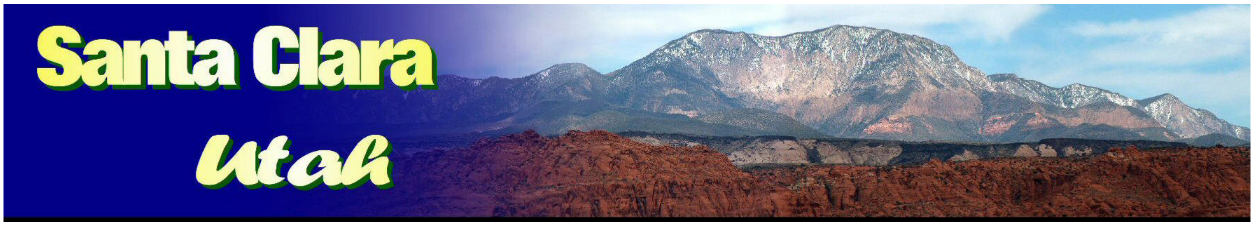

Santa Clara City

Electrical Distribution System
Capital Facilities & Work Plan

January 2022

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INTRODUCTION

Intermountain Consumer Professional Engineers ("ICPE") has prepared this "Electrical Distribution System Capital Facilities and FiveYear Work Plan (CFP) at the request of Santa Clara City. The intent of the CFP is to anticipate future demand for electricity, and evaluate the capacity of the City's electrical system to supply the demand. Improvements to the system are proposed to ensure that capacity is in place to maintain existing level of service to existing and new customers. Where appropriate, improvements for safety, reliability, and efficiency of the electric system are recommended. This report has been prepared to provide Santa Clara City information for budgeting and planning purposes. Detailed design work is not included as part of this study.

This document contains this Introduction Section, a Summary Section, Report Body Section and a Report Appendix.

The Report Body Section includes six subsections that include a System Load History and Forecast Section, Level of Service Standard Section, Transmission Evaluation Section, Substation Evaluation Section, Distribution Evaluation Section, Generation Evaluation Section, and System Improvement Summary Section.

General findings and recommendations of the CFP study are presented in the Summary Section of this Capital Facilities and Work Plan.

The Report Body subsections contain data supporting findings as presented in the Summary section.

The System Load History and Forecast subsection covers load history from 1991 thru 2021 and includes load projections through the period of this CFP and to 2032 for growth within the City boundary.

The Level of Service Standard subsection covers criteria that the City uses to plan, design and operate its system and establishes a uniform benchmark for Level of Service to customer.

Power system element subsections (Transmission Evaluation Section, Substation Evaluation Section, Distribution Evaluation Section, and Generation Evaluation Section) contain detailed information on each element of the power system that was evaluated for the CFP and contains data supporting findings as presented in the Summary Section.

The System Improvement Summary section lists major projects that are proposed in this CFP study, the general timeframe when the projects should be completed, and the estimated cost of the projects.

SUMMARY

This study considers the electrical load growth within the Santa Clara City Power service area, existing system performance and needed system improvements to facilitate growth. To evaluate system performance under existing and projected peak load conditions, a computer model of Santa Clara City's power system was developed and load flow simulations performed. Computer system analysis indicates that the current level of service is within Santa Clara City Power's level of service standard and acceptable utility practice. From the simulations, and system evaluation, projects that are necessary to accommodate growth in the next five years were identified.

Projects that are proposed in the Plan are listed in the System Improvement Summary section with the recommended completion date and the estimated cost of the project in 2022 dollars. Actual timing of these projects may vary depending on the actual load growth of the electrical system.

Load Forecasts

The demand on the City's electrical system grew at an annual average rate of a 4.67%, from 2011 through 2021 and at 6.16% from 2016 through 2021. For the period from 2010 through 2015 average annual growth was at 1.34%. Moving forward, residential and commercial growth is expected to continue and is projected at 4.6% annually through 2027 with initial years projected at 5% annually. The number of requests Santa Clara City has received for project approval supports the expectation of continued growth for the period of time covered by CFP.

The load forecasts assume a steady rate of growth within the City. Advanced planning is required to allow facilities to be in place when needed and the financial impact to the City's budget can be identified and incorporated. Due to Santa Clara City's historically high growth rate, growth could quickly accelerate beyond projections and should be closely monitored as it would affect project timing.

Historical and forecast data is listed in Tables 1 and 2 and shown graphically in Graphs 1 and 2 of this report.

Transmission

Santa Clara City's 69 kV electrical system receives power from a radial 69 kV UAMPS owned transmission line that is also interconnected to St. George City's electrical system. The City's 69 kV electrical system can also receive power from a "normal open" interconnection with Rocky Mountain Power at its Red Mountain interconnection point on an emergency basis. The UAMPS line connects to Santa Clara City's 69 kV transmission systems near the Parley Hassell Substation on the east side of the City. The City has two substations, Paul Grimshaw in the northwest area of the city and Parley Hassell located in the southeast area. The City-owned 69 kV transmission line runs from the Parley Hassell Substation to the Paul Grimshaw Substation, then west and south to the normal open PacifiCorp interconnection point on the western City boundary. The line then proceeds southward to the city's power plant and on to a future substation site.

The majority of the City's existing sub-transmission system was built in 1993. The 69 kV sub-transmission system is constructed with 4/0 AWG ACSR conductor. Past studies have utilized a maximum capacity of 28 MVA during extreme heat conditions, for the 69 kV sub-transmission systems. Based on load projections, Santa Clara loads will be at 30 MVA by 2032; if unexpectedly high growth occurs transmission loading could become a concern at an earlier date.

For normal operation and configuration, the existing sub-transmission system should serve the city's need through the 5-year period of this CFP. However, for a system outage beyond Santa Clara's system, the ability of Rocky Mountain Power system to carry the complete Santa Clara load during peak loading may be exceeded within the next four years.

As indicated Santa Clara City's electrical system is served from a radial system with approximately 30 MVA capacity; previous long-term planning, and as supported in this report, calls for addition of a third substation (south hills area) with transmission interconnection to the existing system and to an external source. Under a previous project Santa Clara City extended its 69 kV transmission system to the future substation site.

In previous years, to address projected transmission and substation requirements due to growth, Santa Clara city secured interconnection rights to St. George City's 138-69 kV Green Valley transmission substation. Interconnection to the Green Valley substation will require construction of approximately 2.3 miles of 69kV between interconnection points. Interconnection to the Green Valley substation is recommended during the period of the CFP. The future interconnection will increase system reliability and provide needed additional transmission capacity to accommodate growth. Interconnection transmission is depicted in the Long-Term Planning map included in this report.

Santa Clara City, through UAMPS, is involved in countywide planning. The existing external jointly owned transmission system (Central/Red Butte to St. George) is expected to be upgraded to 345kV operation in the 2026 time frame, the impact to UAMPS is currently not known but, as a UAMPS participant, may require Santa Clara City participation and could impact the city budget. Participation in county wide planning should continue to allow for advance planning and city input on potential projects.

Substations

The existing Paul Grimshaw and Parley Hassell Substations can be used to supply near term electrical demand in the City. For safe and efficient operation of the system replacement of Parley Hassell recloser controller(s) is scheduled in the coming year. Through this study it is acknowledged that controller replacement with SCADA integration is necessary.

System studies indicated that additional transformer capacity will be necessary by the 2025/2026 time frame.

From previous work, Santa Clara City Power has identified the location for a third substation near the south west city boundary (south hill area). Through this study it is seen that the identified location is well suited to cover expected growth in the area and would also provide to facilitate backup support to adjacent circuits and substations.

With consideration of needed capacity, expected growth pattern and developing distribution constraint the installation of an additional substation is recommend to occur in the 2026 time frame.

Distribution

General guidelines for main feeder distribution line construction are included in the distribution section. The guidelines emphasize construction of lines with the capacity to handle current and expected future load, provide backup capacity, maintain reliability and minimize losses.

The long-range planning map included with the work plan shows prospective routes for future transmission and new main feeder distribution lines. The lines run along existing and future road right-of-ways. Potential locations for switches to interconnect major feeders are shown on the map.

The distribution routes on the long-range map are intended as a guide to aid in planning new distribution facilities. Line routing will vary from the plan depending on where development occurs and the actual alignment of the roads at the time of construction.

Currently, under normal conditions, the present 12.47 kV distribution system has adequate capacity to handle existing load and ability to backup load for most contingencies. Due to known load growth, addition of 12.47 kV circuits is required as follows:

1. 0.21 mile of three phase 750 MCM URD Arrowhead to Vineyard drive. (2022-2023)
2. Extension of Paul Grimshaw circuits PRG-5 and PGR-6 approximately 0.63 miles each with 750 MCM URD northward of the Paul Grimshaw substation (2023-2024).

Although outside of this CFP period, it is noted that studies show some overhead distribution circuit sections, associated with Paul Grimshaw substation PGR-1circuit, will need to be reconductored or interconnection to the recommended south hills substation in the 2028- 2030 time frame. The upgrades will be needed to address voltage drop for loss of the Paul Grimshaw power transformer contingency and timing is based on study projections.

Generation

Santa Clara City has an existing power plant with two (2) 2MW generator units. The Plant, as constructed, has the infrastructure to add four (4) additional units. The plant was initially installed to cover peak spiking periods and with the recognition that future units would likely be required due to load growth.

Review of Santa Clara's resources mix shows that during high loadings hours Santa Clara has a resource short fall that will continued to grow with load growth. Obtaining resource to cover peak spiking can be very costly and difficult to predict from a budgetary perspective. As a means to control costs, generation should be considered for installation during the 2022-2024 period of this CFP. In conjunction with the 2.5 MW unit (Unit 3) that was recommended for installation under the previous study, installation of Unit 4 (2.5 MW) and Unit 5 (2.5 MW) is recommended for installation during this CFP period.

In conjunction with Unit 5 addition, an equipment building will be needed as the existing Unit 5 bay is currently serving as equipment storage.

Power Factor Correction

In power purchase contracts with UAMPS and PacifiCorp, Santa Clara City has agreed to correct system power factor to at least 95%. Through Area Planning, systems in the Washington County area have developed 98% power factor criteria at distribution substation circuits for the area during peak loading. Review of Santa Clara's electrical system power factor data for 2021 peak loading periods indicate Santa Clara power factor at 95% at the 69 kV level. Power factor of 95% at the 69kV level would correlate to a power factor of approximately 97% at the 12.47kV level.

To maintain system power factor, it is estimated that two (2) capacitor banks will be required through the period of this CFP. The size of capacitor banks and location for installation should be determined through a specific power factor study.

Protective Device Coordination

Over-current devices such as fuses, reclosers, and sectionalizers are used to protect substation equipment and power lines from damage. Proper operation of these devices is necessary to protect equipment and clear fault conditions. Coordinated application of protective devices reduces the frequency and length of outages, assist response personnel in locating the cause of outages, and improve protection of lines and equipment. A comprehensive system coordination that includes evaluation of all existing distribution devise is recommended to occur during this CFP period.

Work Plan Summary

The following Work Plan Summary Table contains a listing of projects recommended for this CFP necessary to maintain the current level of service to Santa Clara City Power Customers. Projects are listed by year and include conceptual cost estimates and project timing.

Capital Facilities Plan and Conceptual Estimates Summary Table

Generation, Transmission, Distribution, and Substation Projects

All Estimates Are In 2022 Dollars

Item and Description	Item Cost	Total For Year		Running Total
2022/2023				
1. Install Arrowhead to Vineyard 12.47 kV URD circuit extension (0.24 miles)	$120,000.00	$120,000.00		$120,000.00
2. Install/replace Parley Hassell Station Recloser Controllers and SCADA integration.	$170,000.00	$170,000.00		$170,000.00
3. Install 2-2.5MW generation units	$4,600,000.00	$4,600,000.00		$4,600,000.00
2022/2023 Total Estimate	**$4,890,000.00**	**$4,890,000.00**		
				$4,890,000.00
2023/2024				
1. Install Paul Grimshaw 12.47kV circuit # PGR-5 extension (0.63 miles ea.)	$404,000.00	$404,000.00		$404,000.00
2. Install Paul Grimshaw 12.47kV circuit # PGR-6 extension (0.63 miles ea.)	$404,000.00	$404,000.00		$404,000.00
3. Capacitor Bank(s) Installation	$20,000.00	$20,000.00		$20,000.00
2023/2024 Total Estimate	**$828,000.00**	**$828,000.00**		
				$5,718,000.00
2025/2026				
1. Install 69kV line extension – St.George Canyon View substation to south hill substation.	$1,300,000.00	$1,300,000.00		$1,300,000.00
2. Equipment Building	$300,000.00	$300,000.00		$300,000.00
2025/2026 Total Estimate	**$1,600,000.00**	**$1,600,000.00**		
				$7,318,000.00
2026/2027				
1. Install South Hill Substation	$2,600,000.00	$2,600,000.00		$2,600,000.00
2. Capacitor Bank(s) Installation	$22,000.00	$22,000.00		$22,000.00
3. Install 1-2.5MW generation units	$2,300,000.00	$2,300,000.00		$2,300,000.00
2026/2027 Total Estimate	**$4,22,000.00**	**$4,922,000.00**		
				$12,240,000.00
2022 to 2027 Total Estimate				**$12,240,000.00**

Assumptions:

1-Basis is Santa Clara City Electrical Load Growth Projection
2-Cost estimates do not include Right-Of-Way acquisition expense
3-Cost estimates are based on per-unit budgetary values only -
No design or engineering work has been done to create these estimates.
4-Substation estimates do not include property purchase.
5-Actual timing will vary depending on system load growth type and timeframe.
6- 750 URD estimate based on percentage of 1-mile unit cost estimate.

REPORT BODY

System Load History and Forecast

Management of an electric utility system requires careful planning. Load forecasts are essential to the planning process. New facilities must be designed, ordered, and installed in time to meet the needs of new residences and businesses; power resource contracts must be in place to supply growing demand at the most economical rate. In addition, budgetary estimates for new facilities need to be created for short term and long-range financial planning.

Santa Clara City projected peak electrical demand values, as provided in this study, are based on load history, known pending development and economic conditions. The historical data shows growth trends and provides for development of forecast for planning purposes. Many factors may cause variation in the annual kilowatt peak including weather, construction schedules of developers and businesses, annexations, and factors affecting the general economy of the region. The short-term forecasts are the most reliable. Longer-term forecasts need to be periodically updated based on current information and forecast trends.

Load history and changing economic conditions are indicators of what load growth to expect in the future. Santa Clara City's historical load data indicates a high growth rate occurred from 1991 through 2008. From 2007 to 2015 average annual growth was relatively small (0.73%). Examination of the past five years shows growth occurred at a yearly average of 6.16%. Currently Santa Clara City and surrounding areas are experiencing high growth. A listing of known and pending projects was provided by the city that indicated the potential for continued high growth, for review, the listing of pending and potential project is provide in the appendix of this report. Because of Santa Clara City's location, continued interest of developers, and favorable interest rates for investment, it is expected that high growth rate will continue in coming years and through the period of this CFP. If growth accelerates above projections, system improvements must also be accelerated.

Under current city boundaries, Santa Clara City has limited area for growth but can still support growth for some time. Major growth is expected to continue in the northwest area of the city and the south hills area (area south of the river and within city boundaries).

Historical load data and forecast load data for Santa Clara City are listed in Tables 1 and 2, and shown graphically in Graphs 1 and 2. Santa Clara City's customer count from 1991 through 2021 is presented in graphical form in Graph 3.

The load forecast shows a projected average annual growth rate of 4.8% for the next 5 years with the initial years at 5%.

In developing the forecast the following was considered:

- Historical Load data
- Santa Clara City General Plan Land Use Map
- Current projects under development.
- All new developments, loads, etc. within Santa Clara City's corporate city limits would be served by the Santa Clara City Power Department.

In planning for additions to Santa Clara City's electrical system, summer loads are used. Santa Clara City's electrical load has been summer peaking since 1992. Loading of all system equipment, such as transformers and power lines, is more critical in summer due to the higher ambient temperatures.

TABLE 1

SANTA CLARA CITY
ELECTRICAL DEMAND HISTORY

Year	Summer Peak (kW Demand)
1991	3,042
1995	4,802
2000	7,639
2001	7,253
2002	8,987
2003	10,142
2004	10,427
2005	11,980
2006	12,030
2007	12,880
2008	12,430
2009	13,310
2010	12,770
2011	12,800
2012	13,900
2013	13,970
2014	13,150
2015	13,650
2016	14,983
2017	15,220
2018	16,128
2019	16,138
2020	18,636
2021	20,172

Data analysis indicates that the ten year (2011 to 2021) average annual growth was at 4.67%. Growth from 2007 through 2015 was at 0.73%, the last five-year average annual growth was at 6.16%.

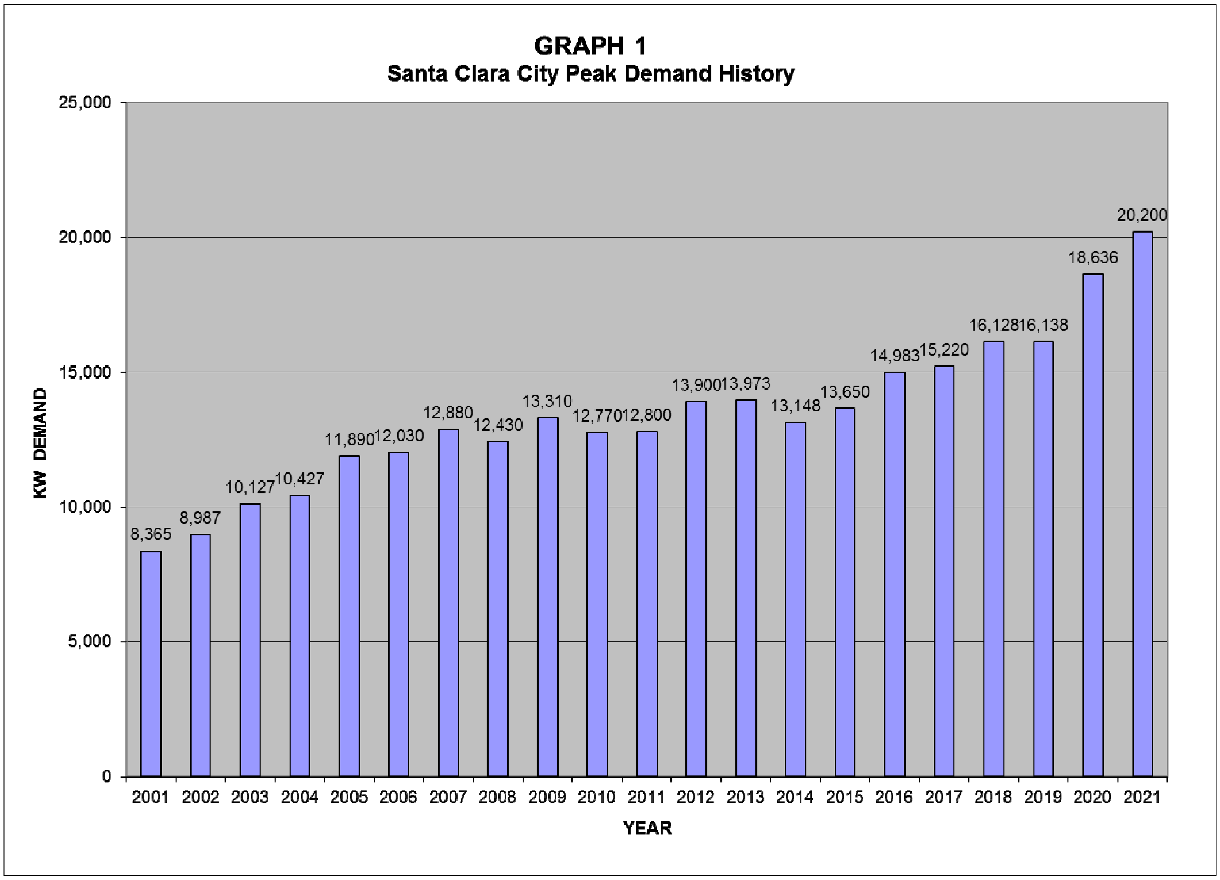
TABLE 2

SANTA CLARA CITY
ELECTRICAL LOAD FORECAST

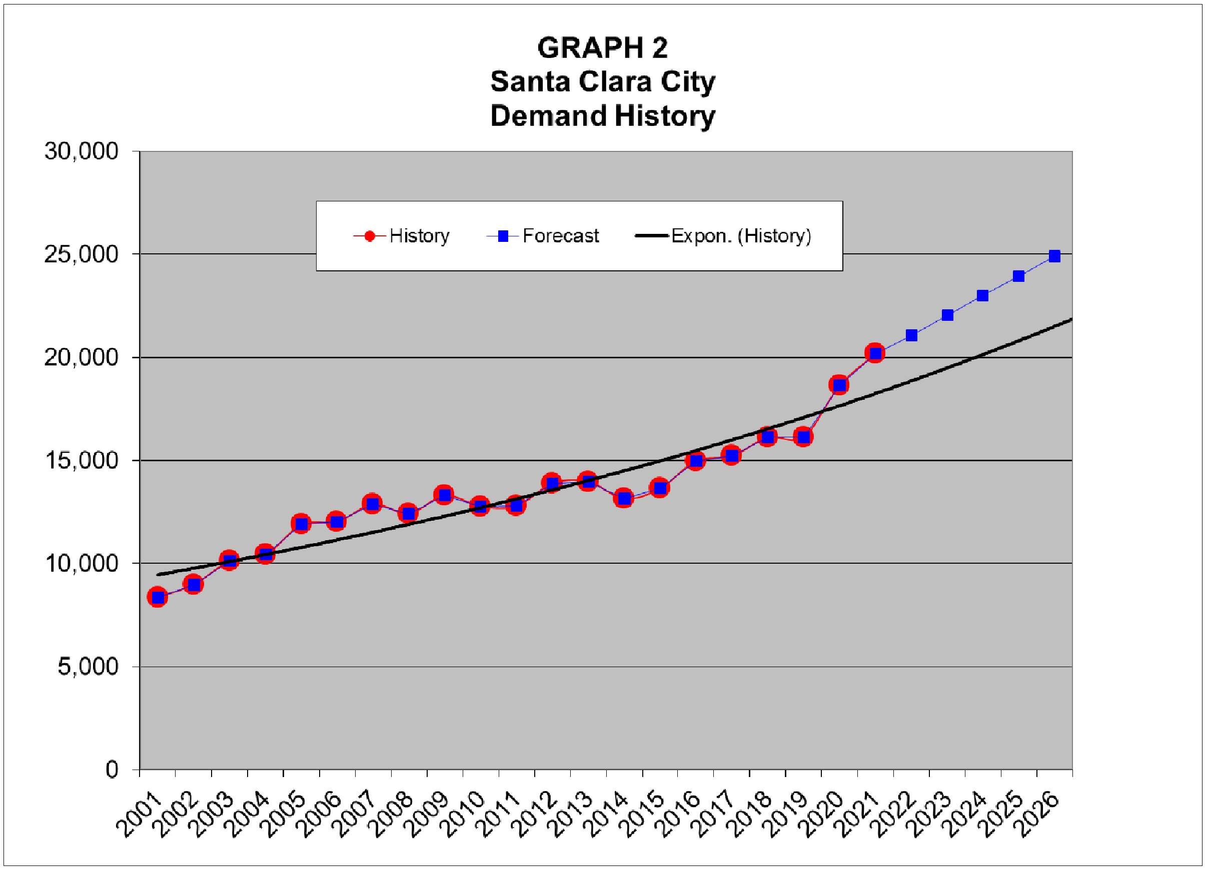
KW DEMAND		
Year	**Summer Peak (History)**	**Summer Peak (Forecast)**
1991	3,042	
2002	8,987	
2003	10,142	
2004	10,427	
2005	11,980	
2006	12,030	
2007	12,880	
2008	12,430	
2009	13,310	
2010	12,770	
2011	12,800	
2012	13,900	
2013	13,970	
2014	13,150	
2015	13,640	
2016	14,983	
2017	15,220	
2018	16,128	
2019	16,138	
2020	18,636	
2021	20,172	
2022		21,210
2023		22,271
2024		23,273
2025		24,320
2026		25,293
2027		26,304
2032		30,200

With consideration of historic loads and continuing load additions, an average yearly growth of 4.8% is projected for the period of this CFP (2022 to 2027). The first three years are projected at 5% annual growth.

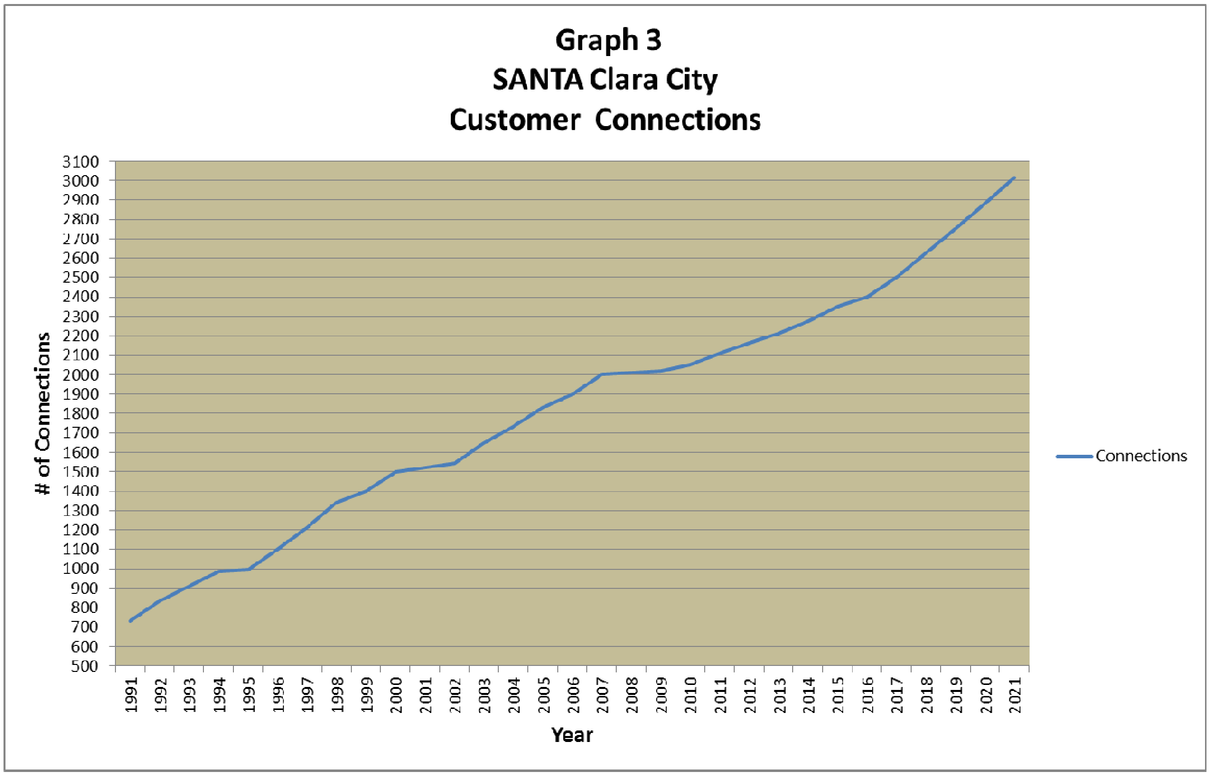
Graph 1(below), is a graphical representation of yearly historic peak load on the Santa Clara System. As previously indicated Santa Clara's electrical system high demand period occurs in the summer months. System peaks are subject to high temperature conditions. High demand in 2020 and 2021 can be attributed to growth in 2020 and 2021 and from previous years where weather was not extreme.



Graph 2(below), is a graphical representation of yearly historic peak and with load projections on the Santa Clara System through 2027.



Graph3 (below), indicates Santa Clara City's customer connections from 1991 through 2021. Customer connections from 2016 through 2021 are presented as a yearly average from known 2016 and 2021 counts.



A listing of known and potential projects was provided by the city indicating the potential for the addition of 3,500 new customers to be added to the system over the next five years. The projection, as provided in this study, is based on historical growth and consideration of recent years growth rate. However; if potential projects being considered actually develop and, at an accelerated rate, the actual growth rate would be considerable higher.

LEVEL OF SERVICE STANDARD

Santa Clara City strives to maintain and operates it system to obtain a uniform level of service throughout its system. The intent is to provide reliable power delivery at competitively low cost and equitably to all its customers. Below is a typical Level of Service Standard used for operations and to assess the need for new infrastructure.

The City should plan, designs and operates its system based on the following criteria:

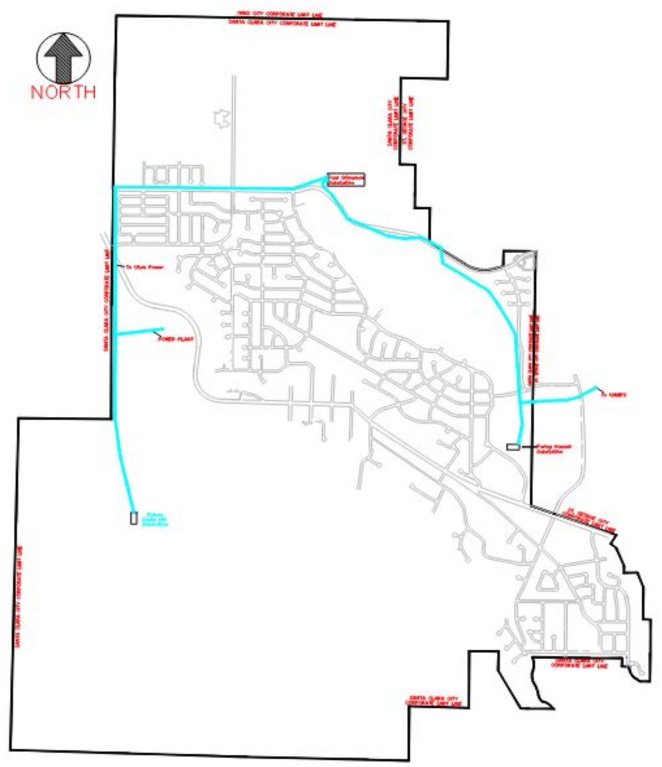
- Transformer ratings under varying load levels and loading conditions must remain below their ONAN/ONFA/ONFA 65degree rating.
- The system must be able to adequately serve load under single contingency (N-1) situations, where "N" is a power system element such as a transformer or line.
- Substation loading shall be limited to allow for N-1 situations.
- The system switching required under an N-1 contingency should remain as simplified as possible to ensure that switching orders not become unnecessarily complex.
- For normal operation, transmission circuit voltage must remain between 95% and 105% of its nominal value; and
- Primary distribution circuit voltage must remain between 98% and 105% (at loads) of its nominal value; and
- Distribution circuit mains must be able to serve additional load under N-1 contingencies.
- Distribution circuit loading criteria must remain below its maximum current rating;
- System Power Factor, during peak, at substation recloser should be at 0.98 or better.

The above criteria were used in the study to determine Santa Clara City's facility needs based on the amount of load (i.e., demand) placed on the existing system over the study planning horizon.

TRANSMISSION EVALUATION

Santa Clara City takes metered delivery at 69 kV. The City owns and operates approximately three miles of 69 kV subtransmission line. This is a radial line that interconnects with a UAMPS radial 69 kV line on the east side of the City and extends to the City's two distribution substations, to the city's power plant, and on to a future substation location.

On an emergency bases, the 69kV line has the ability to connect to Rocky Mountain Power's (RMP) 69kV system on the west side of the City through a normal open interconnection point. As indicated, The RMP interconnection point is an established emergency interconnection point for both Santa Clara City and RMP. Use of the emergency interconnection point by either party is subject to "the ability to serve" and is not a binding requirement. For a system outage beyond Santa Clara's system, the ability of Rocky Mountain Power system to carry Santa Clara load during peak loading may be exceeded within the next four years. Map 1 generally depicts the existing 69kV transmission system route.



Map 1 Existing 69 kV Transmission Route

The majority of the City's existing sub-transmission system was built in 1993. The 69 kV sub-transmission system is constructed with 4/0 AWG ACSR conductor up to the generation Plant. 69kV system extending from the generation plant to the future substation site is constructed with 795 ACSR. For the 4/0 sections, past studies have utilized a maximum capacity of 28 MVA during extreme heat conditions. Based on load projections, Santa Clara loads will be at 30 MVA by 2032; if unexpectedly high growth occurs transmission loading could become a concern at an earlier date.

System load flow studies indicated that the existing transmission does have the capacity to serve expected load through the study period (2022 to 2027) but will out-grow the ability for full back-up from Rocky Mountain Power due to load growth. Studies indicate that external system contingencies (outages on the St. George or UAMPS systems) can result in low voltage to the Santa Clara 69kV system under the current radial configuration toward the later part of this CFP period.

The radially fed substations are vulnerable to extended outage if disruption to service occurs on the UAMPS or Santa Clara City 69 kV lines. In previous Work Plans, ICPE has recommended that long term future plans include a 69 kV loop within the City and interconnection to a second power delivery point. In recognition of long-term system requirements, and to maintain the current level of service, Santa Clara City Power has secured interconnection right to St. George City's Green Valley substation. With consideration for the need of an additional substation (see substation section) and growing transmission constraints, ICPE recommends that interconnection to the Green Valley substation system occurs during the period of this CPF. The Green Valley interconnection will increase system reliability and provided additional transmission capacity that will be needed due to load growth. With appropriate switching capability at each substation, the second interconnection point and future loop will allow the City to maintain transmission service to each substation during abnormal operating conditions. These might include line maintenance work or an outage to any segment of the loop. This versatility will enhance the City's ability to operate the electrical system and improve service reliability to all city customers. Recommended transmission extensions are depicted in Maps 3, seen in the distribution section and appendix of this report.

As a member of UAMPS, Santa Clara City has participated in required transmission system upgrades external to the Santa Clara City service area as required by its power contracts. The external system upgrades are identified through the Southwest Utah Technical Studies Group that includes UAMPS, Santa Clara City, St. George, Washington City, Hurricane, PacifiCorp, and Dixie-Escalante. Through the coordinated efforts substantial transmission system upgrades have occurred over the past 15 years.

As a UAMPS member, external system upgrades can have an impact on the city's budget and the city should be aware of external transmission requirements and expected costs.

PacifiCorp's currently plans on converting one of the UAMPS/PacifiCorp jointly owned 138kV operated/345kV constructed circuits to 345 kV operations in 2026. As a part of the conversion 345 kV -138 kV transformers will be installed in the jointly owned St. George substation. Cost responsibilities, if any, have not been indicated.

SUBSTATION EVALUATION

Substations

Santa Clara City currently has two 69kV -12.47kV substations for power distribution that are served by Santa Clara's radial 69kV system. The Parley Hassell Substation is located in the southeast side of town and the Paul Grimshaw Substation is located on the northwest side of the City. The Paul Grimshaw substation and the Parley Hassell substations' general locations are as depicted in Map 1as seen in the transmission section of this report. The distribution substations step the voltage from 69 kV to 12.47 kV for distribution to City customers.

The major equipment ratings and capacities of each substation are listed in Tables 3 and Table 4 below.

TABLE 3
SANTA CLARA CITY SUBSTATION EQUIPMENT RATINGS

SUBSTATION	TRANSFORMER	REGULATOR	RECLOSERS
Parley Hassell Bank #1	10/12.5 MVA @55°C (OA/FA) 14.4 MVA @ 65°C (OA/FA) 67000 –12470Y/7200 volts	3-509 kVA (15.3 MVA)	**Ckt #1:** Cooper VWE w/ 4C control;560 Amp Rating **Ckt #2:** Cooper VWE w/ 4C control; 560 Amp Rating **Ckt #3:** Cooper VWE w/ 4C control; 560 Amp Rating **Ckt #4:** Cooper Type NOVA; Form 6 Control 600 Amp Rating
Paul Grimshaw Bank #1	10/12.5 MVA @55°C(OA/FA) 14.4 MVA @ 65°C (OA/FA) 67000 – 12470Y/7200 volts	3-509 kVA (15.3 MVA)	**Ckt #1:** Cooper Type NOVA; Form 6 Control 600 Amp Rating **Ckt #2:** Cooper Type NOVA; Form 6 Control; 600 Amp Rating **Ckt #3:** Cooper Type NOVA; Form 6 Control; 600 Amp Rating
Paul Grimshaw Bank #2	10/12.5 MVA @55°C(OA/FA) 14.4 MVA @ 65°C (OA/FA) 67000 – 12470Y/7200 volts	3-509 kVA (15.3 MVA)	**Ckt #4:** Cooper Type NOVA; Form 6 Control 600 Amp Rating **Ckt #5:** Cooper Type NOVA; Form 6 Control 600 Amp Rating **Ckt #6:** Cooper Type NOVA; Form 6 Control 600 Amp Rating

Parley Hassell Substation has one 69/12.47 kV, 10/12.5/14.4 MVA power transformer with three single-phase, 509-kVA, voltage regulators connected to the transformer to provide voltage regulation on the 12.47kV bus. The substation transformer currently serves four (4) distribution circuits. Existing circuit reclosers are equipped with old recloser controllers that limit the ability to integrate to the city SCADA. Under current planning, existing recloser controllers are to be replaced to allow for integration to the SCADA system and provides for efficient system operation. Through this study the recloser controller(s) replacement project was reviewed and it is acknowledged that controller(s) replacement and integration to the SCADA system is beneficial for system operation and safety.

Historically, this substation provided load relief and backup to the Paul Grimshaw Substation. Under long range consideration, as loads grow, and outside the scope of this work plan time frame, a second substation transformer may need to be installed at this substation. The timing for the additional transformer will be based upon the area load growth. In near term years, for the event of a power transformer failure at the Parley Hassel substation, the Parley Hassel substation load will need to be picked up from the Paul Grimshaw substation.

The Paul Grimshaw Substation has two (2) 69/12.47 kV, 10/12.5/14.4 MVA transformer. Three (3) single-phase, 509 kVA, substation regulators (per transformer) are connected to each transformer bank to provide voltage regulation on the transformer 12.47kV bus. The substation has six (6) distribution circuits, there are currently four (4) circuits in service from the substation. This substation provides load relief and backup to the existing Parley Hassell Substation.

In Table 4 (below) two capacity ratings, normal and maximum are listed for each substation. Normal capacity is used in planning and should match or exceed the substation load. The basis for using the normal capacity rating is the ability to back up loss of a transformer using another transformer within the substation and/or using adjacent substations and distribution lines.

The maximum rating is based on transformer forced air rating at 65° C winding temperature rise. This is the maximum load that should be placed on the substation, and should be used only when necessary to back up loss of another transformer or system element for a 4-6 hour time period. Due to high ambient temperatures, transformer maximum loads should not exceed top end rating.

TABLE 4

SUBSTATION CAPACITY

SUBSTATION	TOTAL CAPACITY (MVA)(1) NORMAL	MAXIMUM	LIMITING ELEMENT	CAPACITY OF CIRCUITS LEAVING THE SUBSTATION (AMPS/MVA) CIRCUIT	CONDUCTOR	MAXIMUM(2) AMPS
Parley Hassell - Bk#1	10	14.4 @ 65°C OA/FA Regulators: 15.3 MVA @ 65°C	Transformer	#1	4/0 ACSR	340
				#2	4/0 ACSR	340
				#3	397 ACSR	560 (Recloser Rating)
				#4	750 AL URD	560 (Recloser Rating)
Paul Grimshaw - Bk#1	10	14.4 @ 65°C OA/FA Regulators: 15.3 MVA @ 65°C	Transformer	#1	397 ACSR	560 (Recloser Rating)
				#2	397 ACSR	560 (Recloser Rating)
				#3	750 AL URD	560 (Recloser Rating)
Paul Grimshaw - Bk#2	10	14.4 @ 65°C OA/FA Regulators: 15.3 MVA @ 65°C	Transformer	#4	750 AL URD	560 (Recloser Rating)
				#5 (Future)	750 AL URD	560 (Recloser Rating)
				#6 (Future)	750 AL URD	560 (Recloser Rating)

NOTES:

(1) Normal capacity of the substation should be exceeded only temporarily for emergencies or maintenance. The normal rating is based on the ability to backup loss of a transformer using another transformer within the substation or using adjacent substations and lines. The maximum capacity is based on transformer forced air rating at 65º C rise. This is the maximum load that should be placed on the substation transformer and should be used only when necessary to backup loss of another transformer or system element. In cold weather, substation transformers can be temporarily loaded above the maximum rating. ANSI Standard C57.92 provides a guide for loading transformers at various temperatures. The standard indicates that if the average daily temperature is 30º F, a transformer can be loaded to about 120% of nameplate rating with the same life expectancy as if it were loaded to nameplate. If the average daily temperature exceeds 86º F, the transformer loading should be reduced below nameplate rating. Average daily temperature of 86º F is often exceeded in the Santa Clara City area. This requires that the loading on each substation transformer during the summer peaking time be maintained below the top nameplate rating.

(2) Circuit ampacities for overhead lines are given for moderate ambient temperatures (77 º F) Underground circuit ampacities are given for earth at 68º F. Conservative loading of underground three phase circuits is recommended where single cables are run in metallic conduits. For extreme summer conditions (110º F) a derate should be applied to overhead lines.

Good engineering practice requires that the electrical system be able to withstand the loss of a single substation transformer (typically the largest on the system), without leaving any customers out of power. This is most often referred to as the “N-1” condition. In order to meet this requirement, normal loading of the substation transformers should be limited to allow for N-1 conditions. Spare capacity is then available to provide power to customers who would otherwise be without power when a substation transformer fails. It is critical that adequate ties are created between distribution circuits to allow load transfers from one circuit to another or from one substation to another. These interconnection points on the distribution system are best accomplished with three-phase gang-operated airbreak switches for overhead or with pad-mounted three-phase operated switchgear for underground applications.

Through the study it was determined that the existing Paul Grimshaw and Parley Hassell Substations can be used to supply near term (2022-2026) electrical demand in the City. At projected growth an additional substation transformer (10/12/14.4 MVA) will be necessary by 2027 to maintain the current level of service. With consideration of needed capacity, expected growth pattern and developing distribution circuit constraint (see distribution section) the installation of an additional substation, to provide transformer capacity, is recommend to be installed in the 2026/2027 time frame. Actual timing for the substation installation may be impacted by accelerated or delayed growth.

From previous work plans, Santa Clara City Power has identified the location for a third substation near the southwest city boundary (south hill area). Through this study it is seen that the identified location is well suited to cover expected growth in the area and would also provide to facilitate backup support to adjacent circuits and substations.

Table 5 provides information on substation transformer loading for the period of this CFP and without the addition of transformer capacity through 2028. Indicated transformer loading is based on projected growth, for the years 2022 through 2028. As presented in the Table it is assumed that transformers can be uniformly loaded at the two substations; the data shows that there is capacity through the 2025/2026 period. By 2027 projected loads are near 28 MVA. 28 MVA represents full loading of two of the three available power transformers. As indicated in Note 2 of Table 4, due to high ambient conditions the transformer should have a de-rate to avoid loss of transformer life.

TABLE 5

SANTA CLARA CITY
SUBSTATION LOAD MANAGEMENT PLAN
(Present System with 4.8% growth per year – (No transformer addition)

Substation	**YEAR**							**Transformer Base Rating**
	2022	2023	2024	2025	2026	2027	2028	
Paul Grimshaw								
Bank #1	7,442	7,814	8,166	8,533	8,874	9,229	9,598	10,000 kVA
Bank #2	7,442	7,814	8,166	8,533	8,874	9,229	9,598	10,000 kVA
(kVA @ 95% PF)								
Parley Hassell								
Bank #1	7,442	7,815	8,165	8,534	8,874	9,230	9,599	10,000 kVA
(kVA @ 95% PF)								
Total kVA	22,326	23,443	24,497	25,600	26,624	27,688	28,795	

Note: 2027 loading at two transformer top-end rating (14.0 MVA) @ 95% P.F. -- Loss of one transformer Would result in remaining transformers above top-end rating.

Table 6 provides information on substation transformer loading for the period of this CFP with the addition of transformer capacity by 2027. Indicated transformer loading is based on projected growth, for the years 2022 through 2028. As presented in the Table it is assumed that transformers can be uniformly loaded at the three substations;

Table 6

SANTA CLARA CITY
SUBSTATION LOAD MANAGEMENT PLAN
(4.8% average growth per year with transformer addition and load transfers)

Substation	**YEAR**							Transformer Base Rating
	2022	2023	2024	2025	2026	2027	2028	
Paul Grimshaw								
Bank #1	7,442	7814	8166	8533	8874	6,922	7199	10,000 kVA
Bank #2	7,442	7814	8166	8533	8874	6,922	7,199	10,000 kVA
(kVA @ 95% PF)								
Parley Hassell								
Bank #1	7,442	7815	8165	8534	8874	6,922	7,199	10,000 kVA
(KVA @ 95% PF)								
South Hills Banks #1	----	----	----	----	----	6,922	7,199	10,000 kVA
Total kVA	22,326	23,443	24,497	25,600	26,624	27,688	28,795	

Note: 2026/2027 -- Install South Hill Substation with 1- 10/12/14 MVA substation transformer.

1) This plan has been developed using a projected growth rate of 4.85% per year for the Santa Clara City Power system.

2) If the rate of growth and electrical usage vary from this rate, the plan will need to be adjusted to meet actual growth.

3) This plan recognizes that necessary distribution circuits of adequate capacity will need to be maintained to accommodate proposed load transfers. Appropriate switchgear (VFI's, air break switches, etc.) may need to be included for switching.

DISTRIBUTION CIRCUITS EVALUATION

To evaluate the distribution circuits, the existing Santa Clara system SKM software modeled, developed in 2015, was updated to reflect system changes that have occurred since model development. The system was studied for normal and potential outage (N-1) conditions at 2021 actual load levels and at 2027 and 2031 projected load level. For review a system model diagram and input data is provide in the appendix of this report.

Distribution Evaluation: Parley Hassell Substation

The Parley Hassell substation serves four distribution circuits that are numbered; PH271, PH272, PH273 & PH274.

Circuit PH271 leaves the substation as a 4/0 ACSR overhead circuit and then drops to underground circuit serving the southeast part of the city. The circuit can interconnect to Circuit PH274 near Arrowhead and Hafen providing, and receiving, some circuit backup remote from the substation. Areas along Malaga and Claude are radial feed leaving loads in those areas of town vulnerable to long outages. As growth requires, plans are to extend the end of the circuit (near Claude) to Arrowhead drive allowing interconnection to PH274 in a second location.

Due to new development and load growth a portion (0.24 miles) of the needed circuit is to be installed between Arrowhead and Vineyard with 750 MCM in 2022. ICPE recommend that, through continued growth and circuit requirements, the additional tie between PH274 and PH271 be completed.

Circuit PH272 is an overhead circuit with 4/0ACSR conductor. The circuit's primary path run westward and south of Crestview drive. The circuit feeds the Heights area and interconnects to Paul Grimshaw substation circuit PGR-1 near Crestview and Gubler through a normal open airbreak switch.

Circuit PH273 is a 397 ACSR circuit that can feed northward to Lava Cove and interconnect to Paul Grimshaw substation through recloser PGR-2. Lava Cove load can be served from either the Paul Grimshaw substation or the Parley Hassell substation. Recloser PH273 is normally open with normal feed to Lava Cove through PGR-2. This 397 ACSR circuit currently is lightly loaded and makes this feeder an effective backup to the Paul Grimshaw or Parley Hassell Substation. Significant load transfer between substations can occur across this circuit.

Circuit PH274 leave the Parley Hassell substation as a 750 Al URD circuit and interconnects to overhead 4/0 circuit. At the interconnection point, the 4/0 circuit extends both eastward and westward. The eastward section interconnects to PH271 near Arrowhead and Hafen through a normal open switch. The westward section extends to near Chapel and Santa Clara Drive where it interconnects to PGR-1 through a normal open switch.

For normal configuration load flow analysis of Parley Hassell substation circuits indicate that circuits are adequately sized for existing and future loading through the horizon of this study; some circuit extension typical of the needed Arrowhead to Vineyard extensions previously noted maybe be required to meet load growth. Under normal configuration voltage is within criteria and circuits are not overloaded and have margin for additional load. The circuits have the capability to back up Paul Grimshaw circuits for sectional losses. The need for circuits to cover major Paul Grimshaw outages is remote with two power transformers at Paul Grimshaw substation.

For the loss of the Parley Hassell power transformer all loads served by Parley Hassell substation would need to be transferred to the Paul Grimshaw substation. System studies show that for the initial years of this CFP period loads can be transferred with acceptable result. In the later years (2026-2027) studies show that low voltage begins to occur on circuits at the southeast area of town for the noted contingency. Addition of the south hills substation will address this concern. In years beyond the period of this CFP addition of a main feeder distribution circuit from the south hills substation or some circuit reconductor will likely be required.

Distribution Evaluation: Paul Grimshaw Substation

The Paul Grimshaw substation currently has six (6) distribution circuit positions, with four (4) (PGR-1, PGR-2, PGR-3 and PGR-4) of the six (6) circuits in service. PGR-5 and PGR-6 are extended, and dead-ended, outside of the substation and currently do not serve load.

Circuit PGR-1 leaves the substation as a 750AL URD circuit and serves the load on Rachel Drive and interconnect to overhead 397ACSR feeding south along Gubler. The 397 ACSR circuit has the ability to interconnect to Parley Hassel substation circuits PH272 and PH274 through normal open interconnection points and can also interconnect to circuit PGR-3. The ability to interconnect to PRG3 provides backup to each circuit beyond the substation.

Circuit PGR-2 is a 397 ACSR circuit that feed east to Lava Cove and interconnect to Parley Hassel substation through recloser PH273. Lava Cove load can be served from either the Paul Grimshaw substation or the Parley Hassel substation. Recloser PH273 is normally open with normal feed to Lava Cove through PGR-2. This 397 ACSR circuit currently is lightly loaded and makes this feeder an effective backup to the Parley Hassell Substation and or to the Paul Grimshaw substation. Significant load transfer between substations can occur across this circuit. However, due to voltage drop- system reconfiguration is needed if the Parley Hassel substation transformer is lost during peak loading season. i.e., some loads would also need to be transferred to circuit PGR-1.

Circuit PGR-3, is primarily an overhead 397ACSR circuit that runs west to the city boundary then southward and has the ability to interconnect to PGR-1 and PGR-4. This circuit is constructed as underbuild on the 69kV transmission line and is currently extended to the location of the future south hill substation.

Circuit PGR-4 exists the substation in the westward direction to Rachel Drive and then goes northward serving loads along Rachel Drive and subdivisions on the north end of the city. PGR-4 has the ability to interconnect to PGR-3 in two locations providing for back up to both circuits.

System growth now requires the installation/extension of PGR-5 and PGR-6 circuit (approximately 0.63 miles each of 750 MCM) within the time frame of this CFP. The circuits are to extend northward of the substation to serve new developments in the area.

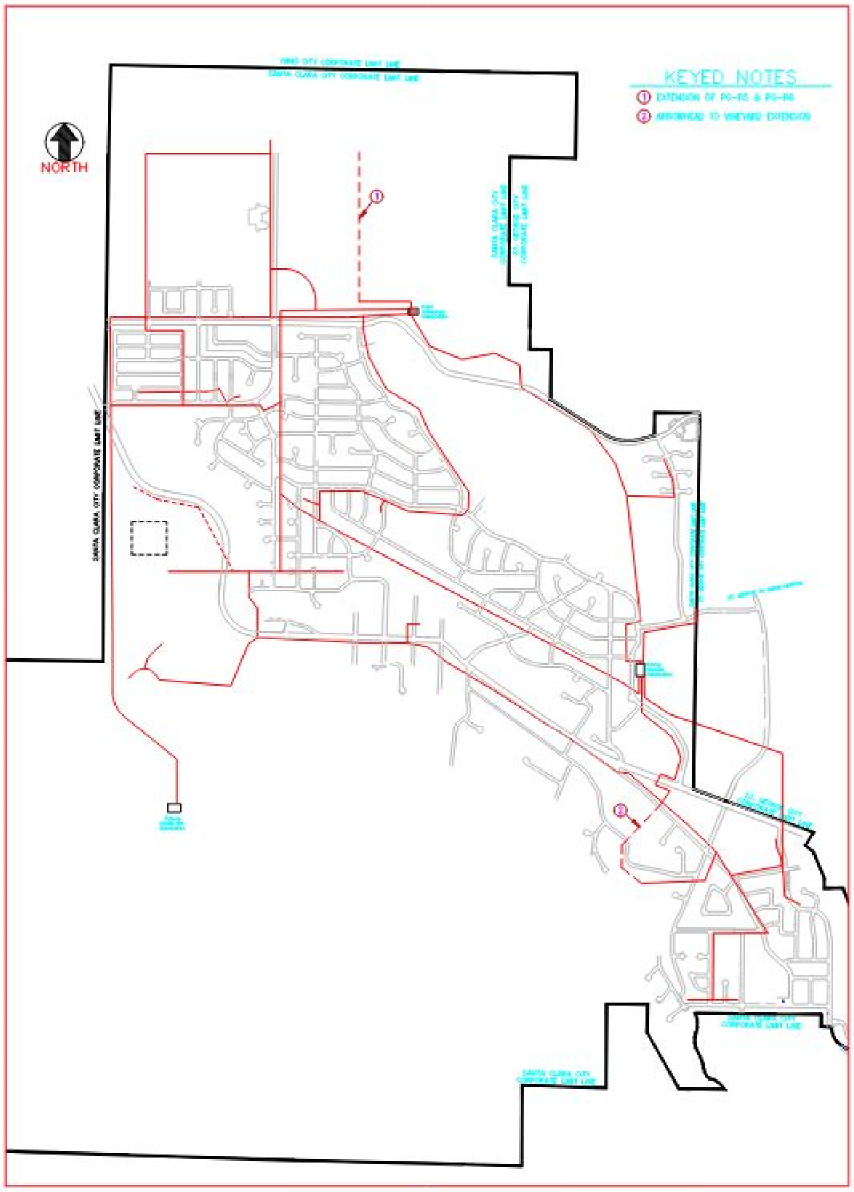
Load flow analysis of Paul Grimshaw substation distribution circuits indicate that circuits are adequately sized for existing and future loading through the horizon of this study. Under normal configuration voltage is well within criteria and circuits are not overloaded. Jointly, the circuits have the capability to back up Parley Hassel circuits and can currently cover loss of the Parley Hassel substation transformer during peak loading. However, proper power factor correction and system configuration is critical for this contingency and should be understood. As previously noted, loss of the Parley Hassell transformer will result in low voltage to the southeast side of town if only served through Paul Grimshaw substation in the later years of this CFP. This contingency concern is addressed through the addition of the south hills substation.

Distribution Evaluation: New South Hills Substation

Currently, the Paul Grimshaw substation's circuit PG-R3 is extended to the site of the recommend south hills substation. With the installation of the south hills substation initial interconnection would be to PG-R3 with a new normal open point established between substations. In subsequent years, and likely outside of the CFP period additional distribution circuits will be necessary. Eventual goal would be to provide a strong tie to the southeast area of town.

Map 2 (below) illustrates the primary circuit routes serving Santa Clara City and with indication of known distribution additions through the CFP period.

Map 2

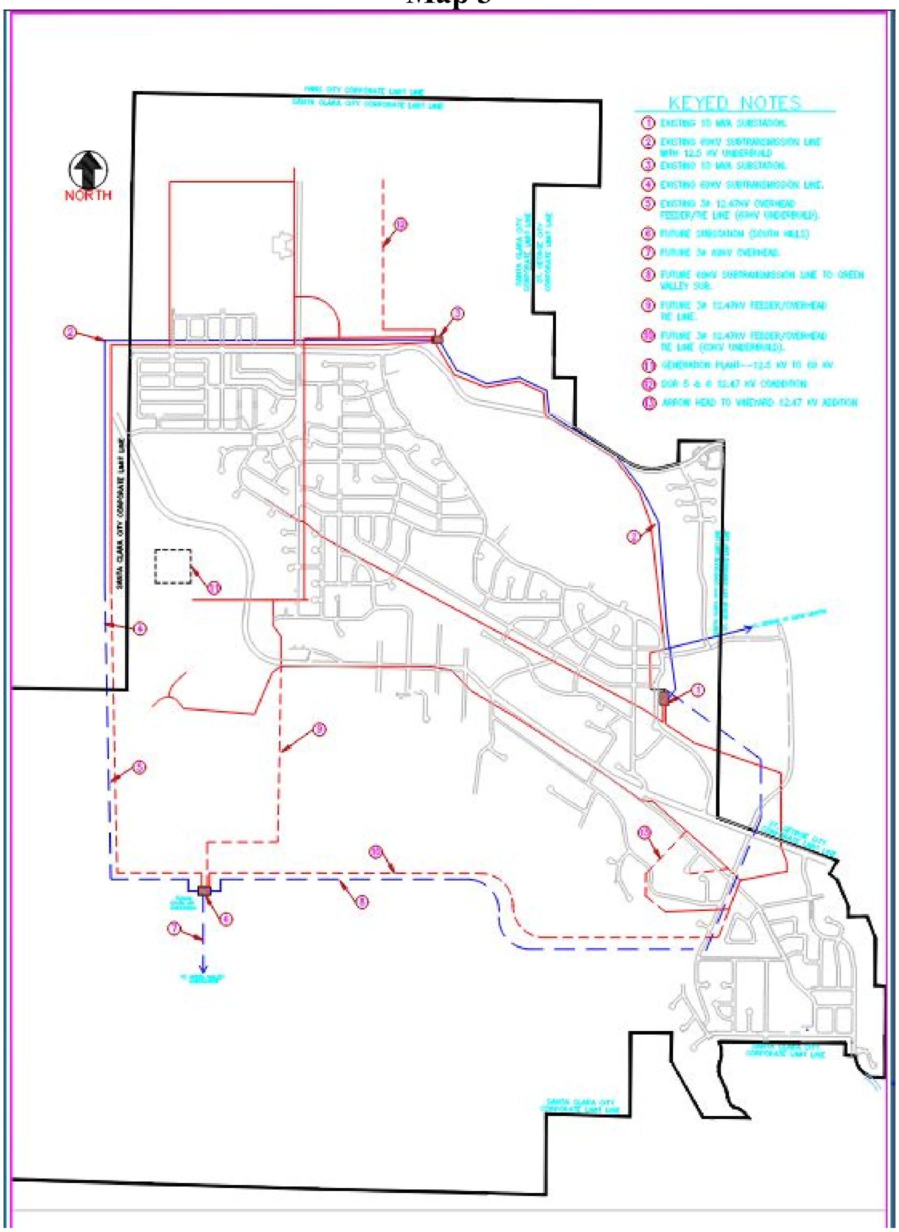


Distribution: Long Term Plans

Long-term transmission and distribution plans are intended as a guide to be followed as service is provided for new customers. Most new construction can be delayed until forecasts are certain. However, duplication and waste can be avoided if conformance to the City's master plan is verified before line improvements or extensions are made. The long-term plans are speculative and should be adapted as circumstances change, such as the location of electrical load and routing of streets. The City should use the long-term plans as a guide to assure proper right-of-ways are obtained as each development is approved. Another benefit of following the long-term plan is to assure that feeder cables installed will be properly sized to meet the future needs of the area. This will minimize the need to upgrade these cables in the future. Having adequate right-of-ways secured in advance will streamline the construction process for the City Power Department.

Prospective locations for transmission and main distribution feeders in Santa Clara City are shown on the Long-term Planning Map, Map 3 (below and in appendix). The map also shows existing main feeders, existing interconnection points, and proposed interconnection points between feeders. New feeder routes may need to be selected to supply load in the northeast and southwest part of the City. As these areas develop, heavy backbone feeders need to be extended along major streets. Main feeders from each substation should intersect to form a looped system. This will permit load to be transferred between substations, and will establish alternate sources of power during outages or for maintenance work.

Map 3



Distribution: General Recommendations

Long term, additional main feeder distribution circuits will be needed to supply power to new customers, depending upon where the development occurs. General recommendations to be followed as these new feeders are built are listed herein. Following these guidelines will make the operation and maintenance of the expanding system more manageable and cost less to operate over a period of time.

Distribution lines are used to deliver power from substations to customers throughout the City. Safe, reliable, electrical service is dependent on these lines. To maintain quality service requires engineering planning, quality construction, and good maintenance. This work plan provides input to the planning process. During this period of the CFP, the City should continue to work closely with engineering. Decisions made now will affect utility operations for many years. Construction depends on trained and experienced line crews, who are well supported and equipped, and on good material and construction specifications. Maintenance requires a commitment in labor and materials to keep facilities in good operating order. All of these measures require funding. However, neglecting or delaying these actions carries a penalty of a less reliable power system, and higher operational and maintenance costs over time.

Loading capacities of three-phase distribution lines are listed in Table 7. Overhead line ampacities are given for conductors in air at 77^{o} F. These ratings must be reduced when the temperature is above 77^{o} F. Summer ratings for air at 100^{o} F are listed for 477 ACSR and 4/0 ACSR. The table refers to loading ampacities only. Capacity to supply power over specific lines in the City may be restricted by voltage drop or other constraints.

A planning rating is listed in the table for each conductor type. This rating is based on a load level of about 50% of line capacity. The planning rating is recommended as a general guide to maximum line loading for normal conditions. Limiting load to the planning rating has the following benefits: line loss is reduced significantly since loss increases by the square of the current, capacity is available in the line for backing up load or for other contingencies, voltage drop is reduced and is more likely to remain at acceptable levels under a range of conditions, and capacity is available in the line for unanticipated new load.

The planning rating should not be considered as a strict limitation on loading a line. Where line sections are short, losses or voltage drop may not be a significant factor, even at heavy load. On the other hand, where lines are long, voltage drop may be excessive when loaded to the planning rating. More detailed analysis is recommended for these lines.

Recommended general guidelines for new distribution line construction are:

- Use a minimum of 477 kcmil ACSR (overhead) or 750 kcmil Aluminum underground cable for all distribution feeders leaving a substation, for all main feeders supplying heavy load centers, and for feeders in which extra capacity is needed to back up or provide an alternate source for another main feeder. A network of “main feeders” should be developed between substations to allow for needed load transfers between substations.

- Use a minimum of # 4/0 ACSR (overhead) or #4/0 Aluminum underground cable for all three-phase main feeders within the City. If lines extend more than 2 miles or are expected to supply loads in excess of 2000 kW, consult engineering.

- Use a minimum of # 1/0 ACSR (overhead) or #1/0 Aluminum underground cable for all distribution system tap lines and branch segments.

- Use at least two underground cable entries to serve multiple lot subdivisions. Interconnect the cables using pad-mounted switchgear within the subdivision.

The work plan recommends that switches be installed throughout the distribution system to interconnect main three-phase feeders. The switches that interconnect main trunk lines will improve reliability and reduce costs. The ability to quickly restore service to customers when outages occur will be improved by this action. Line sections can be taken out of service or bypassed for maintenance or construction. This will reduce customer outage time and reduce construction costs. Switches should be installed where main trunks from the same or different feeders intersect. Load-break switches, overhead or pad-mounted, should be used where frequent switching is anticipated or where paralleling is required. Taps from the main trunk lines should use over-current protective devices such as fuses and/or Vacuum Fault Interrupters (VFI's) to minimize the area affected by a system fault.

TABLE 7

DISTRIBUTION LINE CAPACITY RATINGS(1) THREE PHASE 12.47 kV SERVICE

LINE CONDUCTOR	OVERHEAD LINES(2) (AMPS or MVA)	UNDERGROUND LINES(2)		SUMMER RATING(3) (MVA)	PLANNING RATING(4) (MVA)
		3 Conductors in 1 Duct	3 Conductors in 3 PVC Ducts		
1000 AL CN Cable		574 or 12.3	707 or 15.2	11.0	6.0
750 AL CN Cable		497 or 10.7	601 or 12.9	9.8	5.0
500 AL CN Cable		400 or 8.6	472 or 10.1	8.0	4.0
4/0 AL CN Cable		230 or 5.0	268 or 5.8	4.6	2.5
477 ACSR	670 or 14.4			12.0	7.0
397 ACSR	590 or 12.7			10.6	6.4
4/0 ACSR	340 or 7.3			6.0	3.5
1/0 ACSR	230 or 4.9			4.0	2.5
2 ACSR	180 or 3.8			3.1	2.0
2/0 Copper	360 or 7.7			6.3	3.5
6 Copper	120 or 2.5			2.0	1.5

NOTES:

(1) Thermal overload ratings are listed. Capacity to supply power over specific lines in the City may be restricted by voltage drop or other constraints.

(2) Ampacities for underground cable: 194^0 F conductor, 68^0 F earth, and 75% load factor. From Okonite Engineering data book. Ampacities for overhead conductor: 77^0 F air, 167^0 F conductor, wind 1.4 mph.

(3) Summer rating for overhead conductor: 100^0 F air, 176^0 F conductor. Wind 1.4 mph. Underground conductor: 3 cables in single direct-buried conduit, 194^0 F conductor, 68^0 F earth, 75% load factor.

(4) Planning rating is established at approximately 50% loading.

Power Factor Correction

In power purchase contracts with UAMPS and PacifiCorp, Santa Clara City has agreed to correct system power factor to at least 95%. No penalties are stipulated in these contracts. Through Area Planning, systems in the Washington County area have developed 98% power factor criteria, at distribution substation circuits, for the area during peak loading. Santa Clara City typically complies with contract power factor requirements. Review of power factor data for 2021 peak loading periods indicate Santa Clara power factor at 95% at the 69 kV level. On line generation during peak periods does affect system power factor and should be utilized to maintain power factor at 95% to 98% during peak hours.

Due to load growth, Power Factor correction is an ongoing concern, Santa Clara Power should evaluate its power factor on a yearly bases and capacitors added when power factor drops near contractual requirement. Capacitors that are properly located on distribution feeders will provide the VAR support needed to maintain acceptable power factor. In addition to VAR support, other benefits of power factor correction are:

2. Line losses are reduced resulting in a more efficient system and savings in power purchase costs.
2. Capacity of feeders and substation transformers is increased because electrical current required to serve the load is reduced and the circuit voltage profile is improved.
3. Reduce VAR demand on the transmission system, which improves overall voltage support.

Electrical System Analysis studies indicate that the City has adequate capacitors installed, with var support through on line generation, to support loading conditions at present. As indicated, the City will want to monitor the power factor on the system to recognize when additional capacitor banks may be needed. Through the period of this CFP, it is estimated that the installation of two (2) capacitor banks will be required.

Protective Device Coordination

Over-current devices such as fuses, reclosers, and sectionalizers are used to protect substation equipment and power lines from damage. Proper operation of these devices is mandatory to protect equipment and clear fault conditions. Coordinated application of protective devices reduces the frequency and length of outages, assist response personnel in locating the cause of outages, and improve protection of lines and equipment. Proper fuse-breaker coordination helps limit the number of customers affected by a system fault. Cost savings will result from fewer and shorter outages, and a lower frequency of equipment failure. Customer satisfaction will improve and operating cost will be lower as the number of service interruptions/outages is reduced.

Typically, coordination work is done on the electrical system for specific equipment installations, such as the installation of a substation transformer or a piece of switchgear. This approach only insures proper coordination for a limited part of the system and only at the time of installation. Periodically, and as load increases, a review of the entire system should be done to ensure that protective devices are still coordinated. Any distribution circuit reconfiguration or new line equipment installation must be reviewed to insure proper coordination with any upstream protective devices. Protective devices (fuses, sectionalizers and reclosers) should be thoroughly reviewed for each line extension or new load addition. A comprehensive system coordination that includes evaluation of all existing distribution devise is recommended. Any contemplated load transfers, and changes to system configurations for backup purposes, should be considered in the coordination as a change in configuration can conflict with existing coordination.

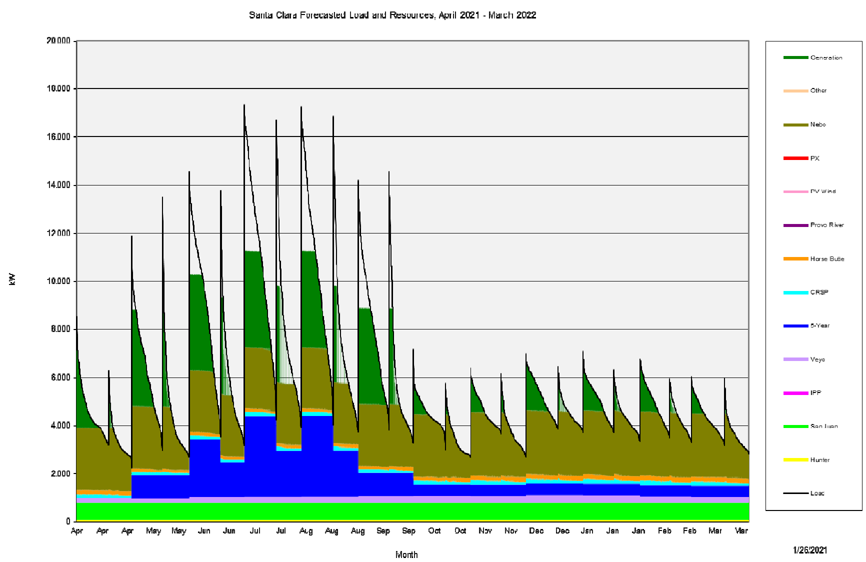
GENERATION EVALUATION

As seen in the load growth section of this report, Santa Clara City has had a history of rapid load growth with high system peaks occurring during summer months. During summer months, Santa Clara City's system experiences short duration peaks on a daily basis. Firm power resource to cover daily peak loads during summer months can be difficult or impossible. To cover daily peak load power purchase off the hourly spot market is sometime necessary; however, during summer months power purchase off the hourly market can be costly.

To offset resources deficiencies during peak loading periods and to aid in resources shaping, Santa Clara City installed a power plant in 2006. When installed, the plant was built to allow for the installation of up to six (6) two megawatt units. Currently, the Santa Clara City power plant has two (2) – 2 MW units installed (Units 1 and Unit 2). The existing power plant has been used during summer months to address peak loading issues, and when economical, as base loading units.

Projected load and resource, as developed prior to 2021 peak loading is depicted in Graph 4[1]. Actual 2021 loading was at 20.2 MW, with resources short fall greater than indicated. The resource short fall will continue to grow with projected load growth.

Graph 4 [1]



(1. Provided from UAMPS load and resource analysis)

With consideration of load growth since 2006 and from review of Santa Clara's resources mix, additional generation should be considered for installed during the 2022-2026 period of this CFP. To address peak resource deficiencies for summer 2021 approximately 8 MW was needed. From previous planning, and as included in the 2015/2016 CFP and System Impact Fee assessment, a 2.5 MW unit (Unit 3) was to be installed in 2020. That project was delayed.

Recommendation for generation addition under this CFP is as follows:

1. Install 1- 2.5 MW unit (unit 3) as recommended in the 2015/2016 CFP in 2022.
2. Install additional 2.5 MW unit (unit 4) in 2022.
3. Install 2.5 MW unit (unit 5) in 2026.

Cost for the addition of each 2.5 MW units into the existing plant has been indicated to be $2.30 million per unit. For review, a quote, as provided by the supplier, is provided in the appendix. As infrastructure exists for the addition of new units and plant operation and maintenance is ongoing, addition of new units maybe economically advantageous. In conjunction with Unit 5 addition, an equipment building will be needed as the existing Unit 5 bay is currently serving as equipment storage.

SYSTEM IMPROVEMENT SUMMARY

The following project summary highlights projects indicated necessary and recommended due to load growth to sustain the projected growth rate for Santa Clara City's electrical system for the next 5 years. Table 8 contains recommended projects, associated cost estimates, and timing for projects recommended herein.

1. Install approximately 0.24 miles of underground 750 MCM distribution circuit between Arrowhead and Vineyard for area growth.

2. Install new Recloser Controllers and integrated to SCADA at Parley Hassell Substation

3. Install/Extend circuits PGR-5 and PGR-6 approximately 0.63 mile (each) with 750 URD and associated switch gear for commercial/residential growth.

4. Install two (2) 2.5MW generation units into the existing Power Plant Facility.

5. Install approximately 2.3 mile of 69kV transmission From the Green Valley transmission substation to interconnect to Santa Clara's existing 69kV system currently existing at the recommended south hills substation site.

6. Install the south hills substation (initially with one 69kV-12.47kV transformer bay).

7. Install distribution capacitor banks as necessary for Power Factor correction.

There is greater confidence in projecting requirements for 2 to 3 years than there is for a 5-year outlook. However, it is necessary to forecast future projects due to the magnitude (and cost) of the modifications necessary should the annual rate of growth exceeds projection. Substation, distribution, and transmission line requirements need to be addressed to meet future needs of the City in a timely fashion.

The proposed projects, as listed above and in Table 8, will provide a method for Santa Clara City to plan and budget for the facilities necessary to serve the anticipated electrical load growth while maintaining the current level of service.

TABLE 8

Santa Clara City CFP Estimates

Generation, Transmission, Distribution, and Substation Projects

All Estimates Are In 2022 Dollars

Item and Description	Item Cost	Total For Year		Running Total
2022/2023				
1. Install Arrowhead to Vineyard 12.47 kV URD circuit extension (0.24 miles)	$120,000.00	$120,000.00		$120,000.00
2. Install/replace Parley Hassell Station Recloser Controllers and SCADA integration.	$170,000.00	$170,000.00		$170,000.00
3. Install 2-2.5MW generation units	$4,600,000.00	$4,600,000.00		$4,600,000.00
2022/2023 Total Estimate	**$4,890,000.00**	**$4,890,000.00**		
				$4,890,000.00
2023/2024				
1. Install Paul Grimshaw 12.47kV circuit # PGR-5 extension (0.63 miles ea.)	$404,000.00	$404,000.00		$404,000.00
2. Install Paul Grimshaw 12.47kV circuit # PGR-6 extension (0.63 miles ea.)	$404,000.00	$404,000.00		$404,000.00
3. Capacitor Bank(s) Installation	$20,000.00	$20,000.00		$20,000.00
2023/2024 Total Estimate	**$828,000.00**	**$828,000.00**		
				$5,718,000.00
2025/2026				
1. Install 69kV line extension – St.George Canyon View substation to south hill substation.	$1,300,000.00	$1,300,000.00		$1,300,000.00
2. Equipment Building	$300,000.00	$300,000.00		$300,000.00
2025/2026 Total Estimate	**$1,600,000.00**	**$1,600,000.00**		
				$7,318,000.00
2026/2027				
1. Install South Hill Substation	$2,600,000.00	$2,600,000.00		$2,600,000.00
2. Capacitor Bank(s) Installation	$22,000.00	$22,000.00		$22,000.00
3. Install 1-2.5MW generation units	$2,300,000.00	$2,300,000.00		$2,300,000.00
2026/2027 Total Estimate	**$4,922,000.00**	**$4,922,000.00**		
				$12,240,000.00
2022 to 2027 Total Estimate				**$12,240,000.00**

Assumptions:

1-Basis is Santa Clara City Electrical Load Growth Projection
2-Cost estimates do not include Right-Of-Way acquisition expense
3-Cost estimates are based on per-unit budgetary values only -
No design or engineering work has been done to create these estimates.
4-Substation estimates do not include property purchase.
5-Actual timing will vary depending on system load growth type and timeframe.
6- 750 URD estimate based on percentage of 1-mile unit cost estimate.

APPENDIX

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(Appendix separately bound)