2023 Local Capacity Technical Analysis

Supplemental Local Capacity Assessment for the Santa Clara Sub-Area

June 18, 2018

(Revised)

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1 Introduction

1.1 Background and Objective

In the 2023 Local Capacity Technical Analysis[1], California ISO (CAISO) provided an updated projection of the 2023 Local Capacity Requirement (LCR) for the Santa Clara Sub-Area. The report identified a deficiency in local capacity due to the retirement of Mandalay (560 MW), Ellwood (54 MW) and the potential continued unavailability of the Las Flores Canyon Cogeneration Facility or EXGEN (7 MW NQC). The report also showed the dependence of the local capacity need on the location and reactive power capability of new resources that are procured to address the need.

Southern California Edison (SCE) has issued a Request for Proposals (RFP) to procure new resources to fill the local capacity need. The RFP will consider variable or runtime-limited resources such as energy storage, solar, demand response and energy efficiency resources. In order to facilitate consideration of these resources in the RFP process, SCE requested the CAISO to provide an assessment of the hourly local capacity need including the duration and the time of day of the local capacity need. The RFP will also consider gas-fired generation.

This report is prepared in response to SCE's request and supplements the 2023 Local Capacity Technical Analysis for the Santa Clara Sub-Area. As such, it uses the same starting power flow base case, load forecast, transmission, resource and other assumptions as the local capacity technical analysis. Additional assumptions and data used in the assessment are explained in this report. The methodology used in the hourly assessment of local capacity need is based on the methodology outlined in the Moorpark Sub-Area Local Capacity Alternative Study (Moorpark Study)[2].

1.2 Overview of Santa Clara Sub-Area

An overview of the Santa Clara local capacity Sub-Area is shown in Figure 1-1. The forecasted 2023 Santa Clara Sub-Area peak load is 923 MW based on the CEC managed load forecast as shown in Table 1-1. The CEC managed forecast includes the impact of Additional Achievable Energy Efficiency (AAEE) and Additional Achievable Photovoltaic generation (AAPV).

[1] http://www.caiso.com/informed/Pages/StakeholderProcesses/LocalCapacityRequirementsProcess.aspx, Page 59
[2] http://www.caiso.com/Documents/Aug16_2017_MoorparkSub-AreaLocalCapacityRequirementStudy-PuentePowerProject_15-AFC-01.pdf

Figure 1-1 Overview of the Santa Clara Sub-Area

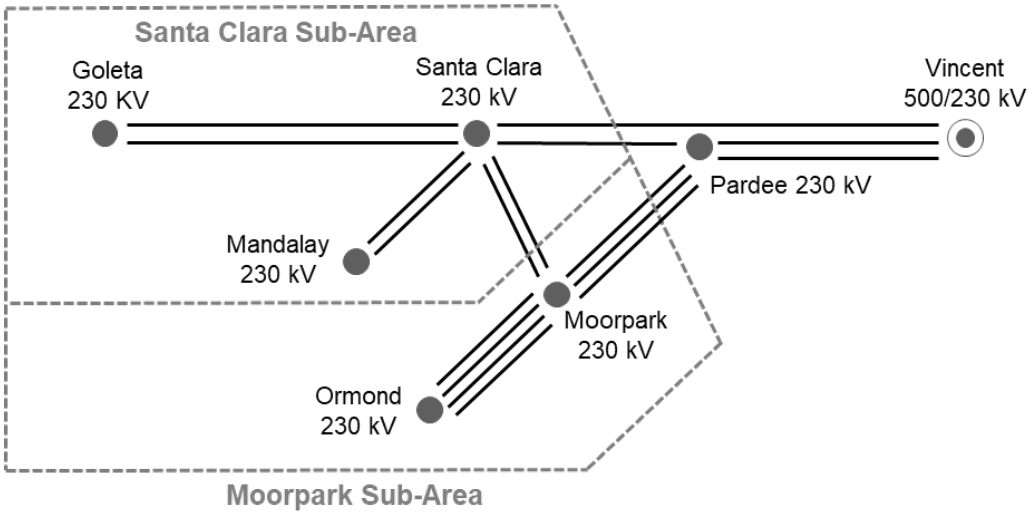


Table 1-1 Sub-Area 2023 Peak Load Modeled

Active Load (MW)	Reactive Load (MVar) (negative values represent injection into the grid)
923 MW	- 29 MVar

Table 1-2 provides the net qualifying capacity (NQC) of resources expected to remain available in the Santa Clara Sub-Area in the post 2020 period after the retirement of Mandalay and Ellwood.

Table 1-2 Available Resources in the Post 2020 Period

Remaining existing generation (after the retirement of Mandalay (560 MW) and Ellwood (54 MW) and assuming Goleta_6_Exgen (6.9 MW) will remain unavailable)	187 MW
Existing and approved preferred resources	7 MW
Available resources in the post 2020 period	**194 MW**

2 Current Projection of Local Capacity Need

The most critical contingency that establishes the minimum LCR in the Santa-Clara Sub-Area is the loss of the Pardee–Santa Clara 230 kV line followed by the loss of Moorpark–Santa Clara 230

kV #1 and #2 lines, which would cause voltage collapse. The 2023 Local Capacity Technical Analysis, established a minimum LCR of 295 MW for the Santa Clara Sub-Area assuming new resources will have capability to provide reactive power and they will be located in the most effective location[3]. The study indicated that the LCR can vary from 295 MW to 358 MW depending on location and incremental reactive power capability provided by new resources as shown in Table 2-1.

Table 2-1 Variation of LCR with Location and Reactive Capability of New Resources

Location of new resource(s)	Reactive power capability of new resource(s)	
	0.95 lead/lag power factor range	Unity power factor
Goleta 66 kV	295 MW	316 MW
Santa Clara 66 kV	322 MW	358 MW

Accordingly, the resulting local capacity deficiency will range approximately from 102 MW to 164 MW as shown in Table 2-2.

Table 2-2 Projected Sub-Area Local Capacity Deficiency

Location of new resource(s)	Reactive power capability	
	0.95 lead/lag power factor range	Unity power factor(1)
Goleta 66 kV	102 MW[4]	122 MW
Santa Clara 66 kV(1)	128 MW	164 MW

(1) SCE models load reactive power based on a 25-to-1 active power to reactive power ratio measured on the high side of distribution transformers based on its distribution planning target. Accordingly, a total of about 29 MVar of negative reactive (capacitive) load is modeled in the Santa Clara Sub-Area despite the inductive nature of load. As such, some or all of the incremental reactive power capability of the new distribution connected resources is likely to be subsumed within the planning target.

[3] http://www.caiso.com/informed/Pages/StakeholderProcesses/LocalCapacityRequirementsProcess.aspx, Page 59.
[4] The current 102 MW projected minimum local capacity need represents an increase of 16 MW from the 86 MW minimum local capacity need that the ISO identified in the 2017-2018 Transmission Plan for year 2022. The assessment last year provided only the minimum need and didn't consider variations due to locational effectiveness and reactive power capability. The increase in minimum projected local capacity is comprised of 6 MW increase in LCR and 9 MW decrease in available capacity. It is to be noted that EXGEN (6.9 MW, 56 MVar) is assumed to be unavailable in this year's 2023 LCR assessment.

The combined relative locational and reactive capability effectiveness factors shown in Table 2-3, which are derived from the above table using Goleta as the locational reference and unity power factor as the reference for reactive capability, may be used to facilitate the resource evaluation process.

Table 2-3 Combined Relative Locational and Reactive Power Effectiveness Factors

Location of new resource(s)	Reactive power capability	
	0.95 lead/lag power factor range	Unity power factor(2)
Goleta 66 kV(1)	1.20	1.00 (reference)
Santa Clara 66 kV(1)	0.95	0.74

3 Assessment of Hourly Local Capacity Need

The assessment of hourly local capacity need is performed using a methodology similar to that used in the Moorpark Study and involves the following steps:

- For each hour, comparing the voltage stability area load limit derived using power flow analysis excluding the output of all variable and time-limited resources with;
- The net hourly area load obtained by subtracting from area load the hourly output of available non-dispatchable resources, if any; and
- Dispatching dispatchable resources whenever the net load for a given hour is greater than the load limit. Energy storage resources must be charged when area load is sufficiently below the voltage stability area load limit so that the charging load plus area load does not exceed the area load limit.

The analysis should consider the relative effectiveness factors provided in the preceding section. SCE can consider the methodology in the development or screening of portfolios comprised of resources submitted in response to the RFO. Once SCE completes the screening process, the ISO will model the final portfolio(s) in power flow to validate adequacy. This step is necessary because the spreadsheet load and resource analysis described above does not account for reactive power and locational impacts of loads and resources.

All resources are assumed to meet CPUC requirements for qualifying for RA credit. In particular, it is assumed that all resources to be offered into the ISO market to meet the Santa Clara subarea local capacity need will be available for a minimum of four hours per day.

The hourly analysis requires hourly sub-area peak day load forecast and the voltage stability sub-area load limit, the derivation of which is described in the next sections.

3.1 Forecast Hourly Load

The CEC does not provide an hourly forecast for the Santa Clara Sub-Area. As a result, the CAISO considered two alternatives to develop hourly load for the sub-area for the 2023 peak day. The first alternative considered was to use the CEC forecast load shape for the entire SCE area to produce a load shape for the Santa Clara Sub-Area. The second alternative was to use recorded sub-area load shape. The CEC load shape was used because the historical Santa Clara peak day load shape was found to be similar to that of the SCE-wide peak day load shape. On the other hand, the historical load shape was not used since it does not capture future changes in load shape resulting from increased penetration of BTM PV. The CEC hourly load forecast uses Pacific Standard Time (PST) all year round without adjustment for daylight savings time. The CEC data was shifted here by one hour since the peak day occurs in summer when daylight savings time is in effect. Table 3-1 provides the SCE area 2023 peak day forecast hourly load and the resulting Santa Clara Sub-Area hourly load in Pacific Prevailing Time (PPT).

Table 3-1 Derivation of Sub-Area Hourly Peak Day Load Forecast

Date (PST)	Hour Ending (PST)	Date (PPT)	Hour Ending (PPT)	SCE Area Forecast Hourly Load (Mid-Low) (MW) (Note 1)	Santa Clara Sub-Area Forecast Hourly Load
08/31/2023	12	08/31/2023	13	17,858	724
08/31/2023	13	08/31/2023	14	18,966	769
08/31/2023	14	08/31/2023	15	21,121	856
08/31/2023	15	08/31/2023	16	22,454	910
08/31/2023	16	08/31/2023	17	22,783	923
08/31/2023	17	08/31/2023	18	22,162	898
08/31/2023	18	08/31/2023	19	21,399	867
08/31/2023	19	08/31/2023	20	21,360	866
08/31/2023	20	08/31/2023	21	20,636	836
08/31/2023	21	08/31/2023	22	19,793	802
08/31/2023	22	08/31/2023	23	17,892	725
08/31/2023	23	08/31/2023	24	16,242	658
08/31/2023	24	09/01/2023	1	14,957	606
09/01/2023	1	09/01/2023	2	14,009	568
09/01/2023	2	09/01/2023	3	13,492	547
09/01/2023	3	09/01/2023	4	13,151	533

09/01/2023	4	09/01/2023	5	12,964	525
09/01/2023	5	09/01/2023	6	13,443	545
09/01/2023	6	09/01/2023	7	14,434	585
09/01/2023	7	09/01/2023	8	14,775	599
09/01/2023	8	09/01/2023	9	15,033	609
09/01/2023	9	09/01/2023	10	15,010	608
09/01/2023	10	09/01/2023	11	15,448	626
09/01/2023	11	09/01/2023	12	16,147	654
Note 1 – SCE Area forecast 2023 peak occurs on 08/31/2023 HE 17, PPT.					

3.2 Derivation of Area Load Limit

The voltage stability area load limit for the Santa Clara Sub-Area for the critical contingency is determined using the Power-Voltage (P-V) method. In this method the load in the area is increased proportionally in small increments until the power flow solution diverges. The analysis is performed with the output of all variable and runtime limited resources excluded in order to properly account for variability in output of non-dispatchable intermittent resources and determine the limit that dictates dispatch of runtime-limited dispatchable resources.

4 Summary of Results

The study results from the supplemental local capacity analysis are set out in the attachment. From the study, it was concluded that:

- The MW local capacity need in the Santa Clara Sub-Area is in the range of 102 MW to 164 MW depending on locational effectiveness and reactive power capability of the new resources;
- The duration of local capacity need is approximately 8 hours and occurs between HE 15 to HE 22 PPT, respectively; and
- Resources located at Goleta are more effective than those located at Santa Clara and help to address additional NERC TPL 001-4 and LCR criteria contingencies impacting only the Goleta system.

The attachment includes templates for developing or screening portfolios consisting of resources submitted in response to Santa Clara area RFO. The hourly analysis template is approximate in

nature and is intended only as a screening tool. Validation of the selected portfolio(s) using power flow analysis will be needed.

The ISO would note that local capacity need is subject to change with changes in the sub-area's share of the CEC managed forecast and its load shape, or changes in existing resource availability or NQC. The assessment does not include provision for such planning uncertainties.

Attachment

Slide Deck – Sent to SCE on May 14, 2018 (Revised)

California ISO

2023 Local Capacity Technical Analysis

Supplemental Portfolio Screening Information for the Santa Clara Sub-Area RFP

June 18, 2018

Background and objective

- Material is prepared for consideration in the procurement of new local capacity resources for the Santa Clara Sub-area
- Supplements the 2023 Local Capacity Technical Analysis(1) and uses the same load forecast, transmission, resource and other assumptions
- Assesses hourly resource needs and provides templates that can be used for screening portfolios of variable and run-time limited resources such as PV, energy storage, and demand response
- Methodology is based the preferred resources methodology outlined in the Moorpark Sub-Area Local Capacity Alternative Study(2)
- Includes locational and reactive power considerations

(1) http://www.caiso.com/informed/Pages/StakeholderProcesses/LocalCapacityRequirementsProcess.aspx

(2) http://www.caiso.com/Documents/Aug16_2017_MoorparkSub-AreaLocalCapacityRequirementStudy-PuentePowerProject_15-AFC-01.pdf

Santa Clara 2023 resource needs

	Assuming resources w/ reactive power capability (0.95 lead/lag)	Assuming resources w/o reactive power capability
LCR	295 - 322 MW(1)	316 - 358 MW(1)
Post 2020 available capacity	194 MW	194 MW
Deficiency	~102 - 128 MW(1)	~122 - 164 MW(1)

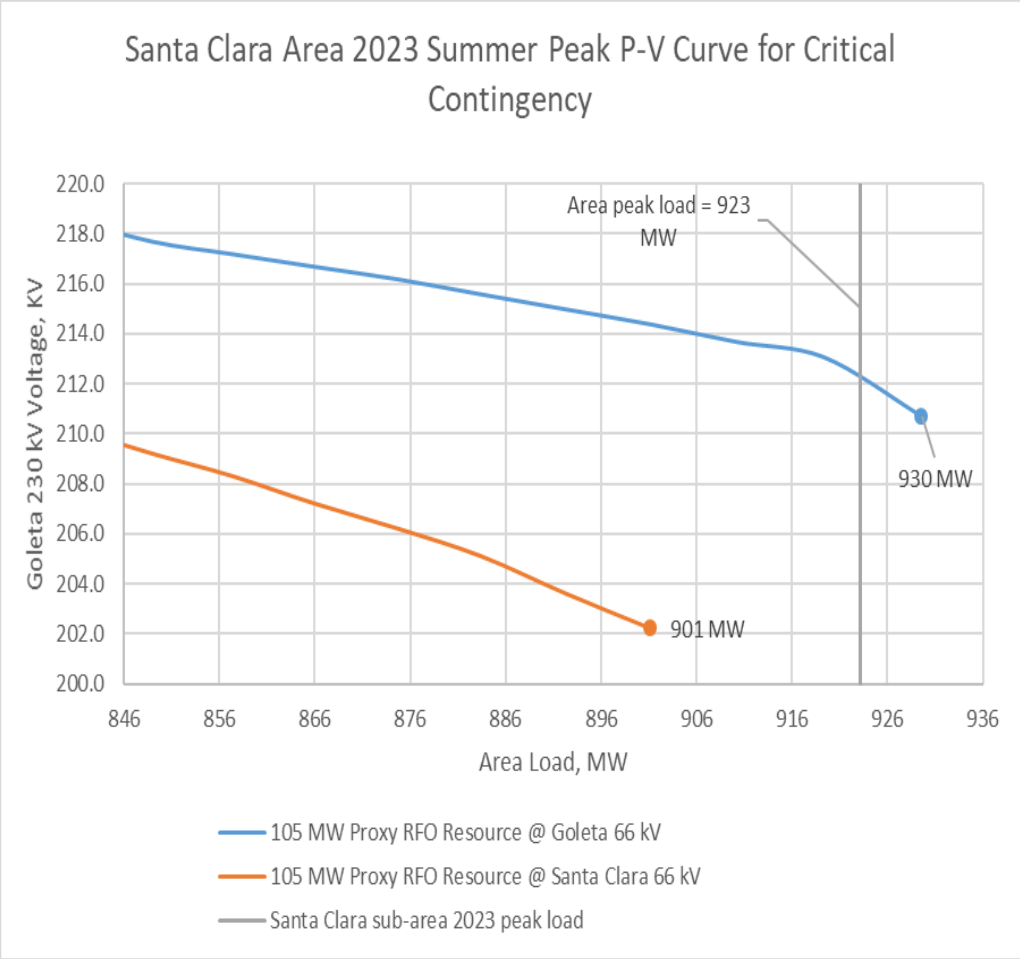
(1) Low end and high end of the range assume new resource location is Goleta or Santa Clara, respectively.

- SCE models load reactive power based on a 25-to-1 active power to reactive power ratio measured on the high side of distribution transformers based on its distribution planning target. Accordingly, a total of about 29 MVar of negative reactive (capacitive) load is modeled in the Santa Clara sub-area despite the inductive nature of load. As such, some or all of the incremental reactive power capability of the new distribution connected resources is likely to be subsumed within the planning target.

Post 2020 resource assumptions

		Current Aug NQC	Post 2020 Available Capacity	Comments
MNDALY_7_UNIT 1	MANDALAY GEN STA. UNIT 1	215	0.0	Retired
MNDALY_7_UNIT 2	MANDALAY GEN STA. UNIT 2	215	0.0	Retired
MNDALY_7_UNIT 3	MANDALAY GEN STA. UNIT 3	130	0.0	Retired
GOLETA_6_ELLWOD	ELLWOOD ENERGY SUPPORT FACILITY	54	0.0	Expected to retire by 2021
GOLETA_6_EXGEN	EXXON COMPANY USA	6.93	0.0	Out of service since 2015
MNDALY_6_MCGRTH	McGrath Beach Peaker	47.2	47.2	
SNCLRA_6_OXGEN	E.F. OXNARD INCORPORATED	34.1	34.1	
SNCLRA_6_PROCGN	PROCTER AND GAMBLE OXNARD II	45.7	45.7	
SNCLRA_2_UNIT1	New Indy Oxnard (Willamet)	19.0	19.0	formerly SNCLRA_6_WILLMT
MOORPK_6_QF	MOORPARK QFS (CAMGEN - O.L.S. ENERGY - CAMARILLO STATE HOSPITAL)	26.4	26.4	
SNCLRA_2_HOWLNG	Houwelings Nurseries Oxnard, Inc	7.6	7.6	
N/A	CHARMIN	2.8	2.8	
GOLETA_2_QF	GOLETA QFS	0.1	0.1	Not modeled explicitly but taken into account in the calculation of LC deficiency
GOLETA_6_GAVOTA	Point Arguello Pipeline Company	0.3	0.3	
GOLETA_6_TAJIGS	GOLETA_6_TAJIGS	2.8	2.8	
SNCLRA_6_QF	SANTA CLARA QFS	0.0	0.0	
SNCLRA_2_SPRHYD	Springville Hydroelectric Generator	0.4	0.4	
N/A	Aggregate fast-response demand response	5.4	5.4	
N/A	Aggregate LTPP 2012 Track 1 preferred resources	1.9	1.9	
	Total	815.0	194	

Locational effectiveness: Goleta Vs. Santa Clara



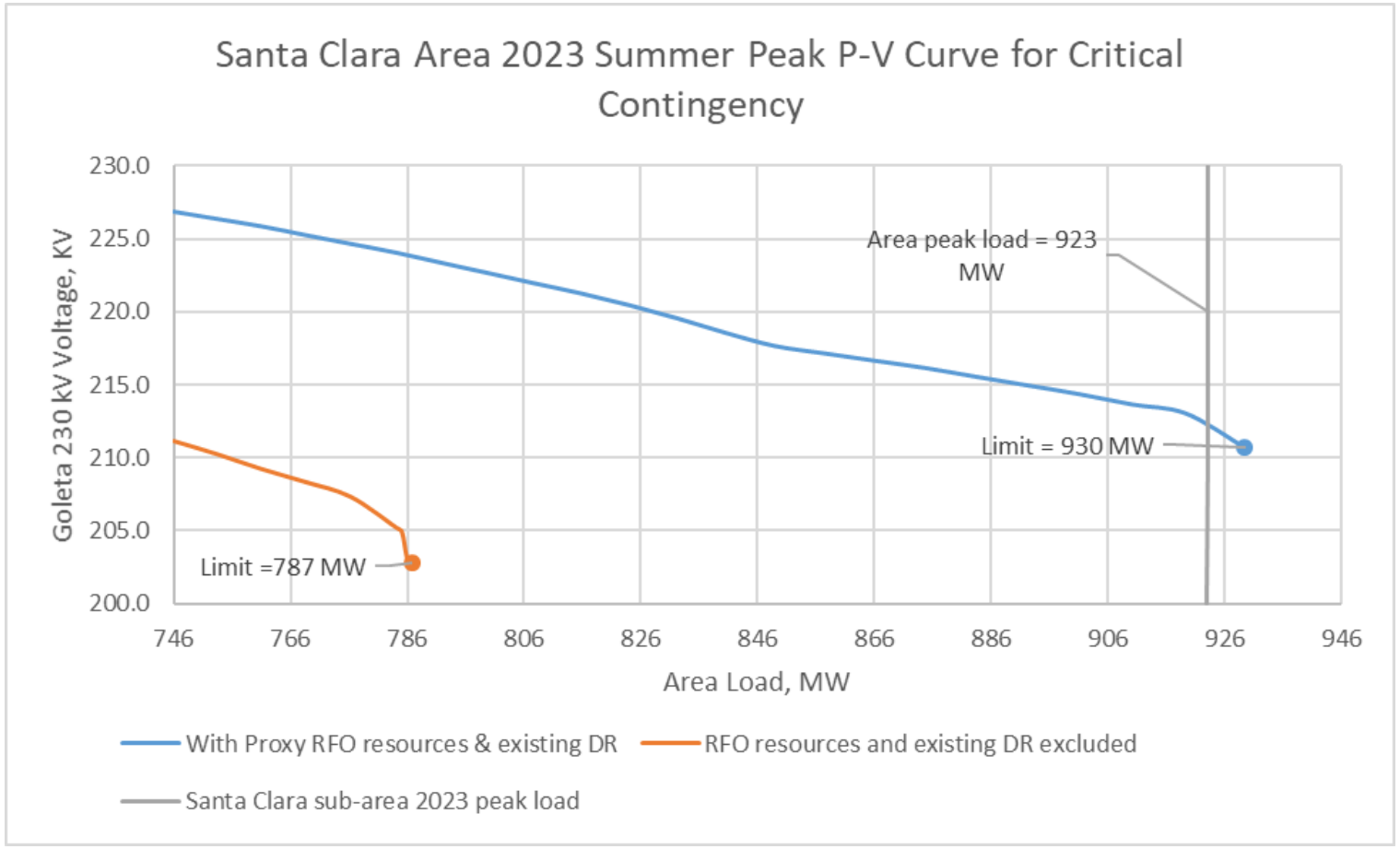
Goleta appears to be technically better

- 23-42 MW less resource needs depending on VAR capability
- Resources located at Goleta help to meet TPL 1-4 and LCR criteria voltage requirements (0.90 p.u.). Critical contingency is N-1/N-1 outage of one Goleta–Santa Clara line & Santa Clara capacitor (not a LCR criteria contingency)
- May address the N-2 resiliency target at Goleta
- 2.7 MW less area transmission losses

Resource amounts needed at Goleta to meet TPL 1-4 and LCR criteria voltage requirements

Contingency	Category	Applicable Criteria	Minimum amount to maintain acceptable 230 kV voltage	
			Assuming 0.95 lead/lag reactive power capability	Assuming resources w/o reactive power capability
Santa Clara–Goleta 230 kV line (No. 1 or 2)	P1 (L-1)	LCR & TPL	5 MW	10 MW
Largest unit at Goleta & Santa Clara–Goleta 230 kV line	P3 (G-1/L-1)	LCR & TPL	10 MW (two 5 MW units)	20 MW (two 10 MW units)
Vincent–Santa Clara & Santa Clara–Goleta 230 kV line	P6 (L-1/L-1)	LCR & TPL	15 MW	25 MW
Santa Clara shunt Capacitor & Santa Clara–Goleta 230 kV line	P6 (L-1/L-1)	TPL only	35 MW	50 MW

Area load voltage stability limits for use in hourly analysis

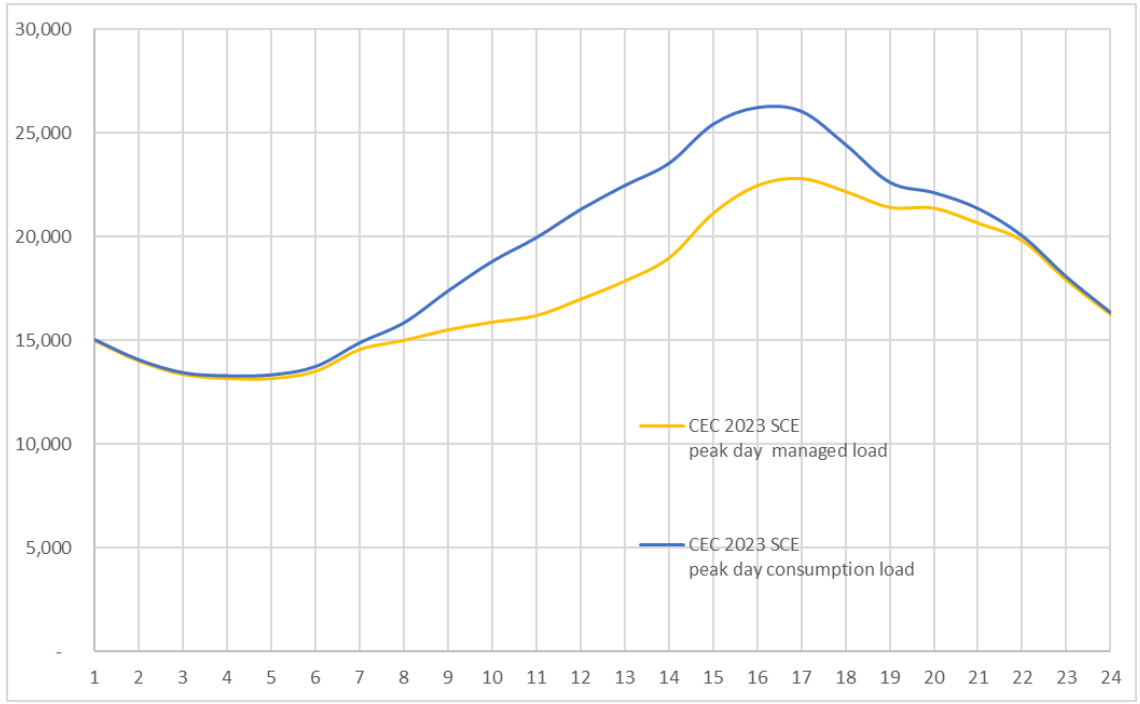


Forecast CEC load shape is used in the analysis

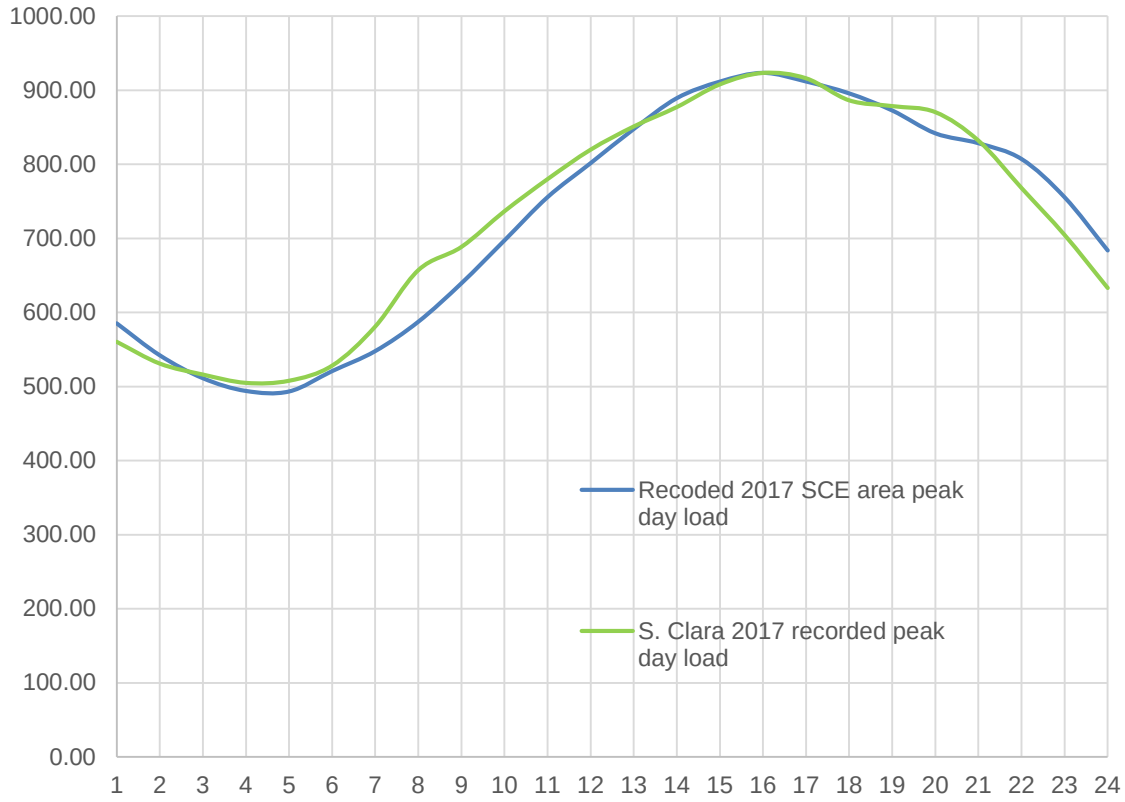
- CEC forecasted load shape for SCE area (2023 peak day - 8/31/2023)
  - More granular forecasted load shape is not available
  - Historical Santa Clara sub-area load shape is similar to the larger SCE area load shape
  - Future changes in Santa Clara load shape are assumed to be similar to that of the larger SCE area
  - The CEC data is shifted here by one hour to convert if from PST to PPT
- Historical load shape (2017 Santa Clara sub-area peak day - 10/24/2017)
  - Granular data available but is not used since it does not capture future changes in load shape

Forecast and historical load shapes

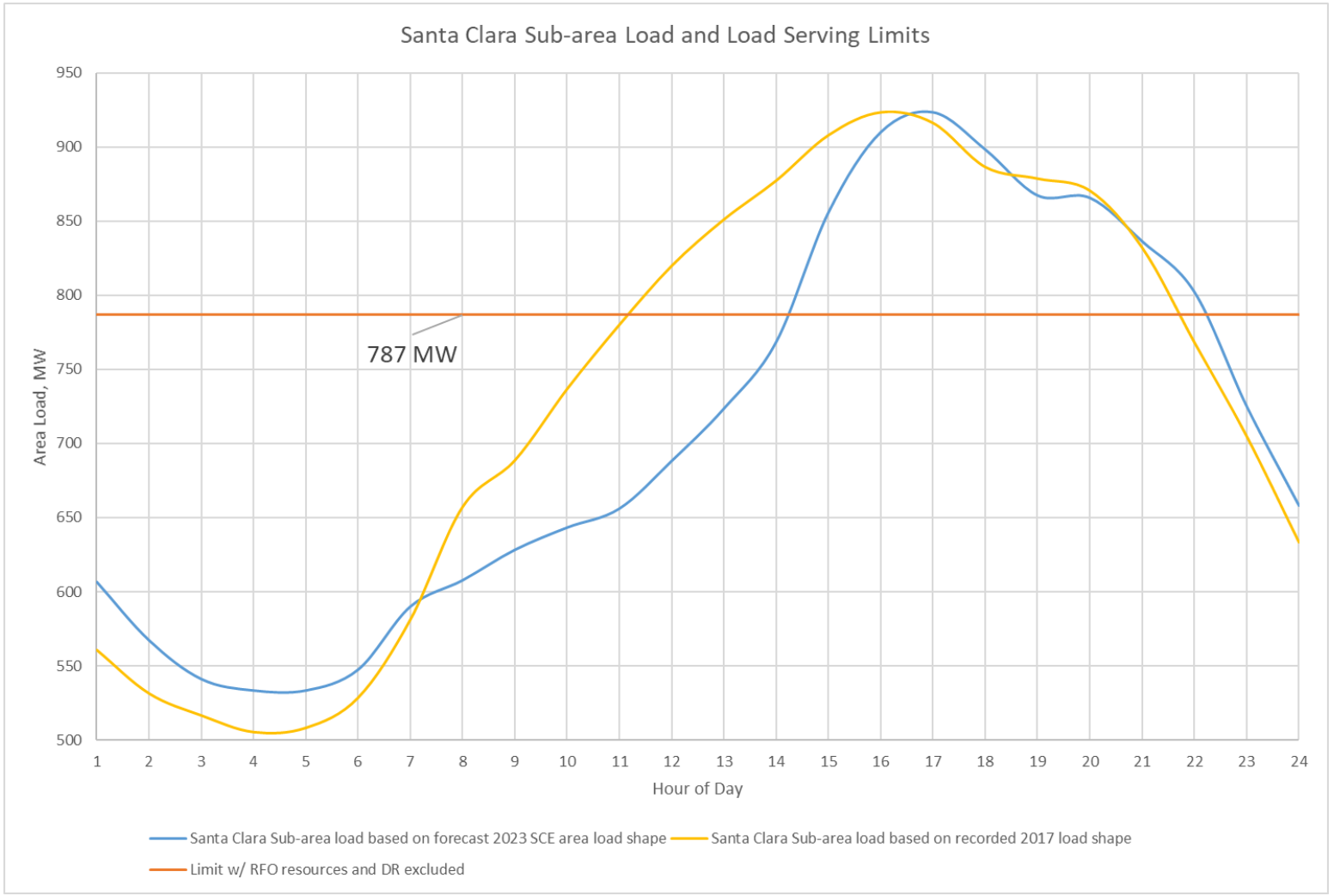
Future changes in load shape due to BTM PV, etc.



Recorded SCE vs Santa Clara load (scaled)



CEC load shape results in reduced runtime duration needs



Hourly analysis template

	Duration (Hrs)	Capacity (MW)	Relative Effectiveness Factor	Effective Capacity (MW)	ROW	Peak Load Day (HE, PPT)											
						13	14	15	16	17	18	19	20	21	22	23	24
2023 SCE Area Peak Day Load (Note 1)					A	17,858	18,966	21,121	22,454	22,783	22,162	21,399	21,360	20,636	19,793	17,892	16,242
2023 Santa Clara Load (Note 1)					B	724	769	856	910	923	898	867	866	836	802	725	658
Voltage Stability Load Limit (Note 2)					C	787	787	787	787	787	787	787	787	787	787	787	787
Resources @Goleta not explicitly modeled	Continuous	3.2	1.00	3.2	D	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Resources @Santa Clara not explicitly mode	Continuous	0.4	0.74	0.3	E	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Existing Fast DR @ Goleta	6	0.9	1.00	0.9	F					0.9	0.9	0.9	0.9	0.9	0.9		
Existing Fast DR @ Santa Clara	6	4.4	0.74	3.3	G					3.3	3.3	3.3	3.3	3.3	3.3		
Local Capacity Need (Notes 3, 5)					H=B-SUM(C to G)	(67)	(22)	65	119	129	103	72	71	42	7	(65)	(132)
RFO Portfolio Resource 1					I												
RFO Portfolio Resource 2					J												
RFO Portfolio Resource 3					K												
RFO Portfolio Resource 4					L												
RFO Portfolio Resource 5 (and so on)					M												
Total Resources Dispatched					N=SUM(I to M)	0	0	0	0	0	0	0	0	0	0	0	0
Remaining Local Capacity Need (Note 2)					O=H-N	(67)	(22)	65	119	129	103	72	71	42	7	(65)	(132)
Power Flow Validation					P	When requested by SCE, ISO will validate the final short list of resource portfolios											

Notes -

1. Hourly load for the Santa Clara sub-area (Row B) is obtained by scaling down the CEC 2023 forecasted managed hourly load for SCE area (Row A) (2023 peak load day - 08/31/2023).
2. Local Capacity Need is negative when no additional resources are required.
3. There is a contracted 1.0 MW of EE and 0.9 MW of PV modeled at Goleta. Due to the small size of these resources their variability is ignored are are modeled in the determination of the voltage stability limit.
4. Energy storage discharging is positive and charging is negative. Charging is not expected to be a concern since there are sufficient hours in the day with sufficiently low load to charge storage for next day duty
5. Due to the approximate nature of the methodology, this spreadsheet overestimates the HE 17 local capacity need by 7 MW compared to the amount determined using powerflow analysis.

Summary

- The MW local capacity need in the Santa Clara Sub-Area is in the range of 102 MW to 164 MW depending on locational effectiveness and incremental reactive power capability of the new resources
- The duration of local capacity need is approximately 8 hours and occurs between HE 15 to HE 22 PPT
- Resources located at Goleta are more effective and help to address LCR/TPL 001-4 voltage requirements in the Goleta area and SCE's N-2 resiliency target
- Minimum requirements are subject to change with changes in CEC forecast including changes in forecasted peak load, BTM PV, AAEE and load shape. The above estimates do not include provisions for such planning uncertainties
- Requirements may increase if additional resources retire or NQCs decrease