfolio**: Most criteria non-alignment flags for alignment are centered on solar (in both 2034 and 2039) results and storage mapping (in 2034 in particular).
  - **New screens:** Updated land-use environmental screens cause some substations to have worse criteria alignment.
  - **New substation info:** With the addition of many substations and several proposed substations from new white paper information, resources have been shifted from previous substation to better reflect expected development reality.
- Northern California – criteria analysis
  - North of Greater Bay area has roughly 2 GW fewer resources than the 23-24 TPP 2035 portfolio.
  - Resource amounts are comparable for the 2039 mapped results.
    - Mapped results have 1.88 GW more onshore wind than 23-24 TPP portfolio, but no offshore wind and 500 MW less solar.
  - Greater Bay area resources are comparable to the amounts mapped in the 23-24 TPP.

PG&E North of Greater Bay	Total Res (2034)	Total Res (2039)	23-24 TPP (2035)
Geothermal (MW)	107.0	124.0	118.2
Biomass (MW)	98.1	98.1	80.0
OnshoreWind (MW)	971.0	2,104.0	383.5
OOS Wind (MW)	-	-	-
Offshore Wind (MW)	-	-	1,607.0
Solar (MW)	331.2	731.2	1,249.1
Li_Battery (MW)	331.9	501.9	392.7
LDES (MW)	5.0	5.0	-
Total by Status (MW)	1,844	3,564	3,830

PG&E Greater Bay	Total by Res Type (2034)	Total by Res Type (2039)	23-24 TPP (2035)
Geothermal (MW)	-	-	-
Biomass (MW)	29.2	29.2	22.4
OnshoreWind (MW)	875.0	875.0	566.8
OOS Wind (MW)	-	-	-
Offshore Wind (MW)	-	-	-
Solar (MW)	138.3	538.3	511.7
Li_Battery (MW)	1,090.4	1,440.4	905.3
LDES (MW)	-	-	-
Total by Status (MW)	2,133	2,883	2,006

Alignment with Previous TPP – Southern PG&E

- In both PG&E Fresno and Kern interconnection areas the key differences with the 23-24 TPP are in the 2034 mapping results.
  - Between the two areas, there are ~3 GW less solar and 1 GW less storage in the 2034 mapping results.
  - However, in the 2039 portfolio, both areas have comparable amounts of solar and storage as in the 23-24 TPP base case.

PG&E Fresno	Total by Res Type (2034)	Total by Res Type (2039)	23-24 TPP (2035)
Geothermal (MW)	-	-	-
Biomass (MW)	**16.0**	**16.0**	**7.6**
OnshoreWind (MW)	**265.0**	**265.0**	**73.6**
OOS Wind (MW)	-	-	-
Offshore Wind (MW)	-	-	-
Solar (MW)	**2,691.6**	**4,815.6**	**4,885.1**
Li_Battery (MW)	**1,849.2**	**2,830.3**	**2,345.3**
LDES (MW)	-	-	-
Total by Status (MW)	**4,822**	**7,927**	**7,312**

PG&E Kern	Total by Res Type (2034)	Total by Res Type (2039)	23-24 TPP (2035)
Geothermal (MW)	-	-	-
Biomass (MW)	**17.0**	**17.0**	**2.0**
OnshoreWind (MW)	**285.0**	**285.0**	**262.6**
OOS Wind (MW)	-	-	-
Offshore Wind (MW)	**3,855.0**	**4,531.0**	**3,100.0**
Solar (MW)	**1,659.6**	**2,759.6**	**2,993.1**
Li_Battery (MW)	**918.8**	**1,368.8**	**1,467.6**
LDES (MW)	-	-	**300.0**
Total by Status (MW)	**6,735**	**8,961**	**8,125**

Alignment with Previous TPP: Tehachapi, LA Metro, Kramer

- SCE Northern area has over 3 GW less solar in 2034 than the TPP base case 2035 portfolio and remains 2 GW below still in 2039.
- SCE Metro area has slightly more storage mapped in 2034 and 2039 than in the 23-24 TPP
- SCE North of Lugo area has slightly less solar and storage mapped in 2034 but slightly more in 2039.

SCE Northern Area	Total by Res Type (2034)	Total by Res Type (2039)	23-24 TPP (2035)
Geothermal (MW)	-	-	-
Biomass (MW)	1.0	1.0	6.4
OnshoreWind (MW)	614.0	814.0	126.9
OOS Wind (MW)	-	-	-
Offshore Wind (MW)	-	-	-
Solar (MW)	3,084.0	4,634.0	6,894.2
Li_Battery (MW)	3,409.4	3,973.9	4,057.7
LDES (MW)	481.0	481.0	500.0
Total by Status (MW)	7,589	9,904	11,585

SCE Metro	Total by Res Type (2034)	Total by Res Type (2039)	23-24 TPP (2035)
Geothermal (MW)	-	-	-
Biomass (MW)	5.6	5.6	3.8
OnshoreWind (MW)	-	-	-
OOS Wind (MW)	-	-	-
Offshore Wind (MW)	-	-	-
Solar (MW)	27.0	34.0	20.0
Li_Battery (MW)	1,961.5	2,291.5	1,765.3
LDES (MW)	-	-	-
Total by Status (MW)	1,994	2,331	1,789

SCE North of Lugo	Total by Res Type (2034)	Total by Res Type (2039)	23-24 TPP (2035)
Geothermal (MW)	-	-	-
Biomass (MW)	1.5	1.5	2.7
OnshoreWind (MW)	650.0	650.0	-
OOS Wind (MW)	-	-	-
Offshore Wind (MW)	-	-	-
Solar (MW)	1,585.0	2,037.0	1,930.0
Li_Battery (MW)	806.0	1,011.0	1,036.4
LDES (MW)	-	-	-
Total by Status (MW)	3,043	3,700	2,969

Alignment with Previous TPP – SNV, Riverside, Arizona, Imperial, and San Diego

- All three areas have roughly significantly less solar resources mapped than in the 23-24 TPP base case even in 2039.
- Both East of Pisgah and SCE Eastern areas have comparable slightly less battery storage in 2034 and comparable amounts of geothermal.
- All three regions have significantly more in-state wind in 2034 and more OOS wind interconnecting by in 2039 mapping results.

East of Pisgah	Total by Res Type (2034)	Total by Res Type (2039)	23-24 TPP (2035)
Geothermal (MW)	716.0	816.0	816.8
Biomass (MW)	-	-	-
OnshoreWind (MW)	1,810.0	1,910.0	353.0
OOS Wind (MW)	3,268.4	5,704.1	2,500.0
Offshore Wind (MW)	-	-	-
Solar (MW)	2,440.0	2,840.0	4,818.0
Li_Battery (MW)	1,864.0	2,614.0	2,624.0
LDES (MW)	-	-	-
Total by Status (MW)	10,098	13,884	11,112

SCE Eastern	Total by Res Type (2034)	Total by Res Type (2039)	23-24 TPP (2035)
Geothermal (MW)	740.0	740.0	805.0
Biomass (MW)	2.6	2.6	2.6
OnshoreWind (MW)	599.0	599.0	-
OOS Wind (MW)	2,000.0	4,500.0	2,328.0
Offshore Wind (MW)	-	-	-
Solar (MW)	3,058.5	5,408.5	7,441.3
Li_Battery (MW)	2,950.0	3,750.0	3,820.3
LDES (MW)	-	-	700.0
Total by Status (MW)	9,350	15,000	15,097

SDG&E	Total by Res Type (2034)	Total by Res Type (2039)	23-24 TPP (2035)
Geothermal (MW)	50.0	50.0	-
Biomass (MW)	-	-	-
OnshoreWind (MW)	2,060.0	2,860.0	495.0
OOS Wind (MW)	-	-	-
Offshore Wind (MW)	-	-	-
Solar (MW)	1,382.8	1,382.8	2,187.5
Li_Battery (MW)	1,489.7	1,581.7	1,503.0
LDES (MW)	449.0	449.0	500.0
Total by Status (MW)	5,432	6,324	4,686

Transmission constraints criteria analysis – Overall summary

- Table right shows number and locations of exceedances as well as likely upgrades triggered based on CAISO 2023 White Paper.
- Most exceedances and likely upgrades are in the PG&E and SDG&E areas.
  - Aligns with updated transmission information that included approved upgrades from the 22-23 TPP.

Tx Constraint Exceedances	2034		2039		Likely Upgrades by 2039			Upgrades for review/re-mapping
	Actual	Default	Actual	Default	Number	Avg. MWs	Total Costs (millions)	
PG&E North of Greater Bay	2	0	2	0	1	8,645	$ 2,852	1
PG&E Greater Bay	3	0	3	0	0	-	$ -	3
PG&E Fresno	2	0	4	1	1	10,038	$ 35	2
PG&E Kern	2	0	3	0	1	16,891	$ 940	2
SCE Northern Area	1	0	1	0	0	-	$ -	1
SCE Metro	0	0	0	0	0	-	$ -	0
SCE North of Lugo	0	0	0	0	0	-	$ -	0
East of Pisgah	1	0	1	1	1	6,800	$ 2,165	0
SCE Eastern	0	1	1	3	0	-	$ -	1
SDG&E	4	0	4	3	3	2,552	$ 341	1
Total	15	1	19	8	7	7,147	$ 6,333	11

- Default exceedances in the SCE eastern area and SDG&E area in the 2039 mapping result from mapped resources exceeding capability estimates of approved upgrades for those constraints.
  - Large amount of OOS wind interconnecting at Palo Verde is main source of default exceedance in SCE Eastern area.
  - Staff will be seeking additional CAISO input on potential additional transmission needs not captured by the White Paper information.
- Additional resources mapped in 2039 do also trigger several actual exceedances in the Fresno and Kern areas and generally increase exceedances where they already are occurring from the 2034 mapping.

Transmission constraints criteria analysis – Overall summary

- This part of the transmission analysis focuses only on the existing CAISO footprint needs. Portfolio and mapping also likely trigger out-of-CAISO transmission needs or potential transmission expansion that staff are continue to analyze.
- Table shows upgrades likely triggered by the 2034 mapping vs 2039 mapping
  - Key differences are constraints with minor exceedance that may not warrant triggering upgrade.
- In both 2034 and 2039 mapping, several constraint exceedances need further review and are potential remapping situations.
  - Exceedances are relatively small compared to size and cost of upgrade.
  - Upgrade capability does not accommodate resources mapped.
- Key next step: sharing transmission calculations and workbook with CAISO staff to seek additional information on exceedance areas
  - Confirm constraint capability amounts are accurate and are facing exceedances.
  - Identify potential transmission needs in default exceedance areas.
  - Identify alternative transmission solutions if any are known.

Potential Transmisison Upgrades	**2034**	**2039**
Actual Exceedances	15	19
Default Exceedances	1	8
Upgrades Likely Triggered	5	7
Cost of likely triggered upgrades (millions)	$ 3,446	$ 6,333
Average capacity increase (MWs)	6,269	7,147
Actual Exceedances for additional review/remap	10	11
Cost of potential upgrades (millions)	$ 11,098	$ 8,413
Average capacity increase (MWs)	2,678	1,904

Gas capacity not retained mapping criteria

Gas capacity not retained in proposed TPP portfolios

- Both the base case and sensitivity portfolios have input assumptions for gas capacity not retained that included:
  - OTC retirements
  - Phase out of CHPs between 2031-2040
- Ruling's proposed base case has 2.1 GW of economic capacity not retained selected by REOLVE in both 2034 and 2039 model years.
- Proposed High Gas Retirement Sensitivity has over 10 GW of gas capacity not retained (by 2039) forced in.
- The purpose of these slides is to provide stakeholders visibility into criteria that would inform development of the gas not retained assumptions in the High Gas Retirement Sensitivity.

Oct 5 Ruling Portfolios	OTC	CHPs	Additional Gas	Total
Proposed Base Case (2034)	3.692 GW	0.758 GW	2.128 GW	**6.578 GW**
Proposed Base Case (2039)	3.692 GW	1.731 GW	2.128 GW	**7.551 GW**
Gas Sensitivity (2034)	3.692 GW	0.758 GW	4.677 GW	**9.127 GW**
Gas Sensitivity (2039)	3.692 GW	1.731 GW	10.514 GW	**15.937 GW**

Criteria for selecting resources to be modeled as offline in TPP portfolios

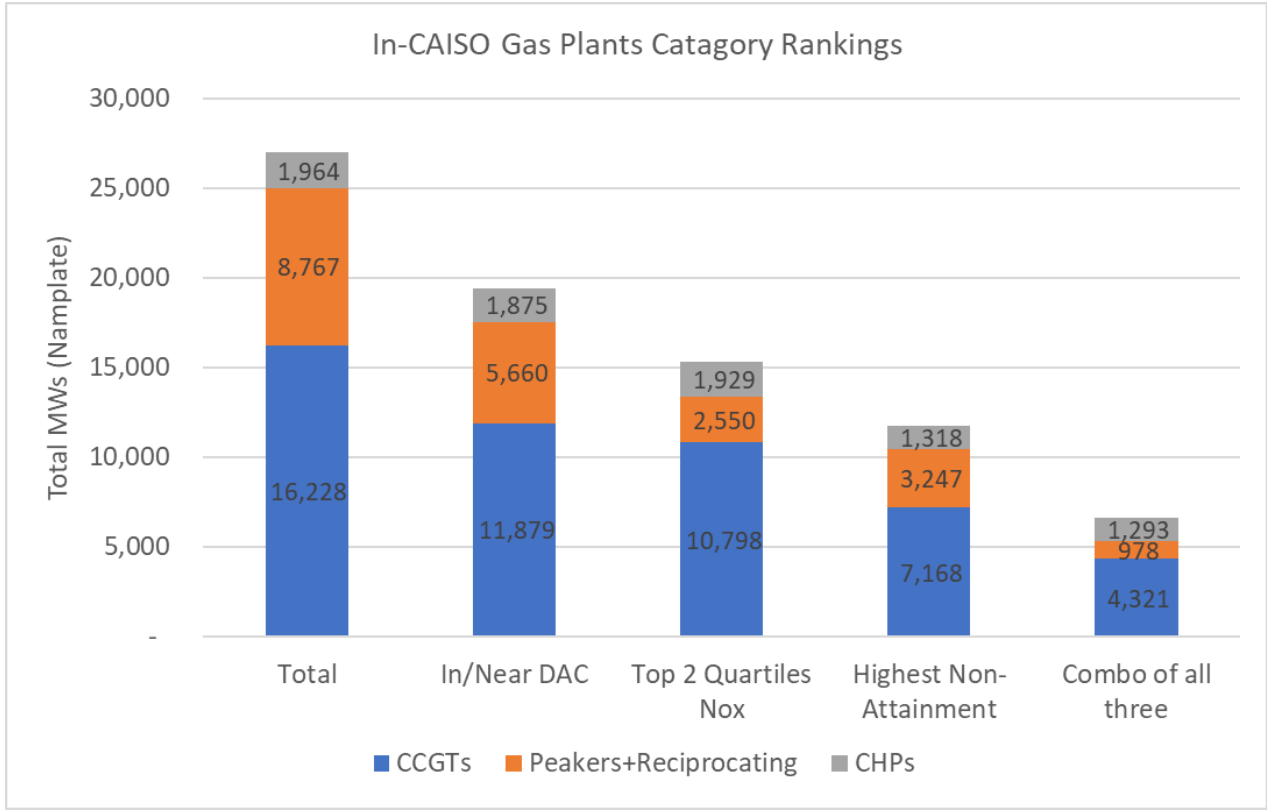
- Criteria incorporates several locational, emissions related, and performance related data.
  - Resources receive scores per factor and overall goal is to identify those resource with highest scores to prioritize for modeling as offline.
- Factors used to prioritize resources to be modeled as offline in TPP portfolios:
  - Proximity to an area identified as a Disadvantaged Community (DAC):
    - Highest score for plants in DAC, next highest for plants < 5 miles from DAC.
  - NOx emission ranking quartile (NOx rate multiplied by capacity factor):
    - Highest score for plants in top quartile of emissions data.
    - Utilize 2018 emission data from EIA database.
  - Location in EPA's Ozone and PM2.5 Non-attainment zones:
    - Highest score for plants within highest non-attainment levels for both pollutants.
  - Age by model year (i.e., age in 2035, 2039):
    - Highest scores for oldest plants.

Criteria for selecting resources to be modeled as offline in TPP portfolios

- Additional factors centered on performance related data:
  - Heat rate and capacity factors:
    - Highest ranking for resources in top quartile of heat rate and capacity factor data based on 2018 data.
  - Non-contracted resources:
    - Prioritize resources not identified as contracted by LSEs beyond though the model year, based on Nov. 2022 IRPs (incorporated but will not be shown in analysis).
  - Plants with lower or no local efficiency factors:
    - Prioritize plants with lower local efficiency factor identified from CAISO's most recent LCR studies.

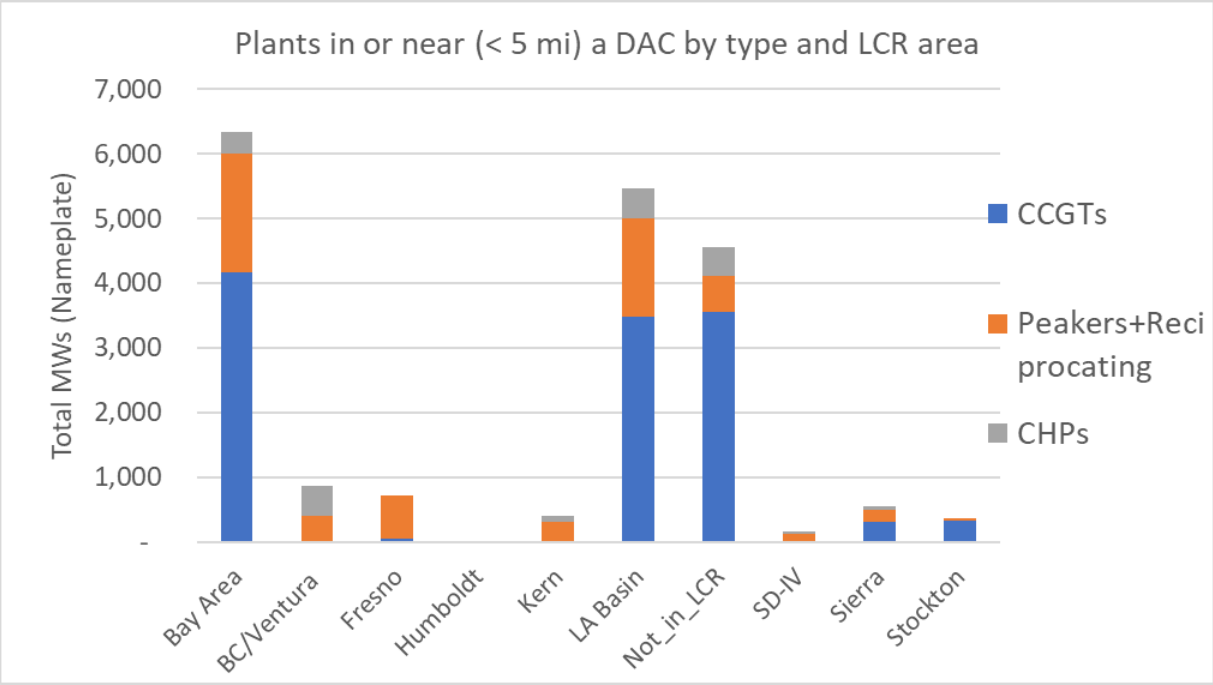
Existing Gas Plants in the CAISO system

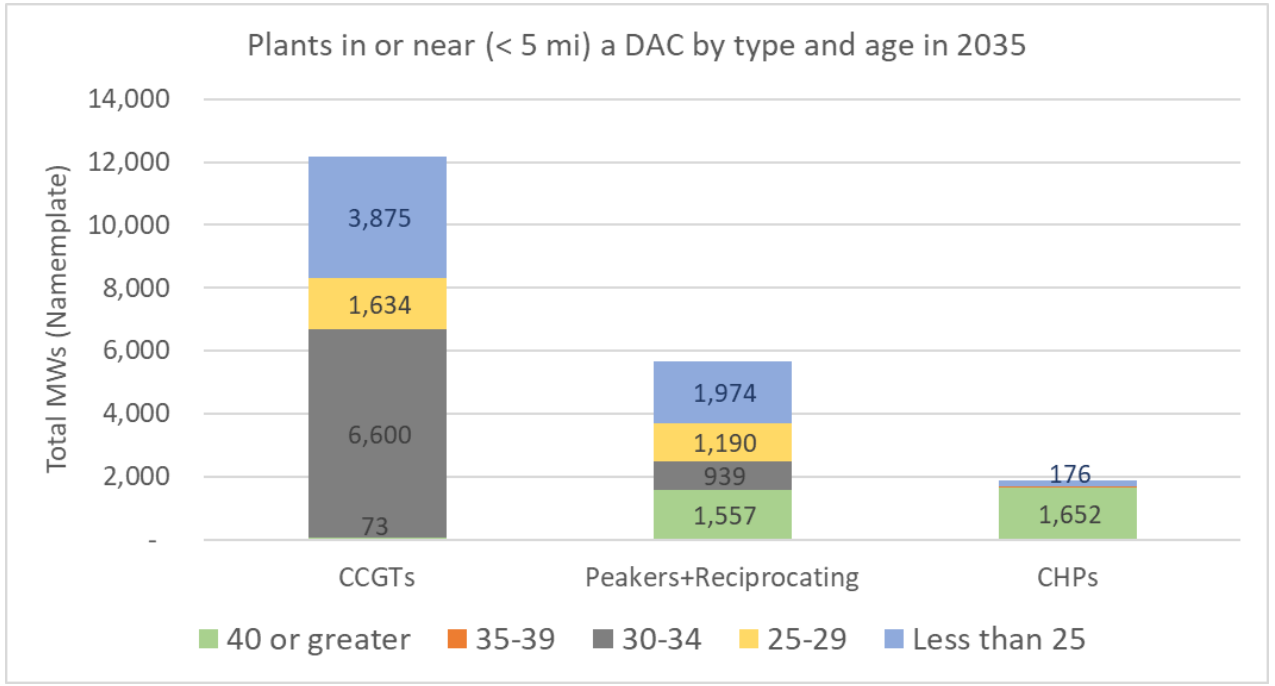
- Criteria data for most in-CAISO existing generators on CAISO's master generating list:
  - Missing info on and exclude analysis for generators outside of CAISO (imports in the master generator list) and smaller QF resources.
- Figure below has generators by RESOLVE resource type (excluding OTC plants) and amounts with higher priority for environment/emissions criteria.



Existing Gas Plants in the CAISO system

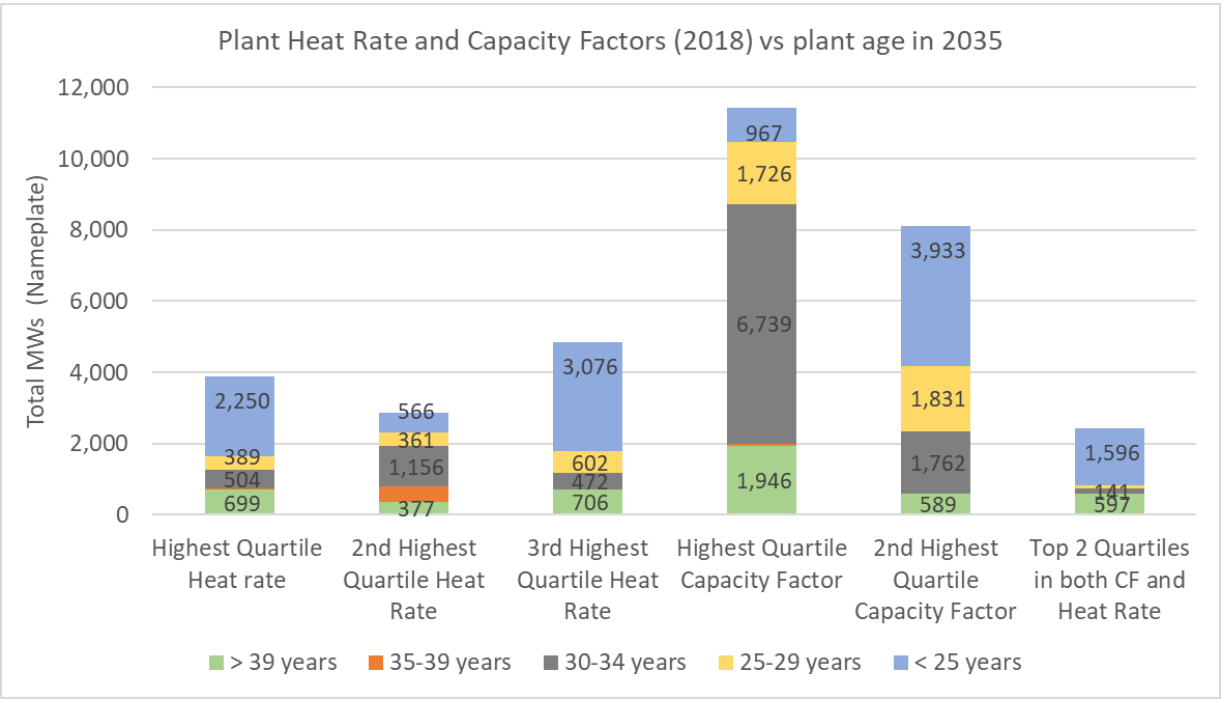
- (Left) Breakdown of gas located in or near disadvantaged communities by LCR area.
  - "Not_in_LCR" column sums up plants outside of CAISO identified local areas.
- (Right) Breakdown by age of plants for gas plants located in or near disadvantaged communities.

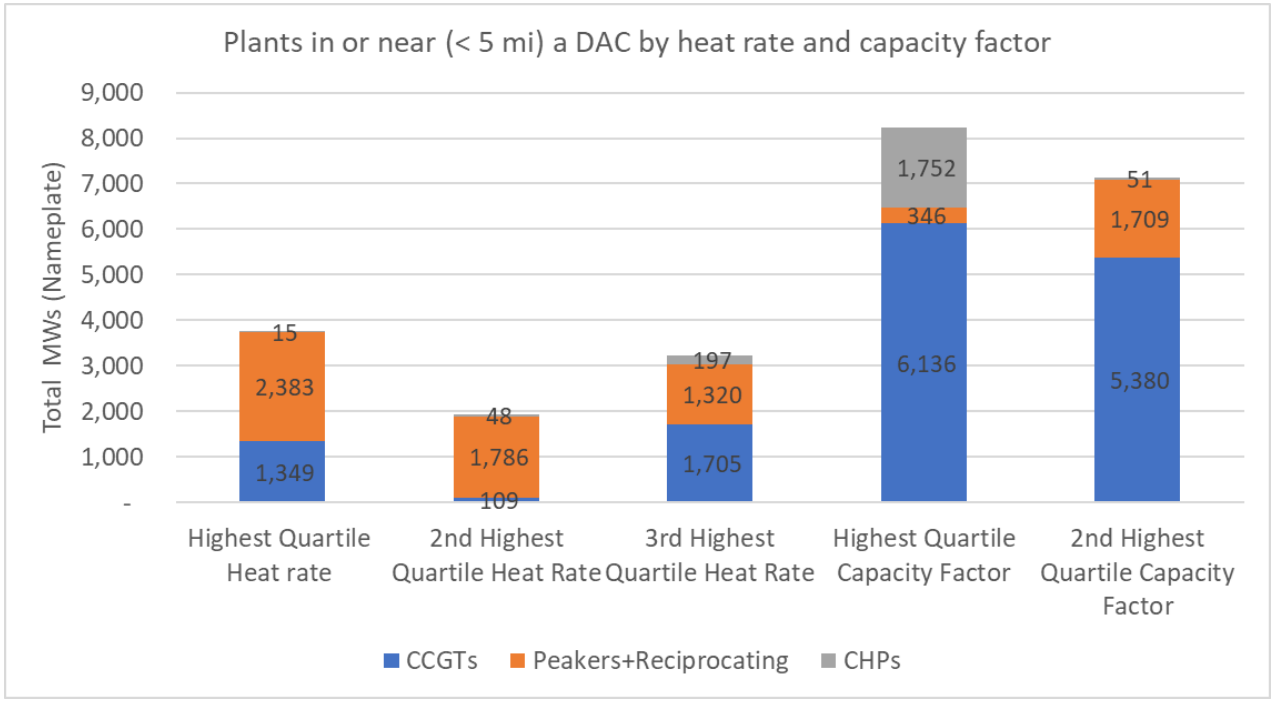




Existing Gas Plants in the CAISO system

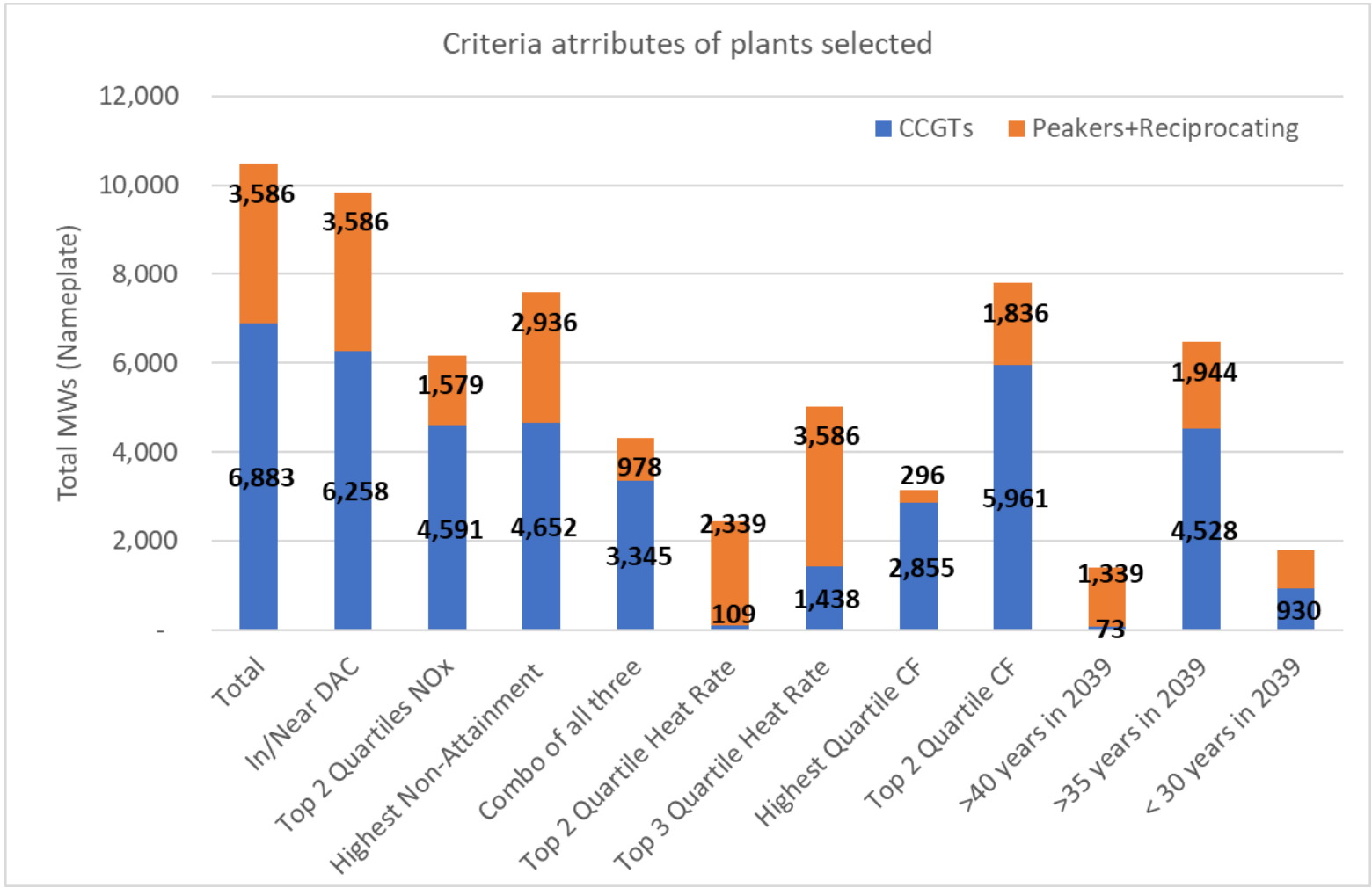
- Comparison of heat rate and capacity factor ranking data for CAISO gas plants.
  - (Left) Heat and capacity ranking data for plants compared to plant age in 2035.
  - (Right) Heat and capacity ranking data for plants in or near disadvantage communities.





Example selection of resources to not retain

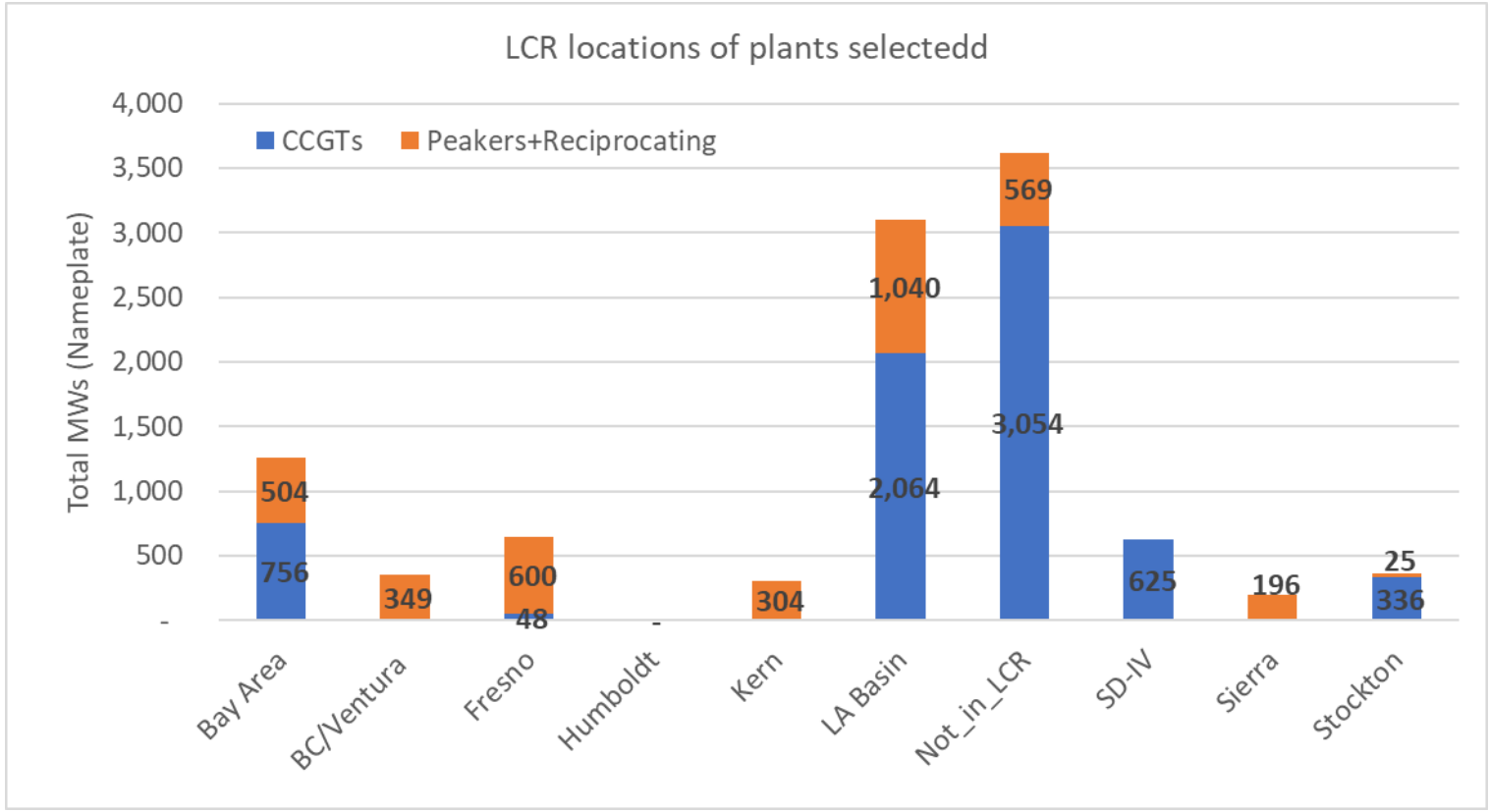
- An example selection of ~10.5 GW of gas resources based on a "balanced" use of the criteria.
  - Applying all criteria listed earlier, roughly equally weighted.
    - Each criterion's compliance was ranked on a scale of 1 to 4, and those plants with highest overall score were prioritized.
  - In deciding amongst plants with similar scores preferring to select resources with higher environmental criteria flags.
  - Focused only on non-CHP resources as CHPs not being retained is an input assumption in the portfolios and will be mapped separately.
  - Figure right show's breakdown of gas selected by criteria attributes.



Example selection of resources to not retain

- An example selection of ~10.5 GW of gas resources based on a balanced use of the criteria.
  - Figure right show's breakdown of gas selected by location.
  - Table below shows comparison with gas amounts not retained in CAISO's first 20-year outlook scenario.

LCR Areas	20-year outlook Amounts (MW)	Sample Mapping (MW)
Total	**14,408**	**10,469**
Bay Area	4,427	1,260
BC/Ventura	695	349
Fresno	669	648
Humboldt	-	-
Kern	407	304
LA Basin	3,632	3,104
Not_in_LCR	3,933	3,622
SD-IV	131	625
Sierra	153	196
Stockton	361	361



Questions