BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF PUBLIC SERVICE COMPANY OF NEW MEXICO'S APPLICATION FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT, OWN, AND OPERATE 30 MEGAWATTS OF BATTERY ENERGY STORAGE FACILITIES	)	**Case No. 25-000__- UT**
PUBLIC SERVICE COMPANY OF NEW MEXICO,	)	
Applicant	)	

DIRECT TESTIMONY

OF

ERFAN HAKIMIAN

August 6, 2025

NMPRC CASE NO. 25-000__-UT
INDEX TO THE DIRECT TESTIMONY OF
ERFAN HAKIMIAN

WITNESS FOR
PUBLIC SERVICE COMPANY OF NEW MEXICO

DIRECT TESTIMONY
OF ERFAN HAKIMIAN
NMPRC CASE NO. 25-000__-UT

I. INTRODUCTION AND PURPOSE

Q. Please state your name, title, and business address.

A. My name is Erfan Hakimian. I am the Director of Transmission/Distribution Planning and Contracts for Public Service Company of New Mexico ("PNM" or "Company"). My business address is 2401 Aztec Road NE, Albuquerque, NM 87107.

Q. Please summarize your educational and professional qualifications.

A. PNM Exhibit EH-1 describes my educational and professional qualifications.

Q. What is PNM requesting in this case?

A. PNM is seeking a certificate of public convenience and necessity ("CCN") for 30 MW (120 MWh) of battery energy storage systems ("BESS") consisting of five 6 MW, 4-hour batteries on five PNM distribution feeders (the "BESS Project"). The BESS will be located at five different locations in PNM's service territory on PNM's distribution system. The locations are described later in my testimony.

Q. Has PNM previously requested a similar CCN?

A. Yes. On May 3, 2023, PNM filed an application for a CCN for installation and operation of 12 MW of distribution-sited BESS, which was approved by final order on December 21, 2023.[1] PNM is now seeking approval for a second phase of distribution-sited BESS.

Q. What is the overall purpose of distribution-sited energy storage systems and what are the benefits?

A. Distribution-sited energy storage systems are a tool that provides benefits to customers and PNM's distribution system, including increased hosting capacity, allowing for increased interconnection of distributed energy generation ("DG"), storage of excess solar energy to better align energy production with times of system need, a commensurate reduction in the need to procure high-priced energy during times of peak system need, firming capacity, and provision of ancillary services. On August 24, 2024, PNM provided the Commission with a study, "Rule 568 Hosting Capacity Improvement Solutions" ("Rule 568 Study"), performed by 1898 & Co.,[2] which identified 18 distribution feeders as either having reached hosting capacity limits or nearing hosting capacity limits. The Rule 568 Study identified efficient ways to increase hosting capacity on constrained feeders to allow more interconnection of DG. The Rule 568 Study is attached as PNM Exhibit

---

[1] Case No. 23-00162-UT.
[2] 1898 & Co. is the management, technology, and cybersecurity consulting arm of Burns & McDonnell. *See* https://1898andco.burnsmcd.com/.

EH-2. PNM analyzed the Rule 568 Study in selecting the five sites proposed in this application but looked at an additional site in Alamogordo where the feeder is nearing hosting capacity limits and where there is an existing distributed sited DG system.

Q. Where does PNM propose to deploy the BESS as part of this application?

A. For this applications PNM is proposing to co-locate the batteries at five locations within PNM's service territory, including:

1. Alamogordo Otero site on Alamogordo feeder A10012
2. San Miguel site on Arriba feeder 11
3. Deming site on Hondale feeder 12
4. Meadow Lake site on El Cerro feeder 11
5. Rio Communities site on Jarales feeder 12

All five sites are within existing PNM solar generation facilities at the distribution level. As in Case No. 23-00162-UT, co-locating the BESS with existing PNM solar generation sites streamlines the process, since PNM already has control of the locations, and in most cases, there are no additional permits or reviews required. One of the facilities in Valencia County, Jarales feeder 12, is within the City of Rio Communities. If a CCN is granted, prior to commencing any construction, PNM or its contractor will obtain all necessary governmental permits and comply with all applicable zoning and building requirements with respect to the construction and operation of the BESS.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to:

1. Describe the current state of hosting capacity on the PNM distribution system;
2. Identify potential solutions to increase hosting capacity on PNM's distribution system, including the utilization of BESS;
3. Describe the proposed 30 MW of BESS and explain the analysis of the sites, and;
4. Outline the potential benefits of BESS, demonstrating that these systems are in the public interest, and explain how the BESS meets certain criteria for approval of a CCN under Section 62-9-1(E) of the Public Utility Act ("PUA").

II. HOSTING CAPACITY OF THE PNM DISTRIBUTION SYSTEM

Q. Describe the features and purpose of PNM's electric utility distribution feeders.

A. A traditional distribution feeder, or distribution line, carries electricity from a utility substation to the customer's point of connection with the grid. Integration of distribution-sited batteries, solar photovoltaic ("PV") and other DG systems necessitate new technology or facility upgrades to manage multi-directional power flows on the distribution feeders, meaning instances where there are power flows from the substation onto the distribution feeder, or vice versa. PNM's distribution system includes both overhead and underground facilities, with different types of configurations and equipment. A feeder is generally comprised of conductor, underground cable, circuit breaker(s), protective relay(s), poles, insulator(s), recloser(s), voltage regulators, capacitors, switches, switchgear, fuses, and load serving transformers.

Q. How is PNM's hosting capacity defined?

A. Hosting capacity is the physical limit of simultaneous power generation, measured in kilowatts ("kW"), that can safely be "hosted" (or flow) on a distribution feeder. Once the hosting capacity or physical limit has been reached on a distribution feeder, interconnection of more power generation on the feeder will cause thermal overloads to the feeder and its associated equipment, which creates potential public safety and risk of equipment damage or destruction.

Q. Do distribution feeders have operational and design standards and are there limitations on how much energy they can carry?

A. Yes. Distribution feeders have operational and design standards as well as physical limitations on the amount of energy they can carry; each of which help ensure power is safely and reliably delivered to the customer. The amount of energy that can safely flow on a distribution system is established by national standards such as those set by the American National Standards Institute ("ANSI").[3] Equipment manufacturers and equipment specifications determine the amount of energy that can flow through the equipment within physical limitations. ANSI, combined with the national electrical safety code ("NESC")[4] and industry/equipment standards, including those established by the Institute of Electrical and Electronics Engineers ("IEEE"),[5] ensure the amount of energy that flows on a distribution facility and through the customer interconnection is operating within nationally recognized safety and reliability guidelines. These standards are necessary to ensure both the utility's and customer's equipment and the public's safety are protected. If the amount of energy flow exceeds these standards, the risk for a public safety event, equipment failure, degradation of equipment life increases in likelihood. The physical limits of a distribution facility include standards for both voltage and

[3] *See* https://www.ansi.org/.
[4] *See* https://standards.ieee.org/products-programs/nesc/.
[5] *See* https://www.ieee.org/.

current. Voltage limits are established to ensure that both distribution equipment and customer owned equipment function within a specified voltage operating range that is predetermined by the national standards and the equipment manufacturers. If those identified voltage limits are not maintained, it could cause equipment failure and/or system operating issues. Voltage standards limits are set by ANSI and PNM adheres to those limits. Current rating limits are established for the same reason. Current ratings establish the maximum amount of current in amperes that can safely flow through the distribution feeders. Exceeding these limits can degrade equipment that could potentially lead to equipment failure and safety risks.

Q. How does DG increase feeder capacity risks for PNM?

A. Traditionally, distribution circuit power flowed in one direction: from the generation plant to transmission, then to the substation, through distribution lines and then to the customer's point of interconnection. With the integration of DG, such as solar and energy storage systems, energy flow on distribution circuits has become bi-directional. In addition, DG resources such as solar, inject energy into the system intermittently. The amount of energy produced by a DG facility cannot always be fully absorbed by the customer load present at any given time on that circuit. As such, the presence of excess energy on the distribution system can cause reverse power flow on the distribution system and can also cause flows that exceed the feeder ratings. As mentioned above, it is a utility's obligation to ensure distribution feeders are sized properly so that the magnitude of power flow in either direction does not exceed the feeder ratings under the wide variety of expected conditions (feeder generation output vs. feeder load) and ensure the equipment specification ratings and ANSI standards are maintained at all times. When net load (amount of load on a feeder left after subtracting the amount of generation present on the feeder at any given time) or the total generation flowing on a feeder exceeds equipment ratings, equipment can degrade and fail due to thermal overloads, and public safety could be at risk. In addition, when the amount of energy flow in either direction exceeds the feeder rating, voltage quality issues appear that can negatively impact customer equipment, such as refrigerator compressors, digital, or computer equipment. As more DG such as PV are added to the feeders, the risk for exceeding feeder ratings increases. The distribution feeder and its equipment must be able to safely and reliably transport energy, especially at times when the generation or customer load is at its maximum.

Q. The final order in Case No. 23-00162-UT states that "Applicants [for a CCN for energy storage systems] should submit data demonstrating voltage and power quality issues on the feeders where the proposed battery storage systems are to be located." Has PNM provided that data?

A. Yes. PNM Exhibit EH-2, Appendix 7.0, and PNM Exhibit EH-3 contain the voltage, current and power quality data for feeders that are at or near hosting capacity and could have power quality issues. The five feeders where PNM is proposing installing BESS on are included in those exhibits.

Q. Do you have an illustration of how increased DG on a distribution feeder impacts the system?

A. Yes. PNM Figure EH-1 below, which was previously provided by PNM witness Omni Warner in Case No. 23-00162-UT,[6] demonstrates how a distribution feeder operates with increasing risk of failure as it hosts additional DG. As more feeders operate at or near their hosting capacity limit, PNM must modify the facilities to ensure continued safe and reliable operation of the distribution system. These planned modifications need to accommodate the interconnection of additional customer-owned DG pursuant to Rule 568, as well as programs such as community solar. Phase I of the community solar program includes approximately 125 MW of DG in PNM's service territory, while the next phase of that program will add an additional 185 MW to the PNM distribution system.[7]

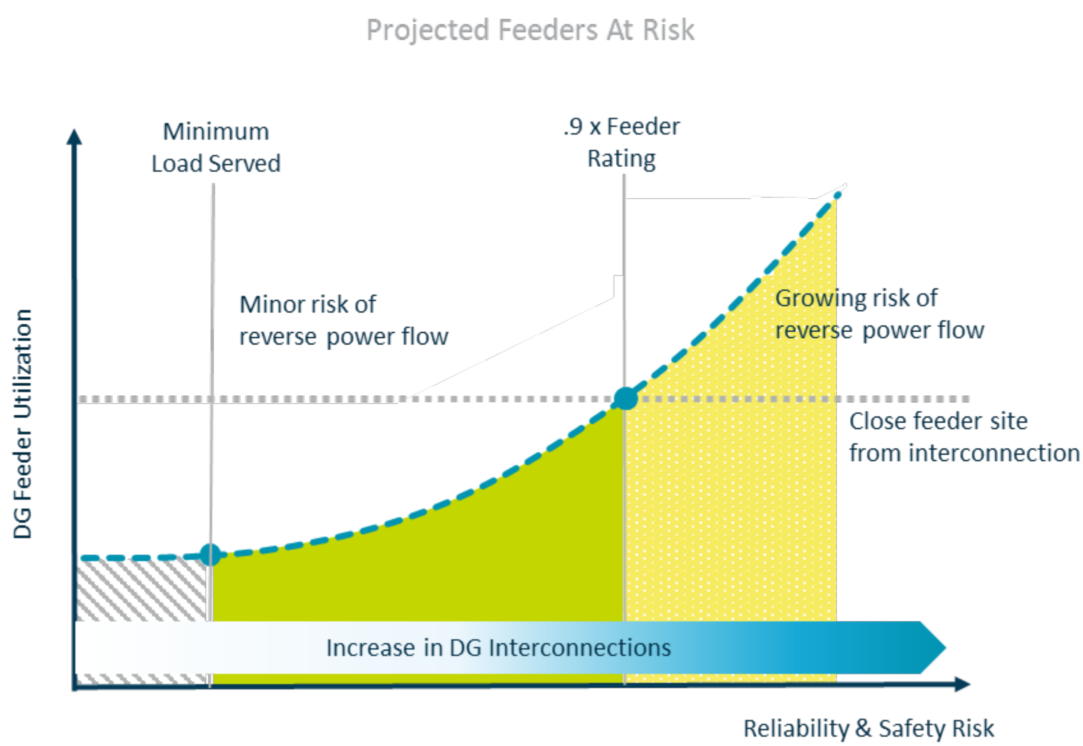
---

[6] Case No. 23-00162-UT, Direct Testimony of Omni B. Warner at p. 8 (May 3, 2023).

[7] PNM anticipates the first community solar facilities coming online in the third quarter of 2025, with the entire first tranche of 125 MW online by the end of 2026. No RFP has been issued for the second tranche of 185 MW as of the time of this filing.

"Solar saturation" refers to a situation where PV systems are generating more electricity than the system can use, and that the feeder can safely handle. Distribution feeders in these scenarios approach or exceed their hosting capacity limits or the amount of DG they can safely host.

PNM Figure EH - 1



Q. Has PNM performed any studies or obtained detailed data to address feeders at solar saturation or nearing saturation?

A. Yes. Based on the updated Rule 568 Study results, PNM has 18 feeders at or nearing hosting capacity limits. The Rule 568 Study included engineering plans for solutions designed to increase hosting capacity on these distribution feeders. The study provides a variety of options that were analyzed, including traditional feeder upgrades, BESS, dedicated feeders, or some combination of these solutions. A cost-benefit analysis ("CBA") was performed for each feeder in order to identify the most cost-effective solution for each. In addition, the Alamogordo feeder A10012 was identified and studied as that feeder has started to approach hosting capacity limits.

Q. What has PNM done to ensure new DG interconnections do not negatively impact the grid?

A. PNM adheres to 17.9.568 NMAC to screen and safely interconnect DG that is less than 10 MW nameplate capacity to its distribution system. Rule 568 establishes the criteria by which PNM evaluates each DG interconnection. If the DG is under 50 kW and does not export more than 25 kW, it is processed through simplified screening. If the DG is above 50 kW, but under 5 MW, it is evaluated using the fast-track process. Any application above 5 MW, but under 10 MW, is evaluated though a detailed study. Due to their size, the larger systems require a more detailed study to ensure they don't pose safety or operational risks. Interconnection customers have the option to obtain a pre-application report which details the capacity of the specific locations of the proposed point of interconnection prior to proceeding with their project. Supplemental reviews are required on any application(s) that fail to meet the safety or reliability criteria in certain screens, further studies must be performed to ensure the DG can be safety and reliability interconnected to the system. If system improvement is needed to ensure safe interconnection, those upgrades are identified in these studies.

Q. How does PNM determine if a proposed DG interconnection may lead to solar saturation?

A. PNM evaluates the feeder rating, plus the minimum daytime load, minus the DG amount in MW. The total amount in MW cannot exceed the feeder rating in the terms of voltage thermal limits. The transfer of energy, whether on the distribution feeder in either direction, cannot exceed the limits set by national standards or standard equipment ratings. Essentially, the total amount of energy in either direction is evaluated to ensure those limits are not exceeded.

Q. Does PNM already have feeders with aggregate DG interconnected near or exceeding solar saturation?

A. Yes. As stated above, there are 18 feeders near or at their physical hosting capacity limit. Of the 18 feeders, two feeders were already at their physical hosting capacity limit, including State Pen feeder 12 and Los Morros feeder 12. Upgrades to relieve the constraints on were successfully completed on November 25, 2024, on Los Morros feeder 12 to increase the hosting capacity on that feeder and the feeder was opened for regular screening. A report was filed with the Commission on April 28, 2025,[8] which included the updated hosting capacity on those two feeders along with engineering plans for State Pen feeder 12. PNM Figure EH-2 below provides the list of the remaining 16 feeders near hosting capacity limits. As noted above, Alamogordo feeder A10012 is also nearing hosting capacity limits.

PNM Figure EH-2

#	Area	Feeder
1	Alamogordo	A10083
2	Las Vegas	ARIB11
3	Valencia	COLL12
4	Deming	DEMW11
5	Valencia	ELCE11
6	Deming	GOLD13
7	Deming	HOND12
8	Valencia	JARA12
9	Albuquerque	LOHO12
10	Albuquerque	LOHO13
11	Albuquerque	LOHO14
12	Valencia	LSMO21
13	Sandoval	PROG13
14	Albuquerque	SCEN12
15	Albuquerque	SOCO12
16	Valencia	TOME12

[8] Case No. 23-00072-UT, PNM's Report on Variance Request No. 1 Pursuant to Commission Order (Apr. 28, 2025).

III. POTENTIAL SOLUTIONS TO RELIEVE FEEDER SOLAR SATURATION

Q. What options does PNM have today to relieve solar saturation and enable additional DG to interconnect to these feeders?

A. There are several solutions that can assist in enabling more interconnection of DG to PNM's distribution system, which include:

1. Performing upgrades to relays, conductors, feeder getaways and other equipment, or installing higher-rated equipment to provide higher capacity on the distribution feeder.
2. Constructing dedicated feeders to connect certain DG facilities back to the substation.
3. Installing control devices to enable curtailment of DG at times of potential overload.
4. Installation and utilization of BESS that can absorb the excess generation of DG and subsequently release that energy when it is safe to do so.

Q. Please describe these potential solutions.

A. Descriptions of each option above are as follows:

1. Performing upgrades to feeders: This is considered a "traditional" feeder upgrade. This option is to upgrade the feeder and its components to allow for a higher capacity for energy to follow. As part of the Rule 568 Study, this was one of the options that was evaluated. If a feeder is not up to the highest rated PNM standards, this is typically the first option performed to bring the hosting capacity to the maximum level of energy flow possible via PNM distribution standard design. Once this has been completed, it is challenging to increase the hosting capacity further via this method because PNM would need to upgrade substation equipment and feeder equipment to higher voltage levels, outside of current PNM standards. This entails removing all existing distribution equipment, wires, poles, etc. and substation equipment such as transformer, breakers etc. and installing new equipment with higher voltage levels. This would be very expensive, time-consuming, and would require outages to customers and a lot of construction both at the substation and distribution system level. This might also require new land acquisition, easements, and rights of way, further complicating the issue.

2. Dedicated feeders: This option is considered a traditional wires solution. It entails building a dedicated feeder consisting of wires, conductors, breakers, switches, and other typical distribution feeder equipment directly to certain solar sites from a substation. This process might require new easements and rights of way, new land acquisition, and constructing new facilities for long

distances on the distribution system. There might be a need to upgrade or install additional substation level transformers at an existing substation or new substations to accommodate this option which increases costs, and timelines for construction. The combination of these factors makes this option both costly and time-consuming.

3. Installing devices to allow curtailment of DG: This option entails installing control devices at DG sites, including commercial, residential, and PNM-owned DG sites to allow for limiting or possibly curtailing DG when there is excess generation on the feeders. This would entail revisiting existing contracts and Commission rules related to reducing or curtailing DG, which would essentially limit DG interconnections. This option would result in a very negative customer and developer experience, since no one wants their PV system curtailed. Community solar facilities only add to the problem, as the current subscriber organization agreement approved in Case No. 23-00071-UT[9] does not allow the utility to curtail these facilities.

4. Utilization of BESS: This option entails installing distribution-sited BESS which is controllable by the utility. BESS allow excess electricity produced by DG to be stored during high production times which can later be released into

[9] The subscriber organization agreement is the contract entered into between each community solar facility and the utility to whose system the community solar facility interconnects. It is a contract separate and apart from the interconnection agreement.

the system when DG is lower and/or load is higher. In addition to allowing more interconnection of DG to the distribution system, BESS offers other benefits such as energy arbitrage, firm or peaking capacity during a certain duration, ancillary services, and other potential benefits. BESS enables more DG to not be curtailed, meaning that PNM and its customers benefit from more of the DG production on PNM's system. Energy arbitrage means charging of the BESS when energy prices are low, and releasing the energy when prices are high. Firm capacity or peaking capacity is the amount of energy that stored in the BESS that can be utilized during maximum peak hours, ensuring utilities are matching generation to their load. Ancillary services include items such as fast response to generators being taken out of service, assistance with frequency response and fast response to unpredictable changes in generation and demand.

Q. Please describe the benefits of BESS as the preferred solution to relieve solar saturation and enable additional DG to interconnect to these feeders.

A. Per the Rule 568 Study, PNM and 1898 & Co. have demonstrated that, in certain instances, the best solution to increase hosting capacity of the solutions considered is the installation of BESS. The study includes a CBA which compared traditional feeder upgrades, dedicated feeders, and BESS. All five sites selected for this phase of BESS installation have the highest benefit-to-cost ratio ("BCR") as compared with the other options. The fifth site, in Alamogordo, was not part of the Rule 568 Study but was selected because this site is soon going to reach hosting capacity limits as well. There is a PNM solar site the BESS can be installed adjacent to without needing to perform extensive line extensions and purchase new land. There will be a small modification for network upgrades in order to accommodate the interconnections as described in the Direct Testimony of PNM witness Kyle Sanders.

Q. Can you provide additional detail as to how the five sites were selected for installation of BESS?

A. In addition to the Rule 568 Study, PNM analyzed additional items when selecting these five sites. Below is a breakdown of those additional items:

All these sites are co-located with PNM-owned DG. Alamogordo Otero site on Alamogordo feeder A10012. BESS will allow the addition of more DG. This site is the only location from the five sites that was not on the feeders from the Rule 568 Study. However, this site is approaching hosting capacity limits, and it was chosen due to the fact that there is room next to an existing PNM-owned solar site which allows less costs because there is no need for additional rights of way, easements, and construction of distribution lines when compared to other potential sites where those items would be needed. PNM worked with

1898 & Co. on the analysis of this feeder and compared installation of BESS and the dedicated feeder options because the existing feeder is already built to the maximum standard (i.e., upgrading the existing feeder is not a feasible option). Installing BESS provides the highest BCR. See PNM Figure EH-3 below:

PNM Figure EH-3

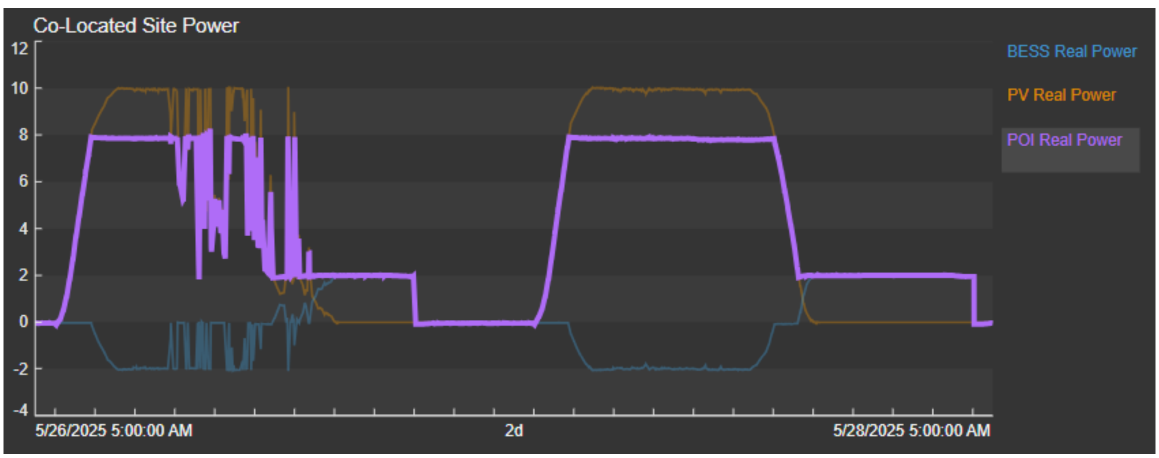
Feeder	Capital Project Category	Net Hosting Capacity Increase (kVA)	Capital Project Cost	BCR	Net Hosting Capacity Increase (kVA) over cost ($K)
A10012	6 MVA BESS	5.58	14,350,000	1.79	0.39
A10012	Dedicated Feeder	8.38	12,613,746	0.68	0.66

Q. Please explain how BESS mitigates solar saturation risk on the distribution system.

A. BESS safely allows more interconnection of DG by allowing the excess power generated from DG to be absorbed onto the BESS. This would decrease the amount of energy flowing onto the distribution system and onto the substation transformer, which would mitigate potential issues of exceeding the feeder and equipment capacity and thermal ratings. The energy generated from the DG would be stored locally and released back onto the system when it is safe and beneficial.

PNM Figure EH-4 below provides a two-day sample of power flow data from the South Valley co-located PV and BESS facility. The orange trace represents the power generated by the PV, which prior to the installation of the co-located BESS, was all injected onto the distribution feeder. Paired with certain feeder conditions, such as low load and high customer DG production, this led to significant reverse power flows and heightened solar saturation risk. The co-located BESS now dynamically charges to limit the amount of PV production that is injected into the distribution feeder, as shown by the purple trace, which reduces solar saturation on the feeder.

PNM Figure EH - 4



Q. Please explain how the BESS Project will relieve feeder thermal and overvoltage issues.

A. The BESS will absorb excess power generation on the feeder which decreases the amount of energy flowing on the feeder that can cause thermal and overvoltage issue and will release that energy when DG is lower on the feeder. By decreasing the amount of amps on the feeder, BESS will safely mitigate feeder thermal and overvoltage issues. As illustrated above in PNM figure EH-4, it can be observed that the excess generation is being absorbed to limit the amount of energy on the feeder and released back to the grid when the overall energy on the feeder is lower.

Q. Please explain how the BESS will increase hosting capacity and enable DG interconnection applications currently on hold to interconnect.

A. By absorbing the excess energy generated from DG during peak generation hours and releasing the energy later as explained above, BESS will increase hosting capacity and enable the safe interconnection of additional DG.

IV. PROPOSED BESS PROJECT

Q. Please explain how the locations for the BESS were determined.

A. The Rule 568 Study identified distribution feeders that are at or near hosting capacity limit and identified which feeders were the most cost effective for a BESS installation. PNM performed further analysis on those sites and also looked at additional feeders that are now approaching hosting capacity limits since that study was performed.

Q. Will distribution-sited BESS be applied solely to address solar saturation constraints?

A. The biggest benefit at this time of installing distribution-sited BESS is to increase hosting capacity and assist with solar saturation constraints. However, there are other potential benefits including energy arbitrage, firm or peaking capacity during a certain duration, and ancillary services, that can be utilized in the future as PNM gains more knowledge of these systems and additional communication and control equipment is installed at the distribution level as described in the Direct Testimony of PNM witness Nicholas Pollman.

Q. Please explain how the BESS Project aligns with PNM's longer-term grid modernization plan related to the distribution system.

A. There are four components in PNM's longer-term grid modernization plan. These include Advanced Distribution Management system ("ADMS"), Fault Location, Isolation and System Restoration ("FLISR"), Integrated Volt Var Control ("IVVC"), and Distributed Energy Resource Management Systems ("DERMS"). As PNM proceeds with the implementation of its grid modernization plan, approved in Case No. 22-00058-UT, installation of distribution-sited batteries is required to realize the benefits of the overall grid modernization plan. The benefits of the distribution-sited BESS have already been discussed earlier in my testimony, but they play a bigger role in grid modernization and are one component of grid modernization which brings benefits such as system reliability, resiliency, decarbonization, and other benefits that were discussed in Case No. 22-00058-UT. These four components function together. For example, with the installation of distributed sited BESS and FLISR, there is potential in the future to utilize the BESS as a generator until the system can be restored during an outage.

V. PUBLIC INTEREST

Q. Please explain how the BESS Project serves the public interest.

A. The BESS Project will assist in ensuring that the five feeders selected can continue to operate reliably and safely and stay within national standards and equipment specification standards. It will allow the interconnection of more DG to those feeders. Based on the CBA that was performed, it offers the highest BCR compared to the other solutions, and it can be constructed faster than the other options. In that it is the most cost-effective and fastest solution to implement, BESS enables faster DG interconnection at the lowest cost as compared to other feasible solutions. With BESS enabling more and faster interconnection of DG, it speeds the transition to a carbon-free grid.

Q. Will the BESS Project help to reduce costs to PNM's customers by avoiding or deferring the need for investment in new generation or for upgrades to systems

for the transmission and distribution of energy as required under Section 62-9-1(E)(1) of the PUA?

A. Yes. The installation of BESS will remove the need to install additional substation and distribution facilities that cost more, take longer to implement, and which often require additional land acquisition, easements, and rights of way. It will assist in utilizing energy from DG that otherwise would have to be possibly curtailed and allow for the release of that energy during hours where energy is more valuable. It will allow for assisting in meeting demand and load by discharging the energy at opportune times.

Q. Will the BESS Project assist in ensuring grid reliability, including transmission and distribution system stability, while integrating sources of renewable energy into the grid as required under Section 62-9-1(E)(3) of the PUA?

A. Yes. Distribution-sited BESS can assist in system resiliency by acting as a backup generation source for short periods of time when there are outages on the system. It can feed a portion of the system depending on the circuit configuration until the system event and outage has been mitigated. It can assist in generator outages by providing ancillary services such as spinning reserves, frequency deviation and voltage support. The ability to discharge and charge rapidly makes BESS ideal to assist in system resiliency. It will allow the distribution feeder to stay within national and equipment specification standards. BESS will ensure feeders stay within voltage and thermal limits.

Q. Will the BESS Project support diversification of energy resources and enhance grid security as required under Section 62-9-1(E)(4) of the PUA?

A. Yes. One of the benefits of BESS is storage of energy from DG, meaning more DG can be installed and it requires less curtailment, thereby helping move toward a carbon-free grid. By allowing more DG, the need for other types of generation interconnected to the transmission system can potentially decrease. This allows generation of energy to be spread out across both transmission and distribution systems to integrate energy generation closer to load in certain instances.

Q. Is the BESS Project the most cost effective among feasible alternatives as required under Section 62-9-1(E)(7) of the PUA?

A. Yes. The five sites selected in this phase of BESS installation all show that installation of BESS provides the highest BCR when compared to other feasible alternatives.

VI. CONCLUSION

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. PNM is requesting a CCN for the installation and operation of five additional BESS on its distribution system. Having performed engineering studies and analyzed different feasible solutions, BESS provides the most cost-effective and beneficial solution. BESS is a newer technology being utilized in distribution systems across the country as it could potentially provide benefits such increasing hosting capacity, allowing for more interconnection of DG, energy arbitrage, firming capacity, ancillary services, and other potential benefits. BESS enables the transition to a carbon free grid.

As PNM develops and installs more distribution-sited BESS, additional potential benefits will be realized with more operating experience. With the addition of a second tranche of community solar facilities, there will be additional DG added to the distribution system which will cause more feeders to reach solar saturation and thermal and voltage limits, and we foresee BESS as a solution to mitigate these issues.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

GCG#534017

Resume of Erfan Hakimian

PNM Exhibit EH-1

Is contained in the following 1 page.

Erfan Hakimian
Educational and Professional Summary

Name: Erfan Hakimian

Address: PNM
2401 Aztec Rd NE
MS Z220
Albuquerque, NM 87107

Position: Director, Transmission and Distribution Planning and Contracts

Education: Bachelor of Science in Electrical Engineering, University of New Mexico, 2013
Master of Business Administration, Grand Canyon University, 2018

Employment: Employed by PNM since 2013:
Positions held with the Company include:
Director, Transmission and Distribution Planning and Contracts
Manager, Strategic Asset Management Department
Engineer III, Technical Maintenance Management Department
Senior Key Account Manager, Key Accounts Team
Engineer I, Distribution Engineering

Rule 568 Hosting Capacity Improvement Solutions

PNM Exhibit EH-2

Is contained in the following 225 pages.

RULE 568 HOSTING CAPACITY IMPROVEMENT SOLUTIONS - FINAL

PUBLIC SERVICE COMPANY OF NEW MEXICO

PROJECT NO. 171847

REVISION 0

August 23, 2024

Disclaimer

1898 & Co.® is a part of Burns & McDonnell that performs or provides business, technology, and consulting services. 1898 & Co. does not provide legal, accounting, or tax advice. The reader is responsible for obtaining independent advice concerning these matters. That advice should be considered by reader, as it may affect the content, opinions, advice, or guidance given by 1898 & Co. Further, 1898 & Co. has no obligation and has made no undertaking to update these materials after the date hereof, notwithstanding that such information may become outdated or inaccurate. These materials serve only as the focus for consideration or discussion; they are incomplete without the accompanying oral commentary or explanation and may not be relied on as a stand-alone document.

The information, analysis, and opinions contained in this material are based on publicly available sources, secondary market research, and financial or operational information, or otherwise information provided by or through 1898 & Co. clients whom have represented to 1898 & Co. they have received appropriate permissions to provide to 1898 & Co., and as directed by such clients, that 1898 & Co. is to rely on such client-provided information as current, accurate, and complete. 1898 & Co. has not conducted complete or exhaustive research, or independently verified any such information utilized herein, and makes no representation or warranty, express or implied, that such information is current, accurate, or complete. Projected data and conclusions contained herein are based (unless sourced otherwise) on the information described above and are the opinions of 1898 & Co. which should not be construed as definitive forecasts and are not guaranteed. Present and future conditions may vary greatly from those utilized or assumed by 1898 & Co.

1898 & Co. has no control over weather; cost and availability of labor, material, and equipment; labor productivity; energy or commodity pricing; demand or usage; population demographics; market conditions; changes in technology, and other economic or political factors affecting such estimates, analyses, and recommendations. To the fullest extent permitted by law, 1898 & Co. shall have no liability whatsoever to any reader or any other third party, and any third party hereby waives and releases any rights and claims it may have at any time against 1898 & Co. and any Burns & McDonnell affiliated company, with regard to this material, including but not limited to the accuracy or completeness thereof.

Any entity in possession of, or that reads or otherwise utilizes information herein is assumed to have executed or otherwise be responsible and obligated to comply with the contents of any Confidentiality Agreement and shall hold and protect its contents, information, forecasts, and opinions contained herein in confidence and not share with others without prior written authorization.

CONTENTS

FIGURES

TABLES

1.0 Executive Summary

Photovoltaic (PV) penetration is growing within the Public Service Company of New Mexico (PNM or the Company) system. High PV penetration can present benefits but can also result in challenges for operating and maintaining the distribution system. In response to rule 568 PNM was granted partial variance in NMPRC Order 23-00072-UT-2023-06-14 to conduct studies to evaluate PNM's technical concerns regarding Variance requests 1, 2, and 3. As ordered, PNM worked with the Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL) to design the pilot study. The purpose of the pilot study was to better understand the actual limits on distribution feeders for hosting new PV generation given the levels of PV penetration PNM is experiencing and identify potential solutions to increase the hosting capacity on the PV saturated feeders. That report[1] was submitted to the NMPRC on May 23, 2024.

In this report, after understanding the limitations of distribution feeders, multiple hosting capacity improvement solutions were evaluated for 18 of PNM's PV saturated feeders. The types of hosting capacity improvement solutions that were evaluated are shown in Figure 1-1. A financial analysis was then performed to understand the value of each solution and ultimately recommend a portfolio of hosting capacity improvement projects for these PV saturated feeders.

Figure 1-1: Hosting Capacity Improvement Solutions Evaluated

Feeder Upgrades	Feeder Upgrades & BESS Charging at 2 MVA	Feeder Upgrades & BESS Charging at 6 MVA	Dedicated Feeder Buildout

1.1 Pending Customer PV Interconnection Analysis

As of January 1, 2024, 13 of the 18 PV saturated feeders had pending customer PV interconnections. Based on the results of the first hosting capacity study report, it was determined that there was remaining hosting capacity on many of the PV saturated feeders. For 11 of the 13 feeders evaluated, all pending PV customers modeled can successfully interconnect without any system improvements. With the proposed hosting capacity improvement solutions constructed, all pending customer PV, through August 19, 2024, can successfully interconnect.

Going forward, all applications on PV saturated feeders will follow the rule 568 screening process. Since these feeders have reverse power flow at minimum load timeframes, they will fail the 100%

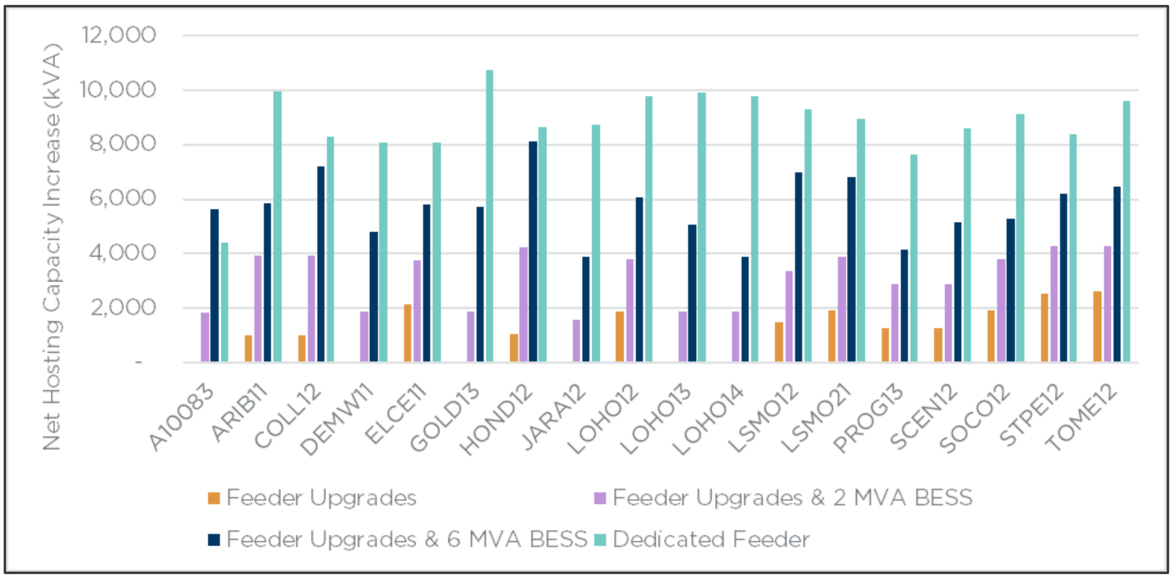
[1]Rule 568 Hosting Capacity Analysis Report
https://edocket.prc.nm.gov/AspSoft/HandlerDocument.ashx?document_id=1233550

of minimum load screen and require supplemental review. Under supplemental review, each application will be studied to see if there is remaining hosting capacity to safely interconnect.

1.2 Hosting Capacity Improvement Solutions Analysis

All capital project solutions investigated for the 18 PV saturated feeders resulted in an increase in hosting capacity. However, the increase in hosting capacity varied across the feeder and was influenced by several factors. The dedicated feeder buildout scenario most often provided the greatest increase in hosting capacity while feeder upgrades generally provided a marginal increase in hosting capacity. For some of the feeders, upgrades were not applicable because the feeder is presently built to the maximum PNM standard ratings and no increase in hosting capacity is shown for that scenario. Figure 1-2 shows the Synergi analysis hosting capacity increase for each capital project alternative relative to the base case model results.

Figure 1-2: Hosting Capacity Increase per Solution Results



Note: An absent vertical bar indicates that hosting capacity increase was not applicable for the given scenario.

1.3 Financial Analysis of Solutions

Two perspectives were used to evaluate all hosting capacity improvement solutions on PV saturated feeders. These perspectives differ by valuing hosting capacity improvement alone, versus taking into consideration the overall system benefits provided by the solution, including both transmission and distribution system benefits.

Hosting Capacity Benefit Cost – solutions were scored based only on the increase in hosting capacity relative to the cost. This perspective does not consider the overall system benefits provided by each solution.

Table 1-1 presents the portfolio of capital project solutions that scored the highest using the hosting capacity benefit cost perspective. Feeder upgrades or dedicated feeder buildout were the types of solutions that scored the highest using the hosting capacity benefit cost perspective.

Holistic System Benefit Cost – solutions were scored based on the value provided by the new PV generation enabled by hosting capacity and by overall system benefits. The complete value of BESS to the PNM system was more holistically considered from this perspective as battery storage can improve distribution feeder hosting capacity as well as provide transmission system benefits. See Section 2.4 for further explanation of the value models used for this analysis.

Table 1-2 presents the portfolio of hosting capacity improvement solutions that scored the highest using a holistic system benefit cost perspective. Considering this holistic value perspective, the 6 MVA BESS solution scored highest for most feeders. However, feeder upgrades in addition to the BESS were not recommended in all instances due to high costs.

Table 1-1: Hosting Capacity Benefit Cost Portfolio

Feeder	Capital Project Category	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)
A10083	Dedicated Feeder	4,426	$4,511,562	0.98
ARIB11	Feeder Upgrades	1,090	$156,470	6.97
COLL12	Feeder Upgrades	1,020	$151,149	6.75
DEMW11	Dedicated Feeder*	8,072	$8,420,781	0.96
ELCE11	Dedicated Feeder*	8,091	$15,970,100	0.51
GOLD13	Dedicated Feeder	10,743	$1,600,027	6.71
HOND12	Feeder Upgrades	2,390	$2,435,763	0.98
JARA12	Dedicated Feeder	8,742	$5,881,256	1.49
LOHO12	Dedicated Feeder*	9,758	$4,134,726	2.36
LOHO13	Dedicated Feeder*	9,898	$4,956,000	2.00
LOHO14	Dedicated Feeder*	9,760	$4,043,470	2.41
LSMO12	Feeder Upgrades	1,469	$885,270	1.66
LSMO21	Feeder Upgrades	1,944	$878,801	2.21
PROG13	Dedicated Feeder*	7,646	$19,546,830	0.39
SCEN12	Feeder Upgrades	1,262	$1,967,632	0.64
SOCO12	Feeder Upgrades	1,943	$183,615	10.58
STPE12	Dedicated Feeder*	8,367	$11,316,078	0.74
TOME12	Feeder Upgrades	2,620	$82,117	31.91
Total	-	**99,241**	**$87,121,647**	-

*A new substation transformer/upgraded substation transformer is required for the dedicated feeder buildout solution. Five (5) total new substation transformers would be required if this portfolio were constructed.

Table 1-2: Holistic System Benefit Cost Portfolio

Feeder	Capital Project Category	Net Hosting Capacity Increase kVA	Capital Project Cost	Holistic Financial Benefit Cost Ratio Score
A10083	6 MVA BESS	5,637	$14,350,000	1.37
ARIB11	Feeder Upgrades & 6 MVA BESS	5,841	$14,506,470	1.37
COLL12	Feeder Upgrades & 6 MVA BESS	7,187	$14,501,149	1.38
DEMW11	Feeder Upgrades & 6 MVA BESS	4,794	$14,892,473	1.34
ELCE11	6 MVA BESS	2,531	$14,350,000	1.31
GOLD13	Feeder Upgrades & 6 MVA BESS	5,699	$14,350,000	1.39
HOND12	Feeder Upgrades & 6 MVA BESS	8,116	$16,785,763	1.37
JARA12	6 MVA BESS	3,897	$14,350,000	1.39
LOHO12	Feeder Upgrades & 6 MVA BESS	6,050	$14,506,470	1.37
LOHO13	6 MVA BESS	5,079	$14,350,000	1.39
LOHO14	6 MVA BESS	5,512	$14,350,000	1.39
LSMO12	Feeder Upgrades & 6 MVA BESS	6,980	$15,385,271	1.30
LSMO21	Feeder Upgrades & 6 MVA BESS	6,802	$15,228,801	1.27
PROG13	6 MVA BESS	2,425	$14,350,000	1.62
SCEN12	Feeder Upgrades	1,262	$1,967,632	1.84
SOCO12	Feeder Upgrades	1,943	$183,615	20.07
STPE12	Feeder Upgrades & 6 MVA BESS	6,207	$18,664,629	1.10
TOME12	Feeder Upgrades	2,620	$82,117	39.92
Total	-	**88,582**	**$227,154,390**	-

Note: 15-6 MVA BESS systems are included in this portfolio focusing on the holistic financial benefit cost analysis. This investment would result in 90 MVA of BESS capacity and 360 MWH of energy storage.

1.4 Portfolio of Recommended Capital Project Solutions

Table 1-3 provides the recommended portfolio of capital project solutions to improve hosting capacity on the PV saturated feeders while also providing the greatest value to PNM customers. Engineering judgement, in combination with the two-perspective financial analysis contained in the tables above, was used to determine this proposed solution portfolio.

In selecting this portfolio of solutions, the BESS solutions were considered valuable because of the hosting capacity increase on the local distribution feeder, but also because of the ability to avoid investments in other parts of the system. PNM foresees battery storage as a need moving forward in the clean energy transition. By building BESS on these distribution feeders, less battery storage must be constructed on the transmission system. While the dedicated feeder buildout solution typically resulted in the greatest hosting capacity increase for distribution feeders, these investments provide no benefit to other parts of the overall PNM system which can also become constrained as PV levels rise. The transmission system can be constrained during times of low load and high PV generation. Even after performing dedicated feeder buildouts, additional transmission system upgrades could be required in certain areas which would significantly impact the cost of upgrades to improve PNM's overall system hosting capacity. BESS solutions located in proximity to PV generation can reduce PV generation power flow on the transmission system and improve transmission congestion in lieu of transmission upgrades.

PNM plans to prioritize the feeder upgrades in the near-term to unlock incremental hosting capacity quickly and enable more customers to connect their new PV systems successfully. The proposed 6 MVA BESS systems can be constructed as PV penetration levels rise locally to improve feeder hosting capacity or BESS systems can be constructed to obtain the overall system benefits captured in the holistic system benefit analysis. Timelines are provided for the individual projects in Table 1-3 below. Where feeder upgrades and a 6 MVA BESS are proposed, the first timeline is for the feeder upgrades only. The second timeline is for the BESS construction. The timeline to construct the overall portfolio will be greater than three years as it will be subject to budget allocations.

Table 1-3: Hosting Capacity Improvement Solutions Portfolio

Feeder	Capital Project Solution Category	Increase in Hosting Capacity kVA	Capital Project Cost	Construction Timeline
A10083	6 MVA BESS	5,637	$14,350,000	3 Years
ARIB11	Dedicated Feeder	9,960	$8,245,205	3 Years
COLL12	Feeder Upgrades & 6 MVA BESS	7,187	$14,501,149	1 Year / 3 Years
DEMW11**	Feeder Upgrades & 6 MVA BESS	4,794	$14,892,473	1 Year / 3 Years
ELCE11	6 MVA BESS	2,531	$14,350,000	3 Years
GOLD13**	Dedicated Feeder	10,743	$1,600,027	1 Year
HOND12	Feeder Upgrades & 6 MVA BESS	8,116	$16,785,763	1 Year / 3 Years
JARA12	6 MVA BESS	3,897	$14,350,000	3 Years
LOHO12	Dedicated Feeder	9,758	$4,134,726	3 Years
LOHO13	Dedicated Feeder	9,898	$4,956,000	3 Years
LOHO14	Dedicated Feeder	9,760	$4,043,470	3 Years
LSMO12	Feeder Upgrades & 6 MVA BESS	6,980	$15,385,271	1 Year / 3 Years
LSMO21	Feeder Upgrades & 6 MVA BESS	6,802	$15,228,801	1 Year / 3 Years
PROG13	6 MVA BESS	2,425	$14,350,000	3 Years
SCEN12	Feeder Upgrades	1,262	$1,967,632	1 Year
SOCO12*	Feeder Upgrades & 6 MVA BESS	5,291	$-	Installed
STPE12	Feeder Upgrades & 6 MVA BESS	8,367	$18,664,629	2 Years / 3 Years
TOME12*	6 MVA BESS	6,460	$-	Installed
-	-	**119,868**	**$177,805,146**	-

***SOCO12 & TOME12 were selected for the Phase I BESS installations and are installed. Phase I selection was based on different criteria. The feeder upgrades only solution scored highest for these feeders because it provided a least cost alternative to provide an increase in hosting capacity. The 6 MVA BESS that is installed provides more hosting capacity for future customer interconnections.

****For DEMW11 & GOLD13, the SGIA has not been constructed. The proposed capital project solution would not be constructed unless the SGIA moves forward with construction, or if pending customers are not able to connect to the PNM system without system improvements built.

2.0 Inputs and Assumptions

Several distribution feeders within the PNM system already have large amounts of interconnected PV generation. High PV penetration can present challenges for operating and maintaining the distribution system. The purpose of this evaluation was to understand the cost of various hosting capacity improvement solutions and the value of these projects. As in PNM's previous report, Rule 568 Hosting Capacity Study Analysis Study – Final, dated May 22,2024 and filed with the NMPRC on May 23, 2024, Synergi Electric is the modeling tool PNM uses for its Distribution System Planning Analysis. This same tool was used for the evaluation of Hosting Capacity solutions in this study. As stated in the previous report, several inputs and assumptions are required to build and prepare distribution feeder models for analysis. These assumptions are described in Section 2 of PNM's previous report. Only new assumptions required for this evaluation are discussed in this report.

2.1 PV Saturated Feeders

For this report, PNM evaluated 18 distribution feeders classified to be at PV Saturation, where generation capacity exceeds 90% of the feeder rating. Presently, when a feeder is classified to be at PV Saturation, new interconnection requests are placed on hold until further study can be performed, and if necessary, system upgrades constructed. Table 2-1 shows the 18 distribution feeders with the associated region identified.

Table 2-1: PNM Feeders at PV Saturation

Feeder	Region
A10083	Alamogordo
ARIB11	Santa Fe
COLL12	Albuquerque
DEMW11	Deming
ELCE11	Albuquerque
GOLD13	Deming
HOND12	Deming
JARA12	Albuquerque
LOHO12	Albuquerque
LOHO13	Albuquerque
LOHO14	Albuquerque
LSMO12	Albuquerque
LSMO21	Albuquerque
PROG13	Albuquerque
SCEN12	Albuquerque
SOCO12	Albuquerque
STPE12	Santa Fe
TOME12	Albuquerque

2.2 Pending Customer PV Interconnections

Presently, customers requesting to interconnect to feeders at PV saturation have been placed on hold until further study could be performed. Pending PV interconnections, as of January 1st, 2024, are summarized in Table 2-2. Prior to evaluating solutions to increase hosting capacity, these pending PV interconnections were modeled, and power flow analysis performed, to determine if these customers could successfully interconnect to the PNM system without causing any negative system impacts. Section 4.2 shows the analysis performed to identify which pending customer PV interconnections can be successfully connected to the PNM system without any feeder modifications.

Table 2-2: Pending Customer PV Interconnections as of January 1, 2024

Feeder	Number of Pending Interconnections	Pending Interconnection Capacity kVA (AC)
A10083	4	30
COLL12	2	11
ELCE11	19	107
HOND12	22	125
JARA12	3	18
LOHO12	2	13
LSMO12	17	72
LSMO21	3	22
PROG13	58	330
SCEN12	35	225
SOCO12	55	371
STPE12	23	1,137
TOME12	29	174
Total	**270**	**2,635**

2.2.1 Pending Customers PV Interconnections in 2024

Since January 1, 2024, seven additional customers have applied to interconnect new PV systems on these PV saturated feeders. These customers were again placed on hold since the evaluation documented in this report was already underway. Table 2-3 shows the pending customer PV interconnections as of August 19, 2024. Once the hosting capacity solution was determined for these PV saturated feeders, and applied to the planning model, the pending customer PV interconnections were modeled to confirm successful interconnection.

Table 2-3: 2024 Pending Customer PV Interconnections Between 1/1/2024 and 8/19/2024

Feeder	Number of additional Pending Interconnections	Pending Interconnection Capacity kVA (AC)
ARIB11	1	6
COLL12	1	5
HOND12	3	25
SCEN12	1	6
SOCO12	1	9
Total	**7**	**51**

2.3 Hosting Capacity Planning Criteria and Considerations

Thermal loading and voltage are the main criteria that influence hosting capacity analysis within the Synergi software platform. PNM standard planning criteria were applied to this hosting capacity analysis and are listed in detail in Section 2 of PNM's first hosting capacity report. Various system improvements were evaluated for each feeder to improve hosting capacity limits. For select feeders, battery energy storage was also evaluated to understand the impact to hosting capacity where large-scale solar facilities are presently operating.

2.3.1 Distribution Feeder DER Inverter Limit

PNM published a DER integration plan[2] that outlined their approach to increasing hosting capacity on distribution feeders. This report also discusses a PV inverter penetration limit of 150% of the feeder rating. For distribution feeders to achieve this level of PV penetration, system upgrades and BESS are generally required to regulate power flow on the feeder and avoid thermal or voltage violations. This PV inverter penetration limit was incorporated into this evaluation so that hosting capacity was not overstated for distribution feeders after various types of system improvements were applied.

2.3.2 DER Integration Plan - Anticipated Capital Improvements

The previous report recommends changes to PNM's initial DER Integration Plan. In Sections 1.2.2 and 9.5, the report recommends that at 60% PV penetration, feeder upgrades should be performed to bring a distribution feeder to the current PNM standard rating. Next the report stated that at 80% PV penetration, BESS systems should be constructed to continue increasing the hosting capacity of feeders as PV penetration increases. If this updated DER integration plan had been in place while PV penetration levels rose on these PV saturated feeders, hosting capacity improvement projects could have been constructed as needed to avoid delaying new customer PV interconnections. However, because these feeders are already beyond 90% PV penetration, a

[2] https://edocket.prc.nm.gov/AspSoft/HandlerDocument.ashx?document_id=1226661

detailed evaluation of each feeder was required. Going forward, the updated DER integration plan will provide criteria for upgrades on feeders that are not presently at PV saturation as the total generation rises.

2.3.3 System Improvements Standard Equipment

Table 2-4 shows the standard equipment sizes and configurations that are commonly used for planning studies at PNM. Equipment and conductor upgrades were investigated within this evaluation to understand if certain upgrades could improve a distribution feeder's hosting capacity limits.

Table 2-4: System Improvement Upgrades

System Improvement	Standard Size
Lateral Conductor Upgrade	#2 ACSR or 2/0 ACSR
Main Line Conductor Upgrade	397 AAC @ 570
Lateral Cable Upgrade	1/0 AL
Main Line Cable Upgrade	750 CU or 750 AL
New Capacitor Bank	1,200 kVAR Switched
New Voltage Regulator	501 kVA
New Switch Overhead	SCADA Control Pole Top Switch
New Underground Switch	Various SCADA Controlled PME Configurations

2.3.4 Battery Energy Storage Systems

BESSs are another solution for improving hosting capacity on a distribution feeder when operated and optimized by PNM for this benefit. Battery storage can consume excess PV generation on a distribution feeder and can increase the minimum daylight gross load. Battery storage may be an option for improving hosting capacity for feeders that are at solar saturation where feeder upgrades have maximized the hosting capacity they can support. Table 2-5 shows the two scenarios of battery storage system specifications used for this evaluation. First, a 6 MW battery will be installed with a charge rate of 2 MW representing a control scheme where the battery can charge for an extended amount of time during daytime hours. Second, a 6 MW battery will be installed with a charge rate of 6 MW using the full capability of the equipment. It is anticipated that a BESS installation operating to the full capability may require additional investment into communications infrastructure to monitor power flow and customer service voltage more accurately on the feeder.

Table 2-5: BESS Operation Scenarios

Battery	Rating	Operational Charge Rate	Energy Storage
BESS Scenario 1	6 MW	2 MW	24 MW Hours
BESS Scenario 2	6 MW	6 MW	24 MW Hours

2.4 Copperleaf – Value Models

Copperleaf is a decision analytics tool primarily used for asset investment planning and management, particularly in asset-intensive industries such as energy, utilities, and infrastructure. It helps organizations maximize capital efficiency, manage asset risk, and achieve environmental, social, and governance (ESG) goals by providing a comprehensive platform for making data-driven investment decisions. Overall, Copperleaf's solutions are designed to help organizations navigate complex investment decisions by providing a unified platform that aligns financial, environmental, and community objectives. To obtain robust results, a utility must thoughtfully develop various "value models" which is a way of capturing the whole value of a potential investment. Since this is a new tool for PNM, it is anticipated that refining the inputs to Copperleaf will be an iterative process as PNM gains more experience using it.

Various models within Copperleaf were used to assess the benefits of each investment solution evaluated. The focus of this evaluation was to determine the appropriate projects to increase hosting capacity on distribution feeders and provide the greatest total benefit to customers. The following list shows the value models utilized within Copperleaf for this evaluation which are further discussed in the sections below.

- Capital Project Cost
- New Distributed PV Generation Distribution Feeder Benefit
- New Distributed PV Generation System Benefit
- Increase in Load Serving Capacity
- Evening Hours BESS Capacity/Capacity Over Risk Hours
- BESS Energy Supplied to the System
- Energy Arbitrage
- Avoided Curtailment (Contractual Take or Pay)
- Public Perception for Improving Hosting Capacity

2.4.1 Capital Project Cost

A class 5 (high level) cost estimate was performed for each alternative evaluated. The alternative cost is categorized as a negative value within Copperleaf. Quantified benefits from the other value models are summed to determine if the anticipated benefits exceed the up-front investment cost of the alternative.

2.4.2 New Distributed PV Generation Distribution Feeder Benefit

Power flow analysis performed within Synergi was used to determine the increase in hosting capacity in terms of Megawatts for the minimum daylight load hour. This increase in hosting capacity represents the potential to connect more distributed PV generation to a distribution feeder. To determine the benefit to the distribution feeder, the total amount of energy produced by new customer PV generation was calculated using Equation 2-1 shown below. The hosting capacity increase was multiplied by the number of daylight hours per year, then scaled by 60% to estimate the actual production of distributed PV facilities throughout the year as daylight hours vary through each day and season.

Equation 2-1: Total Yearly Energy Produced by New Distributed PV

$$New\ PV\ Yearly\ Energy\ Produced = Hosting\ Capacity\ Increase * 3{,}412\ Daylight\ Hours\ Per\ Year * 60\%$$

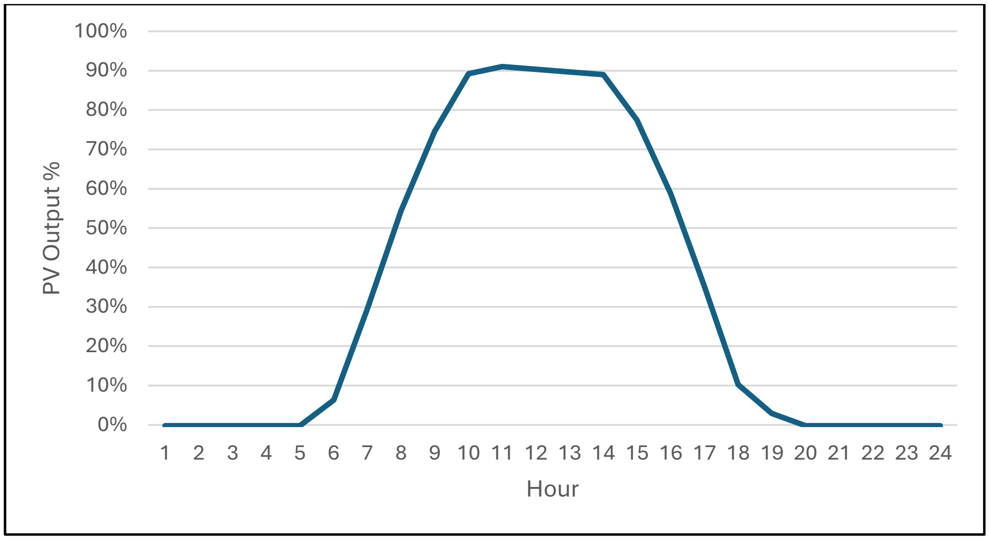
Total yearly daylight hours were calculated using the daylight hour ranges shown in Table 2-6. The total number of daylight hours for a typical year is estimated to be 3,412.

Table 2-6: Daylight Time Periods for PV Studies

7 AM - 7 PM	8 AM - 5 PM	8 AM - 4 PM
April	March	January
May	September	February
June	October	November
July		December
August		

Solar irradiance profiles were reviewed for the Albuquerque area to estimate the amount of energy that is supplied by a typical PV system during a summer day. Based on an assumption of fixed axis PV, the estimated output profile is shown in Figure 2-1. Summing up the energy supplied by a typical PV system, approximately 60% of the rated energy production was recorded during 12 hours of daylight. To estimate the energy supplied by new distributed PV systems, a 60% scaling was used based on this example.

Figure 2-1: PV Output % 24 Hour Profile

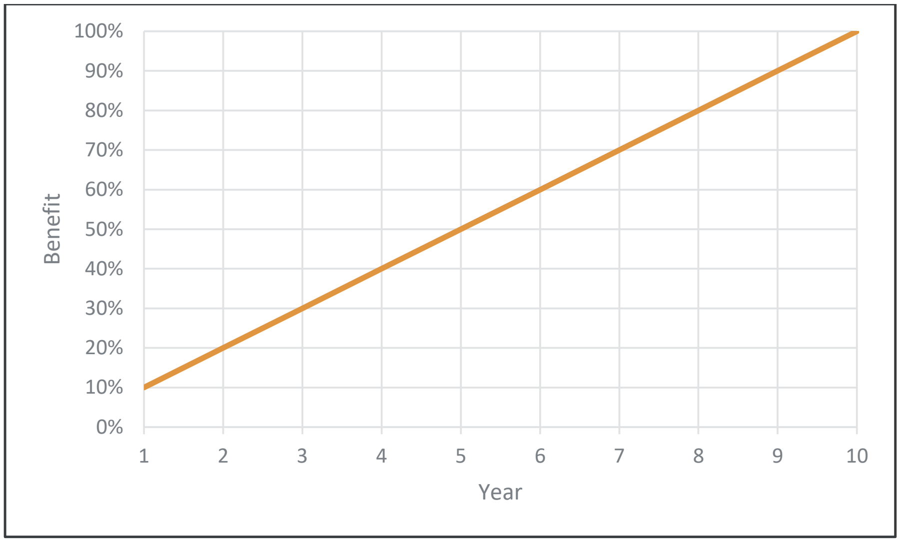


New distributed PV generation can benefit a feeder by reducing peak demand and result in cost savings from avoidance/deferral of distribution feeder projects. One source showed that the value of new PV generation on a distribution feeder was $5/MWH[3]. Since this value is not specific to PNM, and so as not to overstate the value, this $5/MWH benefit for new PV generation was reduced to $4/MWH. For distribution feeders that are not heavily loaded, new customer owned PV generation does not provide PNM with any cost avoidance/deferral because no projects are necessary to increase load serving capacity. The new distributed PV generation distribution feeder benefit was set to $0 in instances where the distribution feeder is not heavily loaded.

Once new hosting capacity is enabled on distribution feeders, it will take time for PNM customers to construct new PV generators. The monetary benefit within Copperleaf was scaled overtime so that in the first year of analysis only 10% of this benefit would be realized per year. However, by the end of the 10-year outlook, it was assumed that 100% of the benefit of new distributed PV generation would be realized. Figure 2-2 shows the ramp of anticipated benefit for new distributed PV generation.

[3]See The Value of Distributed Solar: Evidence from a Field Experiment - https://resources.environment.yale.edu/gillingham/ValueofDistributedSolar.pdf

Figure 2-2: New Distributed PV Generation Benefit Over Time



2.4.3 New Distributed PV Generation System Benefit

New distributed PV generation also provides benefit to the overall PNM electric system by customers constructing their own generation systems, which in some cases, allows excess energy to flow onto the PNM system to serve other load. This system benefit is meant to capture the avoided cost of PNM building new generation. System benefits were documented separately from the distribution feeder benefits but follow the same process to equate increased hosting capacity with yearly energy produced by new distributed PV generation – see Equation 2-1 above. Customer owned PV generation does not provide a significant benefit to the PNM system because it may not be located in the best area, and PV generation production, without storage, has limited coincidence with the peak demand times of the PNM electric system. However, a value of $1/MWh was used to attribute some value to the PNM system that results from new distributed PV generation. This minimal value represents the benefit to the PNM system for PV generation alone, if this generation is paired with energy storage, it can be shifted into the higher value evening hours where generation capacity is needed. This is further discussed in the “Evening Hours BESS Capacity/Capacity Over Risk Hours” value model.

Once new hosting capacity is enabled on distribution feeders, it will take time for PNM customers to construct new PV generators. The monetary benefit within Copperleaf was scaled overtime so that in the first year of analysis only 10% of this benefit would be realized per year. However, by the end of the 10-year outlook, it was assumed that 100% of the benefit of new distributed PV generation would be realized. See Figure 2-2 for a representation of the ramp of anticipated benefit for new distributed PV generation.

2.4.4 Increase in Load Serving Capacity

Several of the solutions to increase hosting capacity in this evaluation included substation and feeder upgrades. For these scenarios, system improvements would enable PNM to serve more customer load in addition to customer PV generation. However, for most of the feeders evaluated, the existing PNM system does not have a load serving capacity difficulty. If there is no load serving capacity challenge for a feeder $0 dollar of benefit was attributed to load serving capacity increases. Some feeders in the evaluation do have limited ability to serve new load. If the feeder is heavily loaded, or located near areas of economic development, some value should be attributed to the project. At the time of this evaluation, PNM does not have a monetary value determined for increased load serving capacity. In future iterations, PNM desires to include this benefit into the financial analysis of future projects.

2.4.5 Evening Hours BESS Capacity/Capacity Over Risk Hours

PNM must manage the power system to ensure that sufficient power is available to customers throughout each day. PNM must also plan for adequate generation to meet its system peak, which traditionally has occurred in the early afternoon. However, due to large amounts of PV generation on its system, PNM has seen a shift in its peak to the evening hours. PV generation can produce large amounts of power coincident with solar irradiance. The result is that PNM receives a large amount of PV generation during the middle of the day, but as the sun sets in the evening, customer power demand can remain high, and PNM must use other generation sources to continue serving load. Solutions that increased hosting capacity using a battery system will allow PNM to charge this resource during the daylight hours from excess PV generation and then deliver the energy during the evening hours when additional peaking capacity is needed to continue serving customers. Installing BESS on the PNM system will provide value by shifting excess renewable PV generation from the peak daylight hours to the evening hours.

If BESS is installed on distribution feeders, PNM would be able to avoid some investments to these types of resources on the transmission system. The avoided cost of $130/kW/Year was used to quantify the benefit of BESS for providing peaking capacity to the PNM system and is based on recent RFP efforts. For a 6,000 kW BESS, the yearly monetary benefit was calculated to be $780,000 ($130 * 6000 kW) for providing this generation capacity service during evening hours. For hosting capacity increase solutions that did not involve constructing a BESS, $0 of value was recorded for BESS capacity.

2.4.6 BESS Energy Supplied to the System

A BESS provides a resource for energy storage to the PNM system. Energy storage for recent BESS projects has been valued at $50/MWh. These distribution BESS applications are anticipated to operate with one full cycle per day for 365 days per year. For a 6 MW battery with 24 MWh of storage, the yearly value for energy supplied to the system was estimated to be $438,000 ($50 * 365 days * 24 MWh). For hosting capacity increase solutions that did not involve constructing a BESS, $0 of value was recorded for BESS energy supplied to the system.

2.4.7 Energy Arbitrage

Energy arbitrage is a strategy that involves purchasing energy at a low price and selling back into the market at a higher price. Solutions that increase hosting capacity on distribution feeders using a BESS also provide the opportunity to participate in energy arbitrage. As the needs of the distribution feeder change throughout each day/season, PNM can use a BESS to charge from excess PV generation or grid power to capture the benefit of storing energy when prices are low and then selling to the market as energy prices increase. The monetary value assumed for energy arbitrage in this evaluation was equal to $41,000 per MW per year of BESS capacity[4]. For a 6 MW BESS, the yearly monetary benefit was estimated to be $250,000 ($41,000 * 6 MW). For hosting capacity solutions that did not involve constructing a BESS, $0 of value was recorded for energy arbitrage.

2.4.8 Avoided Curtailment (Contractual Take or Pay)

PNM purchases power from many large wind/solar generators interconnected to the transmission system. Contracts with these power producers require that PNM take all power generated or pay the producer to curtail. During times of low customer demand but high output from renewable sources, PNM must pay the producers to curtail or sell the power at discounted rates to nearby utilities. Installing BESS on the PNM electric system will allow PNM to charge the batteries during times of high renewable energy production, but low customer demand. Charging these batteries will help PNM to avoid curtailing renewable energy sources while enabling a dispatchable resource on a distribution feeder. PNM has estimated $10,000 yearly benefit from a 6 MW 4-hour BESS for limiting curtailment of renewable energy production on the transmission system.

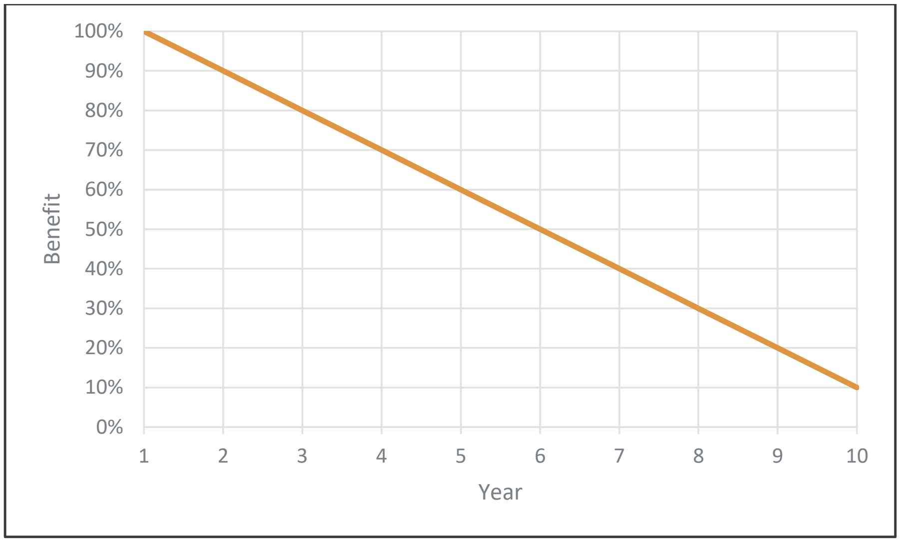
Over time, it is anticipated that PNM customers will interconnect more PV generation to distribution feeders where batteries are constructed. As PV generation continues to increase on these feeders and consumes remaining hosting capacity, the ability of these batteries on the distribution system to mitigate curtailment of these large transmission based renewable energy resources will be reduced. For this evaluation, it was assumed that all hosting capacity would be exhausted on a distribution feeder within the next 10 years and there would be no curtailment avoidance benefit beyond that time frame without further BESS investments. Figure 2-3 shows the ramp of anticipated benefit for avoided curtailment. For capital project solutions that did not involve constructing a BESS, $0 of value was recorded for avoided curtailment.

---

[4] See pages 9-10 direct testimony of Lucas Mcintosh

https://www.txnmenergy.com/~/media/Files/P/PNM-Resources/rates-and-filings/PNM%20CCN%20Application%20for%2012%20MW%20Battery%20Storage/2023-05-03-PNM%20Direct%20Testimony%20of%20Lucas%20McIntosh.pdf

Figure 2-3: Avoided Curtailment Benefit Over Time



2.4.9 Public Perception for Improving Hosting Capacity

PNM customers desire to interconnect new PV generators to feeders at PV saturation. Each hosting capacity improvement solution represents action by PNM to enable the interconnection of customer PV. These solutions also represent PNM's response to supporting the clean energy transition. A qualitative value model was used to represent the benefit to capital projects that correct the issue of PNM customers being unable to interconnect new PV generation to feeders at PV saturation. A more significant consequence value was attributed to distribution feeders with a higher number of pending customer PV interconnections. For feeders with minimal/no pending customer PV interconnections, a reduced consequence value was applied. Among all feeders analyzed, a 30% consistent probability of an event was used to scale the public perception value.

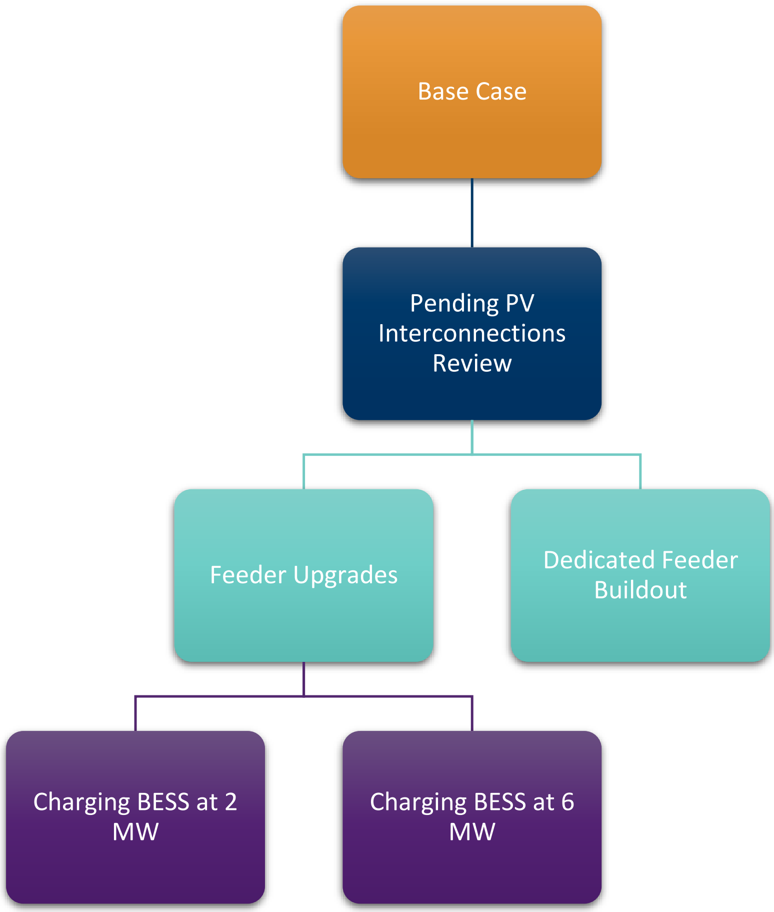
3.0 Hosting Capacity Improvement Solutions Evaluation Approach

Synergi's incremental Hosting capacity analysis and power flow simulations were used to understand the capability of existing distribution feeders to host new PV generation. This analysis was performed and documented within the first hosting capacity study report. The existing capability was established, then pending PV interconnections as of January 1, 2024, were modeled to determine if customer interconnections that were on hold due to high PV penetration levels could successfully interconnect to the PNM system. Once pending PV interconnections were modeled, various solutions to increase hosting capacity were evaluated. A Class 5 cost estimate was performed for each hosting capacity improvement solution evaluated. With the hosting capacity improvement identified, and the cost estimate documented, a financial analysis was performed to determine the recommended capital project portfolio for these 18 feeders.

3.1 Hosting Capacity Analysis and Capital Project Solutions

PNM has 18 feeders at PV saturation that were analyzed for this evaluation. Minimum daylight load was the basis for this analysis to understand the limits of the system when there is the least amount of customer load on the feeder to consume PV generation. There are five specific scenarios that were evaluated for each distribution feeder: base case hosting capacity with queued customer solar (if applicable), hosting capacity with Feeder Upgrades, hosting capacity with system improvements and a 6 MW battery operating at 2 MW or 6 MW, and a dedicated feeder built to serve the existing large-scale solar facility. The scenarios are outlined below in Figure 3-1.

Figure 3-1: Hosting Capacity Analysis and Capital Projects Approach



The process is delineated as follows and explains the major steps of the analysis:

Step 1 - Base Case Hosting Capacity Analysis

1. Document the current system capability.
2. Identify any existing planning criteria violations.

Step 2 - Pending PV Interconnections Review

1. If applicable, model pending customer PV interconnections as of January 1, 2024, and perform power flow simulation.
2. Review power flow results to determine if any new planning criteria violations occurred with pending customer PV interconnections modeled.
3. If no planning criteria violations are observed, pending customer PV interconnections should be approved for interconnection.
4. Perform hosting capacity analysis to determine the remaining hosting capacity after interconnecting pending PV projects.
5. All pending PV interconnections remain in the model for the following steps.

Step 3 - Feeder Upgrades

1. Construct capital projects in the feeder model to increase hosting capacity such as conductor upgrades, protective device upgrades, new equipment, etc.
2. Perform hosting capacity analysis and document the new system capability with the capital projects in place.

Step 4 - Feeder Upgrades and Charging BESS at 2 MVA

1. Construct a BESS co-located with the existing large PV system set to charge at 2 MVA.
2. Perform hosting capacity analysis and document the new system capability with the Feeder Upgrades in place and BESS charging at 2 MVA.

Step 5 - Feeder Upgrades and Charging BESS at 6 MVA

1. Construct a BESS co-located with the existing large PV system set to charge at 6 MVA.
2. Perform hosting capacity analysis and document the new system capability with the Feeder Upgrades in place and BESS charging at 6 MVA.

Step 6 - Build a Dedicated Feeder to Existing Large-Scale PV Site

1. Identify the substation upgrades and conductor buildout required to construct a dedicated feeder to the existing large PV site.
2. Move the existing large PV system to a new dedicated feeder.
3. No upgrades performed for the existing feeder that serves PNM customers.
4. Perform hosting capacity analysis for the existing feeder that serves PNM customers and document the new system capability with the large PV system moved to a dedicated feeder.

Step 7 - Review Pending Customer PV Interconnections in 2024

1. If applicable, pending customer PV interconnections as of August 19, 2024, new PV projects were modeled within the base case model.
2. Review power flow results to determine if any new planning criteria violations occurred with pending customer PV interconnections modeled within the base case model.
3. If no planning criteria violations are observed, pending customer PV interconnections should be approved for interconnection.

3.2 Hosting Capacity Improvement Solutions Cost Estimate

Capital projects identified during the power flow analysis were estimated using a class 5 (high-level) estimate approach. Detailed engineering and design will refine the cost estimate later. However, for larger capital projects like BESS installations and substation upgrades, recent cost data was utilized and applied in this evaluation.

3.2.1 BESS Construction Cost Estimate

PNM recently constructed two battery systems located on distribution feeders sized at 6 MW with 24 MWHs of storage. The installation cost of each system was $14.3M. These recent actual costs were utilized as an estimate for future BESS systems. To enable more functionality for the battery, it is anticipated that PNM will need to install additional communications and relaying infrastructure so that power flow and voltage on the feeder can be monitored more accurately. For scenarios where 6 MW charging was evaluated, an additional cost of $50,000 for this communications infrastructure was included.

3.2.2 Substation Upgrades to Enable Dedicated Feeder Construction Cost Estimate

Many of the feeders evaluated are presently served by fully built-out substations. Traditionally, PNM builds substation transformers with an associated switchgear that contains four feeder breaker compartments. If all existing substation feeder breaker compartments are utilized, building out a dedicated feeder will require significant substation upgrades, and in many cases require a new substation transformer and switchgear. Recent cost estimates from the Community Solar Program were used to estimate these substation upgrades necessary to build out a new dedicated feeder to a large PV site. The cost for a new substation transformer and switchgear was estimated to be $8M based on recent engineering designs.

3.3 Financial Analysis

Two perspectives were used to evaluate all solutions to improve hosting capacity on PV saturated feeders. These perspectives differ by valuing hosting capacity improvement alone, versus taking into consideration the overall system benefits, including both transmission and distribution system benefits.

Hosting Capacity Benefit Cost – solutions were scored based only on the increase in hosting capacity relative to the cost. This perspective does not consider the overall system benefits provided by each solution.

Holistic Financial Benefit Cost – solutions were scored based on the value provided from new PV generation enabled by hosting capacity and by overall system benefits. The complete value of BESS to the PNM system was more holistically considered from this perspective. See Section 2.4 for further explanation of the value models used for this financial benefit cost analysis.

4.0 Hosting Capacity Improvement Solutions Analysis

Table 4-1 shows the 18 feeders that were identified at/near solar saturation for this evaluation. The feeder rating utilization is calculated by comparing the total approved PV capacity, using an installed generation report and pending SGIA interconnections, against the feeder rating. Several feeders have approved PV capacity beyond the feeder rating identified by a feeder utilization greater than 100% and are colored red. Various system improvements were evaluated in this section to improve the hosting capacity of these feeders.

Table 4-1: Feeders at Solar Saturation

Feeder	Region	Feeder Rating kVA	Total Approved PV Capacity kVA	Feeder Rating Utilization %
A10083	Alamogordo	11,663	10,705*	92%
ARIB11	Santa Fe	9,331	10,115	108%
COLL12	Albuquerque	11231	9294	83%
DEMW11	Deming	9,370	8,304	89%
ELCE11	Albuquerque	9,288	9,295	100%
GOLD13	Deming	12,429	11,333	91%
HOND12	Deming	10,039	9,154	91%
JARA12	Albuquerque	11,231	10,068	90%
LOHO12	Albuquerque	9,288	10,249	110%
LOHO13	Albuquerque	9,288	9,036	97%
LOHO14	Albuquerque	9,288	10,006	108%
LSMO12	Albuquerque	11,231	12,223	109%
LSMO21	Albuquerque	11,231	10,000	89%
PROG13	Albuquerque	9,936	9,741	98%
SCEN12	Albuquerque	9,936	10,834	109%
SOCO12	Albuquerque	9,288	10,737	116%
STPE12	Santa Fe	8,208	10,372	126%
TOME12	Albuquerque	9,288	10,575	114%

*The total approved PV capacity for A10083 includes a recently studied Community Solar Program project sized at 3,500 kVA.

4.1 Base Case Hosting Capacity Analysis

Initial base case models were created for 18 feeders at solar saturation using the process outlined in Section 2 of PNM's first Hosting Capacity report. Table 4-2 shows the Synergi calculated results observed for each feeder based on the existing PNM system. Synergi Minimum Daylight Load (MDL) is defined as the lowest kW reading by the feeder meter during daylight hours. Synergi maximum hosting capacity represents the amount of additional PV generation that could be interconnected if placed at an optimal location, which is most often near the substation where equipment ratings are greatest. Maximum thermal and voltage observations are documented as well. For these feeders at PV saturation, many are experiencing maximum voltage and/or maximum conductor loading near the planning criteria limits and are colored yellow. For LSMO12, STPE12, and TOME12 thermal loading violations were observed in the base case model (colored red) and indicate there is no remaining hosting capacity for these feeders. System improvements must be performed for these three feeders before any new PV generation can be successfully interconnected.

Table 4-2: Synergi Base Case Hosting Capacity Results

Feeder	Feeder Rating kVA	Synergi Existing Gen kVA	Synergi MDL kW	Synergi MDL kVA	Synergi MDGL kVA	Synergi Max Voltage	Synergi Max Load %	Synergi Maximum Hosting Capacity kVA
A10083	11,663	9,973	-7,959	8,043	1,478	125.0	95.5	3,675
ARIB11	9,331	10,326	-8,188	8,188	2,121	123.4	89.0	1,099
COLL12	9,072	9,150	-8,297	8,702	372	125.5	96.0	781
DEMW11	10,278	8,304	-8,062	8,070	83	125.3	91.8	1,308
ELCE11	9,288	9,257	-6,954	7,668	1,300	124.4	97.0	2,019
GOLD13	12,429	11,272	-10,292	10,315	730	125.7	81.1	2,139
HOND12	10,039	9,153	-8,561	9,565	267	125.0	86.0	1,352
JARA12	11,231	10,063	-7,944	8,843	848	124.4	96.6	3,269
LOHO12	9,288	10,004	-8,260	8,263	1,660	124.9	86.0	1,060
LOHO13	11,231	12,073	-10,962	11,157	528	123.7	98.0	267
LOHO14	11,231	9,999	-9,616	9,684	529	124.6	86.0	1,616
LSMO12	9,288	10,216	-9,682	9,753	431	125.4	106.0	Thermal Violation
LSMO21	9,288	9,032	-7,944	8,001	848	123.4	97.0	1,272
PROG13	9,936	9,610	-6,367	6,373	1,909	125.3	97.0	3,255
SCEN12	9,936	10,728	-8,421	9,641	1,075	122.7	97.0	1,297
SOCO12	9,288	10,708	-7,707	8,484	2,347	123.0	97.0	1,224
STPE12	8,208	10,066	-7,839	8,703	1,770	124.3	112.0	Thermal Violation
TOME12	9,288	10,698	-8,442	8,624	1,800	123.2	110.0	Thermal Violation

Note: Negative MDL kW indicates reverse power flow on the feeder.

4.1.1 Feeders with Max Thermal Loading Violations

Feeders LSMO12, STEP12 and TOME12 all showed thermal criteria violations when performing the base case power flow analysis. System improvements are required to mitigate this planning criteria violation and risk of equipment failure that can result from use above normal ratings. Due to the thermal violations observed, zero hosting capacity remains for these feeders. Once system improvements are constructed to resolve these thermal violations, some hosting capacity will be enabled on each distribution feeder.

4.1.2 Feeders with Max Voltage Near Planning Criteria

Seven feeders within this evaluation experienced maximum voltage near the planning criteria of 126 V and are colored yellow in Table 4-2. High PV penetration can result in voltage rise on distribution feeders. Location of generation on the feeder, conductor sizes, and other factors will influence the amount of voltage rise that can result from PV generation. Mitigation efforts can be performed to regulate voltage by installing new equipment, adjusting the settings of PV inverters, and using BESS to control power flow. Although none of the feeders experienced high voltage violations in the base case hosting capacity scenario, high voltage violations are something that must be monitored for distribution feeders as PV penetration increases.

4.2 Pending Customer PV Interconnections Review

Several of the feeders had pending customer PV interconnections prior to this study. See Table 2-2 in Section 2.2 for the number of pending customer PV interconnections and the total capacity. If remaining hosting capacity was observed for a distribution feeder in PNM's first Hosting Capacity study, all pending interconnections shown in Table 2-2 were modeled, and power flow analysis performed to determine if all planning criteria were still maintained. Table 4-3 shows the summary power flow results and remaining hosting capacity after modeling the pending PV interconnections shown in Table 2-2. Feeders without pending customer PV interconnections are not shown in the table below.

Table 4-3: Synergi Power Flow Analysis with Pending PV Interconnections Modeled

Feeder	Feeder Rating kVA	Synergi Existing Gen kVA	Pending PV kVA	Synergi Maximum Voltage V	Synergi Maximum Load %	Synergi Maximum Hosting Capacity kVA	Pending PV Customers Can Interconnect?
A10083	11,663	9,973	30	125.0	95.5	3,703	N/A
COLL12	9,072	9,161	11	125.6	96.1	781	Yes
ELCE11	9,288	9,257	107	124.6	96.7	2,019	Yes
HOND12	10,039	9,153	125	125	86	1,352	Yes
JARA12	11,231	10,081	18	124.4	96.6	3,269	Yes
LOHO12	9,288	10,017	13	124.9	86	1,060	Yes
LSMO12	9,288	10,288	72	125.4	106	Thermal Violation	No
LSMO21	9,288	9,040	22	123.4	96.6	1,272	Yes
PROG13	9,936	9,931	330	125.4	96.3	3,255	Yes
SCEN12	9,936	10,948	225	122.8	98.9	1,297	Yes
SOCO12	9,288	11,063	371	123.5	98.2	1,224	Yes
STPE12	8,208	11,175	1,137	124.7	124.6	Thermal Violation	No
TOME12	9,288	10,852	174	123.2	111.6	Thermal Violation	Yes*

*A 6 MVA BESS was recently installed on TOME12. With this BESS in place, the existing thermal violation has been mitigated, and all pending PV projects can successfully interconnect.

4.2.1 Feeders Where Pending PV Projects can Interconnect

If no planning criteria violations were observed after modeling pending PV interconnections, these customers can be allowed to interconnect to the PNM system. All pending PV customers modeled can successfully interconnect without any system improvements on 11 of the 13 feeders evaluated. This would result in 230 new projects interconnecting and an increase of 1,391 kVA in PV capacity. For these 11 feeders, some hosting capacity remains after modeling pending customer PV interconnections and indicates that there is potential to successfully interconnect more PV to these feeders without experiencing planning criteria violations.

4.2.2 Feeders Where Pending PV Projects Cannot Interconnect

Feeders LSMO12 and STPE12 showed thermal criteria violations when performing the base case power flow analysis. If pending PV interconnections were allowed on these feeders, planning criteria violations would be exacerbated. Pending customer PV interconnections on these feeders must not be approved until system improvements can be constructed to mitigate existing planning criteria violations and increase the available hosting capacity for these feeders.

4.3 Feeder Upgrades

For many of these feeders at PV saturation, traditional conductor and equipment upgrades could be performed to bring the feeder up to the current PNM standard rating. Table 4-4 shows the summary of results and indicates the amount/type of system improvements evaluated for each feeder. Each feeder was evaluated individually to determine the appropriate set of system improvements to increase hosting capacity. The Synergi maximum hosting capacity value represents the amount of remaining hosting capacity assuming all pending PV customers are interconnected to the respective feeder if applicable. All feeders show remaining hosting capacity with feeder upgrades applied. Some feeders are already constructed to the maximum PNM standard ratings. The feeder upgrade scenario was not applicable to these feeders.

Table 4-4: Feeder Upgrades Summary Results

Feeder	Feeder Rating kVA	Feeder Cable Upgrade Mi	Main Line Conductor Upgrade Mi	Protective Device Upgrade Units	New Equipment Units	Synergi Maximum Hosting Capacity kVA
A10083	11,663	-	-	-	-	3,675
ARIB11	11,231	0	0	1	0	2,100*
COLL12	11,231	0.1	0	0	0	1,800*
DEMW11	12,429	0.03	0.63	1	0	1,280**
ELCE11	11,231	0.03	0	1	0	4,178
GOLD13	12,429	-	-	-	-	2,139
HOND12	12,429	0.08	3.2	1	0	2,390
JARA12	11,231	-	-	-	-	3,269
LOHO12	11,231	0	0	1	0	2,960
LOHO13	11,231	-	-	-	-	267
LOHO14	11,231	-	-	-	-	1,616
LSMO12	11,231	0	1.17	1	0	1,469
LSMO21	11,231	0	1.17	0	0	3,216
PROG13	11,231	0.16	5.26	0	0	4,506
SCEN12	11,231	0	1.61	0	0	2,559
SOCO12	11,231	0.03	.09	0	0	3,167
STPE12	11,231	0.42	5.24	0	0	2,520
TOME12	11,231	0.03	0	0	0	2,620

*Ariba Substation and College Substation transformers each have high amounts of PV penetration. The substation transformer limits the maximum hosting capacity after feeder upgrades are performed.

** Deming West Substation transformer is more limiting to hosting capacity than the feeder rating. After feeder upgrades are performed, losses decrease on the feeder but power flow through the transformer increases, so the hosting capacity decreased by a small amount.

4.3.1 Conductor Upgrades to Improve Feeder Rating

The maximum standard PNM feeder construction utilizes 750 CU cable for underground construction, rated for 520 Amps, and 397 AAC conductor for overhead construction, rated for 570 Amps. A distribution feeder that is constructed with these conductors/cables typically will have a normal rating of 11.2 MVA and an emergency rating of 13 MVA with a nominal system voltage of 12.47 kV_{LL}. PNM does operate in some regions at a nominal system voltage of 13.8 kV_{LL}. This higher nominal voltage results in a normal rating of 12.5 MVA and an emergency rating of 14.3 MVA. These emergency ratings are a result of the system design based on 600 Amp rated equipment. Emergency capacity is reserved for contingency switching and power restoration.

The Alamogordo South, Gold, Jarales, and Lost Horizon Substation feeders contained in this feeder set could not be upgraded to improve the feeder rating and feeder upgrades were not applicable. Lost Horizon, Gold, and Jarales feeders are newer and were constructed to the present maximum standards. Alamogordo Feeder A10083 was purchased from another utility provider that utilized conductor rated higher than the maximum PNM standard. As PNM continues to expand their system, they are working to construct new feeders to the maximum PNM standard, where possible, to mitigate the cost of future upgrades to increase the capacity of the feeder.

4.3.2 Protection Upgrades

As PV generation increases on a distribution feeder, system protection schemes are impacted. Desensitization of protection schemes can occur as new PV generation sources are distributed throughout the feeder. Reclosers and other sectionalizing devices are used to protect distribution feeders from faults and limit the impact to customers. Additional protective devices were included in the feeder upgrade analysis to mitigate potential desensitization concerns anticipated on distribution feeders as PV penetration increases.

4.4 Feeder Upgrades and Charging BESS at 2 MVA / 6 MVA

Feeder upgrades can bring all distribution feeders at PV saturation to current PNM construction standards and maximum feeder rating. By increasing the feeder rating, hosting capacity was observed to increase. However, once the maximum feeder rating is achieved, no other feeder upgrades can be performed to increase the maximum hosting capacity. Charging a BESS from PV generation is one solution to further increase hosting capacity on a distribution feeder. Charging the BESS from PV generation can regulate the power flow on the feeder during times when there is minimal customer demand, but large amounts of solar generation. Using a BESS to manage power flow on the distribution feeder can help to mitigate potential thermal and voltage violations that can result from PV generation.

Two different BESS charge rates were evaluated in this evaluation. The 2 MVA charge rate represents a simple control scheme where the 24 MWh BESS charges at a low rate for an extended amount of time. This lower charge rate will ensure that the BESS can charge for up to 12 hours during the day. The 6 MVA charge rate represents a more dynamic control scheme where the BESS charges at its full capability during peak solar production to enable more PV generation on the distribution feeder. However, if the BESS charges at 6 MVA it can only sustain this charge rate continuously for up to 4 hours a day. The energy component of BESS solutions is something that PNM will need to continue monitoring. The BESS charge rate may need to vary throughout the day to manage power flow on the distribution feeder while not filling the BESS too quickly to maintain enough storage to last through the solar day. Table 4-5 shows the summary results for all feeders at PV saturation evaluated.

Table 4-5: BESS Charging Hosting Capacity Results with Feeder Upgrades

Feeder	Feeder Rating kVA	New Protective Device Units	Synergi Maximum Hosting Capacity with 2 MVA Charging kVA	Synergi Maximum Hosting Capacity with 6 MVA Charging kVA
A10083	11,231	0	5,501	9,312
ARIB11	11,231	1	5,010	6,940
COLL12	11,231	0	4,698	7,968
DEMW11	12,429	0	3,208	6,102
ELCE11	11,231	0	5,787	7,844
GOLD13	12,429	0	4,037	7,838
HOND12	12,429	0	5,603	9,468
JARA12	11,231	0	4,846	7,166
LOHO12	11,231	0	4,853	7,110
LOHO13	11,231	0	2,157	5,346
LOHO14	11,231	0	3,512	5,512
LSMO12	11,231	1	3,373	6,980
LSMO21	11,231	0	5,161	8,074
PROG13	11,231	0	6,120	7,391
SCEN12	11,231	0	4,179	6,453
SOCO12	11,231	0	5,011	6,515
STPE12	11,231	0	4,289	6,207
TOME12	11,231	0	4,299	6,460

4.4.1 BESS Charging at 2 MVA / 6 MVA without Feeder Upgrades

For distribution feeders where significant amounts of feeder upgrades were identified, an additional scenario was analyzed to determine if a BESS alone would provide increased hosting capacity for the feeder while limiting the amount of capital investment. Only a small subset of the distribution feeders studied were evaluated without feeder upgrades applied. For this subset of feeders, the existing large-scale PV facility was located further away from the substation.

Table 4-6: Hosting Capacity Results with BESS Charging and no Feeder Upgrades

Feeder	Feeder Rating kVA	New Protective Device Units	Synergi Maximum Hosting Capacity with 2 MVA Charging kVA	Synergi Maximum Hosting Capacity with 6 MVA Charging kVA
ELCE11	9,288	0	3,630	4,550
PROG13	9,936	0	4,850	5,680
SCEN12	8,208	0	2,910	4,480
STPE12	9,288	0	1,280	1,600

4.4.2 Distribution Feeder Inverter Capacity Limit

Presently, PNM's DER integration plan indicates a PV penetration limit of 150% of the feeder rating. The intent of this planning criteria is to provide another milestone for distribution feeders where further study and evaluation would be required to understand the implications of allowing PV penetration higher than 150% of the feeder rating. PNM's concern is that the distribution system could become more difficult to operate and maintain power quality to customers as local generation levels exceed local consumption by a significant amount.

For a distribution feeder that has been upgraded to the standard PNM rating of 11.2 MVA, a PV penetration limit of 150% of the feeder rating would allow for up to 16.8 MVA of interconnected PV capacity. The hosting capacity results presented in the table above were limited, in some instances, to align with this planning criteria.

4.4.3 Protection Upgrades with BESS

For these scenarios, some additional protective devices were identified that will be necessary when installing BESS on certain distribution feeders. Adding BESS resources to a distribution feeder results in the ability to better regulate feeder power flow and increase hosting capacity. However, BESS is also a source of generation when discharging and can complicate protection schemes if both existing PV and the BESS feed into a fault. Reclosers and other sectionalizing devices can be used to protect distribution feeders from faults and limit the impact to customers.

4.5 Build a Dedicated Feeder to Existing Large-Scale PV Sites

Many utilities around the country construct dedicated distribution feeders to large-scale PV facilities. This practice has resulted in higher upfront interconnection costs but has simplified the distribution system operation and planning efforts. Historically, PNM has interconnected large-scale PV facilities to shared distribution feeders. This practice of interconnecting large-scale PV facilities to shared feeders has resulted in the challenges to interconnect new customer PV generation to the PNM system. A dedicated feeder scenario was evaluated to identify the hosting capacity benefit to PNM customers by moving these large-scale PV sites to a new dedicated feeder. Table 4-7 shows the summary results of this dedicated feeder buildout scenario.

Table 4-7: Dedicated Feeder Buildout Results

Existing Feeder	Existing Feeder Rating kVA	Substation Upgrade Required?	Feeder Cable Buildout Mi	Main Line Conductor Mi	Synergi Maximum Hosting Capacity kVA (For Existing Feeder)
A10083	11,663	No	0.13	5.3	8,101
ARIB11	9,331	Yes	0.05	0.15	11,061
COLL12	9,072	Yes	0.25	7.1	9,063
DEMW11	10,278	Yes	0.03	0.5	9,380
ELCE11	9,288	Yes	0.02	8.6	10,110
GOLD13	12,429	No	0.07	1.8	12,882
HOND12	10,039	Yes	0.08	3.0	9,994
JARA12	11,231	No	0.04	7.6	12,011
LOHO12	9,288	Yes	0.05	1.8	10,818
LOHO13	11,231	Yes	0.19	2.7	10,165
LOHO14	11,231	Yes	0.03	1.7	11,376
LSMO12	9,288	Yes	0.06	1.2	9,296
LSMO21	9,288	Yes	0.09	0.7	10,196
PROG13	9,936	Yes	3	6.9	10,901
SCEN12	9,936	Yes	1.7	4.3	9,906
SOCO12	9,288	Yes	0.03	2.2	10,350
STPE12	8,208	Yes	0.43	3.4	8,367
TOME12	9,288	Yes	0.3	4.9	9,590

4.5.1 Substation Upgrades

To build out a new dedicated feeder to the existing large-scale PV facilities, upstream infrastructure must be in place. At the Jarales and Gold substations, there was a vacant position in the substation switchgear ready for a new feeder buildout. In this situation, the capital improvements to build out the new dedicated feeder were significantly lower. For 15 of the feeders studied, substation upgrades were required to enable the buildout of a new distribution feeder. Each substation is unique, and the capital work required to build out a new distribution feeder varied. Some of the necessary upgrades were to replace a substation switchgear, upgrade the existing substation transformer to the new PNM standard size, or even construct a new substation because the existing substation has no room for expansion/upgrade. Substation upgrades can require long-lead equipment, significant engineering and design work, land acquisition, and significant cost.

4.5.2 Additional Load Serving Benefit

For 15 of the feeders evaluated, a substation upgrade was required to enable the buildout of a new distribution feeder to serve an existing large-scale PV facility. While upgrading a substation transformer or constructing a new substation transformer is a significant capital project, it also provides additional opportunity to serve load. Substation transformers are shared between 2-4 distribution feeders. If a new substation, or expansion of an existing substation is required to build out a new dedicated feeder to serve the existing large-scale PV, additional feeders could be constructed to serve economic development or traditional customer load. However, it is important to note that while these PV saturated feeders are limited in the ability to host new PV generation, all feeders in this evaluation have some remaining load serving capacity. Typically, the areas of PNM's system that are experiencing significant economic development interest are not where feeders are at PV saturation.

4.6 Hosting Capacity Improvement Observations

Table 4-8 shows the maximum hosting capacity observed for feeders at PV saturation for each scenario evaluated. Limited hosting capacity was observed for each of these saturated feeders in the base case evaluation. System improvements were shown to increase the maximum hosting capacity by increasing feeder ratings and/or installing a BESS that charges from excess PV generation. Building a dedicated feeder to the existing large-scale PV facilities generally unlocked the most hosting capacity for existing distribution feeders. Figure 4-1 visually shows the maximum hosting capacity results.

Figure 4-1: Maximum Synergi Hosting Capacity Results

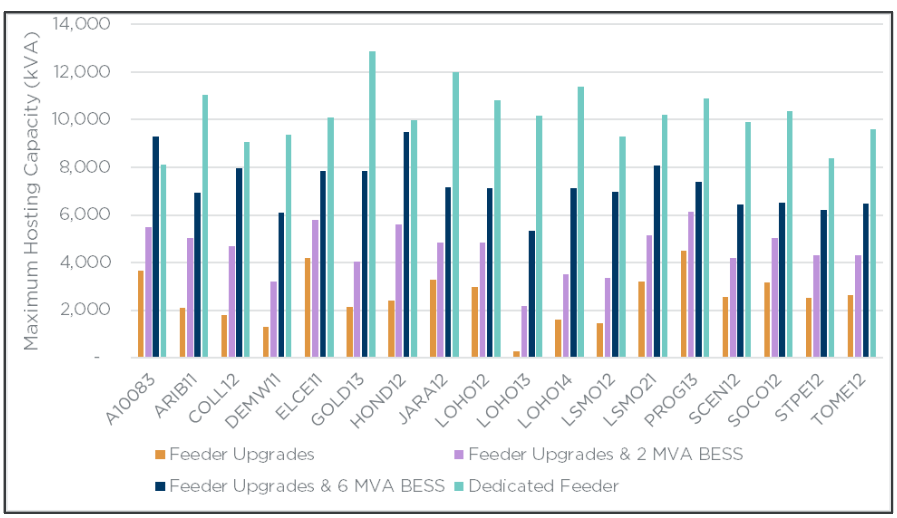


Table 4-8: Maximum Synergi Hosting Capacity Results Summary

Feeder	Base Case Synergi Max Hosting Capacity kVA	Feeder Upgrades Synergi Max Hosting Capacity kVA	2 MVA BESS Charging Synergi Max Hosting Capacity kVA	6 MVA BESS Charging Synergi Max Hosting Capacity kVA	Dedicated Feeder Buildout Synergi Max Hosting Capacity kVA
A10083	3,703	3,680	5,500	9,312	8,102
ARIB11	1,099	2,100*	5,010	6,941	11,061
COLL12	781	1,800*	4,700	7,970	9,063
DEW11	1,308	1,280**	3,210	6,100	9,380
ELCE11	2,019	4,180	5,790	7,840	10,110
GOLD13	2,139	2,139	4,040	7,840	12,882
HOND12	1,352	3,740	5,600	9,470	9,994
JARA12	3,269	3,269	4,850	7,170	12,011
LOHO12	1,060	2,960	4,850	7,110	10,818
LOHO13	267	267	2,160	5,350	10,165
LOHO14	1,616	1.616	3,510	7,130	11,376
LSMO12	Thermal Violation	1,470	3,370	6,980	9,296
LSMO21	1,272	3,220	5,160	8,070	10,196
PROG13	3,255	4,510	6,120	7,390	10,901
SCEN12	1,297	2,560	4,180	6,450	9,906
SOCO12	1,224	3,170	5,010	6,520	10,350
STPE12	Thermal Violation	2,520	4,290	6,210	8,367
TOME12	Thermal Violation	2,620	4,300	6,460	9,590

*Ariba Substation and College Substation transformers each have high amounts of PV penetration. The substation transformer limits the maximum hosting capacity after feeder upgrades are performed.

**Deming West Substation transformer is more limiting to hosting capacity than the feeder rating. After feeder upgrades are performed, losses decrease on the feeder but power flow through the transformer increases, so the hosting capacity decreased by a small amount.

5.0 Financial Analysis

Two perspectives were used to evaluate all hosting capacity improvement solutions on PV saturated feeders. These perspectives differ by the value attributed to hosting capacity improvement and other associated system benefits related to the evaluated solutions.

Hosting Capacity Benefit Cost – solutions were scored based only on the increase in hosting capacity relative to the cost. This perspective does not consider the system benefits provided by each solution. Feeder upgrades or dedicated feeder buildout were the solutions that consistently scored the highest using the hosting capacity benefit cost perspective. Column 6 in the following tables shows the scoring from this benefit cost perspective.

Holistic System Benefit Cost – solutions were scored based on the value provided by the new PV generation enabled by hosting capacity and by overall system benefits. The complete value of BESS to the PNM system was more holistically considered from this perspective. See Section 2.4 for further explanation of the value models used for this analysis. The holistic value provided by the BESS was captured with this perspective and resulted in a 6 MVA BESS solution scoring highest for most feeders. However, feeder upgrades were not recommended in all instances due to high costs. Column 7 in the following tables shows the scoring from the holistic system benefit cost perspective.

5.1 Feeder Upgrades

Feeder Upgrades primarily targeted conductor and cable upgrades to bring each distribution feeder to the maximum PNM standard rating. The capital project costs varied greatly as the number of conductor and equipment upgrades was also influenced by the configuration of each distribution feeder. Table 5-1 shows the financial analysis results for the feeder upgrade solution. Feeder upgrades were not applicable to all feeders at PV saturation. If the feeder is already constructed to the maximum PNM ratings, no hosting capacity increase or benefit cost scoring was provided.

Table 5-1: Feeder Upgrades Financial Analysis Results

Feeder	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
A10083	3,675	3,675	N/A	-	-	-
ARIB11	1,099	2,100	1,090	$156,470	6.97	1.16
COLL12	781	1,800	1,020	$151,149	6.75	1.2
DEMW11	1,308	1,280	-28*	$542,472	-	-
ELCE11	2,019	4,178	2,159	$6,247,100	0.35	0.16
GOLD13	2,139	2,139	N/A	-	-	-
HOND12	1,352	3,740	2,390	$2,435,763	0.98	1.34
JARA12	3,269	3,269	N/A	-	-	-
LOHO12	1,060	2,960	1,900	$156,470	12.14	1.26
LOHO13	267	267	N/A	-	-	-
LOHO14	1,616	1,616	N/A	-	-	-
LSMO12	Thermal Violation	1,469	1,469	$885,270	1.66	0.21
LSMO21	1,272	3,216	1,944	$878,801	2.21	0.23
PROG13	3,255	4,506	1,251	$5,930,712	0.21	0.61
SCEN12	1,297	2,559	1,262	$1,967,632	0.64	1.84
SOCO12	1,224	3,167	1,943	$183,615	10.58	20.07
STPE12	Thermal Violation	2,520	2,520	$4,314,628	0.58	0.26
TOME12	Thermal Violation	2,620	2,620	$82,117	31.91	39.92

* Deming West Substation transformer is more limiting to hosting capacity than the feeder rating. After feeder upgrades are performed, losses decrease on the feeder but power flow through the transformer increases, so the hosting capacity decreased by a small amount.

5.2 Feeder Upgrades and BESS Charging at 2 MVA

The cost of this capital project alternative was significant due to the investment in the battery system. First, all feeders were evaluated with the BESS and applicable feeder upgrades to provide the greatest increase in hosting capacity. For some of the feeders, upgrades were significant and drove up the total project cost. In these instances, 1898 & Co. also evaluated constructing only the BESS and not the feeder upgrades. Table 5-2 shows the financial analysis results for the feeder upgrades and 2 MVA BESS charging solution.

Table 5-2: Feeder Upgrades and BESS Charging at 2 MVA Financial Analysis Results

Feeder	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
A10083*	-	-	-	-	-	-
ARIB11	1,099	5,010	3,911	$14,456,470	0.27	0.74
COLL12	781	4,698	3,917	$14,451,149	0.27	0.74
DEMW11	1,308	3,208	1,900	$14,842,473	0.13	0.72
ELCE11	2,019	5,787	3,768	$20,547,079	0.18	0.54
GOLD13*	-	-	-	-	-	-
HOND12	1,352	5,603	4,251	$16,735,763	0.25	0.82
JARA12*	-	-	-	-	-	-
LOHO12	1,060	4,853	3,793	$14,456,470	0.26	0.74
LOHO13*	-	-	-	-	-	-
LOHO14*	-	-	-	-	-	-
LSMO12	Thermal Violation	3,373	3,373	$15,335,281	0.22	0.7
LSMO21	1,272	5,161	3,889	$15,178,801	0.26	0.68
PROG13	3,255	6,120	2,865	$20,230,712	0.14	0.69
SCEN12	1,297	4,179	2,882	$16,267,632	0.18	0.86
SOCO12	1,224	5,011	3,787	$14,633,616	0.26	0.96
STPE12	Thermal Violation	4,289	4,289	$18,614,629	0.23	0.62
TOME12	Thermal Violation	4,299	4,299	$14,382,117	0.30	0.96

*This feeder is already built to the maximum PNM standard rating. Results for the 2 MVA BESS only solution are shown in the next table.

5.2.1 BESS Charging at 2 MVA without Feeder Upgrades

On four feeders, significant upgrades were required to increase the feeder rating. These feeders were also evaluated if only the BESS was constructed, and no other improvements performed. The benefit cost ratio scores did improve with the lower overall project cost. Five of the feeders evaluated are already built to the maximum PNM standard ratings. For these five feeders, analysis was performed with only the BESS upgrades. Table 5-3 shows the financial analysis results for the 2 MVA BESS charging solution without feeder upgrades.

Table 5-3: BESS Charging at 2 MVA without Feeder Upgrades Financial Analysis Results

Feeder	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic Financial Benefit Cost Ratio Score
A10083	3,675	5,501	1,826	$14,300,000	0.13	0.73
ELCE11	2,019	3,630	1,611	$14,300,000	0.11	0.78
GOLD13	2,139	4,037	1,898	$14,300,000	0.13	0.75
JARA12	3,269	4,846	1,577	$14,300,000	0.11	0.74
LOHO13	267	2,157	1,890	$14,300,000	0.13	0.75
LOHO14	1,616	3,512	1,896	$14,300,000	0.13	0.75
PROG13	3,255	4,850	1,595	$14,300,000	0.11	0.97
SCEN12	1,297	2,910	1,613	$14,300,000	0.11	0.97
STPE12	Thermal Violation	1,280	1,280	$14,300,000	0.09	0.78

5.3 Feeder Upgrades with BESS Charging at 6 MVA

The cost of this capital project alternative was significant due to the investment in the battery system. First, all feeders were evaluated with the BESS and Feeder Upgrades. For some of the feeders, feeder upgrades were significant and drove up the total project cost. In these instances, 1898 & Co. also evaluated the benefit cost ratio of constructing only the BESS and not the feeder upgrades. Table 5-4 shows the financial analysis results for the feeder upgrades and 6 MVA BESS charging solution.

Table 5-4: Feeder Upgrades with BESS Charging at 6 MVA Financial Analysis Results

Feeder	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
A10083*	-	-	-	-	-	-
ARIB11	1,099	6,940	5,841	$14,506,470	0.40	1.37
COLL12	781	7,968	7,187	$14,501,149	0.50	1.38
DEMW11	1,308	6,102	4,794	$14,892,473	0.32	1.34
ELCE11	2,019	7,844	5,825	$20,597,079	0.28	0.98
GOLD13*	-	-	-	-	-	-
HOND12	1,352	9,468	8,116	$16,785,763	0.48	1.37
JARA12*	-	-	-	-	-	-
LOHO12	1,060	7,110	6,050	$14,506,470	0.42	1.37
LOHO13*	-	-	-	-	-	-
LOHO14*	-	-	-	-	-	-
LSMO12	Thermal Violation	6,980	6,980	$15,385,271	0.45	1.3
LSMO21	1,272	8,074	6,802	$15,228,801	0.45	1.27
PROG13	3,255	7,391	4,136	$20,280,712	0.20	1.15
SCEN12	1,297	6,453	5,156	$16,317,632	0.32	1.43
SOCO12	1,224	6,515	5,291	$14,683,616	0.36	1.59
STPE12	Thermal Violation	6,207	6,207	$18,664,629	0.33	1.10
TOME12	Thermal Violation	6,460	6,460	$14,432,117	0.45	1.59

*This feeder is already built to the maximum PNM standard rating. Results for the 6 MVA BESS only solution are shown in the next table.

5.3.1 BESS Charging at 6 MVA without Feeder Upgrades

For the four feeders, significant feeder upgrades were required to increase the feeder rating. These feeders were also evaluated if only the BESS was constructed and no other feeder upgrades. The benefit cost ratio scores did improve with the lower overall project cost. Table 5-5 shows the financial analysis results for the 6 MVA BESS charging solution without feeder upgrades.

Table 5-5: BESS Charging at 6 MVA without Feeder Upgrades Financial Analysis Results

Feeder	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
A10083	3,675	9,312	5,637	$14,350,000	0.39	1.37
ELCE11	2,019	4,550	2,531	$14,350,000	0.18	1.31
GOLD13	2,139	7,838	5,699	$14,350,000	0.40	1.39
JARA12	3,269	7,166	3,897	$14,350,000	0.27	1.39
LOHO13	267	5,346	5,079	$14,350,000	0.35	1.39
LOHO14	1,616	7,128	5,512	$14,350,000	0.38	1.39
PROG13	3,255	5,680	2,425	$14,350,000	0.17	1.62
SCEN12	1,297	4,480	3,183	$14,350,000	0.22	1.61
STPE12	Thermal Violation	1,600	1,600	$14,350,000	0.11	1.08

5.4 Dedicated Feeder Buildout

Most feeders evaluated must include a substation transformer upgrade or new substation transformer to successfully build out a new dedicated feeder and improve hosting capacity in the area. The capital project costs were impacted by the amount of conductor buildout required which varied based on the distance of existing solar facilities from the substation. Also, some cost sharing of substation upgrades can be experienced among the Lost Horizon Substation feeders and the Los Morros Substation feeders. Table 5-6 shows the financial analysis results for the dedicated feeder buildout solution.

Table 5-6: Dedicated Feeder Buildout Financial Analysis

Existing Feeder	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic Financial Benefit Cost Ratio Score
A10083	3,675	8,101	4,426	$4,511,562	0.98	0.12
ARIB11	1,099	11,060	9,960	$8,245,205	1.21	0.04
COLL12	781	9,063	8,282	$13,487,292	0.61	0.02
DEMW11	1,308	9,380	8,072	$8,420,781	0.96	0.04
ELCE11	2,019	10,110	8,091	$15,970,100	0.51	0.07
GOLD13	2,139	12,882	10,743	$1,600,027	6.71	0.23
HOND12	1,352	9,994	8,642	$10,392,223	0.83	0.33
JARA12	3,269	12,011	8,742	$5,881,256	1.49	0.06
LOHO12	1,060	10,818	9,758	$4,134,726	2.36	0.08
LOHO13	267	10,165	9,898	$4,956,000	2.00	0.07
LOHO14	1,616	11,376	9,760	$4,043,470	2.41	0.09
LSMO12	Thermal Violation	9,296	9,296	$5,011,594	1.85	0.07
LSMO21	1,272	10,196	8,924	$4,702,933	1.90	0.09
PROG13	3,255	10,901	7,646	$19,546,830	0.39	0.2
SCEN12	1,297	9,906	8,609	$13,940,195	0.62	0.29
SOCO12	1,224	10,350	9,126	$9,499,505	0.96	0.43
STPE12	Thermal Violation	8,367	8,367	$11,316,078	0.74	0.15
TOME12	Thermal Violation	9,590	9,590	$11,772,572	0.81	0.33

5.5 Capital Project Portfolios

Two separate portfolios were determined based on the two benefit cost perspectives that were scored for this evaluation. Table 5-7 represents the highest scoring solutions portfolio based on the hosting capacity improvement relative to cost perspective. The dedicated feeder buildout or feeder upgrade solutions scored highest from this perspective as these were solutions that provided the greatest increase to hosting capacity for a lower cost. This portfolio would result in a total investment of six new substation transformers to enable the buildout of eight distributed feeders. Feeder upgrades that scored highest typically required small investments, but only resulted in marginal increases in hosting capacity. Additional upgrades would be required in the future to further increase hosting capacity beyond the marginal feeder upgrade increase.

Table 5-8 represents the highest scoring solutions portfolio based on the holistic financial benefit cost perspective. This holistic financial analysis considered the other benefits provided by a BESS installation in addition to increasing hosting capacity. This holistic perspective resulted in the 6 MVA BESS solution scoring highest for each feeder in most cases. However, feeder upgrades were not desirable for some feeders because of the high cost. For additional feeders, feeder upgrades are not applicable because they are presently constructed to the maximum standard. Feeder upgrades only scored the highest for three of the feeders evaluated. Feeder upgrades provide a marginal increase to hosting capacity which will allow customers to interconnect new PV in the near term, but as PV penetration continues to increase, additional solutions will be required. A 6 MVA BESS could be added to SCEN12, SOCO12, and TOME12 to enable more customer PV generation as PV penetration levels necessitate. This portfolio represents 15-6 MVA BESS installations within the PNM distribution system totaling 90 MVA of capacity and 360 MWH of energy storage.

Table 5-7: Hosting Capacity Benefit Cost Portfolio

Feeder	Capital Project Category	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)
A10083	Dedicated Feeder	4,426	$4,511,562	0.98
ARIB11	Feeder Upgrades	1,090	$156,470	6.97
COLL12	Feeder Upgrades	1,020	$151,149	6.75
DEMW11	Dedicated Feeder*	8,072	$8,420,781	0.96
ELCE11	Dedicated Feeder*	8,091	$15,970,100	0.51
GOLD13	Dedicated Feeder	10,743	$1,600,027	6.71
HOND12	Feeder Upgrades	2,390	$2,435,763	0.98
JARA12	Dedicated Feeder	8,742	$5,881,256	1.49
LOHO12	Dedicated Feeder*	9,758	$4,134,726	2.36
LOHO13	Dedicated Feeder*	9,898	$4,956,000	2.00
LOHO14	Dedicated Feeder*	9,760	$4,043,470	2.41
LSMO12	Feeder Upgrades	1,469	$885,270	1.66
LSMO21	Feeder Upgrades	1,944	$878,801	2.21
PROG13	Dedicated Feeder*	7,646	$19,546,830	0.39
SCEN12	Feeder Upgrades	1,262	$1,967,632	0.64
SOCO12	Feeder Upgrades	1,943	$183,615	10.58
STPE12	Dedicated Feeder*	8,367	$11,316,078	0.74
TOME12	Feeder Upgrades	2,620	$82,117	31.91
Total	-	**99,241**	**$87,121,647**	-

*A new substation transformer/upgraded substation transformer is required for the dedicated feeder buildout solution. Five (5) total new substation transformers would be required if this portfolio were constructed.

Table 5-8: Holistic Financial Benefit Cost Portfolio

Feeder	Capital Project Category	Net Hosting Capacity Increase kVA	Capital Project Cost	Holistic Financial Benefit Cost Ratio Score
A10083	6 MVA BESS	5,637	$14,350,000	1.37
ARIB11	Feeder Upgrades & 6 MVA BESS	5,841	$14,506,470	1.37
COLL12	Feeder Upgrades & 6 MVA BESS	7,187	$14,501,149	1.38
DEMW11	Feeder Upgrades & 6 MVA BESS	4,794	$14,892,473	1.34
ELCE11	6 MVA BESS	2,531	$14,350,000	1.31
GOLD13	Feeder Upgrades & 6 MVA BESS	5,699	$14,350,000	1.39
HOND12	Feeder Upgrades & 6 MVA BESS	8,116	$16,785,763	1.37
JARA12	6 MVA BESS	3,897	$14,350,000	1.39
LOHO12	Feeder Upgrades & 6 MVA BESS	6,050	$14,506,470	1.37
LOHO13	6 MVA BESS	5,079	$14,350,000	1.39
LOHO14	6 MVA BESS	5,512	$14,350,000	1.39
LSMO12	Feeder Upgrades & 6 MVA BESS	6,980	$15,385,271	1.30
LSMO21	Feeder Upgrades & 6 MVA BESS	6,802	$15,228,801	1.27
PROG13	6 MVA BESS	2,425	$14,350,000	1.62
SCEN12	Feeder Upgrades	1,262	$1,967,632	1.84
SOCO12	Feeder Upgrades	1,943	$183,615	20.07
STPE12	Feeder Upgrades & 6 MVA BESS	6,207	$18,664,629	1.10
TOME12	Feeder Upgrades	2,620	$82,117	39.92
Total	-	**88,582**	**$227,154,390**	-

Note: 15-6 MVA BESS systems are included in this portfolio focusing on the holistic financial benefit cost analysis. This investment would result in 90 MVA of BESS capacity and 360 MWH of energy storage.

6.0 Conclusion

Photovoltaic (PV) penetration is growing within the Public Service Company of New Mexico (PNM or the Company) system. High PV penetration can present benefits but can also result in challenges for operating and maintaining the distribution system. In response to rule 568 PNM was granted partial variance in NMPRC Order 23-00072-UT-2023-06-14 to conduct studies to evaluate PNM's technical concerns regarding Variance requests 1, 2, and 3. As ordered, PNM worked with the Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL) to design the pilot study. The purpose of this pilot study was to better understand the actual limits on distribution feeders for hosting new PV generation given the levels of PV penetration PNM is experiencing. That report[5] was submitted to the NMPRC on May 23, 2024.

In this report, after understanding the limitations of distribution feeders, multiple hosting capacity improvement solutions were evaluated for 18 of PNM's PV saturated feeders. The types of hosting capacity improvement solutions that were evaluated are shown in Figure 6-1. A financial analysis was then performed to understand the value of each solution and ultimately recommend a portfolio of hosting capacity improvement projects for these PV saturated feeders.

Figure 6-1: Hosting Capacity Improvement Solutions Evaluated

Feeder Upgrades	Feeder Upgrades & BESS Charging at 2 MVA	Feeder Upgrades & BESS Charging at 6 MVA	Dedicated Feeder Buildout

6.1 Pending Customer PV Interconnection Analysis

As of January 1, 2024, 13 of the 18 PV saturated feeders had pending customer PV interconnections. Based on the results of the first hosting capacity study report, it was determined that there was remaining hosting capacity on many of the PV saturated feeders. 1898 & Co. modeled the pending PV projects to determine if the distribution feeder could successfully host all pending customer PV projects as of January 1, 2024. For 11 of the 13 feeders evaluated, the pending PV customers modeled can successfully interconnect without any system improvements. This will result in 230 new PV interconnections and an increase of 1,391 kVA in customer-owned PV capacity. Existing thermal violations were observed on LSMO12 and STPE12 which must be mitigated through system improvements before pending PV interconnections can successfully interconnect. The hosting capacity improvement solutions proposed in this report for

[5] Rule 568 Hosting Capacity Analysis Report
https://edocket.prc.nm.gov/AspSoft/HandlerDocument.ashx?document_id=1233550

these two feeders will allow the pending PV customers to interconnect successfully to LSMO12 and STPE12.

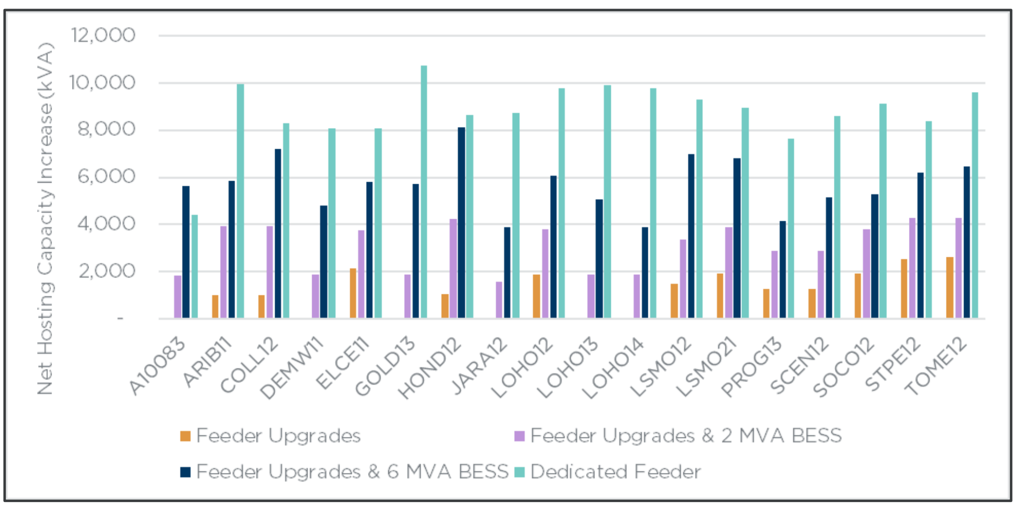
As of August 19, 2024, there are 7 pending customer PV interconnections resulting in 51 kVA of capacity that have been placed on hold since January 1, 2024. All these additional pending customer PV interconnections have been modeled on PV saturated feeders with the proposed hosting capacity improvement solutions in place. With hosting capacity improvement solutions in place, all pending customer PV projects through August 19, 2024, can successfully interconnect.

Going forward, all applications on PV saturated feeders will follow the rule 568 screening process. Since these feeders have reverse power flow at minimum load timeframes, they will fail the 100% of minimum load screen and require supplemental review. Under supplemental review, each application will be studied to see if there is remaining hosting capacity to safely interconnect the project. If it is determined that improvements are required, but that these improvements are within the recommended solutions provided in this report, the customers can be placed on hold until the recommended solutions for the PV saturated feeders are implemented.

6.2 Hosting Capacity Improvement Solutions Analysis

All capital project solutions investigated for the 18 PV saturated feeders resulted in an increase in hosting capacity. However, the increase in hosting capacity varied across the feeder and was influenced by several factors. The dedicated feeder buildout scenario most often provided the greatest increase in hosting capacity while feeder upgrades generally provided a marginal increase in hosting capacity. For some of the feeders, upgrades were not applicable because the feeder is presently built to the maximum PNM standard ratings and no increase in hosting capacity is shown for that scenario. Figure 6-2 shows the Synergi analysis hosting capacity increase for each capital project alternative relative to the base case model results.

Figure 6-2: Hosting Capacity Increase per Solution Results



Note: An absent vertical bar indicates that hosting capacity increase was not applicable for the given scenario.

6.3 Portfolio of Recommended Capital Project Solutions

Table 6-1 provides the recommended portfolio of capital project solutions to improve hosting capacity on the PV saturated feeders while also providing the greatest value to PNM customers. Engineering judgement, in combination with the two-perspective financial analysis, was used to determine this proposed solution portfolio.

In selecting this portfolio of solutions, the BESS solutions were considered valuable because of the hosting capacity increase on the local distribution feeder, but also because of the ability to avoid investments in other parts of the system. PNM foresees battery storage as a need moving forward in the clean energy transition. By building BESS on these distribution feeders, less battery storage must be constructed on the transmission system. While the dedicated feeder buildout solution typically resulted in the greatest hosting capacity increase for distribution feeders, these investments provide no benefit to other parts of the overall PNM system which can also become constrained as PV levels rise. The transmission system can be constrained during times of low load and high PV generation. Even after performing dedicated feeder buildouts, additional transmission system upgrades could be required in certain areas which would significantly impact the cost of upgrades to improve PNM's overall system hosting capacity. BESS solutions located in proximity to PV generation can reduce PV generation power flow on the transmission system and improve transmission congestion in lieu of transmission upgrades.

PNM plans to prioritize the feeder upgrades in the near-term to unlock incremental hosting capacity quickly and enable more customers to connect their new PV systems successfully. The proposed 6 MVA BESS systems can be constructed as PV penetration levels rise locally to improve feeder hosting capacity or BESS systems can be constructed to obtain the overall system benefits captured in the holistic system benefit analysis. Timelines are provided for the individual projects in Table 6-1 below. Where feeder upgrades and a 6 MVA BESS are proposed, the first timeline is for the feeder upgrades only. The second timeline is for the BESS construction. The timeline to construct the overall portfolio will be greater than three years as it will be subject to budget allocations.

Table 6-1: Hosting Capacity Improvement Solutions Portfolio

Feeder	Capital Project Solution Category	Increase in Hosting Capacity kVA	Capital Project Cost	Construction Timeline
A10083	6 MVA BESS	5,637	$14,350,000	3 Years
ARIB11	Dedicated Feeder	9,960	$8,245,205	3 Years
COLL12	Feeder Upgrades & 6 MVA BESS	7,187	$14,501,149	1 Year / 3 Years
DEMW11**	Feeder Upgrades & 6 MVA BESS	4,794	$14,892,473	1 Year / 3 Years
ELCE11	6 MVA BESS	2,531	$14,350,000	3 Years
GOLD13**	Dedicated Feeder	10,743	$1,600,027	1 Year
HOND12	Feeder Upgrades & 6 MVA BESS	8,116	$16,785,763	1 Year / 3 Years
JARA12	6 MVA BESS	3,897	$14,350,000	3 Years
LOHO12	Dedicated Feeder	9,758	$4,134,726	3 Years
LOHO13	Dedicated Feeder	9,898	$4,956,000	3 Years
LOHO14	Dedicated Feeder	9,760	$4,043,470	3 Years
LSMO12	Feeder Upgrades & 6 MVA BESS	6,980	$15,385,271	1 Year / 3 Years
LSMO21	Feeder Upgrades & 6 MVA BESS	6,802	$15,228,801	1 Year / 3 Years
PROG13	6 MVA BESS	2,425	$14,350,000	3 Years
SCEN12	Feeder Upgrades	1,262	$1,967,632	1 Year
SOCO12*	Feeder Upgrades & 6 MVA BESS	5,291	$-	Installed
STPE12	Feeder Upgrades & 6 MVA BESS	8,367	$18,664,629	2 Years / 3 Years
TOME12*	6 MVA BESS	6,460	$-	Installed
-	-	**119,868**	**$177,805,146**	-

*****SOCO12 & TOME12 were selected for the Phase I BESS installations and are installed. Phase I selection was based on different criteria. The feeder upgrades only solution scored highest for these feeders because it provided a least cost alternative to provide an increase in hosting capacity. The 6 MVA BESS that is installed provides more hosting capacity for future customer interconnections.

******For DEMW11 & GOLD13, the SGIA has not been constructed. The proposed capital project solution would not be constructed unless the SGIA moves forward with construction, or if pending customers are not able to connect to the PNM system without system improvements built.

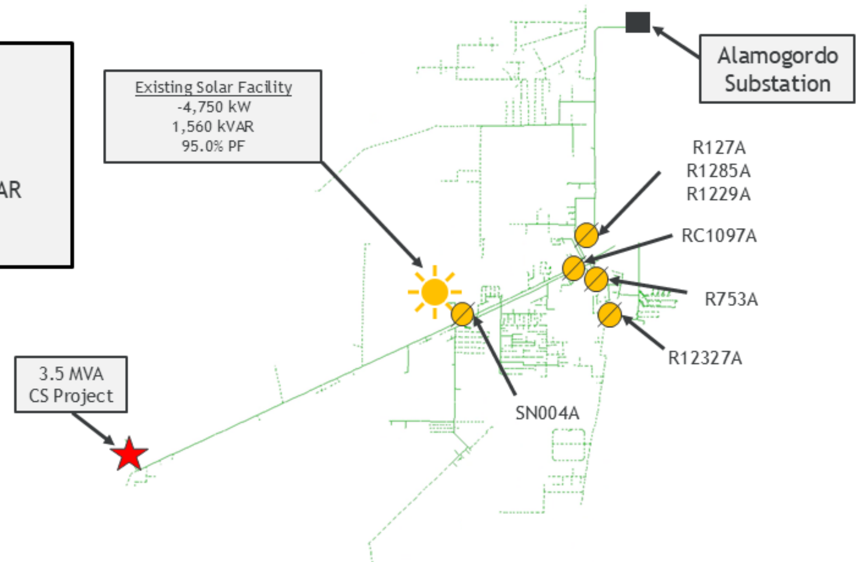
7.0 Appendix - Feeder Analysis


A10083 Analysis
Confidential Information
1

A10083 - Feeder Overview

Feeder Data

- Feeder Rating: 11,663 kVA
- Existing Generation: 9,973 kVA
- Minimum Daylight Load: -7,959 kW
- Minimum Daylight Gross Load: 1,282 kW / 736 kVAR
- Substation LTC Setpoint: 125 V
- Primary Voltage: 12.47 kV



Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	A10083 Breaker	600
Recloser	R1229A	140
Recloser	R12327A	200
Recloser	R127A	140
Recloser	R1285A	140
Recloser	RC1097A	300
Recloser	SN004A	600

Base Case Load Flow Analysis (Minimum daylight Load)

kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-7,959	1,159	8,043	-99	358	360	354	122.4	125.0	96

1898 & Co.

Confidential Information 2

A10083 - Feeder Overview with Queued Solar as of 1-1-24

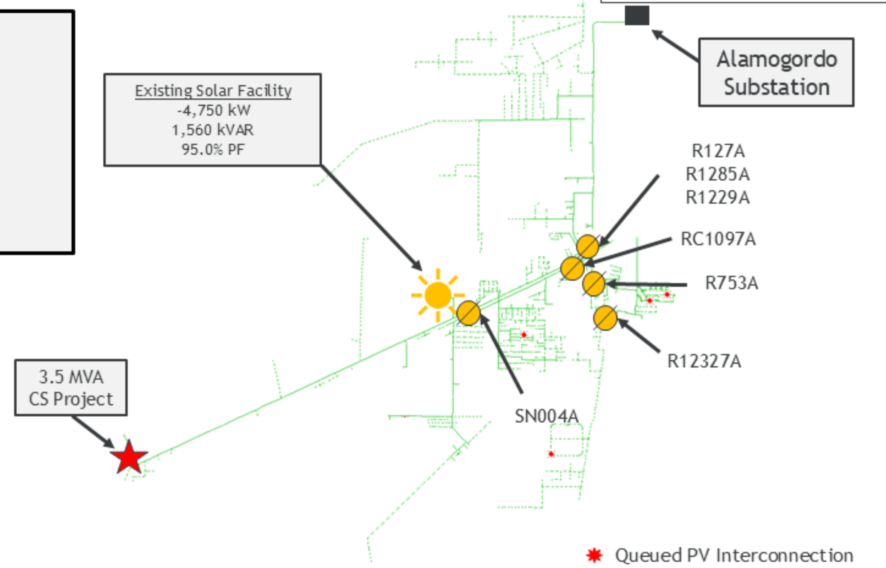
30 kW of queued PV interconnections are on hold for A10083 as of 1-1-2024

Feeder Data

- Feeder Rating: 11,663 kVA
- Existing Generation: 9,973 kVA
- Minimum Daylight Load: -7,959 kW
- Minimum Daylight Gross Load: 1,282 kW / 736 kVAR
- Substation LTC Setpoint: 125 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 4
- Total Queued AC Inverter Nameplate: 30 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	A10083 Breaker	600
Recloser	R1229A	140
Recloser	R12327A	200
Recloser	R127A	140
Recloser	R1285A	140
Recloser	RC1097A	300
Recloser	SN004A	600

The feeder can serve queued PV interconnection requests without violations.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-7,986	1,169	8,071	-99	359	361	356	122.4	125.0	95

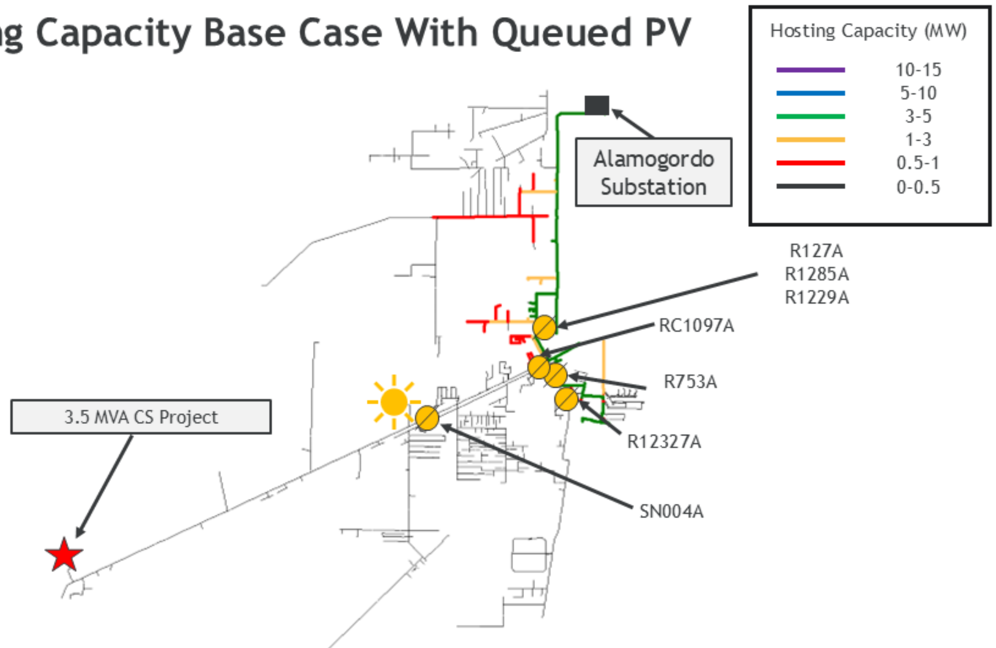
Confidential Information

3

A10083 - Maximum Hosting Capacity Base Case With Queued PV

Maximum Hosting Capacity
3.70 MW

Limiting Factors	
Thermal Loading Violation	84%
Voltage Violation	16%



Feedher Observations

- PV penetration is very high on this feeder; however, existing generation does not exceed the feeder rating.
- Recloser RC1097A must be upgraded to improve a potential thermal violation and improve the spread of hosting capacity.
- Hosting capacity is significantly reduced at the far end of the feeder where the large PV sources are located.

1898 & Co.

Confidential Information

4

A10083 - Feeder Upgrades

Hosting Capacity	
Base HC	3.68 MW
Max HC	3.68 MW
HC Increase	0 MW

Reverse Flow Limits
Max HC

System Improvement	
N/A	Cost
TOTAL	$0

No feeder upgrades are applicable for this scenario.

Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	0
Cost ($)	0
Hosting Capacity Benefit Cost	-
Holistic System Benefit Cost	-

1898 & co.

5

Confidential Information

A10083 - 2 MVA BESS Only

Hosting Capacity	
Base HC	3.68 MW
Max HC	5.5 MW
HC Increase	1.82 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,300,000

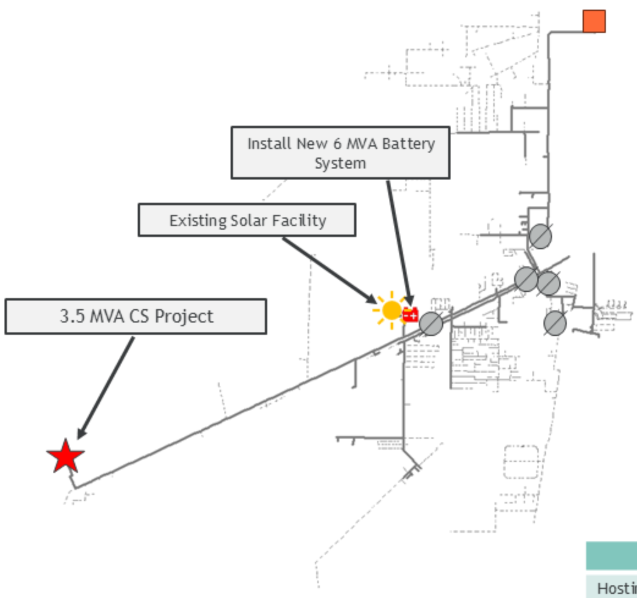
Financial Analysis	
Hosting Capacity Increase (MW)	1.82
Cost ($)	14,300,000
Hosting Capacity Benefit Cost	0.13
Holistic System Benefit Cost	0.73

A10083 - 6 MVA BESS Only

Hosting Capacity	
Base HC	3.68 MW
Max HC	9.31 MW
HC Increase	5.63 MW

Reverse Flow Limits Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,350,000



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	5.63
Cost ($)	14,350,000
Hosting Capacity Benefit Cost	0.39
Holistic System Benefit Cost	1.37

1898 & Co.

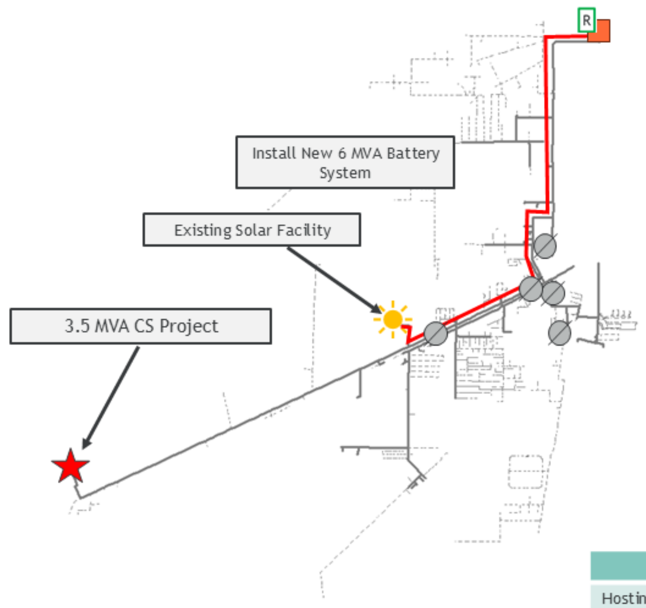
7

A10083 - Dedicated Feeder

Hosting Capacity	
Base HC	3.68 MW
Max HC	8.1 MW
HC Increase	4.42 MW

Reverse Flow Limits Max HC

System Improvement	
	Cost
Build ~700ft of new 397 AAC @ 570 from the new Alamogordo Feeder to a new riser pole.	$102,544
Build ~5.3 miles of new 397 AAC @ 570. Utilize double circuit construction along the existing path of A10083 feeder main line conductor.	$3,983,018
Expand the Alamogordo Substation bus and install new feeder breaker and relay for the New Feeder.	$426,000
TOTAL	$4,511,562



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	4.42
Cost ($)	4,511,562
Hosting Capacity Benefit Cost	0.98
Holistic System Benefit Cost	0.12

1898 & co.

8

Confidential Information

A10083 – Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades*	-	-	-	-	-	-
Feeder Upgrade* with 2 MVA BESS	-	-	-	-	-	-
2 MVA BESS Only	3,675	5,501	1,826	$14,300,000	0.13	0.73
Feeder Upgrades* with 6 MVA BESS	-	-	-	-	-	-
6 MVA BESS Only	3,675	9,312	5,637	$14,350,000	0.39	1.37
Dedicated Feeder	3,675	8,101	4,426	$4,511,562	0.98	0.12

*This scenario was not applicable for this analysis.

The 6 MVA BESS only solution is proposed for Alamogordo Feeder 83. The 6 MVA BESS scored the highest holistic benefit cost ratio. This feeder has an existing large-scale PV facility and a new proposed Community Solar Program project. Installing the BESS will help to regulate power flow on the feeder for both projects. No feeder upgrades are applicable as this feeder is built to the maximum PNM standard.

ARIB11 Analysis

Confidential Information

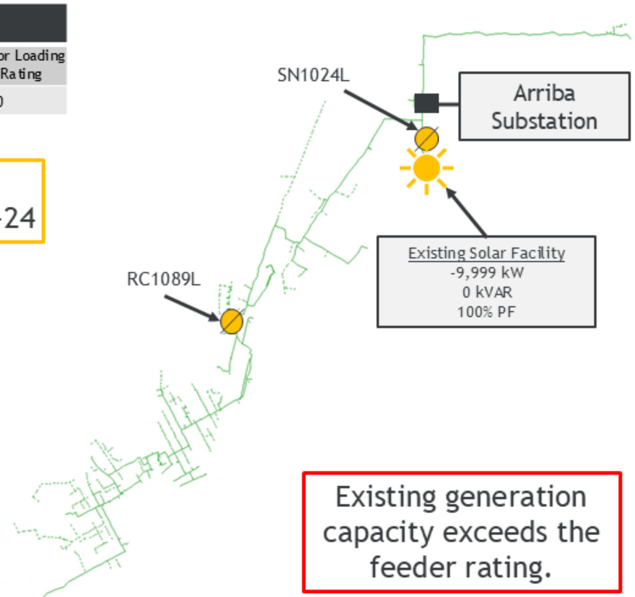
10

ARIB11 - Feeder Overview

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,188	56	8,188	100	371	375	363	120.6	123.4	89.0

Protection Devices		
Device	Name	Pick Up Rating (A)
Breaker	ARIB11 Breaker	480
Recloser	SN1024L	515
Recloser	RC1089L	350

No Pending PV Customers as of 1-1-24



Existing generation capacity exceeds the feeder rating.

Feeder Data

- Feeder Rating: 9,331 kVA
- Existing Generation: 10,326 kVA
- Minimum Daylight Load: -8,188 kW
- Minimum Daylight Gross Load: 2,062 kW / 500 kVAR
- Substation LTC Setpoint: 123 V
- Primary Voltage: 12.47 kV

1898 & Co.

Confidential Information

11

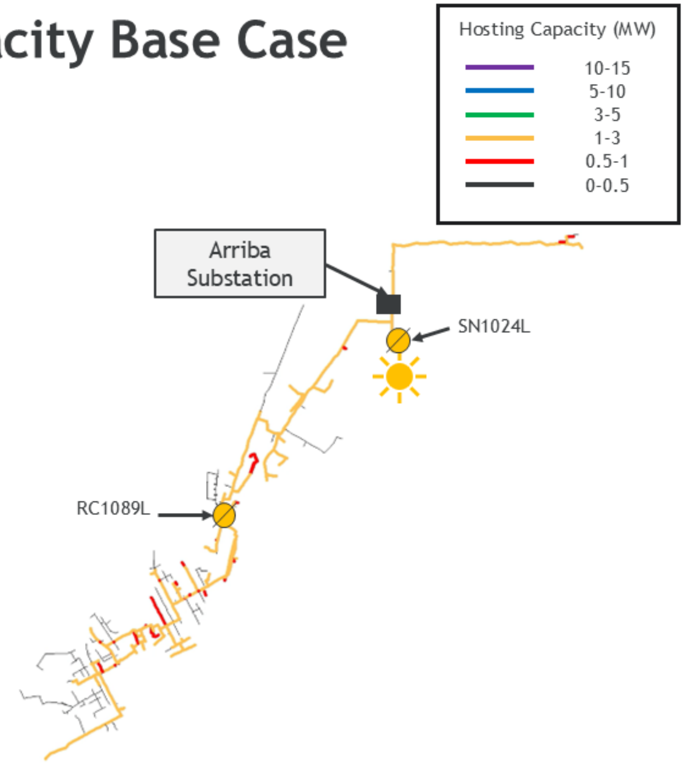
ARIB11 - Maximum Hosting Capacity Base Case

Maximum Hosting Capacity
1.10 MW

Limiting Factors	
Thermal Loading Violation	92%
Voltage Violation	8%

Feeder Observations

- The feeder relay rating of 480 Amps limits the hosting capacity of this feeder. Upgrading the feeder relay would unlock additional hosting capacity.



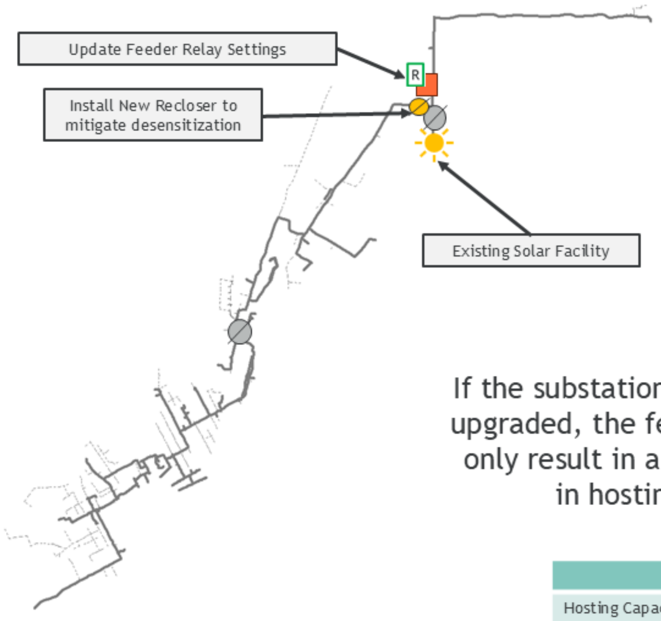
ARIB11 - Feeder Upgrades

Hosting Capacity	
Base HC	1.1 MW
Max HC	3.04 MW
HC Increase	1.94 MW

Arriba XFMR Capacity - 2.1MW
Actual HC Increase - 1.09 MW

System Improvement	Cost
Update Feeder Relay Settings	$6,470
Install new recloser to protect line feeding to the west.	$150,000
TOTAL	$156,470

Reverse Flow Limits
Max HC



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

If the substation transformer is not upgraded, the feeder upgrades will only result in a marginal increase in hosting capacity.

Financial Analysis	
Hosting Capacity Increase (MW)	1.09
Cost ($)	156,470
Hosting Capacity Benefit Cost	6.97
Holistic System Benefit Cost	1.16

1898 & co.

Confidential Information

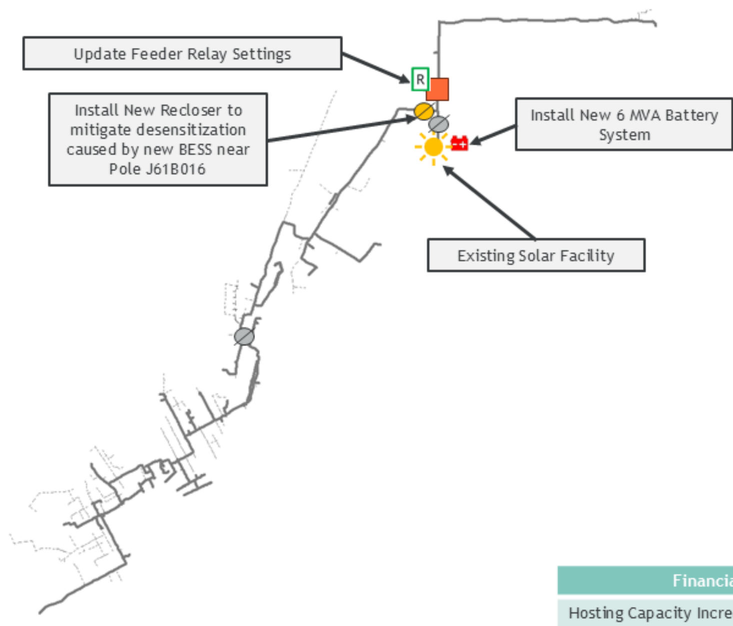
13

ARIB11 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	1.1 MW
Max HC	5.01 MW
HC Increase	3.91 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Update Feeder Relay Settings	$6,470
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
Install new recloser to protect line feeding to the west.	$150,000
TOTAL	$14,456,470



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	3.91
Cost ($)	14,456,470
Hosting Capacity Benefit Cost	0.27
Holistic System Benefit Cost	0.74

1898 co.

Confidential Information

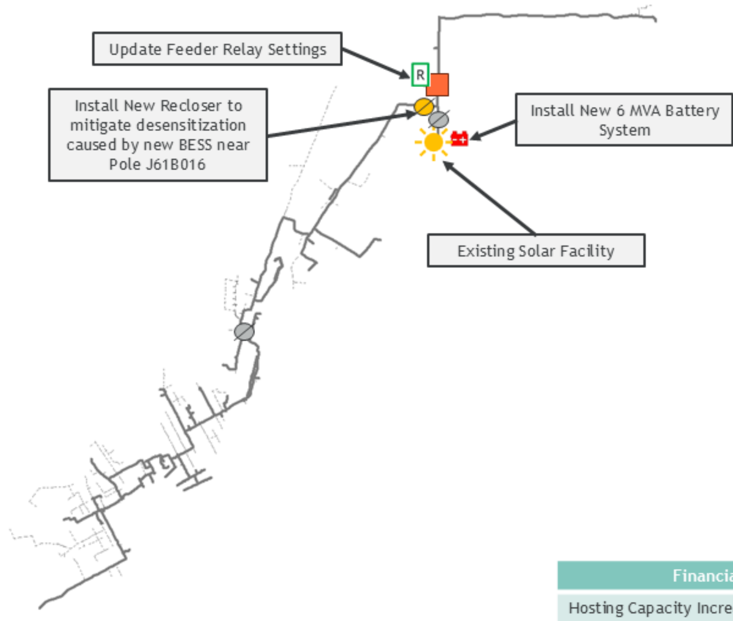
14

ARIB11 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	1.1 MW
Max HC	6.94 MW
HC Increase	5.84 MW

Thermal Loading Limits Max HC

System Improvement	Cost
Update Feeder Relay Settings	$6,470
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
Install new recloser to protect line feeding to the west.	$150,000
TOTAL	$14,506,470



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	5.84
Cost ($)	14,506,470
Hosting Capacity Benefit Cost	0.40
Holistic System Benefit Cost	1.37

1898 & Co.

15

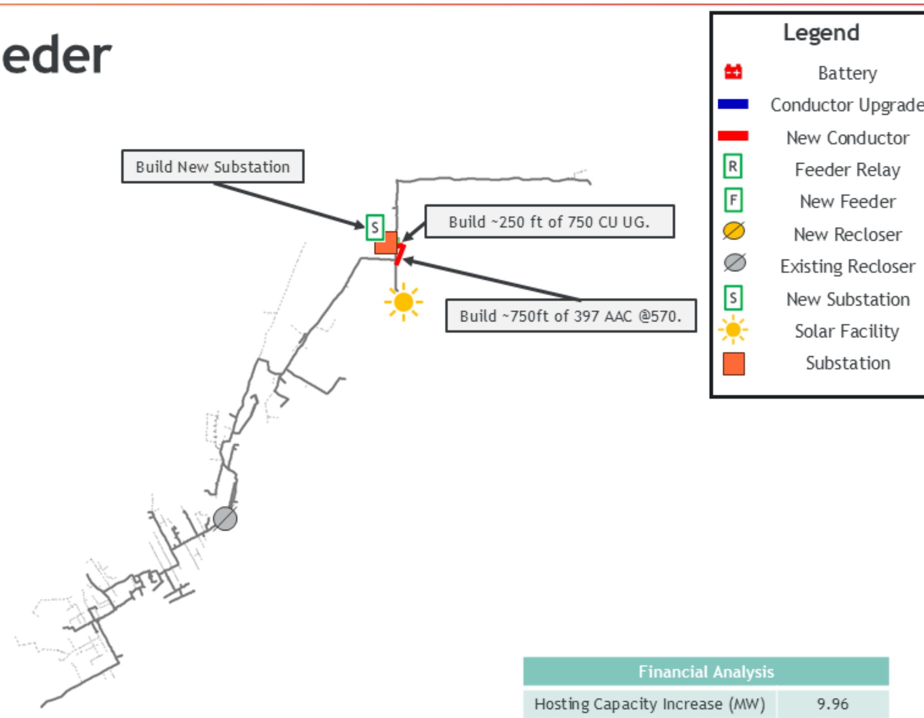
Confidential Information

ARIB11 - Dedicated Feeder

Hosting Capacity	
Base HC	1.1 MW
Max HC	11.06 MW
HC Increase	9.96 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Build ~250ft of new 750 CU cable from the new Arriba Feeder to a new riser pole.	$101,877
Build ~750ft of new 397 AAC @ 570. Utilize double circuit construction along the existing path of Arriba 11 feeder main line conductor.	$143,328
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$8,245,205



Financial Analysis	
Hosting Capacity Increase (MW)	9.96
Cost ($)	8,245,205
Hosting Capacity Benefit Cost	1.21
Holistic System Benefit Cost	0.04

1898 & Co.

16

Confidential Information

ARIB11 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	1,099	2,100	1,090	$156,470	6.97	1.16
Feeder Upgrades with 2 MVA BESS	1,099	5,010	3,911	$14,456,470	0.27	0.74
2 MVA BESS Only*	-	-	-	-	-	-
Feeder Upgrades with 6 MVA BESS	1,099	6,940	5,841	$14,506,470	0.40	1.37
6 MVA BESS Only*	-	-	-	-	-	-
Dedicated Feeder	1,099	11,060	9,960	$8,245,205	1.21	0.04

*This scenario was not applicable to this analysis.

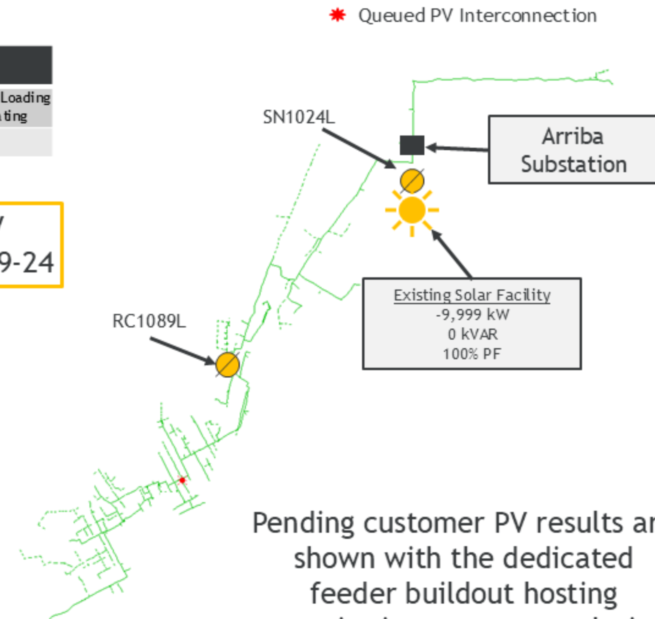
The dedicated feeder buildout solution is proposed for Ariba Feeder 11. Building a dedicated feeder will require an upgrade to the substation transformer to the PNM standard 33.7 MVA size. These substation upgrades will enable the dedicated feeder to provide the greatest increase to hosting capacity in the area as the Ariba Substation transformer is at high PV saturation as well as Ariba Feeder 11.

ARIB11 - Feeder Overview with Queued Solar as of 8-19-2024

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,194	56	8,194	100	371	375	364	120.7	123.4	86.57

Protection Devices		
Device	Name	Pick Up Rating (A)
Breaker	ARIB11 Breaker	480
Recloser	SN1024L	515
Recloser	RC1089L	350

6 kW Pending PV Customers as of 8-19-24



Feeder Data

- Feeder Rating: 9,331 kVA
- Existing Generation: 10,332 kVA
- Minimum Daylight Load: -8,194 kW
- Minimum Daylight Gross Load: 2,062 kW / 500 kVAR
- Substation LTC Setpoint: 123 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 1
- Total Queued AC Inverter Nameplate: 6 kW

The feeder can serve queued PV interconnection requests without violations.

Pending customer PV results are shown with the dedicated feeder buildout hosting capacity improvement solution modeled.

1898 & co.

Confidential Information

18

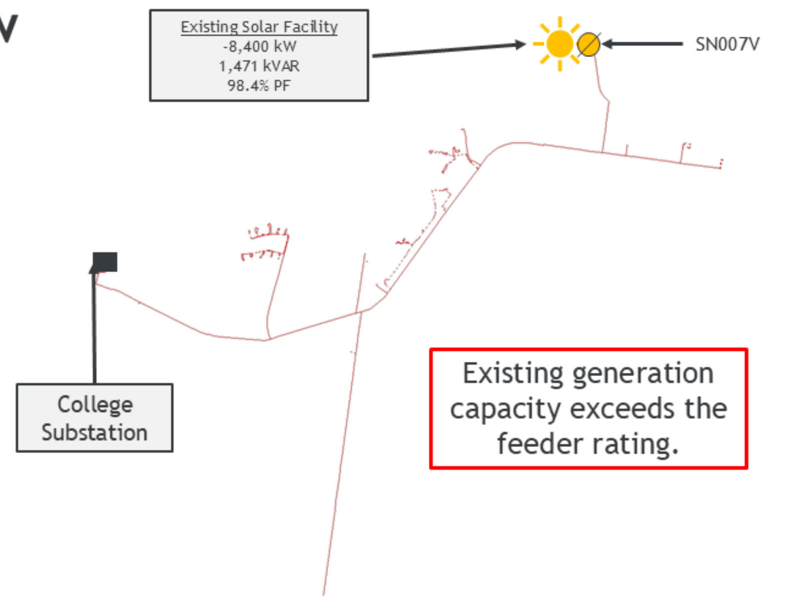

COLL12 Analysis
Confidential Information
19

COLL12 - Feeder Overview

Feeder Data

- Feeder Rating: 9,072 kVA
- Existing Generation: 9,150 kVA
- daylight Minimum Load: -8,297 kW
- daylight Minimum Gross Load: 284 kW / -241 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	COLL12 Breaker	600
Recloser	SN007V	425



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,297	2,662	8,702	-95	404	387	399	122.0	125.5	96.0

1898 & Co.

Confidential Information

20

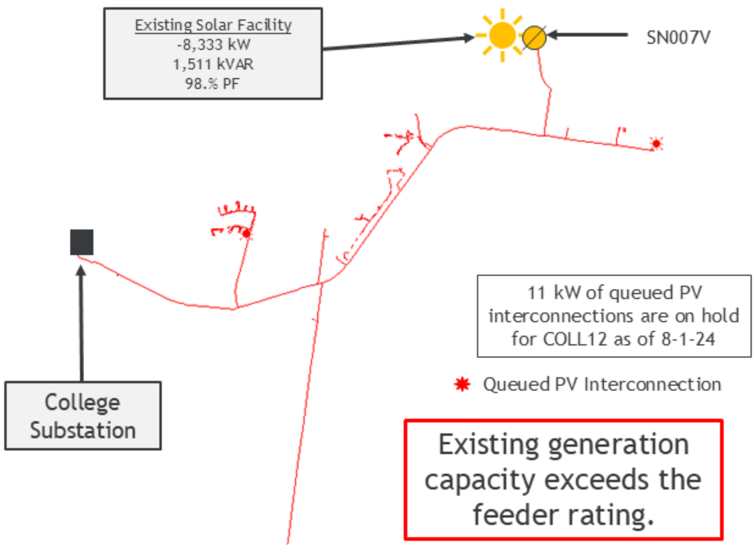
COLL12 - Feeder Overview with Queued Solar as of 1-1-2024

Feeder Data

- Feeder Rating: 9,072 kVA
- Existing Generation: 9,161 kVA
- Minimum Daylight Load: -8,307 kW
- Minimum Daylight Gross Load: 284 kW / -241 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 2
- Total Queued AC Inverter Nameplate: 11 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	COLL12 Breaker	600
Recloser	SN007V	425

The feeder can serve queued PV interconnection requests without violations.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,307	2,624	8,712	-95	404	387	400	122.0	125.6	96.1

1898 & Co.

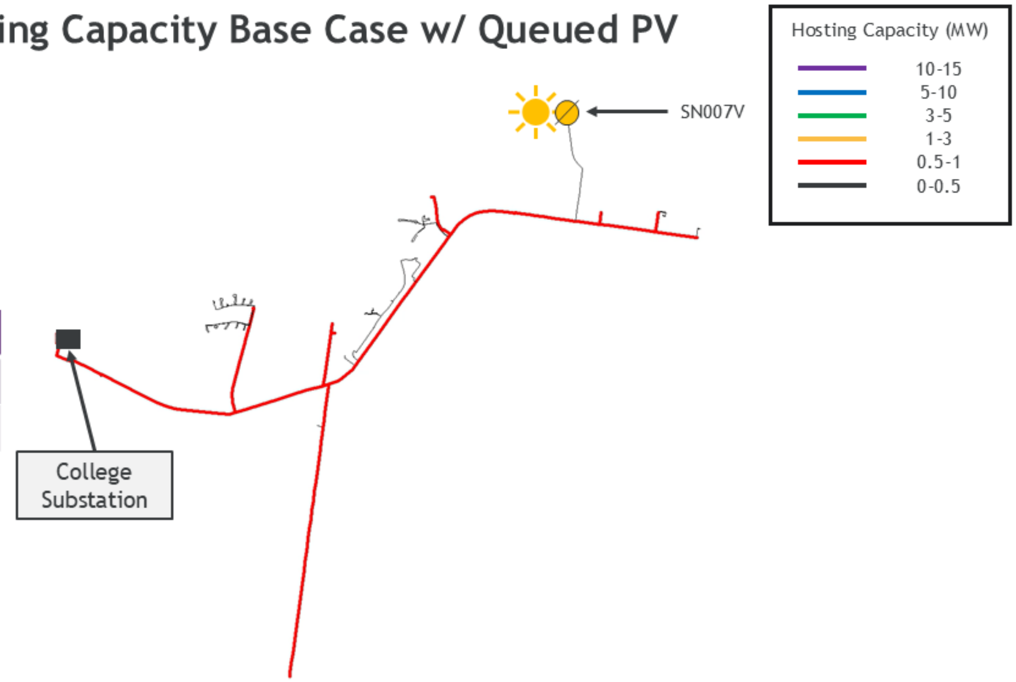
Confidential Information

21

COLL12 - Maximum Hosting Capacity Base Case w/ Queued PV

Maximum Hosting Capacity
0.78 MW

Limiting Factors	
Thermal Loading Violation	92%
Voltage Violation	8%



Feedder Observations

- The feeder getaway has a portion built to 750 AL and is limiting the maximum hosting capacity for the feeder.

1898 & Co.

Confidential Information

22

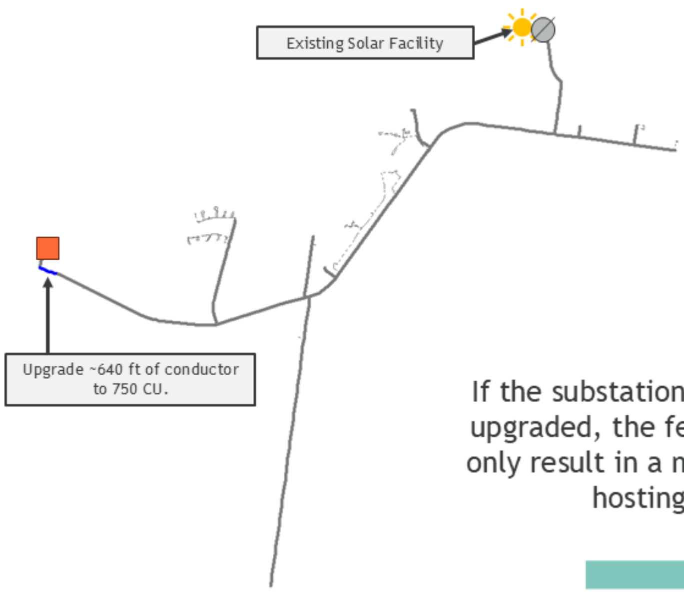
COLL12 - Feeder Upgrades

Hosting Capacity	
Base HC	0.78 MW
Max HC	2.94 MW
HC Increase	2.16 MW

College XFMR Capacity - 1.8 MW
Actual HC Increase - 1.02 MW

Reverse Flow Limits Max HC

System Improvement	Cost
Upgrade ~640 ft of 750 AL UG to 750 CU UG from South of College Substation to Pole E33A031	$151,149
TOTAL	$151,149



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

If the substation transformer is not upgraded, the feeder upgrades will only result in a marginal increase in hosting capacity.

Financial Analysis	
Hosting Capacity Increase (MW)	1.02
Cost ($)	151,149
Hosting Capacity Benefit Cost	6.75
Holistic System Benefit Cost	1.20

1898 & Co.

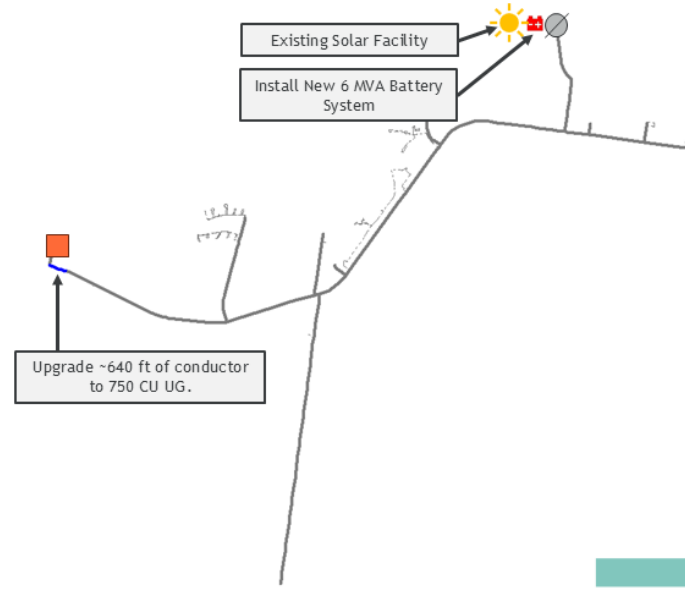
Confidential Information

23

COLL12 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	0.78 MW
Max HC	4.7 MW
HC Increase	3.92 MW

Reverse Flow Limits
Max HC



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

System Improvement	Cost
Upgrade ~640 ft of 750 AL UG to 750 CU UG from South of College Substation to Pole E33A031	$151,149
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,451,149

Financial Analysis	
Hosting Capacity Increase (MW)	3.92
Cost ($)	14,451,149
Hosting Capacity Benefit Cost	0.27
Holistic System Benefit Cost	0.74

1898 & CO.

24

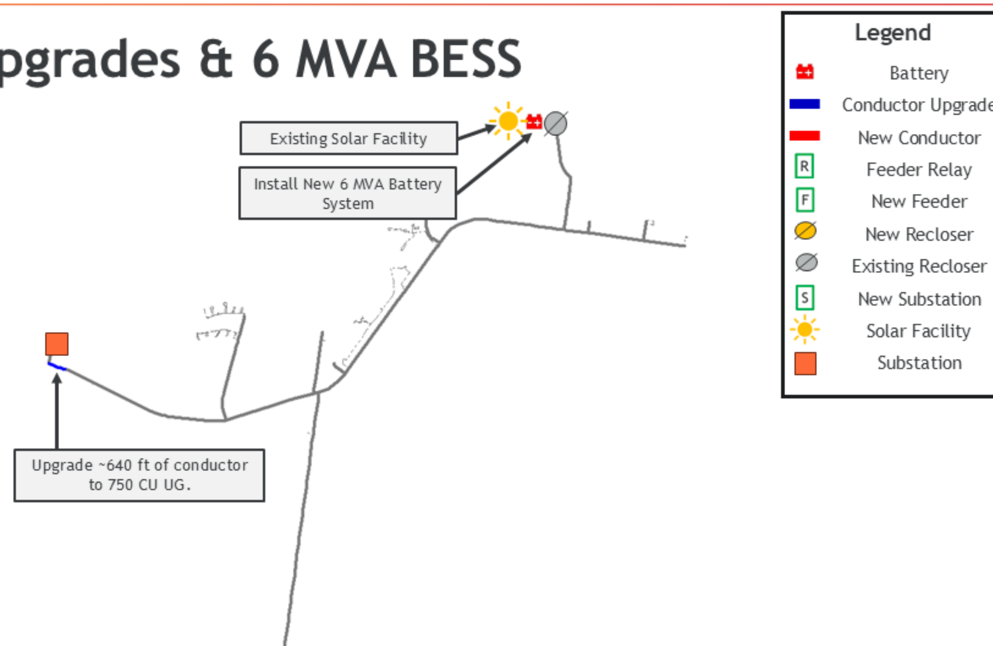
Confidential Information

COLL12 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	0.78 MW
Max HC	7.97 MW
HC Increase	7.19 MW

Thermal Loading Limits
Max HC

System Improvement	Cost
Upgrade ~640 ft of 750 AL UG to 750 CU UG from South of College Substation to Pole E33A031	$151,149
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,501,149



Financial Analysis	
Hosting Capacity Increase (MW)	7.19
Cost ($)	14,501,149
Hosting Capacity Benefit Cost	0.50
Holistic System Benefit Cost	1.38

1898 & Co.

Confidential Information

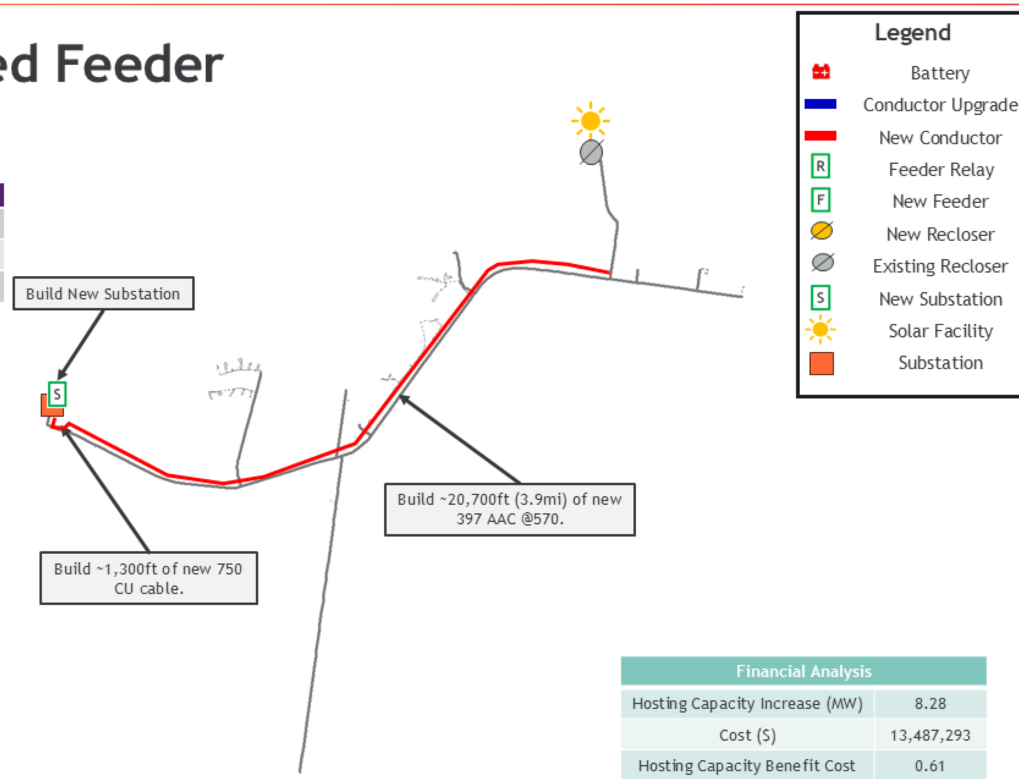
25

COLL12 - Dedicated Feeder

Hosting Capacity	
Base HC	0.78 MW
Max HC	9.06 MW
HC Increase	8.28 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Build ~1,300ft of new 750 CU cable from the New College Substation to a new riser pole.	$331,996
Build ~36,300ft (7.1mi) of new 397 AAC @570. Utilize double circuit construction along the existing path of College 12 main line conductor.	$5,155,297
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$13,487,293



Financial Analysis	
Hosting Capacity Increase (MW)	8.28
Cost ($)	13,487,293
Hosting Capacity Benefit Cost	0.61
Holistic System Benefit Cost	0.02

1898 & Co.

Confidential Information

26

COLL12 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	781	1,800	1,020	$151,149	6.75	1.20
Feeder Upgrades with 2 MVA BESS	781	4,698	3,917	$14,451,149	0.27	0.74
2 MVA BESS Only*	-	-	-	-	-	-
Feeder Upgrades with 6 MVA BESS	781	7,968	7,187	$14,501,149	0.50	1.38
6 MVA BESS Only*	-	-	-	-	-	-
Dedicated Feeder	781	9,063	8,282	$13,487,292	0.61	0.02

*This scenario was not applicable to this analysis.

The Feeder Upgrades and 6 MVA BESS solution is proposed for College Feeder 12. Feeder upgrades should be performed first for this feeder and as PV penetration increases or as the system requires more energy storage, a 6 MVA BESS can be constructed to continue increasing hosting capacity on College Feeder 12.

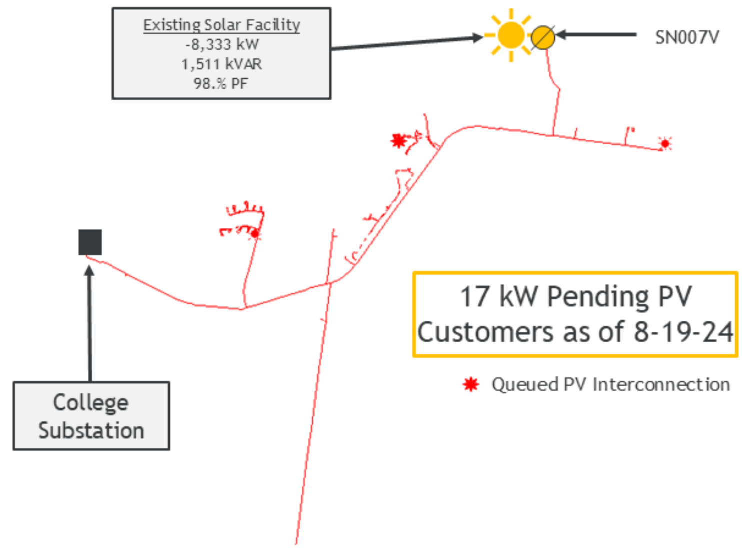
1898 & Co.

27

COLL12 - Feeder Overview with Queued Solar as of 8-19-2024

Feeder Data

- Feeder Rating: 9,072 kVA
- Existing Generation: 9,161 kVA
- Minimum Daylight Load: -8,312 kW
- Minimum Daylight Gross Load: 284 kW / -241 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 3
- Total Queued AC Inverter Nameplate: 17 kW



Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	COLL12 Breaker	600
Recloser	SN007V	425

The feeder can serve queued PV interconnection requests without violations.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,312	2,625	8,717	-95	404	387	400	122.0	125.1	96.1

1898 co.

Confidential Information

28

DEMW11 Analysis

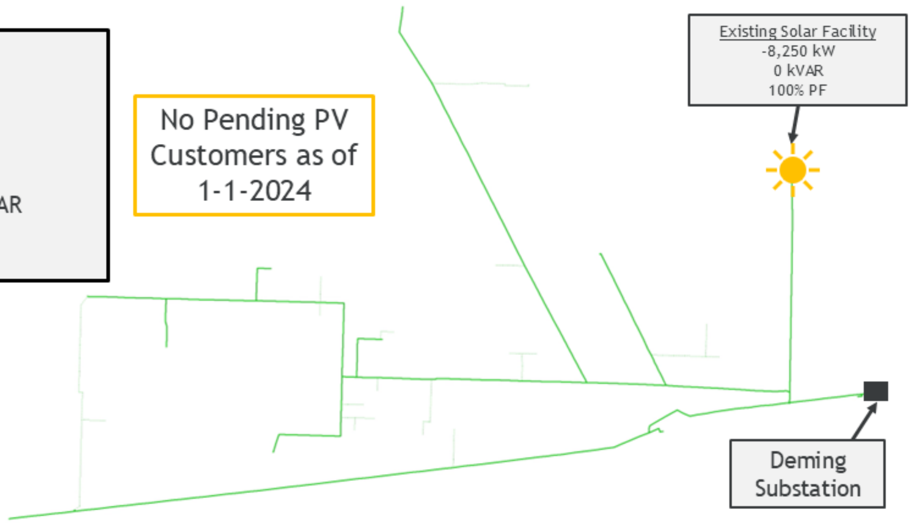
DEMW11 - Feeder Overview

The transformer rating is more limiting than the feeder rating for DEMW11.

Feeder Data

- Feeder Rating: 10,278 kVA
- Transformer Rating: 9,370 kVA
- Existing Generation: 8,304 kVA
- Minimum Daylight Load: -8,062 kW
- Minimum Daylight Gross Load: 83 kW / -10 kVAR
- Substation LTC Setpoint: 123 V
- Primary Voltage: 13.8 kV

No Pending PV Customers as of 1-1-2024



Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	DEM11 Breaker	600

8,250 kVA solar facility shown in the figure is an approved SGIA interconnection that has not been constructed yet. The system improvements identified in the impact study have been modeled to show the hosting capacity performance of the feeder once all system improvements have been constructed that are necessary for interconnecting this project.

Base Case Load Flow Analysis (Minimum daylight Load)

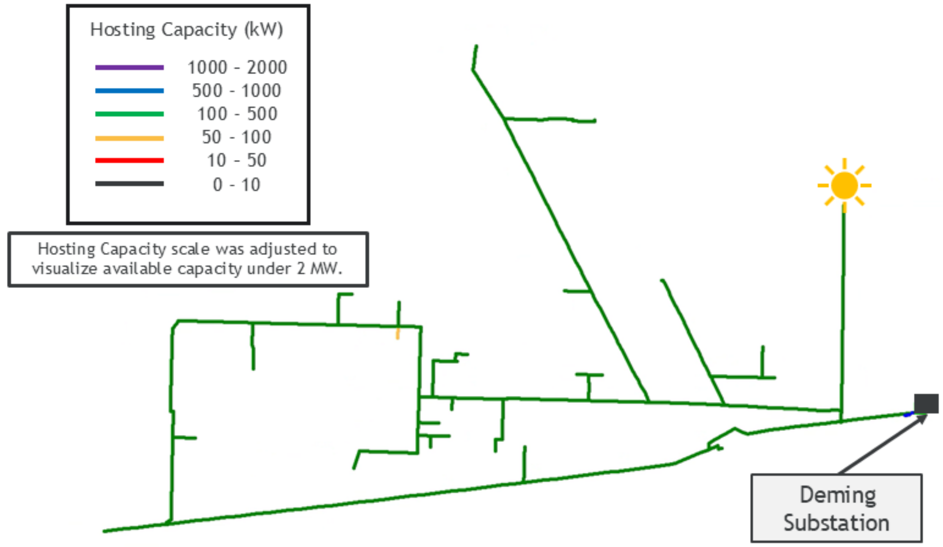
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,062	348	8,070	-100	330	328	331	123.0	125.3	92

1898 & co.

DEMW11 - Maximum Hosting Capacity Base Case

Maximum Hosting Capacity
1.31 MW

Limiting Factors	
Thermal Loading Violation	88%
Voltage Violation	12%



Feeder Observations

- The approved SGIA of 8.25 MVA exhausts most of the hosting capacity on the feeder in the feeder's current state.
- The substation transformer rating is more limiting than the feeder rating. Significant substation upgrades are required to improve the substation transformer rating.
- 4/0 ACSR overhead conductor further limits the amount of hosting capacity observed throughout the rest of the distribution feeder.

1898 & Co.

Confidential Information

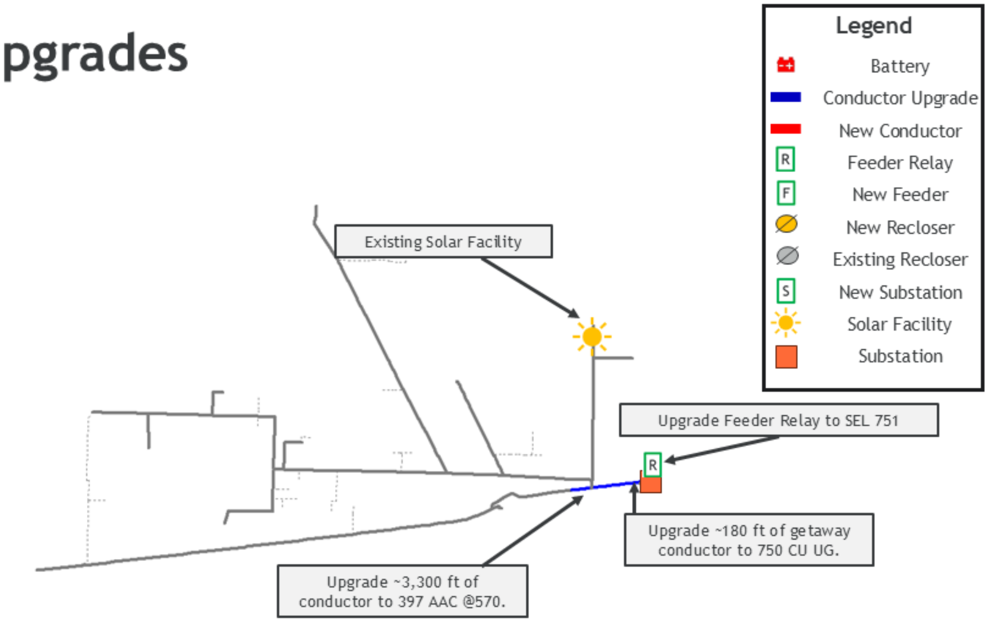
31

DEMW11 - Feeder Upgrades

Hosting Capacity	
Base HC	1.31 MW
Max HC	1.28 MW
HC Increase	-0.03 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Upgrade ~180 ft of 750 AL UG to 750 CU UG from Deming West Substation to Pole H73C514	$50,672
Upgrade ~3,300 ft of 4/0 ACSR to 397 AAC @570 from Pole H73C514 to Pole G73D116	$485,331
Upgrade Feeder relay setting	$6,470
TOTAL	$542,473



Hosting capacity decreased after constructing feeder upgrades. The overall hosting capacity constraint, which is the substation transformer, is not improved with feeder upgrades. The losses on the feeder decrease with new conductor but the power flow through the transformer increases. Reduced losses resulted in slightly less hosting capacity.

Financial Analysis	
Hosting Capacity Increase (MW)	0
Cost ($)	542,473
Hosting Capacity Benefit Cost	-
Holistic System Benefit Cost	-

1898 & Co.

Confidential Information

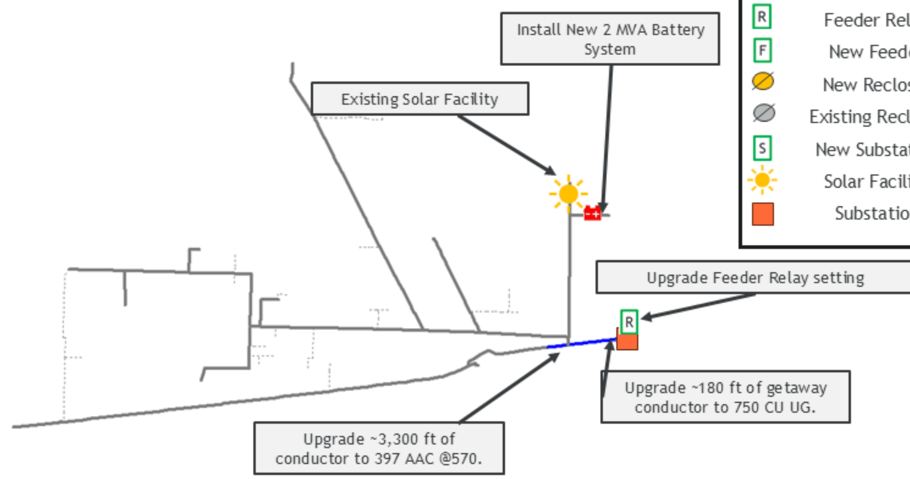
32

DEMW11 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	1.31 MW
Max HC	3.21 MW
HC Increase	1.9 MW

Reverse Flow Limits Max HC

System Improvement	Cost
Upgrade ~180 ft of 750 AL UG to 750 CU UG from Deming West Substation to Pole H73C514	$50,672
Upgrade ~3,300 ft of 4/0 ACSR to 397 AAC @570 from Pole H73C514 to Pole G73D116	$485,331
Upgrade Feeder relay setting	$6,470
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,842,473



Financial Analysis	
Hosting Capacity Increase (MW)	1.90
Cost ($)	14,842,473
Hosting Capacity Benefit Cost	0.13
Holistic System Benefit Cost	0.72

1898 & Co.

Confidential Information

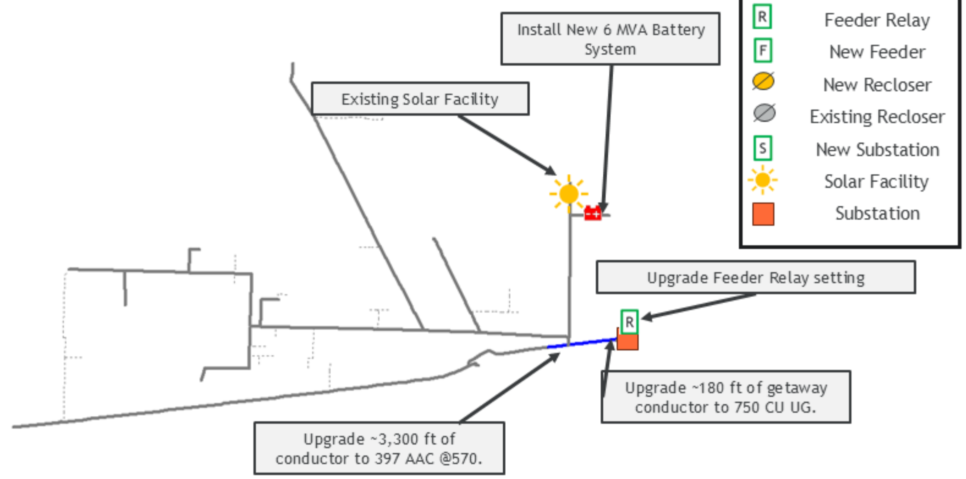
33

DEMW11 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	1.31 MW
Max HC	6.1 MW
HC Increase	4.79 MW

Thermal Loading Limits
Max HC

System Improvement	Cost
Upgrade ~180 ft of 750 AL UG to 750 CU UG from Deming West Substation to Pole H73C514	$50,672
Upgrade ~3,300 ft of 4/0 ACSR to 397 AAC @570 from Pole H73C514 to Pole G73D116	$485,331
Upgrade Feeder relay setting	$6,470
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,892,473



Financial Analysis	
Hosting Capacity Increase (MW)	4.79
Cost ($)	14,892,473
Hosting Capacity Benefit Cost	0.32
Holistic System Benefit Cost	1.34

1898 & Co.

Confidential Information

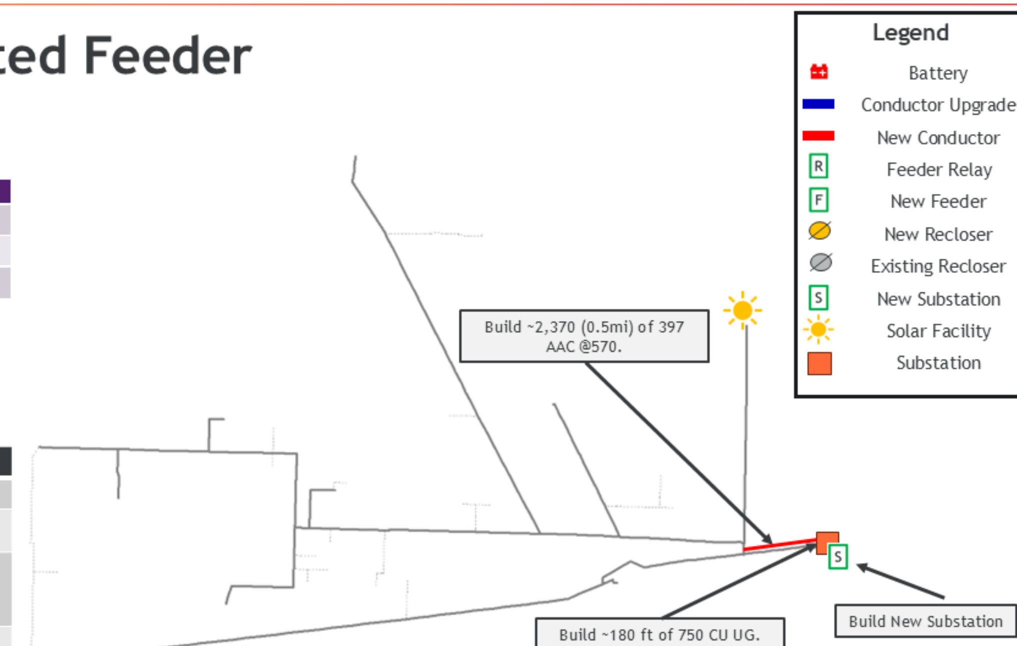
34

DEMW11 - Dedicated Feeder

Hosting Capacity	
Base HC	1.31 MW
Max HC	9.38 MW
HC Increase	8.07 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~180ft of new 750 CU UG cable from the New Deming West Substation to a new riser pole.	$49,059
Build ~2,370ft (0.5mi) of new 397 AAC @ 570. Utilize double circuit construction along the existing path of Deming West 11 feeder main line conductor.	$371,721
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$8,420,780



Financial Analysis	
Hosting Capacity Increase (MW)	8.07
Cost ($)	8,420,780
Hosting Capacity Benefit Cost	0.96
Holistic System Benefit Cost	0.04

1898 & Co.

DEMW11 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	1,308	1,280	-28*	$542,472	-	-
Feeder Upgrades with 2 MVA BESS	1,308	3,208	1,900	$14,842,473	0.13	0.72
2 MVA BESS Only**	-	-	-	-	-	-
Feeder Upgrades with 6 MVA BESS	1,308	6,102	4,794	$14,892,473	0.32	1.34
6 MVA BESS Only**	-	-	-	-	-	-
Dedicated Feeder	1,308	9,380	8,072	$8,420,780	0.96	0.04

*Deming West Substation transformer is more limiting to hosting capacity than the feeder rating. Feeder upgrades would not remove the substation transformer constraint. After feeder upgrades are performed, losses would decrease on the feeder and the maximum hosting capacity decreased by a small amount.

**This scenario was not applicable to this analysis.

The Feeder Upgrades and 6 MVA BESS solution is proposed for Deming West Feeder 11. For DEMW11 the SGIA has not been constructed. The proposed capital project solution would not be constructed unless the SGIA moves forward with construction, or if pending customers are not able to connect to the PNM system without system improvements built.

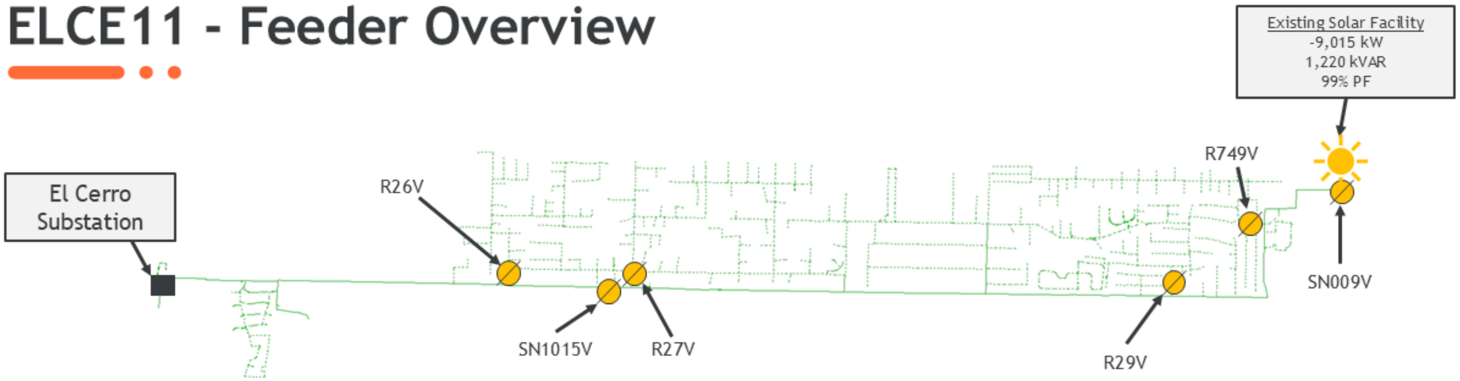
ELCE11 Analysis

1898 & CO.

Confidential Information

37

ELCE11 - Feeder Overview



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-6,954	3,232	7,668	-91	345	350	352	120.6	124.4	97.0

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	ELCE11 Breaker	540
Recloser	R26V	100
Recloser	R27V	100
Recloser	R29V	200
Recloser	R749V	200
Recloser	SN009V	600
Recloser	SN1015V	600

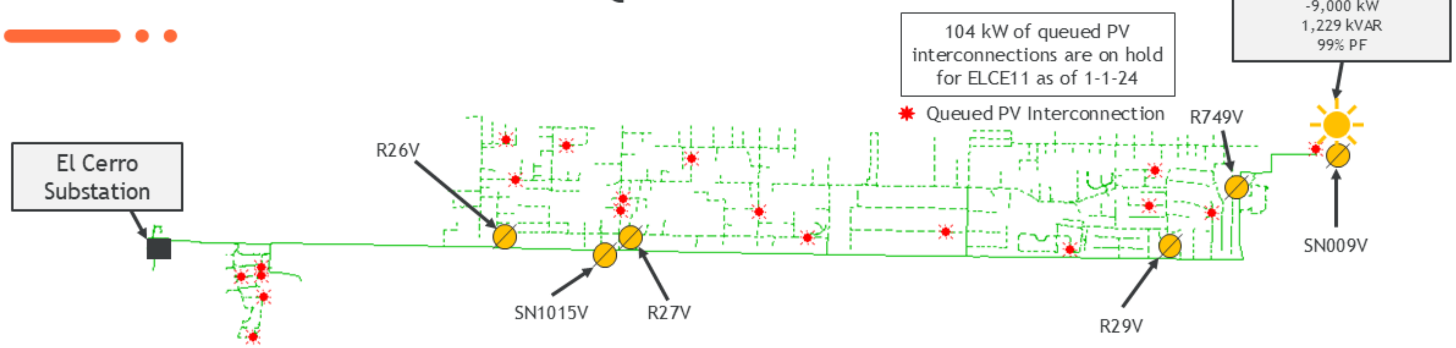
Feeder Data

- Feeder Rating: 9,288 kVA
- Existing Generation: 9,257 kVA
- Minimum Daylight Load: -6,954 kW
- Minimum Daylight Gross Load: 1,288 kW / 180 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV

1898 & co.

38

ELCE11 - Feeder Overview with Queued Solar as of 1-1-24



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-7,039	3,254	7,755	-91	347	356	356	120.8	124.6	96.7

The feeder can serve queued PV interconnection requests without violations.

Feeder Data

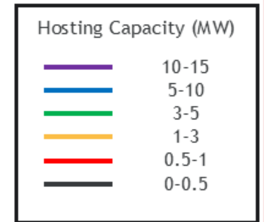
- Feeder Rating: 9,288 kVA
- Existing Generation: 9,284 kVA
- Minimum Daylight Load: -7,039 kW
- Minimum Daylight Gross Load: 1,288 kW / 180 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 19
- Total Queued AC Inverter Nameplate: 104 kW

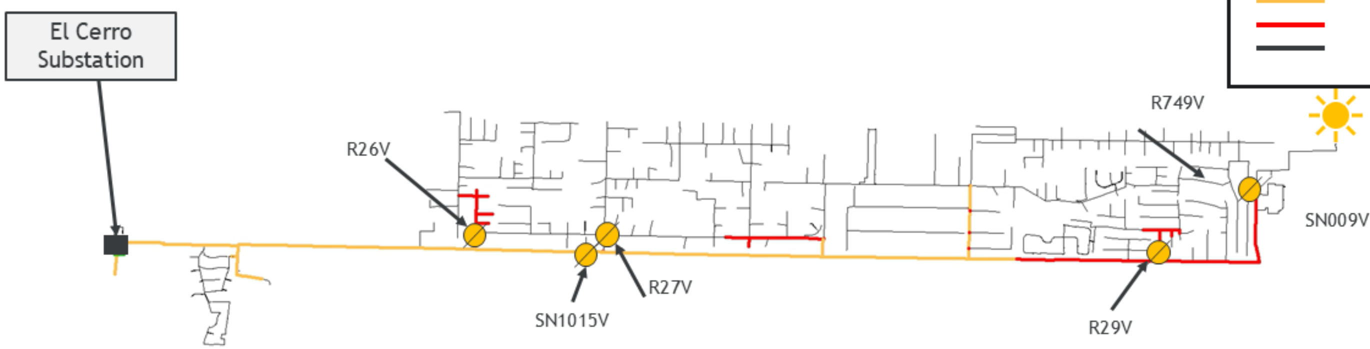
1898 & Co.

39

Confidential Information

ELCE11 - Maximum Hosting Capacity Base Case w/ Queued PV





Maximum Hosting Capacity
2.02 MW

Limiting Factors	
Thermal Loading Violation	78%
Voltage Violation	22%

Feedger Observations

- 750 AL sections of the feeder getaway is the limiting factor for the maximum hosting capacity. Conductor upgrade to 750 CU would increase the feeder rating and maximum hosting capacity.
- Volt-VAR control from the existing large-scale PV facility is helping to regulate voltage and limit the number of voltage violations observed while performing hosting capacity analysis.

1898 & Co.

Confidential Information

40

ELCE11 - Feeder Upgrades

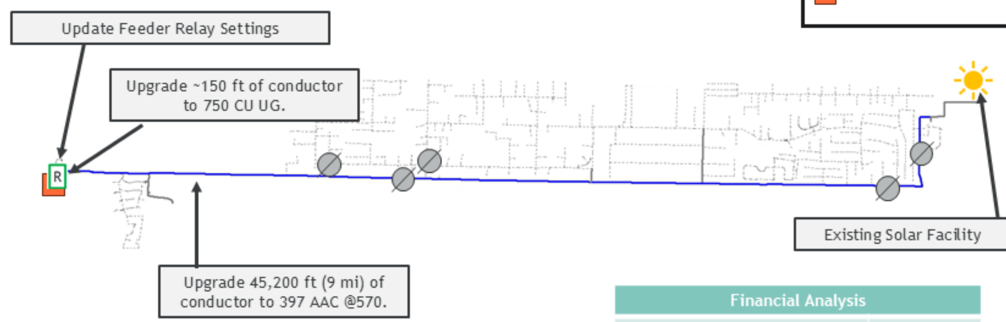
Hosting Capacity	
Base HC	2.02 MW
Max HC	4.18 MW
HC Increase	2.16 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Upgrade 45,200ft (9mi) 397 AAC (old standard) to 397 AAC @570 from Pole E29D367 to near Pole I29C061	$6,170,286
Upgrade ~150 ft feeder getaway cable from 750 AL to 750 CU from El Cerro Substation to Pole E29D367	$70,323
Update Feeder Relay Settings	$6,470
TOTAL	$6,247,100

Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation



Financial Analysis	
Hosting Capacity Increase (MW)	2.16
Cost ($)	6,247,100
Hosting Capacity Benefit Cost	0.35
Holistic System Benefit Cost	0.16

1898 & Co.

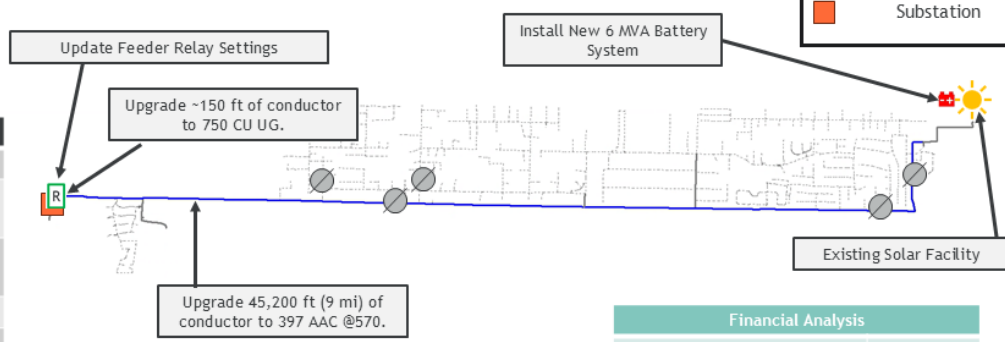
Confidential Information 41

ELCE11 - Feeder Upgrades & 2 MVA BESS

Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Hosting Capacity	
Base HC	2.02 MW
Max HC	5.79 MW
HC Increase	3.77 MW

Reverse Flow Limits Max HC



System Improvement	
	Cost
Upgrade 45,200ft (9mi) 397 AAC (old standard) to 397 AAC @570 from Pole E29D367 to near Pole I29C061	$6,170,286
Upgrade ~150 ft feeder getaway cable from 750 AL to 750 CU from El Cerro Substation to Pole E29D367	$70,323
Update Feeder Relay Settings	$6,470
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$20,547,079

Financial Analysis	
Hosting Capacity Increase (MW)	3.77
Cost ($)	20,547,079
Hosting Capacity Benefit Cost	0.18
Holistic System Benefit Cost	0.54

1898 & Co.

42

Confidential Information

ELCE11 - 2 MVA BESS Only

Hosting Capacity	
Base HC	2.02 MW
Max HC	3.63 MW
HC Increase	1.61 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,300,000

Financial Analysis	
Hosting Capacity Increase (MW)	1.61
Cost ($)	14,300,000
Hosting Capacity Benefit Cost	0.11
Holistic System Benefit Cost	0.78

1898 & co.

43

Confidential Information

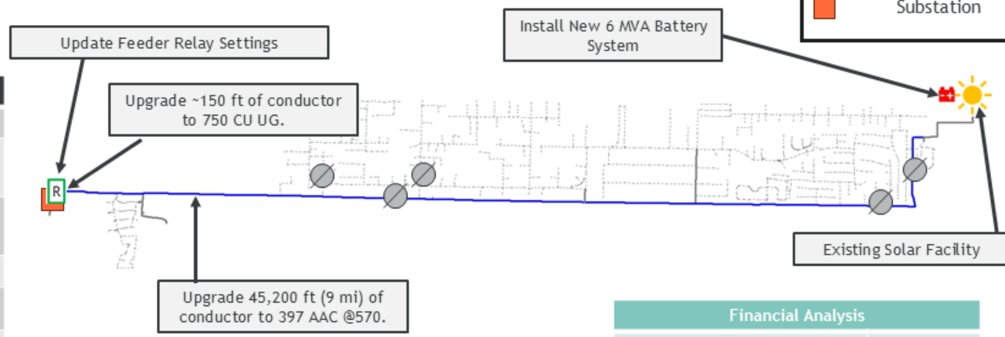
ELCE11 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	2.02 MW
Max HC	7.84 MW
HC Increase	5.82 MW

Thermal Loading Limits
Max HC

System Improvement	Cost
Upgrade 45,200ft (9mi) 397 AAC (old standard) to 397 AAC @570 from Pole E29D367 to near Pole I29C061	$6,170,286
Upgrade ~150 ft feeder getaway cable from 750 AL to 750 CU from El Cerro Substation to Pole E29D367	$70,323
Update Feeder Relay Settings	$6,470
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$20,597,079

Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation



Financial Analysis	
Hosting Capacity Increase (MW)	5.82
Cost ($)	20,597,079
Hosting Capacity Benefit Cost	0.28
Holistic System Benefit Cost	0.98

1898 & co.

Confidential Information

ELCE11 - 6 MVA BESS Only

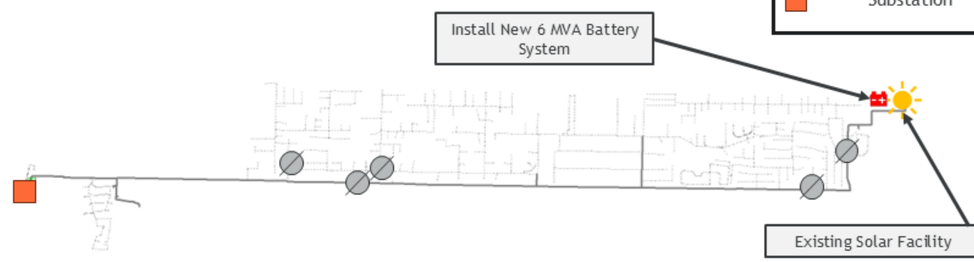
Hosting Capacity	
Base HC	2.02 MW
Max HC	4.55 MW
HC Increase	2.53 MW

Thermal Loading Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,350,000

Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation



Financial Analysis	
Hosting Capacity Increase (MW)	2.53
Cost ($)	14,350,000
Hosting Capacity Benefit Cost	0.18
Holistic System Benefit Cost	1.31

1898 & co.

Confidential Information

45

ELCE11 - Dedicated Feeder

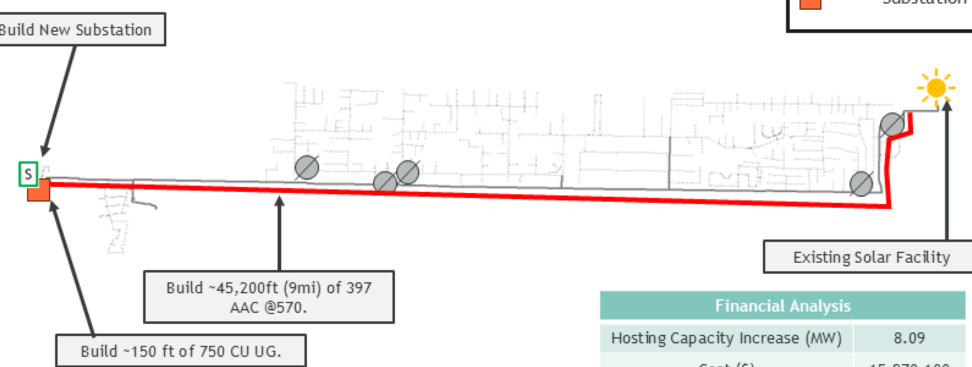
Hosting Capacity	
Base HC	2.02 MW
Max HC	10.11 MW
HC Increase	8.09 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~150ft of new 750 CU UG.	$65,800
Build ~45,200ft of new 397 AAC@ 570. Utilize double circuit construction along the existing path of El Cerro Feeder 11 main line conductor.	$7,904,300
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$15,970,100

Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation



Financial Analysis	
Hosting Capacity Increase (MW)	8.09
Cost ($)	15,970,100
Hosting Capacity Benefit Cost	0.51
Holistic System Benefit Cost	0.07

1898 & Co.

Confidential Information

46

ELCE11 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	2,019	4,178	2,159	$6,247,100	0.35	0.16
Feeder Upgrades with 2 MVA BESS	2,019	5,787	3,768	$20,547,079	0.18	0.54
2 MVA BESS	2,019	3,630	1,611	$14,300,000	0.11	0.78
Feeder Upgrades with 6 MVA BESS	2,019	7,844	5,825	$20,597,079	0.28	0.98
6 MVA BESS	2,019	4,550	2,531	$14,350,000	0.18	1.31
Dedicated Feeder	2,019	10,110	8,091	$15,970,100	0.51	0.07

The 6 MVA BESS only solution is proposed for El Cerro Feeder 11. Installing the BESS only will reduce the overall project cost if feeder upgrades were included. The existing large-scale PV is located at the far end of the feeder and contributed to a significant feeder upgrade cost.

GOLD13 Analysis

1898 & Co.

Confidential Information

48

GOLD13 - Feeder Overview

Gold Feeder 13 is in the Deming, NM area. This area is operated at 13.8 kV.

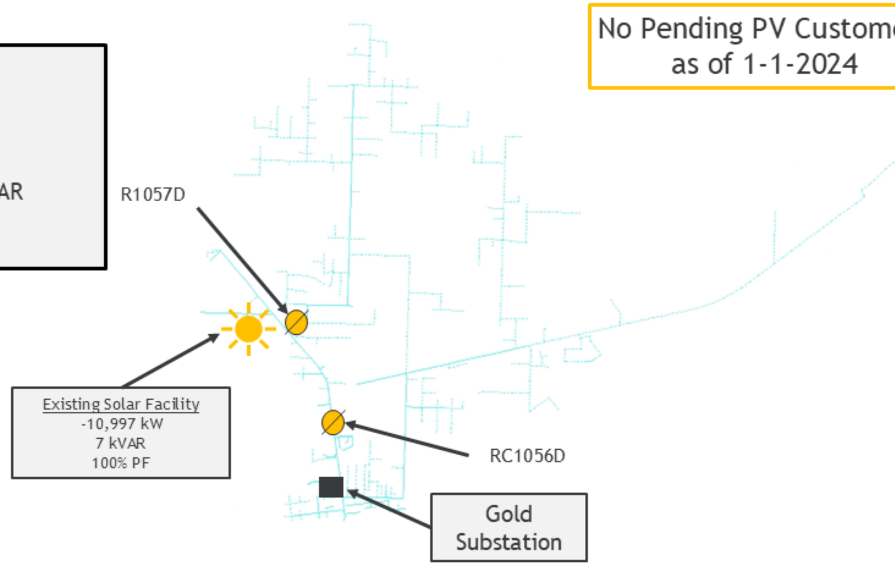
No Pending PV Customers as of 1-1-2024

Feeder Data

- Feeder Rating: 12,429 kVA
- Existing Generation: 11,272 kVA
- Minimum Daylight Load: -10,292 kW
- Minimum Daylight Gross Load: 729 kW / 28 kVAR
- Substation LTC Setpoint: 123 V
- Primary Voltage: 13.8 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	GOLD13 Breaker	600
Recloser	R1057D	600
Recloser	RC1056D	600

11,000 kVA solar facility shown in the figure is an approved SGIA interconnection that has not been constructed yet. The system improvements identified in the impact study have been modeled to show the hosting capacity performance of the feeder once all system improvements have been constructed that are necessary for interconnecting this project.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-10,292	692	10,315	-100	420	422	421	122.4	125.7	81

1898 & co.

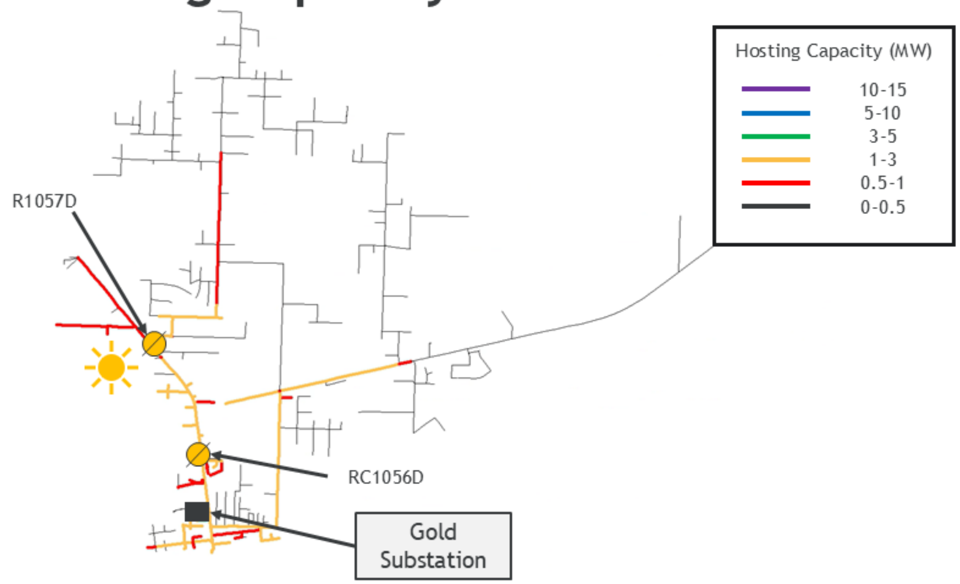
Confidential Information

49

GOLD13 - Maximum Hosting Capacity Base Case

Maximum Hosting Capacity
2.14 MW

Limiting Factors	
Thermal Loading Violation	59%
Voltage Violation	41%



Feeder Observations

- There is an approved SGIA of 11.0 MVA that consumes much of the hosting capacity in this feeder.
- The feeder getaway is built to the maximum PNM standard rating - 750 CU cable.
- Small overhead conductor further limits the amount of hosting capacity observed at the extremities of the distribution feeder.

1898 & co.

Confidential Information

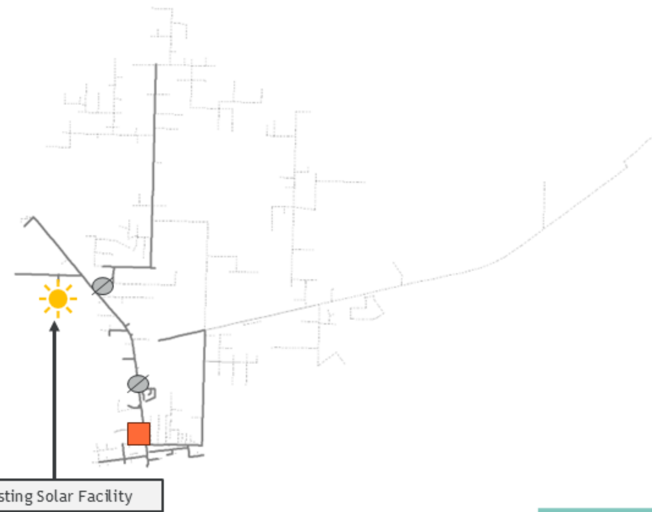
50

GOLD13 - Feeder Upgrades

Hosting Capacity	
Base HC	2.14 MW
Max HC	2.14 MW
HC Increase	0 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
No traditional system upgrades are applicable. The feeder is built to the maximum PNM conductor and equipment standards.	$0
TOTAL	$0



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	0
Cost ($)	0
Hosting Capacity Benefit Cost	-
Holistic System Benefit Cost	-

1898 & Co.

Confidential Information

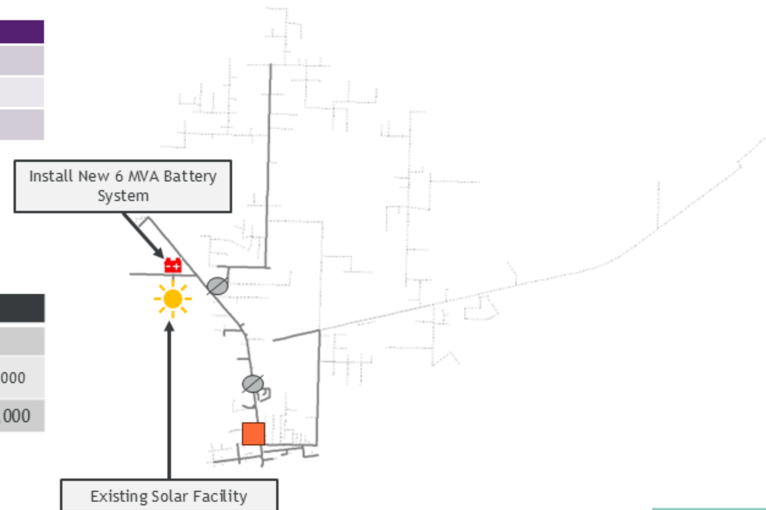
51

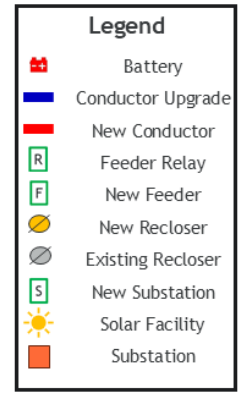
GOLD13 - 2 MVA BESS Only

Hosting Capacity	
Base HC	2.14 MW
Max HC	4.04 MW
HC Increase	1.9 MW

Reverse Flow Limits Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,300,000





Financial Analysis	
Hosting Capacity Increase (MW)	1.90
Cost ($)	14,300,000
Hosting Capacity Benefit Cost	0.13
Holistic System Benefit Cost	0.75

1898 & Co.

Confidential Information

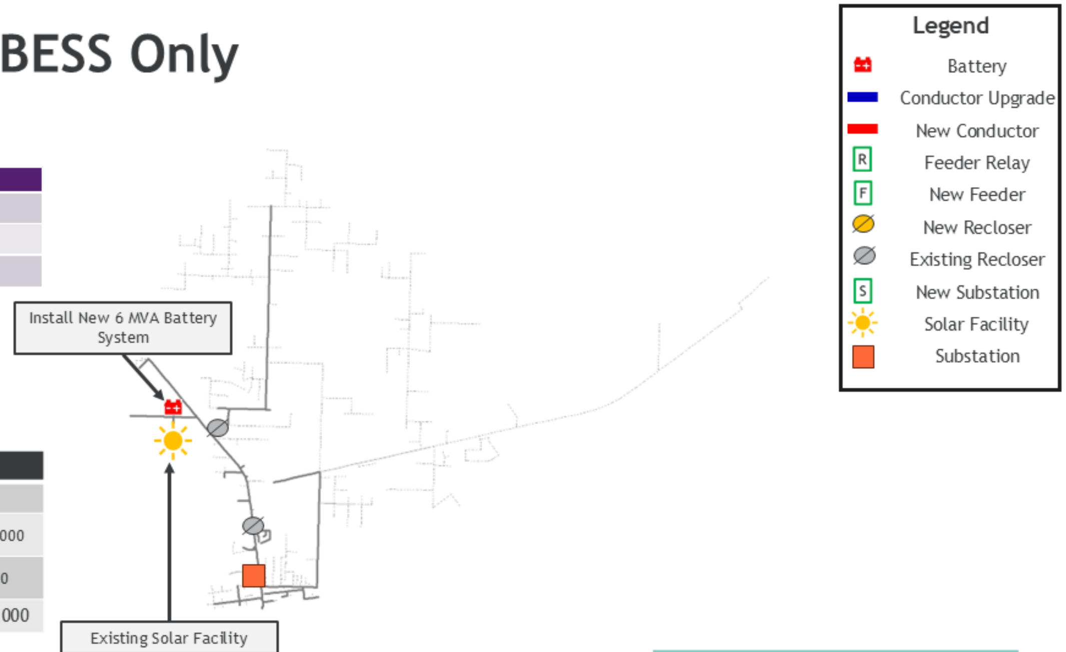
52

GOLD13 - 6 MVA BESS Only

Hosting Capacity	
Base HC	2.14 MW
Max HC	7.84 MW
HC Increase	5.7 MW

Thermal Loading Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,350,000



Financial Analysis	
Hosting Capacity Increase (MW)	5.70
Cost ($)	14,350,000
Hosting Capacity Benefit Cost	0.40
Holistic System Benefit Cost	1.39

1898 & co.

53

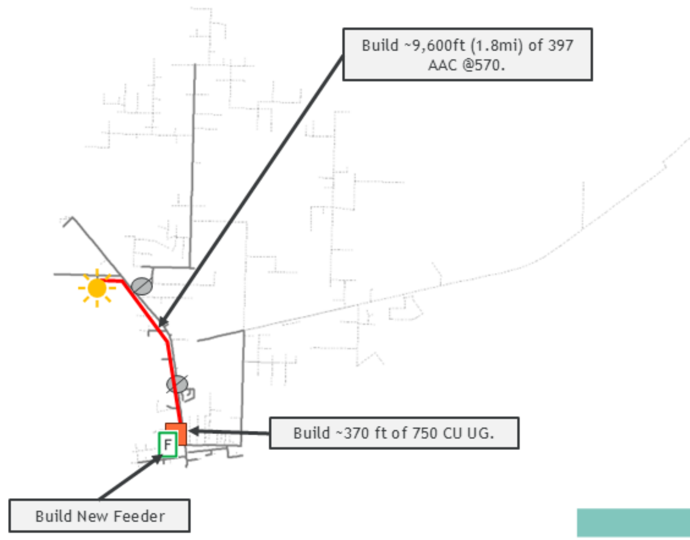
Confidential Information

GOLD13 - Dedicated Feeder

Hosting Capacity	
Base HC	2.14 MW
Max HC	12.88 MW
HC Increase	10.74 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~370 ft of new 750 CU UG cable from the New Gold Feeder to a new riser pole.	$88,512
Build ~9,600 ft of new 397 AAC @ 570. Utilize double circuit construction along the existing path of Gold 13 feeder main line conductor.	$1,391,333
Install Breaker and SEL 751 Relay for the New Feeder.	$120,481
TOTAL	$1,600,027



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	10.74
Cost ($)	1,600,027
Hosting Capacity Benefit Cost	6.71
Holistic System Benefit Cost	0.23

1898 & Co.

Confidential Information

54

GOLD13 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades*	-	-	-	-	-	-
Feeder Upgrades with 2 MVA BESS*	-	-	-	-	-	-
2 MVA BESS Only	2,139	4,037	1,898	$14,300,000	0.13	0.75
Feeder Upgrades with 6 MVA BESS*	-	-	-	-	-	-
6 MVA BESS Only	2,139	7,838	5,699	$14,350,000	0.40	1.39
Dedicated Feeder	2,139	12,882	10,743	$1,600,027	6.71	0.23

*This scenario was not applicable to this analysis.

The Dedicated Feeder Buildout solution is proposed for Gold Feeder 13. For GOLD13 the SGIA has not been constructed. The proposed capital project solution would not be constructed unless the SGIA moves forward with construction, or if pending customers are not able to connect to the PNM system without system improvements built.

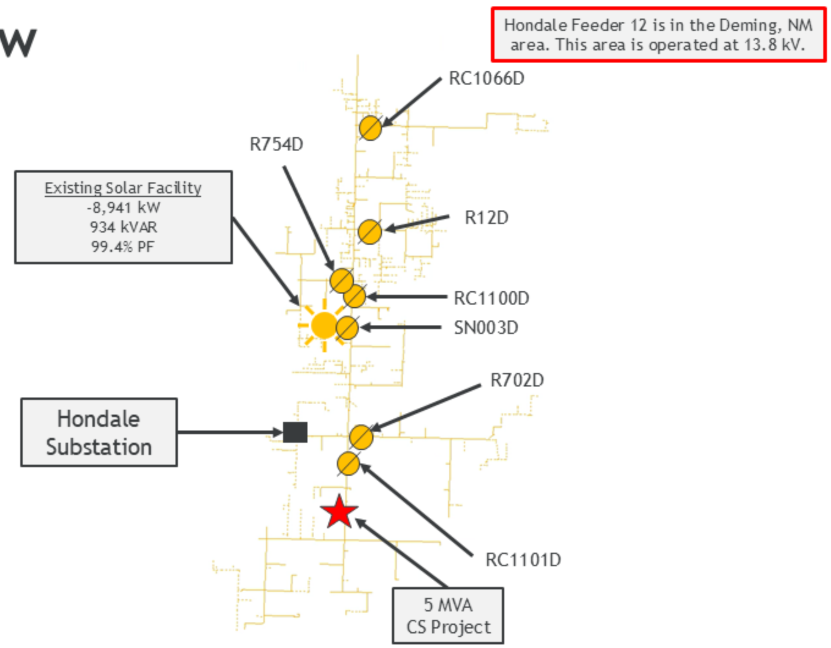
HOND12 Analysis

HOND12 - Feeder Overview

Feeder Data

- Feeder Rating: 10,039 kVA
- Existing Generation: 9,153 kVA
- Minimum Daylight Load: -8,561 kW
- Minimum Daylight Gross Load: 242 kW / -112 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 13.8 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	HOND12 Breaker	480
Recloser	R12D	140
Recloser	R702D	140
Recloser	R754D	150
Recloser	R1066D	70
Recloser	RC1100D	100
Recloser	RC1101D	150
Recloser	SN003D	450



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,561	-277	8,565	100	343	357	352	122.0	125.0	86.0

1898 & Co.

Confidential Information

57

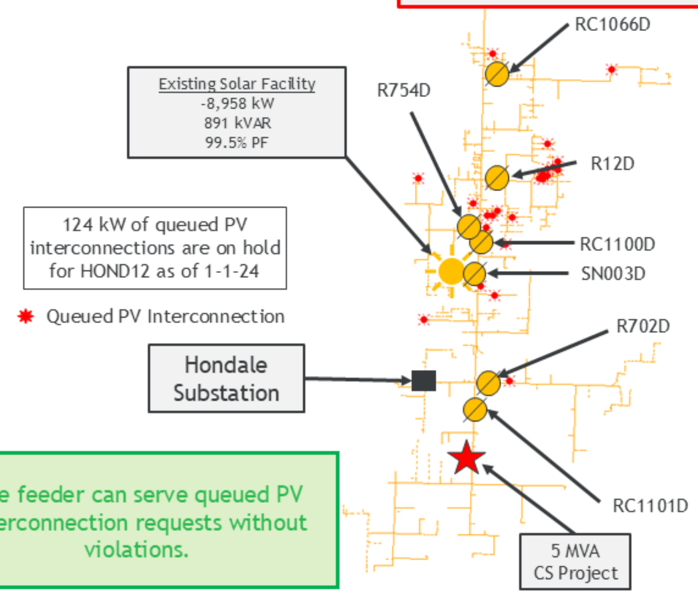
HOND12 - Feeder Overview with Queued Solar as of 1-1-24

Hondale Feeder 12 is in the Deming, NM area. This area is operated at 13.8 kV.

Feeder Data

- Feeder Rating: 10,039 kVA
- Existing Generation: 9,234 kVA
- Minimum Daylight Load: -8,679 kW
- Minimum Daylight Gross Load: 242 kW / -112 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 13.8 kV
- Queued Solar Projects: 22
- Total Queued AC Inverter Nameplate: 125 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	HOND12 Breaker	480
Recloser	R12D	140
Recloser	R702D	140
Recloser	R754D	150
Recloser	R1066D	70
Recloser	RC1100D	100
Recloser	RC1101D	150
Recloser	SN003D	450



The feeder can serve queued PV interconnection requests without violations.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,679	-258	8,682	100	354	361	353	122.0	125.0	86.0

1898 & co.

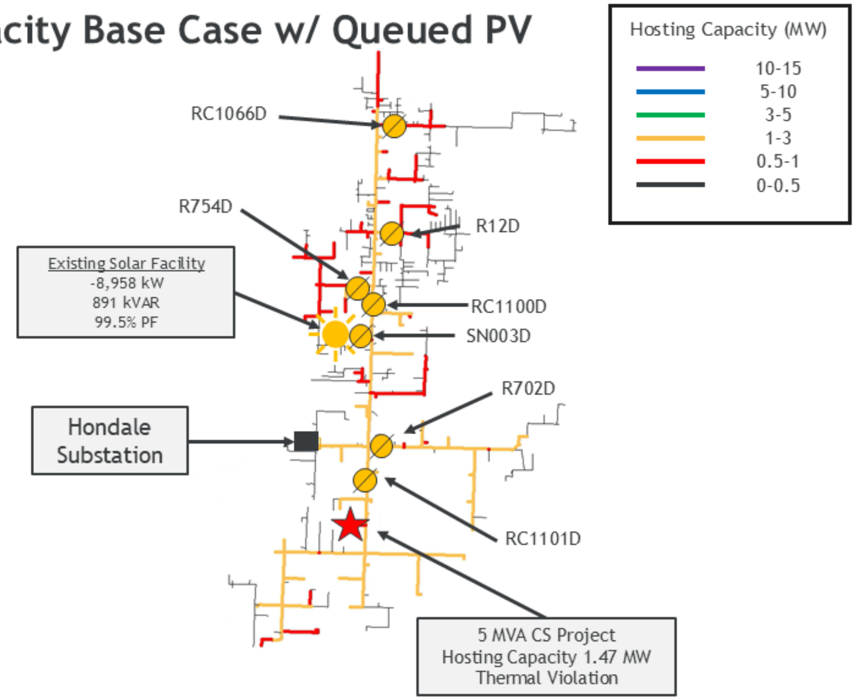
Confidential Information

58

HOND12 - Maximum Hosting Capacity Base Case w/ Queued PV

Maximum Hosting Capacity
1.35 MW

Limiting Factors	
Thermal Loading Violation	59%
Voltage Violation	41%



Feedeer Observations

- The feeder getaway is 750 AL UG and 397 AAC conductor rated for 430 Amps is limiting the hosting capacity for HOND12.

1898 & co.

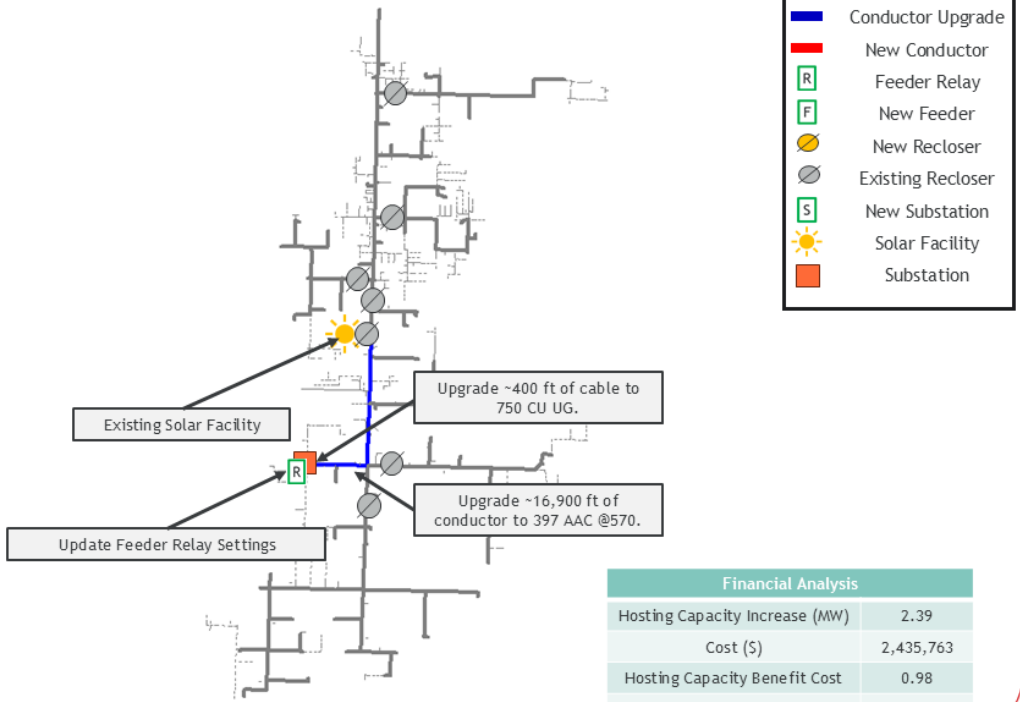
Confidential Information

HOND12 - Feeder Upgrades

Hosting Capacity	
Base HC	1.35 MW
Max HC	3.74 MW
HC Increase	2.39 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Upgrade ~400 ft of 750 AL UG to 750 CU UG from Hondale 12 Substation to Pole G79D002.	$98,726
Upgrade ~16,900 ft of 397 AAC to 397 AAC @570 from Pole G79D002 to near Pole H78A002.	$2,330,567
Update Feeder Relay Settings	$6,470
TOTAL	$2,435,763



Financial Analysis	
Hosting Capacity Increase (MW)	2.39
Cost ($)	2,435,763
Hosting Capacity Benefit Cost	0.98
Holistic System Benefit Cost	1.34

1898 & co.

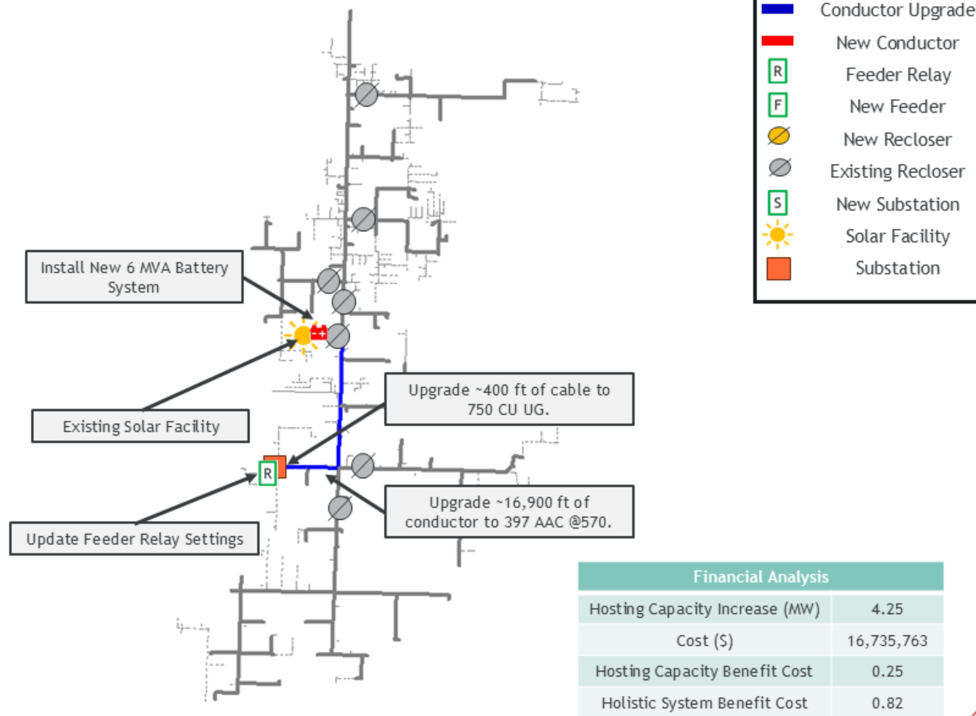
60

HOND12 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	1.35 MW
Max HC	5.6 MW
HC Increase	4.25 MW

Reverse Flow Limits Max HC

System Improvement	
	Cost
Upgrade ~400 ft of 750 AL UG to 750 CU UG from Hondale 12 Substation to Pole G79D002.	$98,726
Upgrade ~16,900 ft of 397 AAC to 397 AAC @570 from Pole G79D002 to near Pole H78A002.	$2,330,567
Update Feeder Relay Settings	$6,470
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$16,735,763



Financial Analysis	
Hosting Capacity Increase (MW)	4.25
Cost ($)	16,735,763
Hosting Capacity Benefit Cost	0.25
Holistic System Benefit Cost	0.82

1898 & Co.

Confidential Information

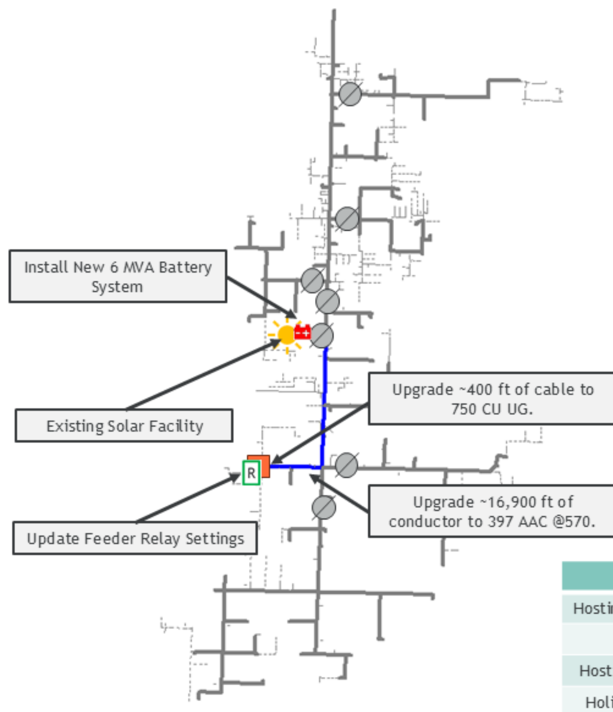
61

HOND12 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	1.35 MW
Max HC	9.47 MW
HC Increase	8.12 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Upgrade ~400 ft of 750 AL UG to 750 CU UG from Hondale 12 Substation to Pole G79D002	$98,726
Upgrade ~16,900 ft of 397 AAC to 397 AAC @570 from Pole G79D002 to near Pole H78A002	$2,330,567
Update Feeder Relay Settings	$6,470
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$16,785,763



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	8.12
Cost ($)	16,785,763
Hosting Capacity Benefit Cost	0.48
Holistic System Benefit Cost	1.37

1898 & Co.

Confidential Information

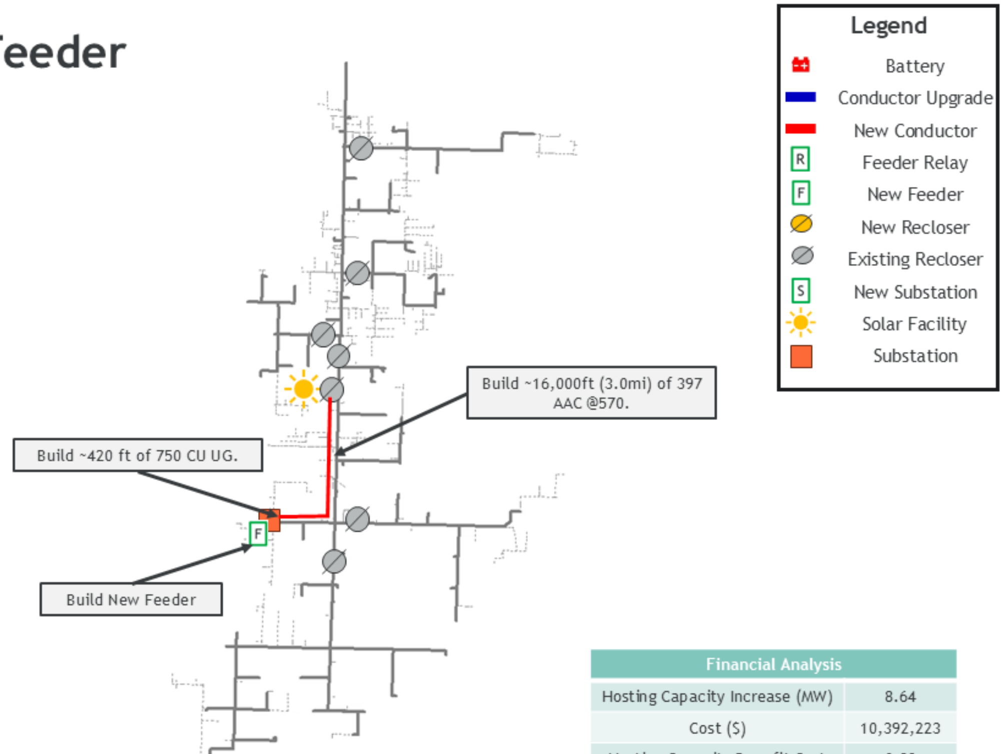
62

HOND12 - Dedicated Feeder

Hosting Capacity	
Base HC	1.35 MW
Max HC	9.99 MW
HC Increase	8.64 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~420ft of new 750 CU cable from the New Hondale Feeder to a new riser pole.	$98,895
Build ~16,000ft of new 397 AAC @ 570. Utilize double circuit construction along the existing path of HOND12 13 feeder main line conductor.	$2,293,328
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$10,392,223



Financial Analysis	
Hosting Capacity Increase (MW)	8.64
Cost ($)	10,392,223
Hosting Capacity Benefit Cost	0.83
Holistic System Benefit Cost	0.33

1898 co.

Confidential Information

63

HOND12 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	1,352	3,740	2,390	$2,435,763	0.98	1.34
Feeder Upgrades with 2 MVA BESS	1,352	5,603	4,251	$16,735,763	0.25	0.82
2 MVA BESS Only*	-	-	-	-	-	-
Feeder Upgrades with 6 MVA BESS	1,352	9,468	8,116	$16,785,763	0.48	1.37
6 MVA BESS Only*	-	-	-	-	-	-
Dedicated Feeder	1,352	9,994	8,642	$10,392,223	0.83	0.33

*This scenario was not applicable to this analysis.

The Feeder Upgrades and 6 MVA BESS solution is proposed for Hondale Feeder 12. Feeder upgrades should be performed first for this feeder and as PV penetration increases or as the system requires more energy storage, a 6 MVA BESS can be constructed to continue increasing hosting capacity on Hondale Feeder 12.

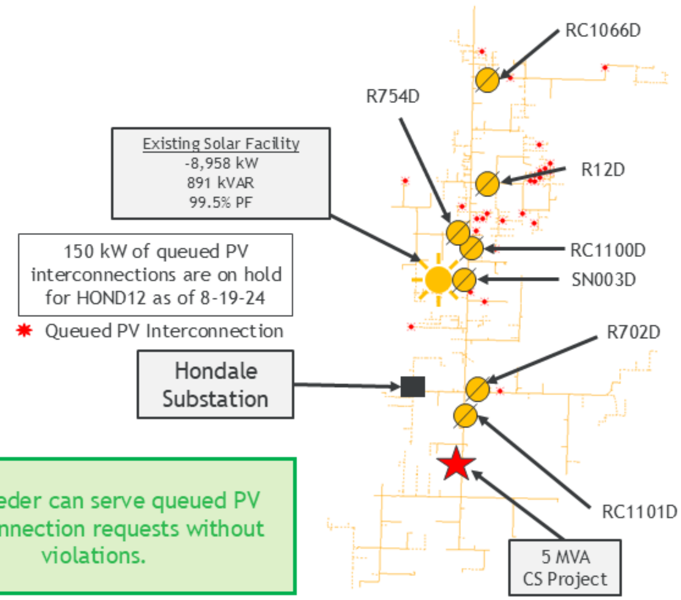
HOND12 - Feeder Overview with Queued Solar as of 8-19-24

Feeder Data

- Feeder Rating: 10,039 kVA
- Existing Generation: 9,268 kVA
- Minimum Daylight Load: -8,702 kW
- Minimum Daylight Gross Load: 242 kW / -112 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 13.8 kV
- Queued Solar Projects: 25
- Total Queued AC Inverter Nameplate: 150 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	HOND12 Breaker	480
Recloser	R12D	140
Recloser	R702D	140
Recloser	R754D	150
Recloser	R1066D	70
Recloser	RC1100D	100
Recloser	RC1101D	150
Recloser	SN003D	450

Hondale Feeder 12 is in the Deming, NM area. This area is operated at 13.8 kV.



The feeder can serve queued PV interconnection requests without violations.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,702	-254	8,706	100	354	362	358	122.0	125.0	86.24

1898 & Co.

Confidential Information

JARA12 Analysis

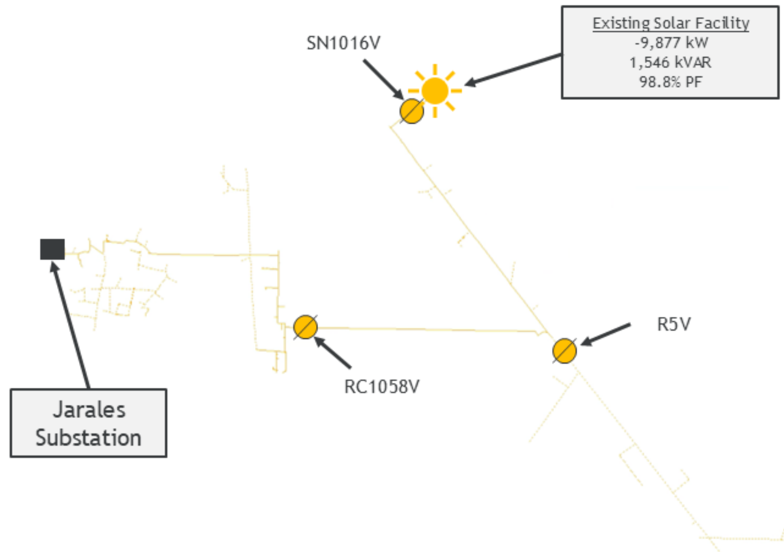
Confidential Information

JARA12 - Feeder Overview

Feeder Data

- Feeder Rating: 11,231 kVA
- Existing Generation: 10,063 kVA
- Minimum Daylight Load: -7,944 kW
- Minimum Daylight Gross Load: 848 kW / -3 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	JARA12 Breaker	600
Recloser	R5V	100
Recloser	RC1058V	225
Recloser	SN1016V	500



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-7,944	3,885	8,843	-90	416	405	387	119.7	124.8	97

1898 & Co.

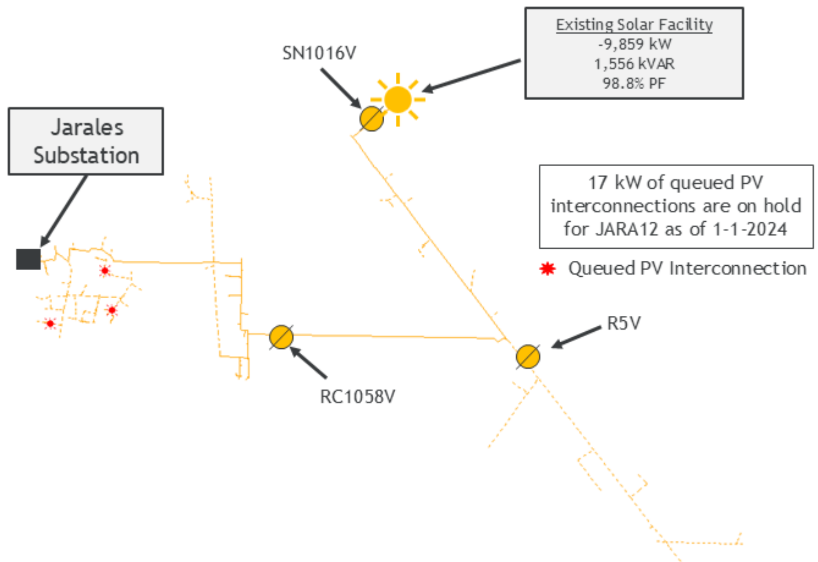
JARA12 - Feeder Overview with Queued Solar as of 1-1-2024

Feeder Data

- Feeder Rating: 11,231 kVA
- Existing Generation: 10,081 kVA
- Minimum Daylight Load: -7,947 kW
- Minimum Daylight Gross Load: 848 kW / -3 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 3
- Total Queued AC Inverter Nameplate: 17 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	JARA12 Breaker	600
Recloser	R5V	100
Recloser	RC1058V	225
Recloser	SN1016V	500

The feeder can serve queued PV interconnection requests without violations.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-7,947	3,886	8,846	-90	415	405	389	119.9	124.7	97

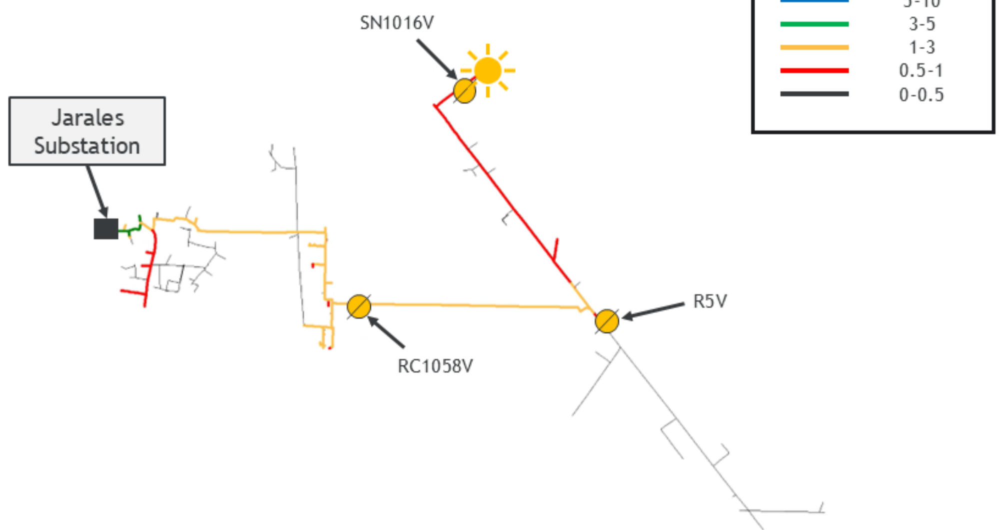
68

Confidential Information

JARA12 - Maximum Hosting Capacity Base Case w/ Queued PV

Maximum Hosting Capacity
3.27 MW

Limiting Factors	
Thermal Loading Violation	85%
Voltage Violation	15%



Feedger Observations

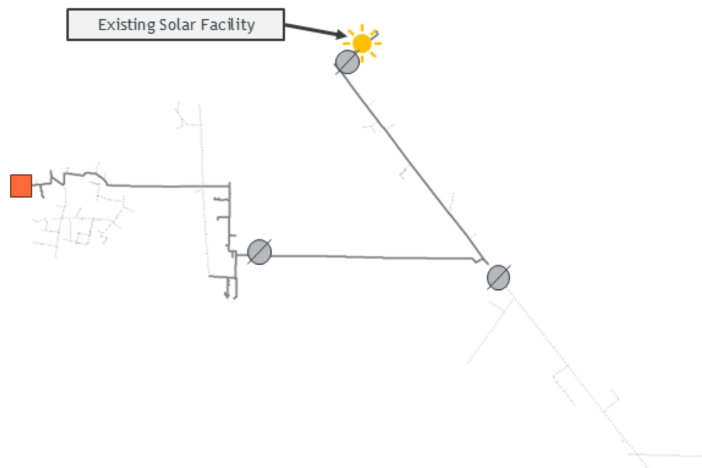
- The feeder getaway is 750 CU and is the maximum PNM standard getaway cable.
- 795 AAC mainline overhead conductor has a rating of 870A which allows for the 750 CU getaway cable to be the limiting factor for hosting capacity.
- Increasing minimum daylight gross load through battery storage could improve the maximum hosting capacity for this feeder.

Confidential Information

69

JARA12 - Feeder Upgrades

Hosting Capacity	
Base HC	3.27 MW
Max HC	3.27 MW
HC Increase	0 MW



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

System Improvement	Cost
No feeder upgrades were applicable. This feeder is already built to the maximum PNM standard ratings.	$0
TOTAL	$0

Financial Analysis	
Hosting Capacity Increase (MW)	0
Cost ($)	0
Hosting Capacity Benefit Cost	-
Holistic System Benefit Cost	-

70

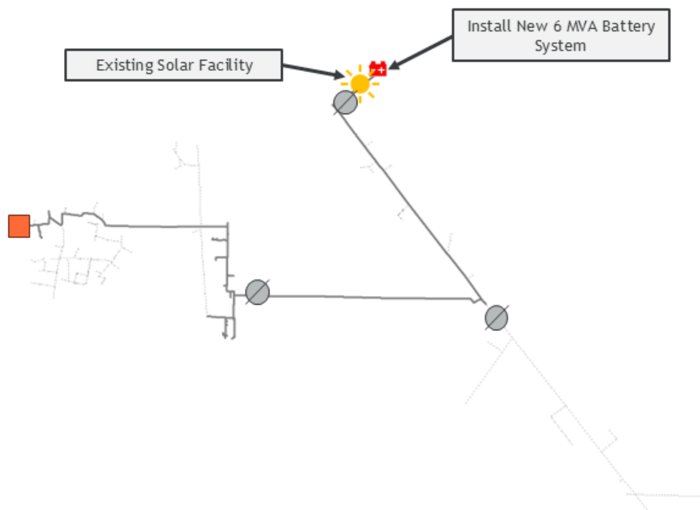
Confidential Information

JARA12 - 2 MVA BESS Only

Hosting Capacity	
Base HC	3.27 MW
Max HC	4.85 MW
HC Increase	1.58 MW

Reverse Flow Limits Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,300,000



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	1.58
Cost ($)	14,300,000
Hosting Capacity Benefit Cost	0.11
Holistic System Benefit Cost	0.74

1898 & Co.

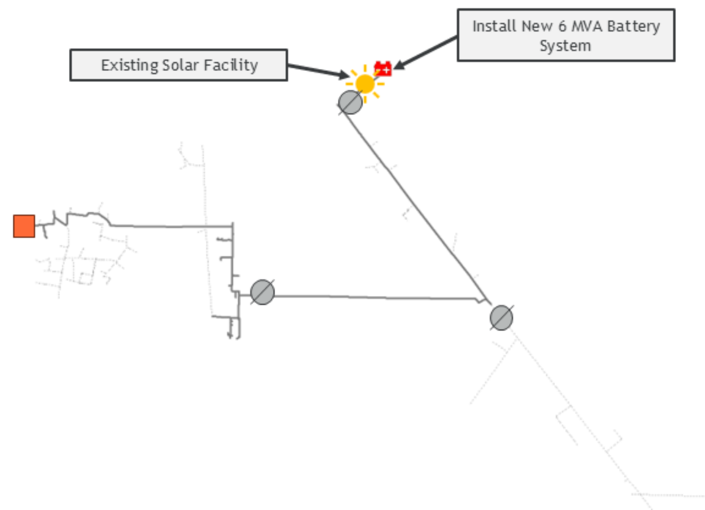
71

Confidential Information

JARA12 - 6 MVA BESS Only

Hosting Capacity	
Base HC	3.27 MW
Max HC	7.17 MW
HC Increase	3.9 MW

Thermal Loading Limits
Max HC



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

System Improvement	Cost
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,350,000

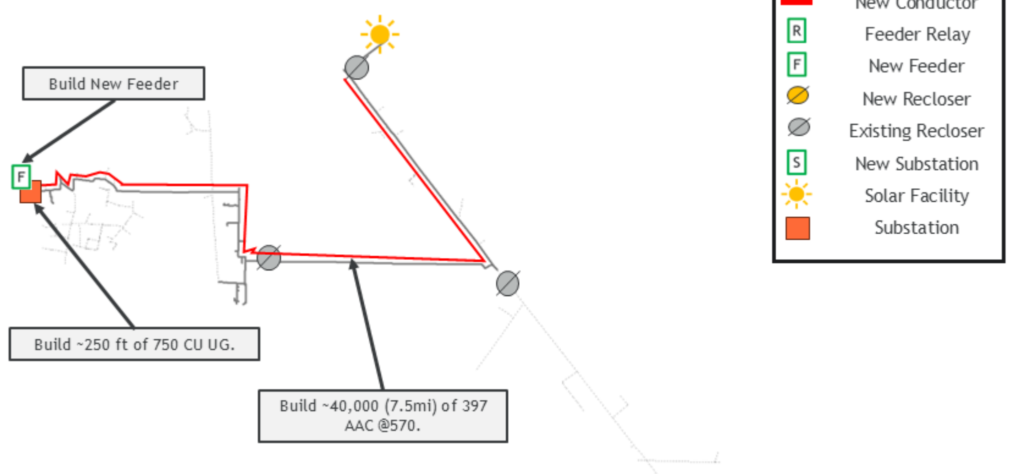
Financial Analysis	
Hosting Capacity Increase (MW)	3.90
Cost ($)	14,350,000
Hosting Capacity Benefit Cost	0.27
Holistic System Benefit Cost	1.39

JARA12 - Dedicated Feeder

Hosting Capacity	
Base HC	3.27 MW
Max HC	12.01 MW
HC Increase	8.74 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~200ft of new 750 CU cable from the Jarales 11 Substation to a new riser pole.	$83,839
Build ~40,000ft (7.5mi) of new 397 AAC @ 570. Utilize double circuit construction along the existing path of Jarales 12 feeder main line conductor.	$5,676,936
Install Breaker and SEL 751 Relay for the New Feeder.	$120,481
TOTAL	$5,881,256



Financial Analysis	
Hosting Capacity Increase (MW)	8.74
Cost ($)	5,881,256
Hosting Capacity Benefit Cost	1.49
Holistic System Benefit Cost	0.06

1898 & Co.

Confidential Information

JARA12 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades*	-	-	-	-	-	-
Feeder Upgrades with 2 MVA BESS*	-	-	-	-	-	-
2 MVA BESS Only	3,269	4,846	1,577	$14,300,000	0.11	0.74
Feeder Upgrades with 6 MVA BESS*	-	-	-	-	-	-
6 MVA BESS Only	3,269	7,166	3,897	$14,350,000	0.27	1.39
Dedicated Feeder	3,269	12,011	8,742	$5,881,256	1.49	0.06

*This scenario was not applicable to this analysis.

The 6 MVA BESS only solution is proposed for Jarales Feeder 12. The 6 MVA BESS scored the highest holistic benefit cost ratio. No feeder upgrades are applicable as this feeder is built to the maximum PNM standard.

1898 & Co.

LOHO12 Analysis

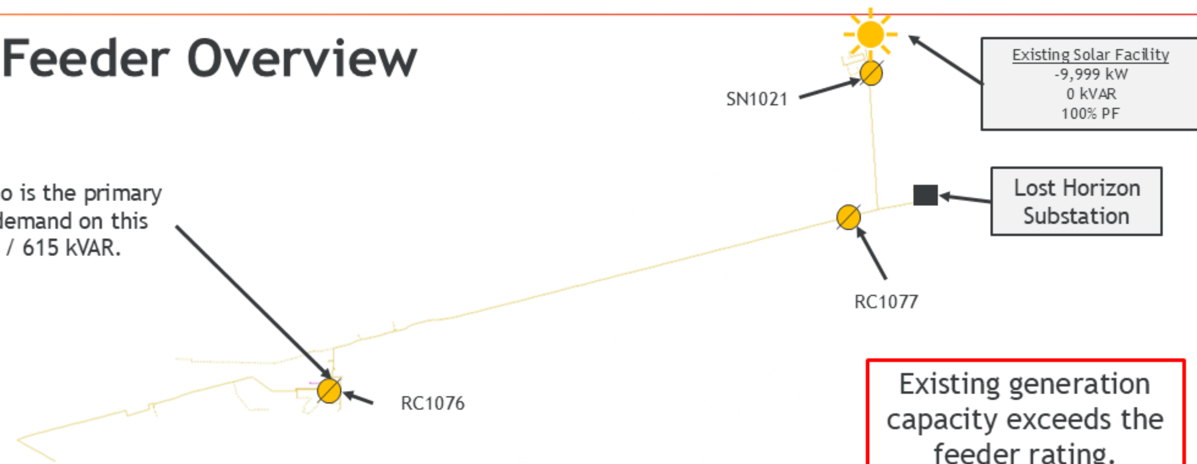
1898 & Co.

Confidential Information

75

LOHO12 - Feeder Overview

Laguna Route 66 Casino is the primary source of customer demand on this feeder - 1,233 kW / 615 kVAR.



Existing generation capacity exceeds the feeder rating.

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	LOHO12 Breaker	480
Recloser	RC1076	70
Recloser	RC1077	400
Recloser	SN1021	600

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,258	268	8,263	-100	380	372	377	120.0	124.9	86.0

Feeder Data

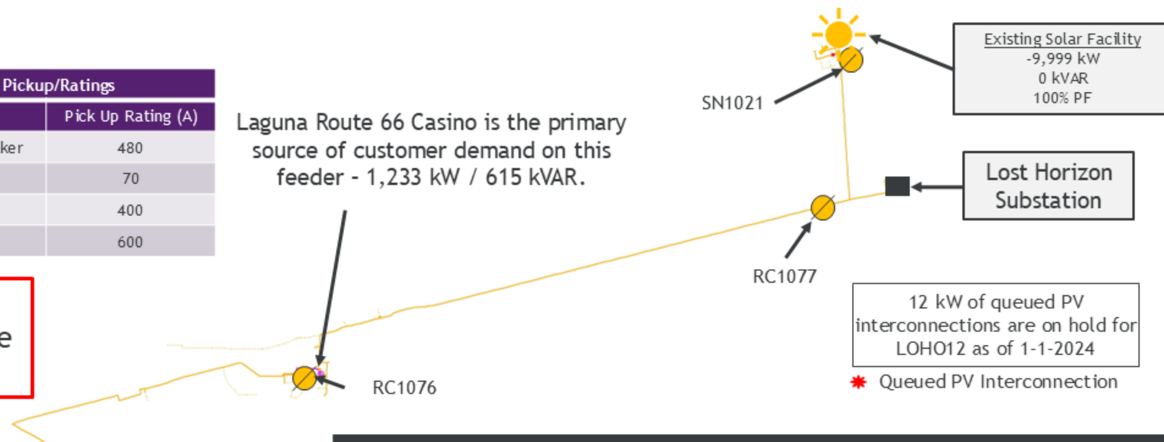
- Feeder Rating: 9,288 kVA
- Existing Generation: 10,004 kVA
- Minimum Daylight Load: -8,260 kW
- Minimum Daylight Gross Load: 1,459 kW / 791 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV

1898 & Co.

LOHO12 - Feeder Overview with Queued Solar as of 1-1-2024

Protection & Equipment Pickup/Ratings		
Device	**Name**	**Pick Up Rating (A)**
Breaker	LOHO12 Breaker	480
Recloser	RC1076	70
Recloser	RC1077	400
Recloser	SN1021	600

Existing generation capacity exceeds the feeder rating.



Feeder Data

- Feeder Rating: 9,288 kVA
- Existing Generation: 10,017 kVA
- Minimum Daylight Load: -8,272 kW
- Minimum Daylight Gross Load: 1,447 kW / 784 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 2
- Total Queued AC Inverter Nameplate: 12 kW

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,272	269	8,276	-100	380	374	377	120.0	124.9	86.0

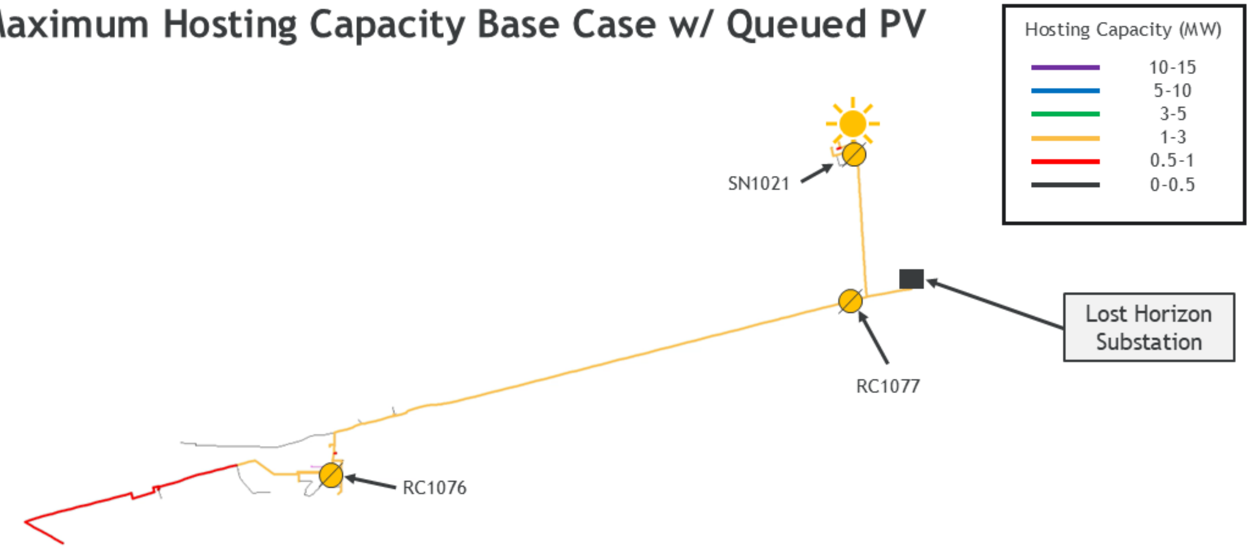
The feeder can serve queued PV interconnection requests without violations.

1898 & Co.

77

Confidential Information

LOHO12 - Maximum Hosting Capacity Base Case w/ Queued PV



Maximum Hosting Capacity
1.06 MW

Limiting Factors	
Thermal Loading Violation	78%
Voltage Violation	22%

Feeder Observations

- Feeder getaway is built to 750 CU which is the maximum PNM standard getaway cable.
- The pickup of the feeder relay (480 Amps) is limiting the hosting capacity of the feeder.
- Enabling directional settings for the existing SEL 751 relay would increase hosting capacity.

1898 & co.

Confidential Information

78

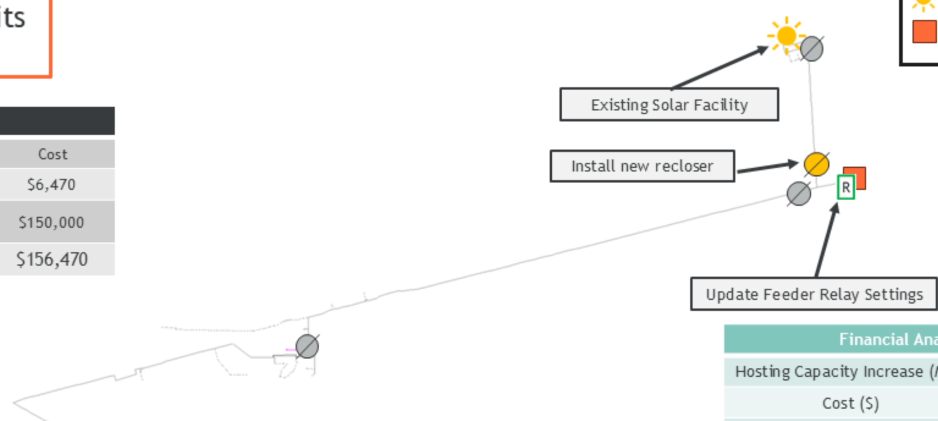
LOHO12 - Feeder Upgrades

Hosting Capacity	
Base HC	1.06 MW
Max HC	2.96 MW
HC Increase	1.9 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Update Feeder Relay Settings	$6,470
Install new Recloser to mitigate EOL fault desensitization.	$150,000
TOTAL	$156,470

Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation



Financial Analysis	
Hosting Capacity Increase (MW)	1.90
Cost ($)	156,470
Hosting Capacity Benefit Cost	12.14
Holistic System Benefit Cost	1.26

1898 & co.

Confidential Information

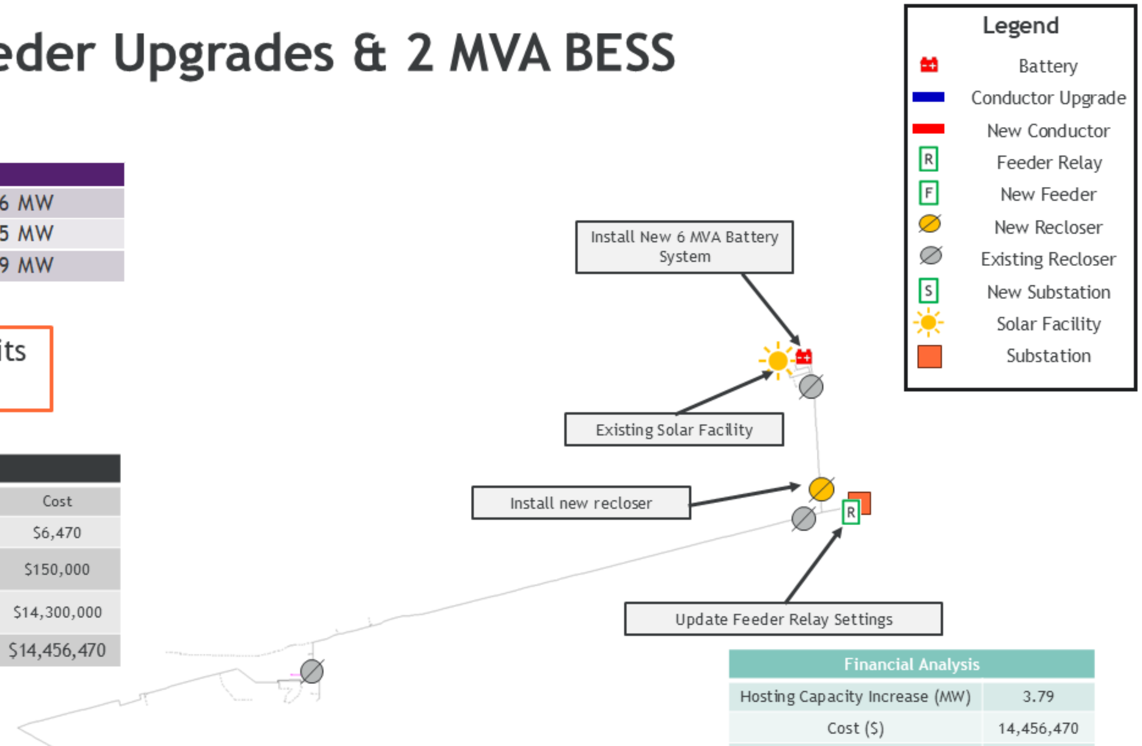
79

LOHO12 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	1.06 MW
Max HC	4.85 MW
HC Increase	3.79 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Update Feeder Relay Settings	$6,470
Install new recloser to mitigate potential EOL desensitization.	$150,000
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,456,470



Financial Analysis	
Hosting Capacity Increase (MW)	3.79
Cost ($)	14,456,470
Hosting Capacity Benefit Cost	0.26
Holistic System Benefit Cost	0.74

1898 & Co.

Confidential Information

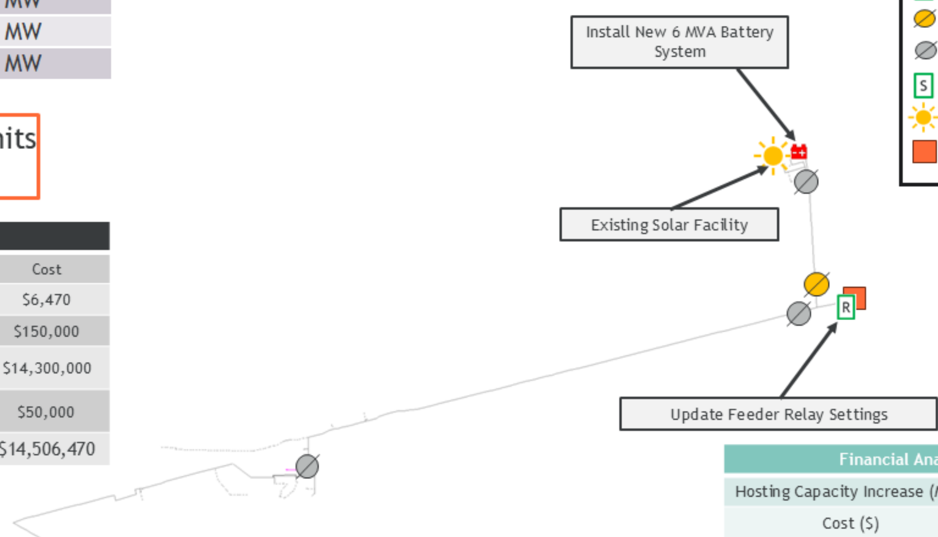
80

LOHO12 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	1.06 MW
Max HC	7.11 MW
HC Increase	6.05 MW

Thermal Loading Limits
Max HC

System Improvement	
	Cost
Update Feeder Relay Settings	$6,470
New Recloser	$150,000
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,506,470



Financial Analysis	
Hosting Capacity Increase (MW)	6.05
Cost ($)	14,506,470
Hosting Capacity Benefit Cost	0.42
Holistic System Benefit Cost	1.37

1898 & co.

Confidential Information

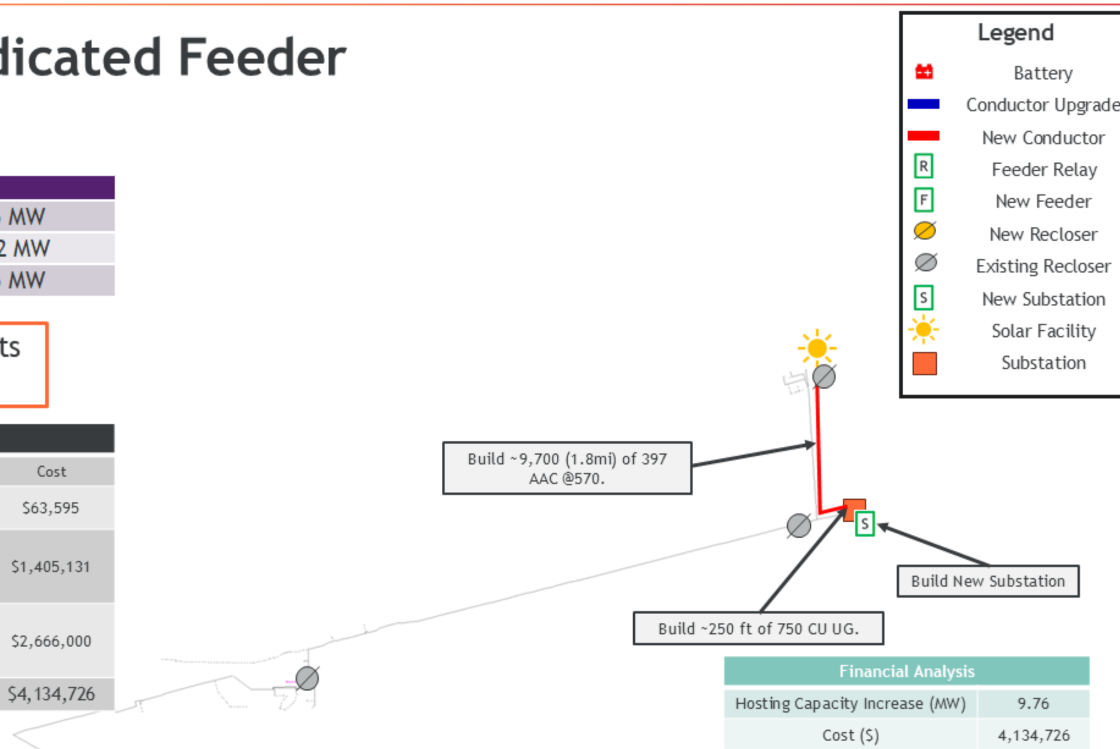
81

LOHO12 - Dedicated Feeder

Hosting Capacity	
Base HC	1.06 MW
Max HC	10.82 MW
HC Increase	9.76 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Build ~250ft of new 750 CU cable from the New Lost Horizon Substation to a new riser pole.	$63,595
Build ~9,700ft (1.8mi) of new 397 AAC @ 570. Utilize double circuit construction along the existing path of Lost Horizon 12 feeder main line conductor.	$1,405,131
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment. Cost shared with the other Lost Horizon Substation feeders (3 total feeders)	$2,666,000
TOTAL	$4,134,726



Financial Analysis	
Hosting Capacity Increase (MW)	9.76
Cost ($)	4,134,726
Hosting Capacity Benefit Cost	2.36
Holistic System Benefit Cost	0.08

1898 & Co.

82

LOHO12 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	1,060	2,960	1,900	$156,470	12.14	1.26
Feeder Upgrades with 2 MVA BESS	1,060	4,853	3,793	$14,456,470	0.26	0.74
2 MVA BESS Only*	-	-	-	-	-	-
Feeder Upgrades with 6 MVA BESS	1,060	7,110	6,050	$14,506,470	0.42	1.37
6 MVA BESS Only*	-	-	-	-	-	-
Dedicated Feeder	1,060	10,818	9,758	$4,134,726	2.36	0.08

*This scenario was not applicable to this analysis.

The Dedicated Feeder Buildout solution is proposed for Lost Horizon Feeder 12. There are three existing large-scale PV facilities served by Lost Horizon feeders. A new substation transformer and switchgear is required to build out this dedicated feeder, but the substation cost can be shared across three feeders.

1898 & Co.

LOHO13 Analysis

1898 & Co.

Confidential Information

84

LOHO13 - Feeder Overview

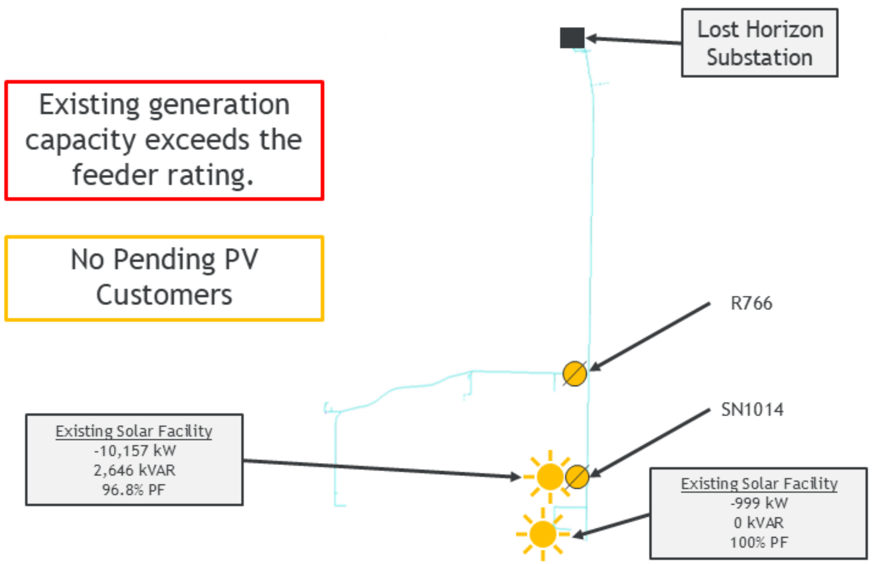
Feeder Data

- Feeder Rating: 11,231 kVA
- Existing Generation: 12,073 kVA
- daylight Minimum Load: -10,962 kW
- daylight Minimum Gross Load: 527 kW / 34 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV

Existing generation capacity exceeds the feeder rating.

No Pending PV Customers

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	LOHO13 Breaker	660
Recloser	SN1014	550
Recloser	R766	140



LOHO13 historically has exceeded the feeder rating due to excess PV generation. Inverter settings were adjusted in the field to reduce power factor and mitigate potential overloads.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-10,962	2,075	11,157	-98	506	508	510	122.0	123.7	98.0

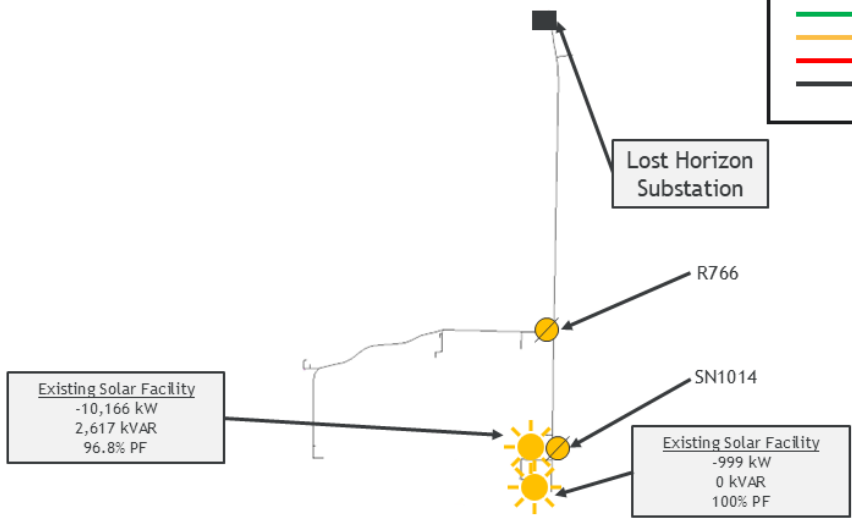
1898 & Co.

LOHO13 - Maximum Hosting Capacity Base Case

Maximum Hosting Capacity
270 kW

Limiting Factors	
Thermal Loading Violation	100%
Voltage Violation	0%

Hosting Capacity (MW)	
Purple	10-15
Blue	5-10
Green	3-5
Yellow	1-3
Red	0.5-1
Black	0-0.5



Feedeer Observations

- The existing generation has exhausted most of the hosting capacity of LOHO13 in its current state.
- The feeder getaway is built to the maximum PNM standard rating - 750 CU cable.
- Increasing gross feeder load would consume excess generation and increase the feeder hosting capacity.

1898 co.

Confidential Information

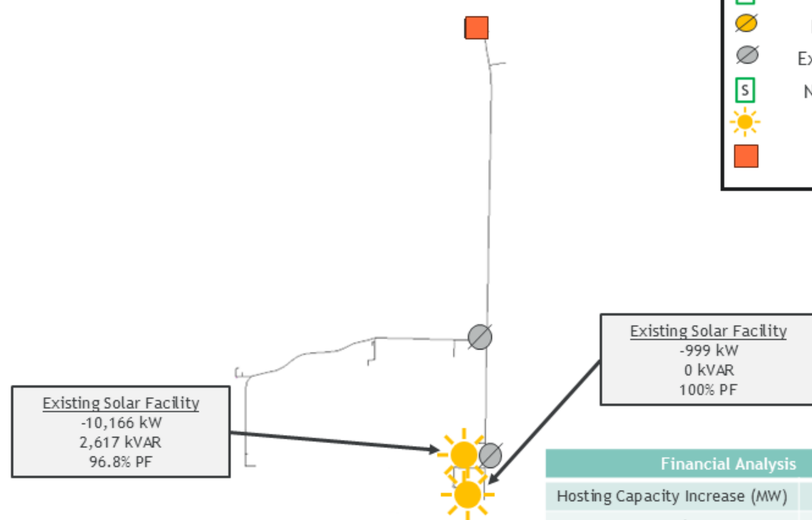
86

LOHO13 - Feeder Upgrades

Hosting Capacity	
Base HC	0.27 MW
Max HC	0.27 MW
HC Increase	0 MW

Reverse Flow Limits Max HC

System Improvement	
	Cost
No traditional system upgrades are applicable. The feeder is built to the maximum PNM conductor and equipment standards.	$0
TOTAL	$0



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	0
Cost ($)	0
Hosting Capacity Benefit Cost	-
Holistic System Benefit Cost	-

1898 & Co.

Confidential Information

87

LOHO13 - 2 MVA BESS Only

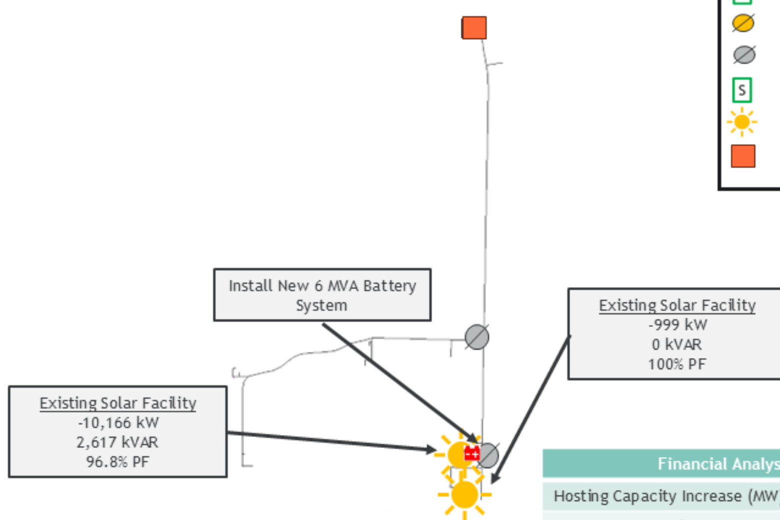
Hosting Capacity	
Base HC	0.27 MW
Max HC	2.16 MW
HC Increase	1.89 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,300,000

Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation



Financial Analysis	
Hosting Capacity Increase (MW)	1.89
Cost ($)	14,300,000
Hosting Capacity Benefit Cost	0.13
Holistic System Benefit Cost	0.75

1898 & Co.

88

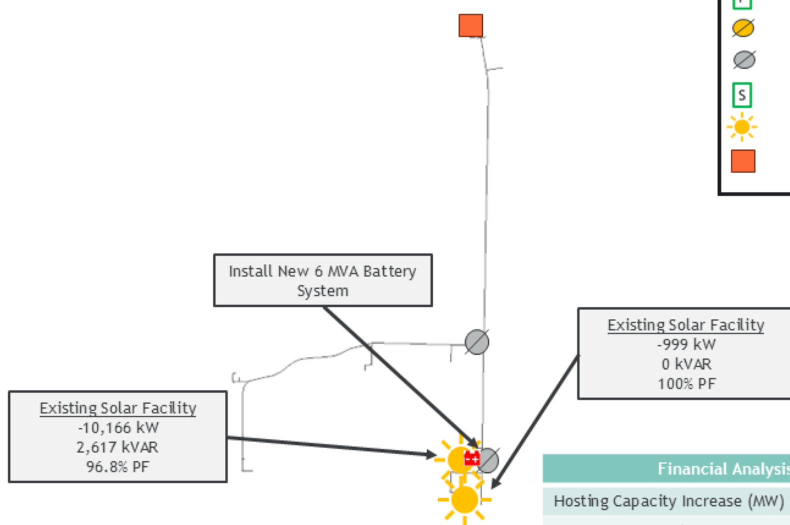
Confidential Information

LOHO13 - 6 MVA BESS Only

Hosting Capacity	
Base HC	0.27 MW
Max HC	5.35 MW
HC Increase	5.08 MW

Thermal Loading Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,350,000



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
Hosting Capacity Increase (MW)	5.08
Cost ($)	14,350,000
Hosting Capacity Benefit Cost	0.35
Holistic System Benefit Cost	1.39

1898 & Co.

Confidential Information

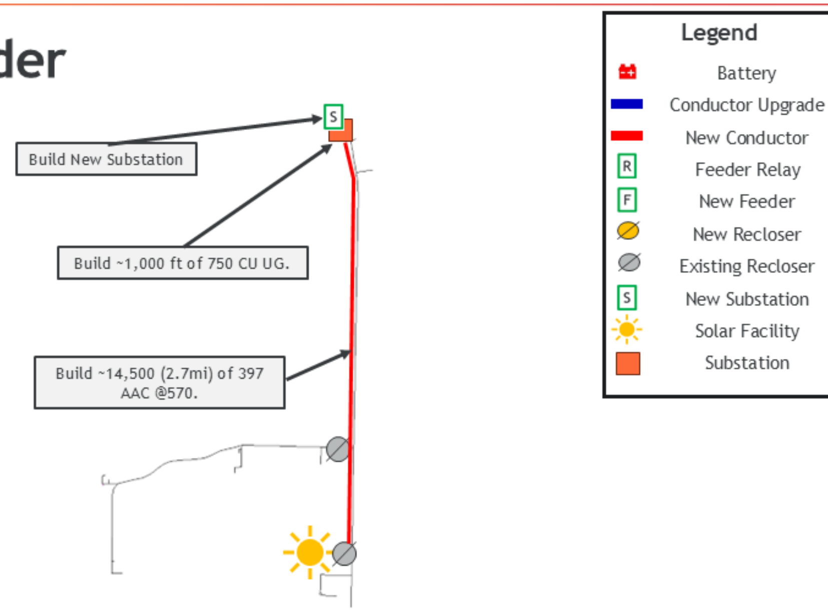
89

LOHO13 - Dedicated Feeder

Hosting Capacity	
Base HC	0.27 MW
Max HC	10.16 MW
HC Increase	9.89 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~1,000ft of new 750 CU cable from the New Lost Horizon Substation to a new riser pole.	$208,147
Build ~14,500ft (2.7mi) of new 397 AAC @ 570. Utilize double circuit construction along the existing path of Lost Horizon 13 feeder main line conductor.	$2,081,853
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment. Cost shared with the other Lost Horizon Substation feeders (3 total feeders)	$2,666,000
TOTAL	$4,956,000



Financial Analysis	
Hosting Capacity Increase (MW)	9.89
Cost ($)	4,956,000
Hosting Capacity Benefit Cost	2.00
Holistic System Benefit Cost	0.07

1898 & Co.

Confidential Information

90

LOHO13 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades*	-	-	-	-	-	-
Feeder Upgrades with 2 MVA BESS*	-	-	-	-	-	-
2 MVA BESS Only	267	2,157	1,890	$14,300,000	0.13	0.75
Feeder Upgrades with 6 MVA BESS*	-	-	-	-	-	-
6 MVA BESS Only	267	5,346	5,079	$14,350,000	0.35	1.39
Dedicated Feeder	267	10,165	9,898	$4,956,000	2.00	0.07

*This scenario was not applicable to this analysis.

The Dedicated Feeder Buildout solution is proposed for Lost Horizon Feeder 13. There are three existing large-scale PV facilities served by Lost Horizon feeders. A new substation transformer and switchgear is required to build out this dedicated feeder, but the substation cost can be shared across three feeders.

LOHO14 Analysis

1898 & Co.

Confidential Information

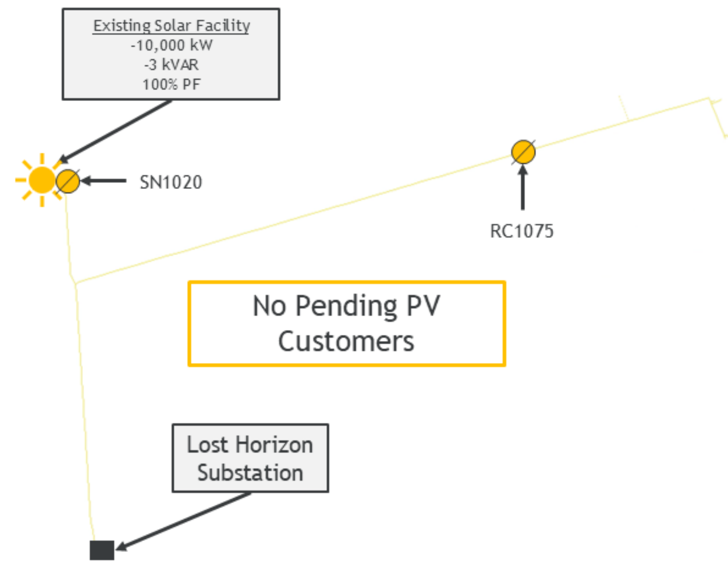
92

LOHO14 - Feeder Overview

Feeder Data

- Feeder Rating: 11,231 kVA
- Existing Generation: 9,999 kVA
- daylight Minimum Load: -9,616 kW
- daylight Minimum Gross Load: 136 kW / 511 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	LOHO14 Breaker	600
Recloser	RC1075	500
Recloser	SN1020V	600



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-9,616	1,146	9,684	-99	445	432	446	122.0	124.6	86

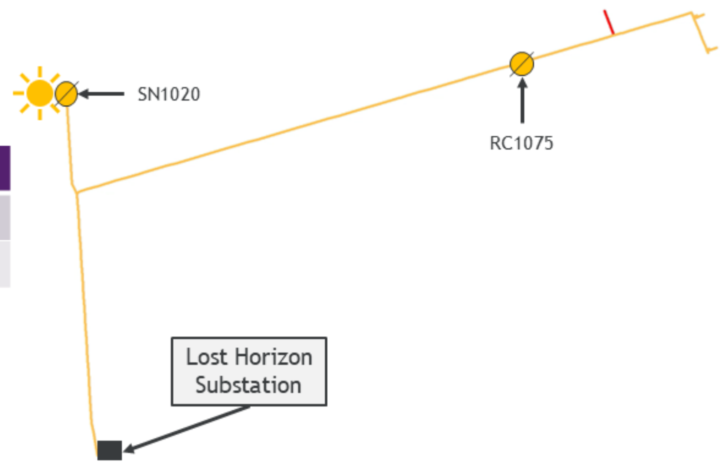
1898 co.

LOHO14 - Maximum Hosting Capacity Base Case

Hosting Capacity (MW)	
Purple	10-15
Blue	5-10
Green	3-5
Yellow	1-3
Red	0.5-1
Black	0-0.5

Maximum Hosting Capacity
1.62 MW

Limiting Factors	
Thermal Loading Violation	97%
Voltage Violation	3%

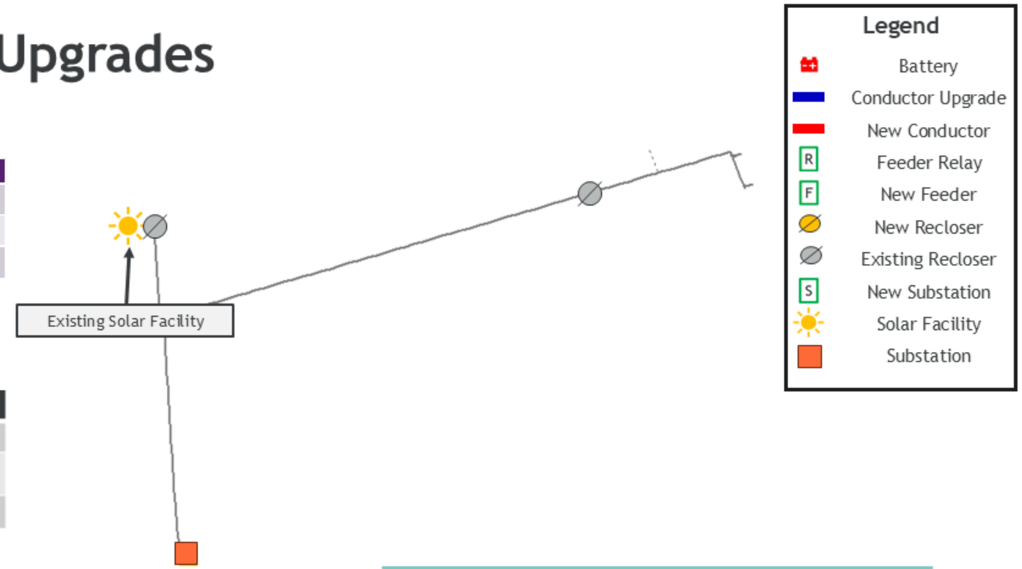


Feedér Observations

- The feeder getaway is 750 CU and is the maximum PNM standard getaway cable.
- The existing generation is consuming most of the hosting capacity for this feeder.
- There is very minimal minimum daylight gross load to consume excess generation on this feeder.

LOHO14 - Feeder Upgrades

Hosting Capacity	
Base HC	1.62 MW
Max HC	1.62 MW
HC Increase	0 MW



System Improvement	
	Cost
No traditional system improvements were necessary	$0
TOTAL	$0

Financial Analysis	
HC Increase	0
Cost ($)	0
Hosting Capacity Benefit Cost	-
Holistic System Benefit Cost	-

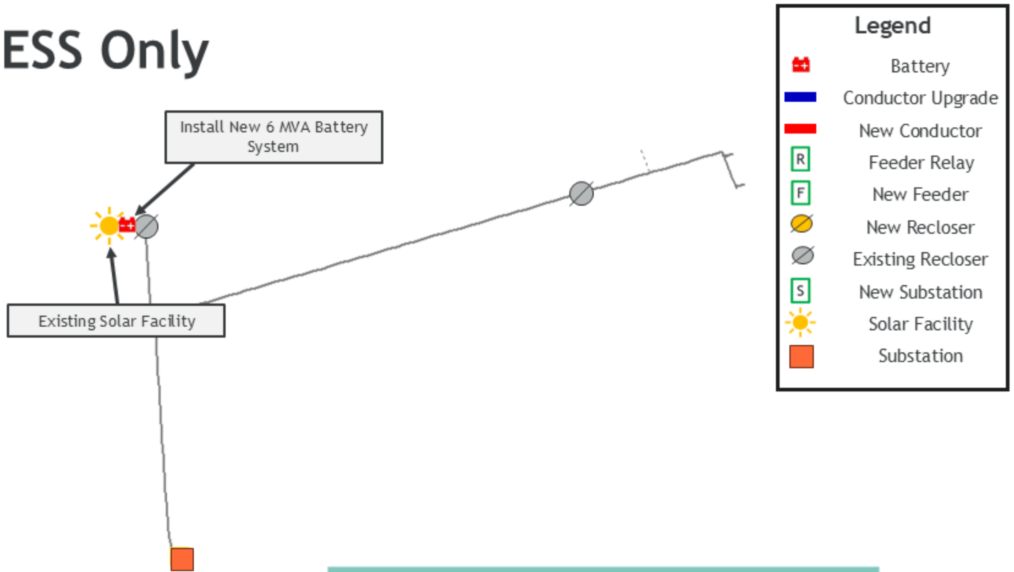
1898 & Co.

LOHO14 - 2 MVA BESS Only

Hosting Capacity	
Base HC	1.62 MW
Max HC	3.51 MW
HC Increase	1.89 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,300,000



Financial Analysis	
HC Increase	1.89
Cost ($)	14,300,000
Hosting Capacity Benefit Cost	0.13
Holistic System Benefit Cost	0.75

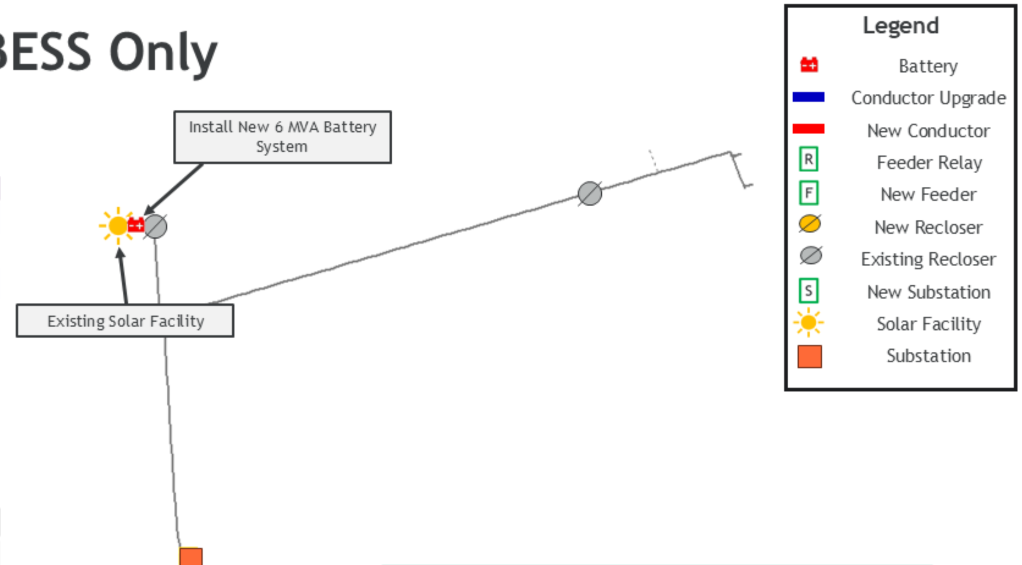
1898 & co.

LOHO14 - 6 MVA BESS Only

Hosting Capacity	
Base HC	1.62 MW
Max HC	7.13 MW
HC Increase	5.51 MW

Thermal Loading Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,350,000



Financial Analysis	
HC Increase	5.51
Cost ($)	14,350,000
Hosting Capacity Benefit Cost	0.38
Holistic System Benefit Cost	1.39

1898 & co.

Confidential Information

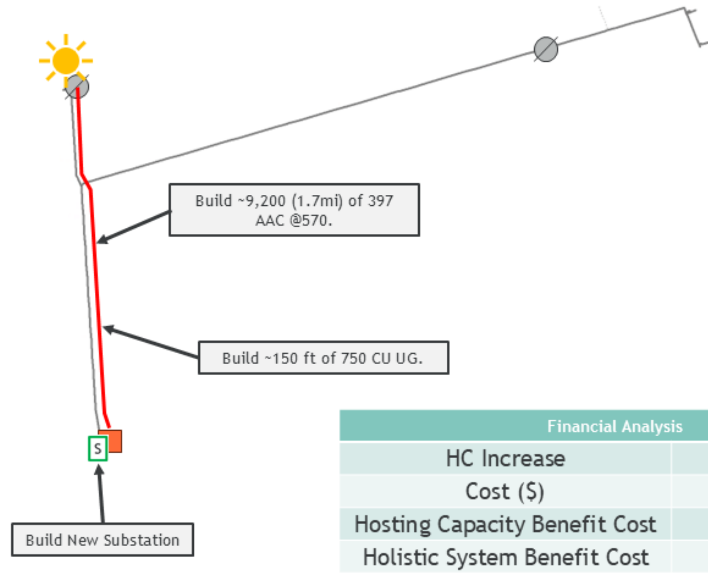
97

LOHO14 - Dedicated Feeder

Hosting Capacity	
Base HC	1.62 MW
Max HC	11.38 MW
HC Increase	9.76 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~150ft of new 750 CU cable from the New Lost Horizon Substation to a new riser pole.	$42,830
Build ~9,200ft (1.7mi) of new 397 AAC @ 570. Utilize double circuit construction along the existing path of Lost Horizon 14 feeder main line conductor.	$1,334,640
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment. Cost shared with the other Lost Horizon Substation feeders (3 total feeders)	$2,666,000
TOTAL	$4,043,470



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	9.76
Cost ($)	4,043,470
Hosting Capacity Benefit Cost	2.41
Holistic System Benefit Cost	0.09

1898 & co.

Confidential Information

98

LOHO14 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades*	-	-	-	-	-	-
Feeder Upgrades with 2 MVA BESS*	-	-	-	-	-	-
2 MVA BESS Only	1,616	3,512	1,896	$14,300,000	0.13	0.75
Feeder Upgrades with 6 MVA BESS*	-	-	-	-	-	-
6 MVA BESS Only	1,616	7,128	5,512	$14,350,000	0.38	1.39
Dedicated Feeder	1,616	11,376	9,760	$4,043,470	2.41	0.09

*This scenario was not applicable to this analysis.

The Dedicated Feeder Buildout solution is proposed for Lost Horizon Feeder 14. There are three existing large-scale PV facilities served by Lost Horizon feeders. A new substation transformer and switchgear is required to build out this dedicated feeder, but the substation cost can be shared across three feeders.

1898 & Co.

LSMO12 Analysis

Confidential Information

100

LSMO12 - Feeder Overview

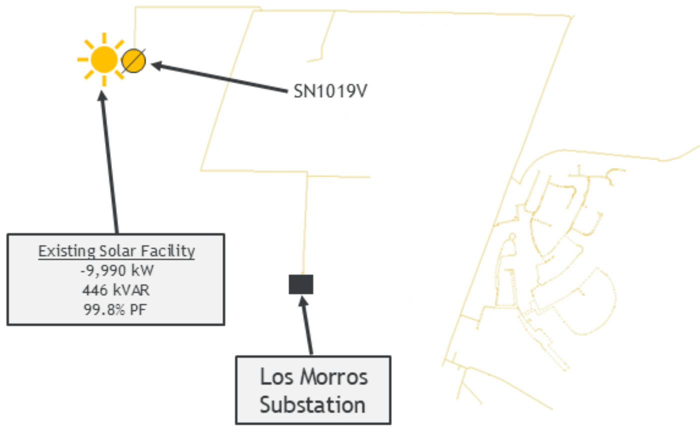
Existing generation capacity exceeds the feeder rating.

Feeder Data

- Feeder Rating: 9,288 kVA
- Existing Generation: 10,216 kVA
- Minimum Daylight Load: -9,682 kW
- Minimum Daylight Gross Load: 307 kW / 302 kVAR
- Substation LTC Setpoint: 123 V
- Primary Voltage: 12.47 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	LOMO12 Breaker	480
Recloser	SN1019V	600

LSMO12 feeder could operate beyond the normal feeder rating if all generation is operating at 100% output coincident with minimum daylight load. This represents risk to the PNM system.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-9,682	1,177	9,753	-99	439	449	434	123.0	125.4	106.0

1898 & Co.

Confidential Information

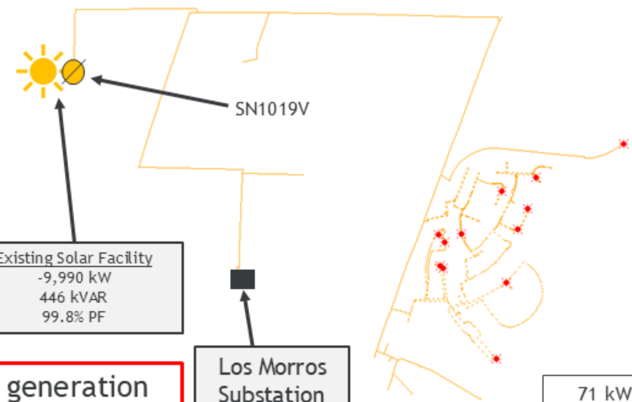
101

LSMO12 - Feeder Overview with Queued Solar

Feeder Data

- Feeder Rating: 9,288 kVA
- Existing Generation: 10,288 kVA
- Minimum Daylight Load: -9,751 kW
- Minimum Daylight Gross Load: 307 kW / 302 kVAR
- Substation LTC Setpoint: 123 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 17
- Total Queued AC Inverter Nameplate: 71 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	LSMO12 Breaker	480
Recloser	SN1019V	600



Existing generation capacity exceeds the feeder rating.

71 kW of queued PV interconnections are on hold for LSMO12

Queued PV Interconnection

The feeder CANNOT serve queued PV interconnection requests without violations.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-9,751	1,184	9,823	-99	443	454	444	123.0	125.4	106.0

1898 & Co.

Confidential Information

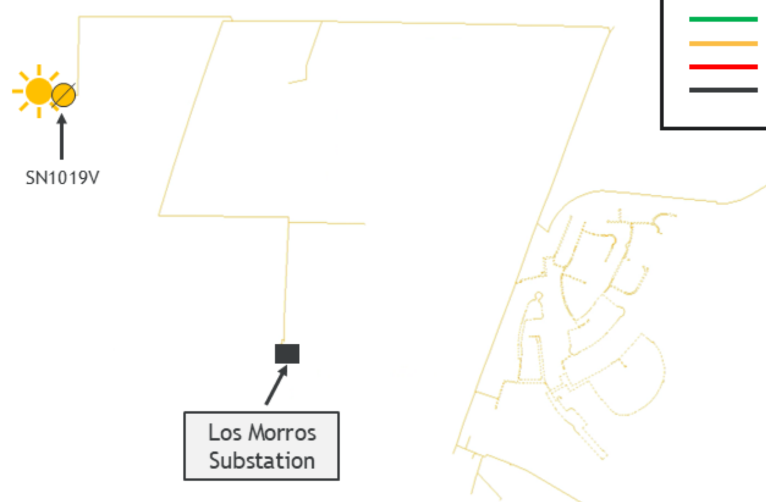
102

LSMO12 - Maximum Hosting Capacity Base Case w/ Queued PV

Hosting Capacity (MW)
10-15
5-10
3-5
1-3
0.5-1
0-0.5

Feedeer Observations

- There is ZERO hosting capacity available in this feeder in the base case scenario.
- The existing generation exceeds the feeder rating. The feeder is rated at 430A or 9,288 kVA due to the overhead conductor 397 AAC and the feeder relay pick up setting of 480A.
- A 106% thermal overload is observed at the feeder getaway if generation is at full output and is coincident with minimum daylight load.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-9,755	1,183	9,827	-99	443	454	434	123.0	125.4	106.0

1898 & co.

Confidential Information

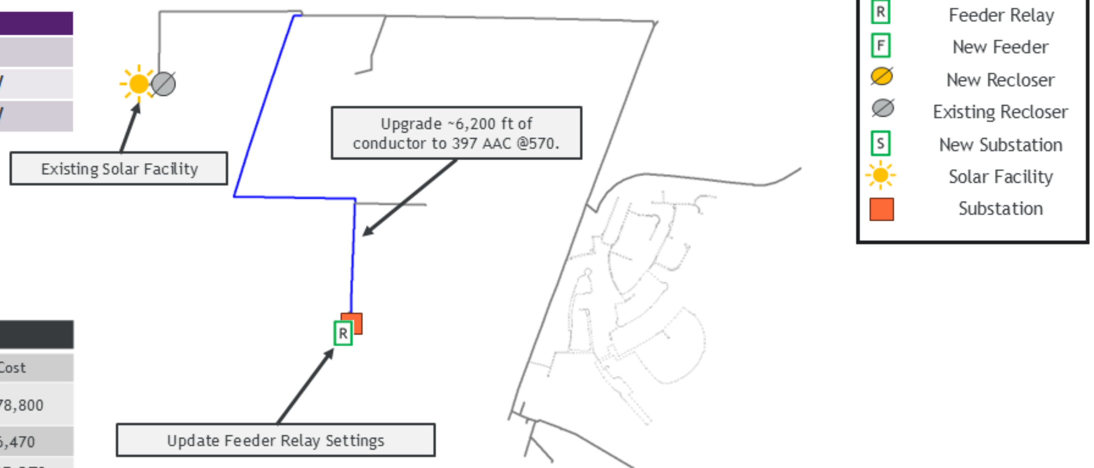
103

LSM012 - Feeder Upgrades

Hosting Capacity	
Base HC	0 MW
Max HC	1.47 MW
HC Increase	1.47 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Upgrade ~6,200 ft of 1/0 ACSR to 397 AAC @570 from Pole C28D034 to Pole C28B081.	$878,800
Update Feeder Relay Settings.	$6,470
TOTAL	$885,270



Financial Analysis	
HC Increase	1.47
Cost ($)	885,270
Hosting Capacity Benefit Cost	1.66
Holistic System Benefit Cost	0.21

1898 & co.

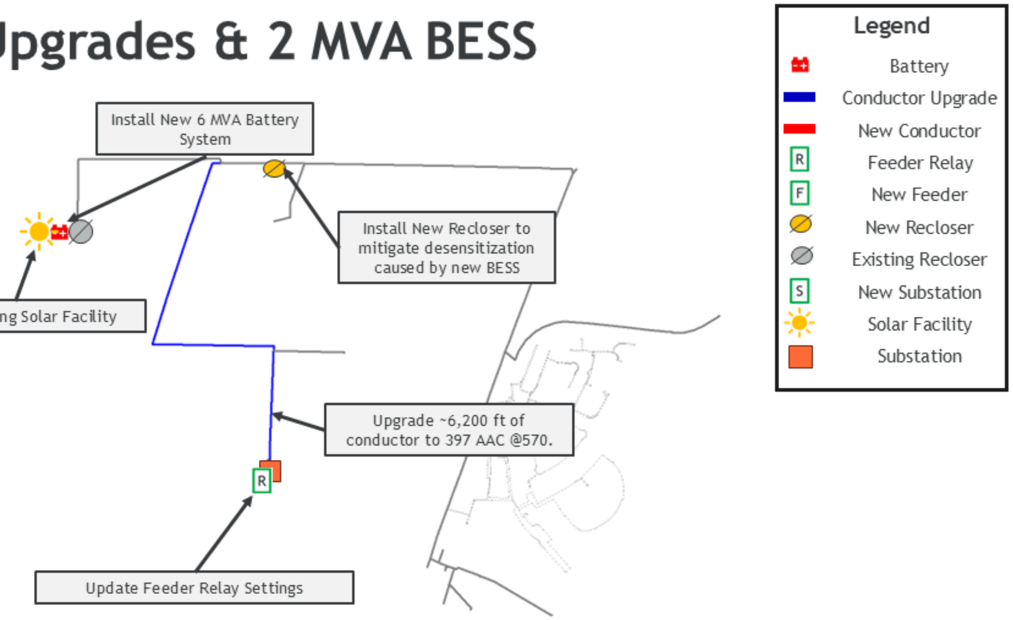
104

Confidential Information

LSMO12 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	0 MW
Max HC	3.37 MW
HC Increase	3.37 MW

Reverse Flow Limits
Max HC



System Improvement	Cost
Upgrade ~6,200 ft of 1/0 ACSR to 397 AAC @570 from Pole C28D034 to Pole C28B081.	$878,811
Update Feeder Relay Settings.	$6,470
Install New 6 MVA Battery. (Operating at 2 MVA Charging/Discharging)	$14,300,000
New Recloser	$150,000
TOTAL	$15,335,281

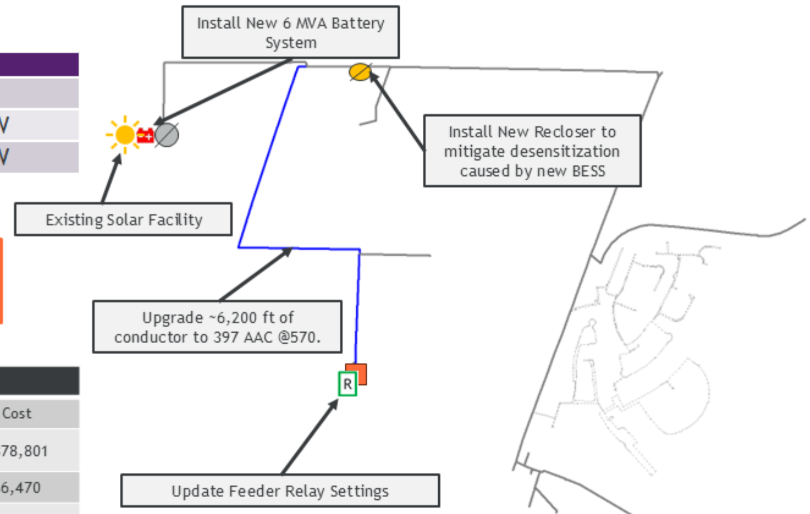
Financial Analysis	
HC Increase	3.37
Cost ($)	15,335,271
Hosting Capacity Benefit Cost	0.22
Holistic System Benefit Cost	0.7

1898 & co.

LSMO12 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	0 MW
Max HC	6.98 MW
HC Increase	6.98 MW

Thermal Loading Limits
Max HC



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

System Improvement	Cost
Upgrade ~6,200 ft of 1/0 ACSR to 397 AAC @570 from Pole C28D034 to Pole C28B081	$878,801
Update Feeder Relay Settings	$6,470
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
New Recloser	$150,000
TOTAL	$15,385,271

Financial Analysis	
HC Increase	6.98
Cost ($)	15,385,271
Hosting Capacity Benefit Cost	0.45
Holistic System Benefit Cost	1.3

1898 & Co.

Confidential Information

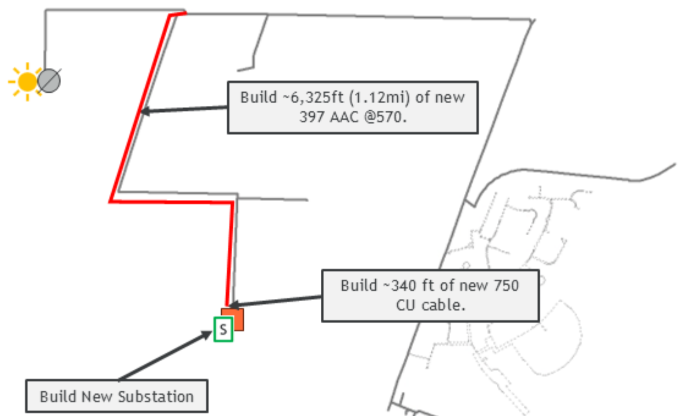
106

LSMO12 - Dedicated Feeder

Hosting Capacity	
Base HC	0 MW
Max HC	9.3 MW
HC Increase	9.3 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~340 ft of new 750 CU cable from the New Lost Morros Substation to a new riser pole.	$82,283
Build ~6,325ft (1.2 mi) of new 397 AAC @570. Utilize double circuit construction along the existing path of Los Morros 12 main line conductor.	$929,311
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$4,000,000
TOTAL	$5,011,594



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	9.3
Cost ($)	5,011,594
Hosting Capacity Benefit Cost	1.85
Holistic System Benefit Cost	0.07

1898 & Co.

Confidential Information

107

LSMO12 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	Thermal Violation	1,469	1,469	$885,270	1.66	0.21
Feeder Upgrades with 2 MVA BESS	Thermal Violation	3,373	3,373	$15,335,281	0.22	0.7
2 MVA BESS Only*	-	-	-	-	-	-
Feeder Upgrades with 6 MVA BESS	Thermal Violation	6,980	6,980	$15,385,271	0.45	1.3
6 MVA BESS Only*	-	-	-	-	-	-
Dedicated Feeder	Thermal Violation	9,296	9,296	$5,011,594	1.85	0.07

*This scenario was not applicable to this analysis.

The Feeder Upgrades and 6 MVA BESS solution is proposed for Los Morros Feeder 12. Feeder upgrades should be performed first for this feeder and as PV penetration increases or as the system requires more energy storage, a 6 MVA BESS can be constructed to continue increasing hosting capacity on Los Morros Feeder 12.

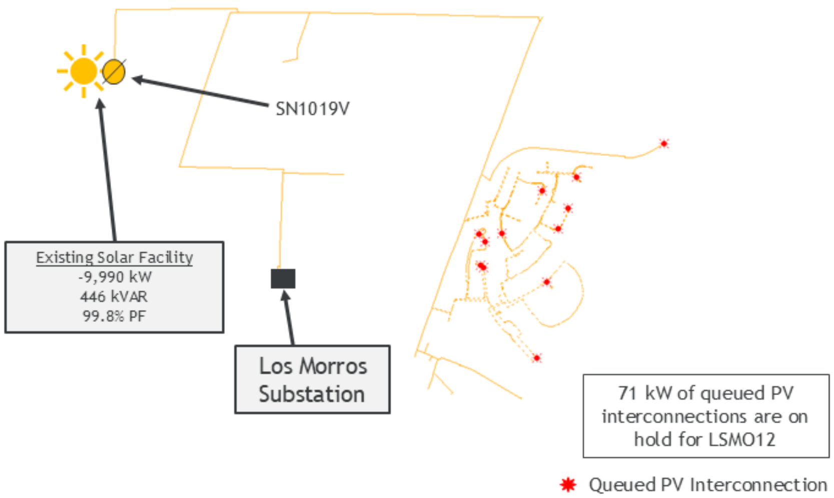
LSMO12 - Feeder Overview with Queued Solar with Feeder Upgrades and 6 MVA BESS Solution Constructed

Feeder Data

- Feeder Rating: 11,231 kVA
- Existing Generation: 10,288 kVA
- Minimum Daylight Load: -4,019 kW
- Minimum Daylight Gross Load: 307 kW / 302 kVAR
- Substation LTC Setpoint: 123 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 17
- Total Queued AC Inverter Nameplate: 71 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	LSMO12 Breaker	480
Recloser	SN1019V	600

The feeder can serve queued PV interconnection requests without violations.



Feeder Upgrades & 6 MVA BESS Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-4,019	449	4,044	-99	184	184	180	123.0	123.9	86.2

1898 co.

Confidential Information

109

LSMO21 Analysis

1898 & Co.

Confidential Information

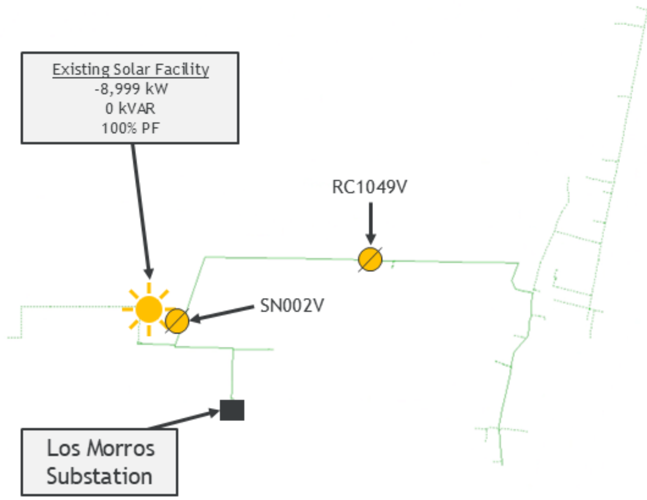
110

LSMO21 - Feeder Overview

Feeder Data

- Feeder Rating: 9,288 kVA
- Existing Generation: 9,032 kVA
- Minimum Daylight Load: -7,944 kW
- Minimum Daylight Gross Load: 848 kW / -3 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	LOMO21 Breaker	600
Recloser	RC1049V	460
Recloser	SN002V	450



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-7,994	333	8,001	-100	364	368	361	122.0	123.4	97.0

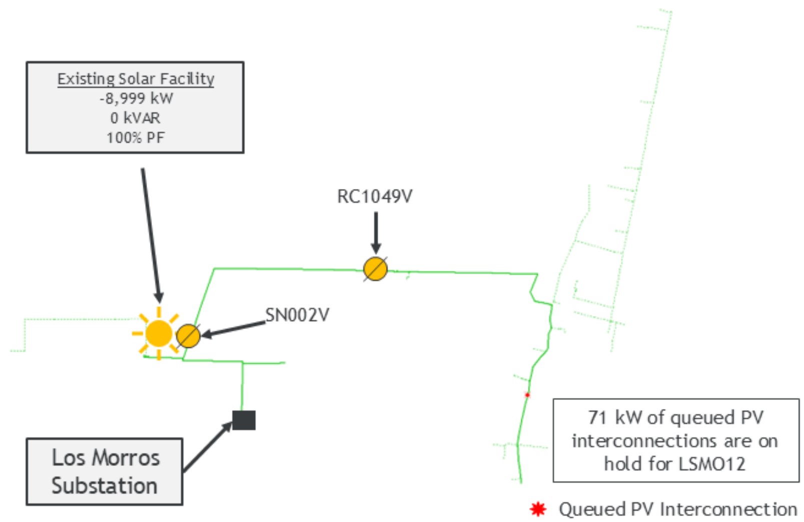
1898 & co.

LSMO21 - Feeder Overview with Queued Solar

Feeder Data

- Feeder Rating: 9,288 kVA
- Existing Generation: 9,040 kVA
- Minimum Daylight Load: -8,001 kW
- Minimum Daylight Gross Load: 848 kW / -3 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 1
- Total Queued AC Inverter Nameplate: 8 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	LOMO21 Breaker	600
Recloser	RC1049V	460
Recloser	SN002V	450



The feeder can serve queued PV interconnection requests without violations.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,001	333	8,008	-100	365	368	361	122.0	123.4	96.6

1898 & co.

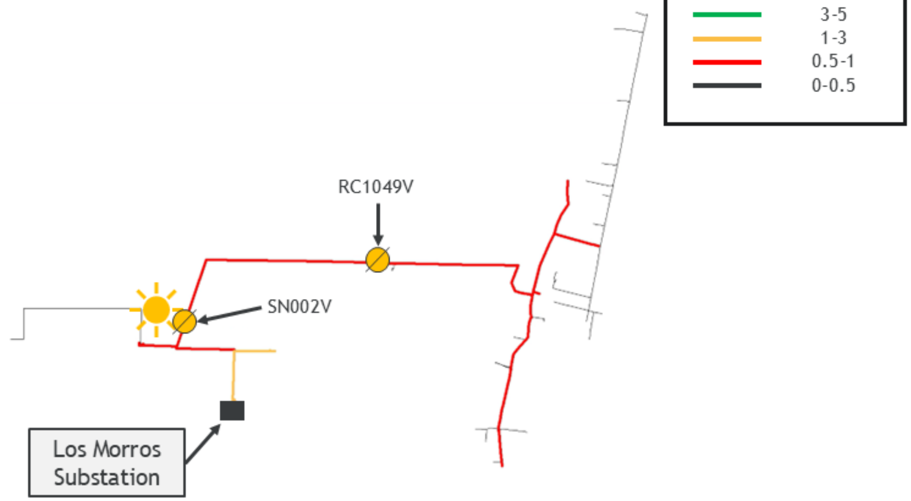
Confidential Information

112

LSMO21 - Maximum Hosting Capacity Base Case

Maximum Hosting Capacity
1.27 MW

Limiting Factors	
Thermal Loading Violation	92%
Voltage Violation	8%



Feedger Observations

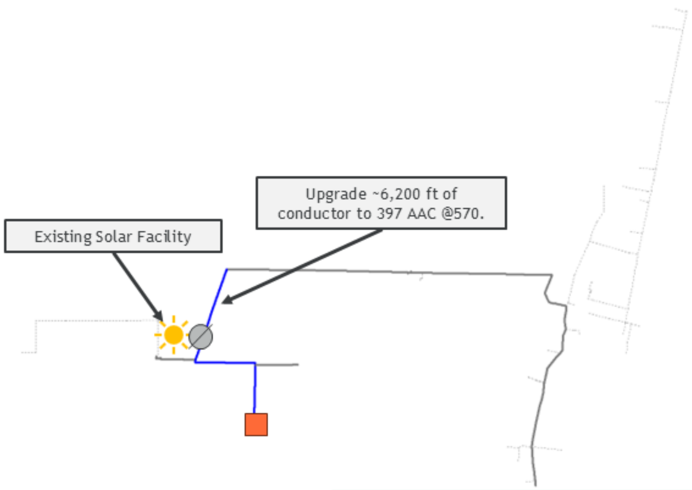
- The existing generation has exhausted most of the hosting capacity of LOMO21 in its current state.
- The feeder getaway is built to the maximum PNM standard rating - 750 CU cable. The limiting factor for hosting capacity becomes the 397 AAC backbone conductor rated to 430 Amps.

LSMO21 - Feeder Upgrades

Hosting Capacity	
Base HC	1.27 MW
Max HC	3.22 MW
HC Increase	1.95 MW

Reverse Flow Limits Max HC

System Improvement	Cost
Upgrade ~6,200 ft of 1/0 ACSR to 397 AAC @570 from Pole C28D035 to Pole C28B081.	$878,801
TOTAL	$878,801



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

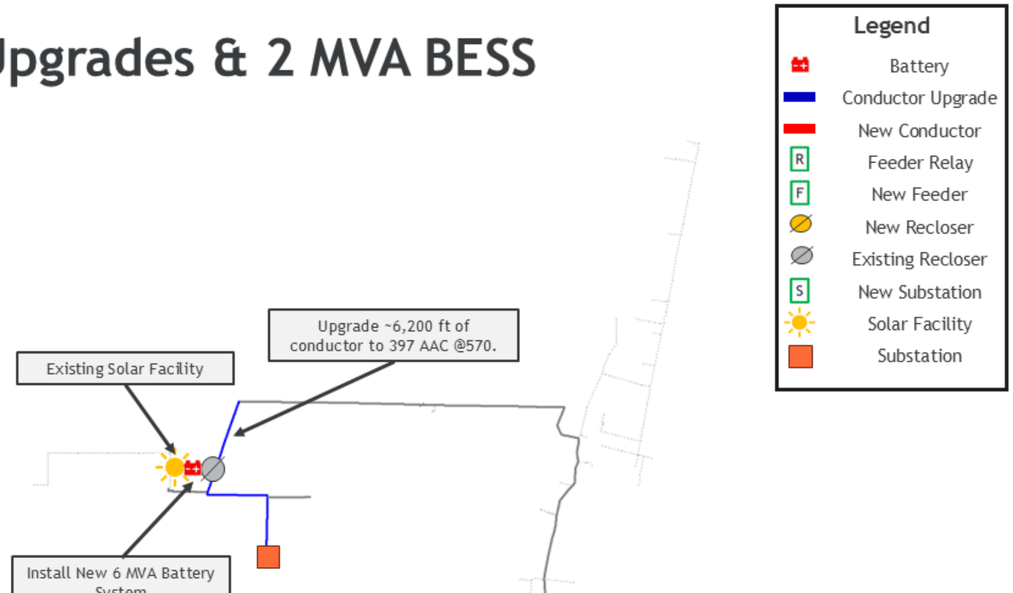
Financial Analysis	
HC Increase	1.95
Cost ($)	878,801
Hosting Capacity Benefit Cost	2.21
Holistic System Benefit Cost	0.23

LSMO21 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	1.27 MW
Max HC	5.16 MW
HC Increase	3.89 MW

Reverse Flow Limits
Max HC

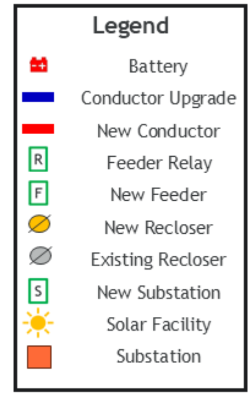
System Improvement	
	Cost
Upgrade ~6,200 ft of 1/0 ACSR to 397 AAC @570 from Pole C28D035 to Pole C28B081	$878,801
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$15,178,801



Financial Analysis	
HC Increase	3.89
Cost ($)	15,178,801
Hosting Capacity Benefit Cost	0.26
Holistic System Benefit Cost	0.68

1898 & Co.

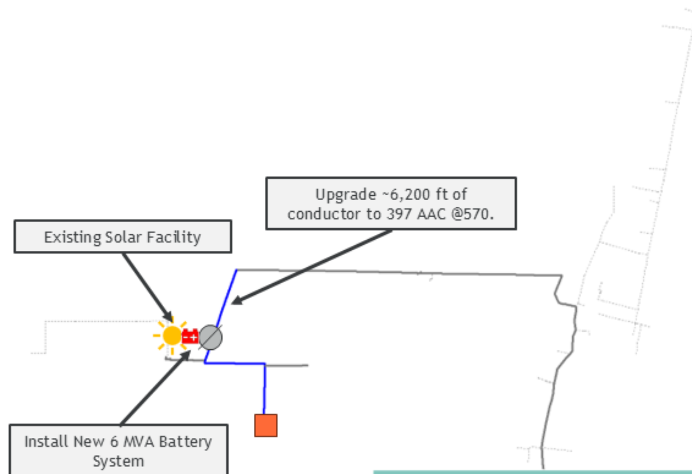
LSMO21 - Feeder Upgrades & 6 MVA BESS



Hosting Capacity	
Base HC	1.27 MW
Max HC	8.07 MW
HC Increase	6.8 MW

Thermal Loading Limits
Max HC

System Improvement	
	Cost
Upgrade ~6,200 ft of 1/0 ACSR to 397 AAC @570 from Pole C28D035 to Pole C28B081	$878,801
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$15,228,801



Financial Analysis	
HC Increase	6.8
Cost ($)	15,228,801
Hosting Capacity Benefit Cost	0.45
Holistic System Benefit Cost	1.27

1898 & co.

Confidential Information

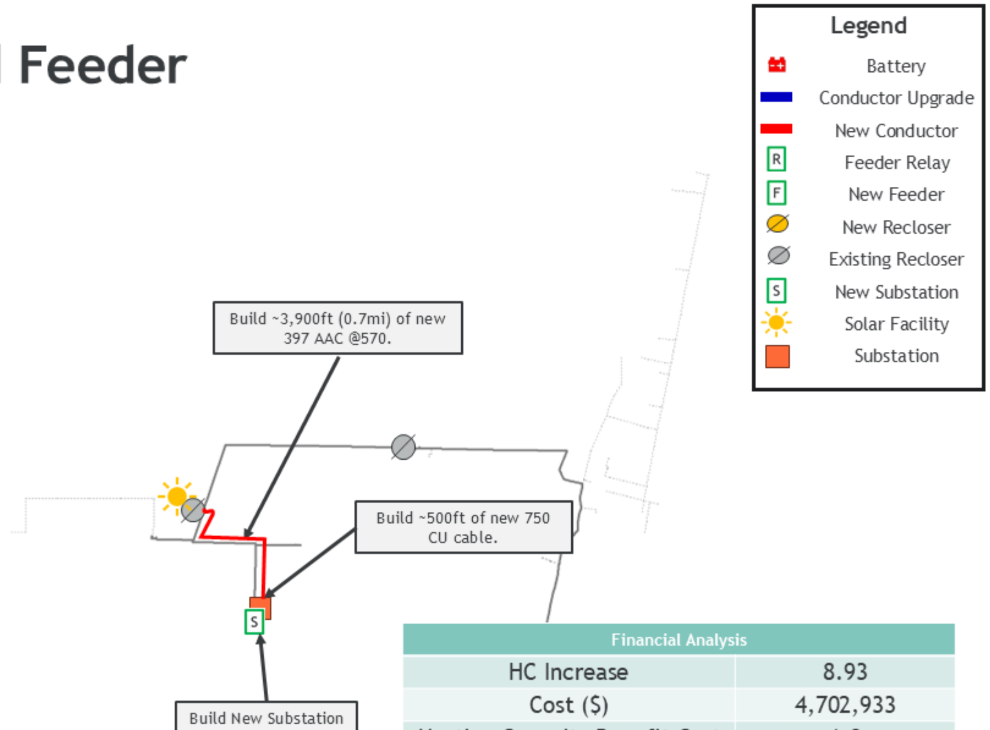
116

LSMO21 - Dedicated Feeder

Hosting Capacity	
Base HC	1.27 MW
Max HC	10.2 MW
HC Increase	8.93 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~500ft of new 750 CU cable from the New Los Morros Substation to a new riser pole.	$115,507
Build ~3,900ft (0.7mi) of new 397 AAC @570. Utilize double circuit construction along the existing path of Los Morros 21 main line conductor.	$587,426
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$4,000,000
TOTAL	$4,702,933



Financial Analysis	
HC Increase	8.93
Cost ($)	4,702,933
Hosting Capacity Benefit Cost	1.9
Holistic System Benefit Cost	0.09

1898 & Co.

117

Confidential Information

LSMO21 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	1,272	3,216	1,944	$878,801	2.21	0.23
Feeder Upgrades with 2 MVA BESS	1,272	5,161	3,889	$15,178,801	0.26	0.68
2 MVA BESS Only*	-	-	-	-	-	-
Feeder Upgrades with 6 MVA BESS	1,272	8,074	6,802	$15,228,801	0.45	1.27
6 MVA BESS Only*	-	-	-	-	-	-
Dedicated Feeder	1,272	10,196	8,924	$4,702,933	1.90	0.09

*This scenario was not applicable to this analysis.

The Feeder Upgrades and 6 MVA BESS solution is proposed for Los Morros Feeder 21. Feeder upgrades should be performed first for this feeder and as PV penetration increases or as the system requires more energy storage, a 6 MVA BESS can be constructed to continue increasing hosting capacity on Los Morros Feeder 21.

PROG13 Analysis

Confidential Information

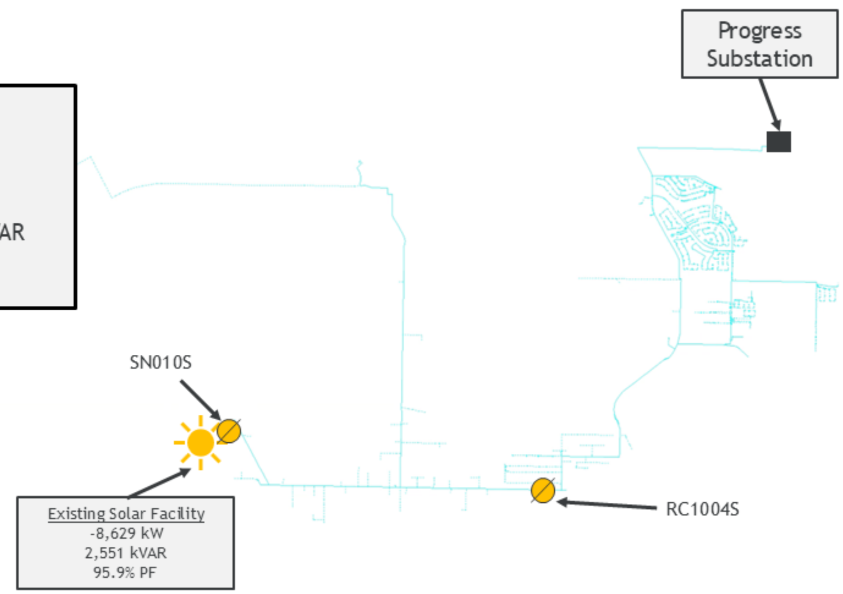
119

PROG13 - Feeder Overview

Feeder Data

- Feeder Rating: 9,936 kVA
- Existing Generation: 9,610 kVA
- daylight Minimum Load: -6,367 kW
- daylight Minimum Gross Load: 1,867 kW / 399 kVAR
- Substation LTC Setpoint - 123 V
- Primary Voltage - 12.47 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	PROG13 Breaker	600
Recloser	RC1004S	325
Recloser	SN010S	450



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-6,367	276	6,373	-100	291	279	294	122.3	125.3	97.0

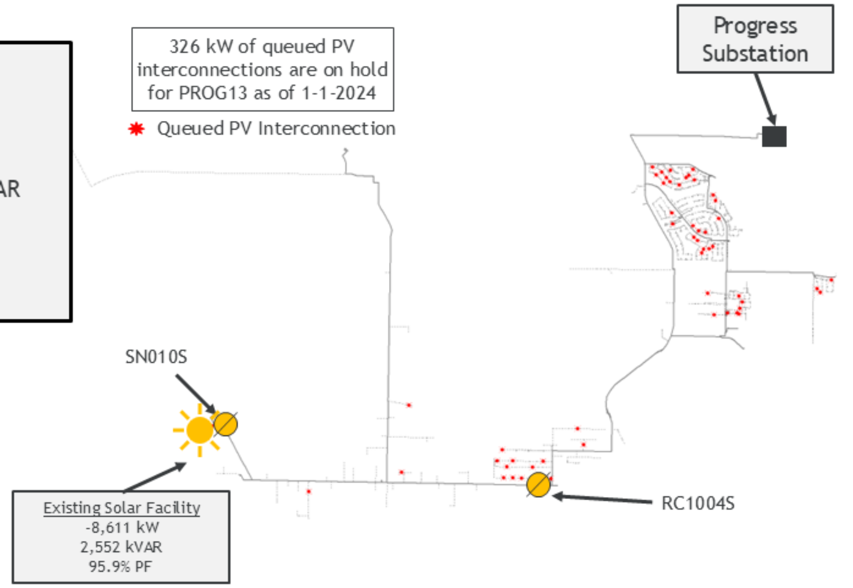
1898 co.

PROG13 - Feeder Overview with Queued Solar

Feeder Data

- Feeder Rating: 9,936 kVA
- Existing Generation: 9,931 kVA
- daylight Minimum Load: -6,667 kW
- daylight Minimum Gross Load: 1,867 kW / 399 kVAR
- Substation LTC Setpoint - 123 V
- Primary Voltage - 12.47 kV
- Queued Solar Projects: 58
- Total Queued AC Inverter Nameplate: 326 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	PROG13 Breaker	600
Recloser	RC1004S	325
Recloser	SN010S	450



The feeder can serve queued PV interconnection requests without violations.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-6,667	291	6,673	-100	312	290	302	122.3	125.4	96.3

1898 & Co.

Confidential Information

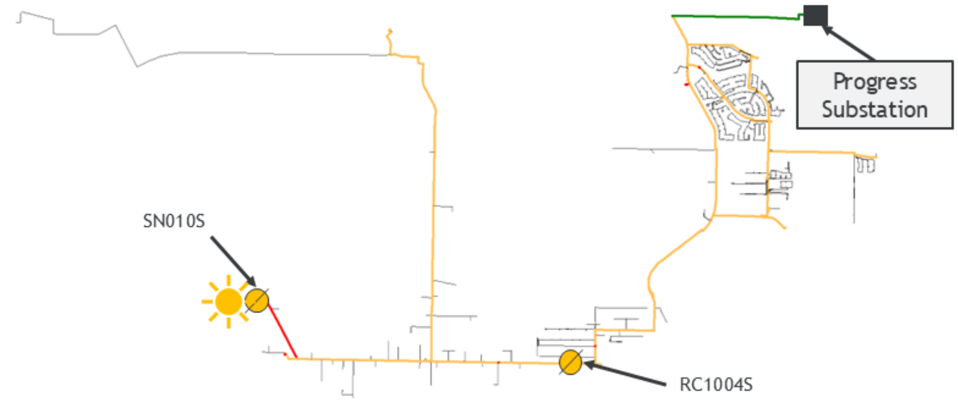
121

PROG13 - Maximum Hosting Capacity Base Case w/ Queued PV

Maximum Hosting Capacity
3.25 MW

Limiting Factors	
Thermal Loading Violation	47%
Voltage Violation	53%

Hosting Capacity (MW)
- 10-15
- 5-10
- 3-5
- 1-3
- 0.5-1
- 0-0.5



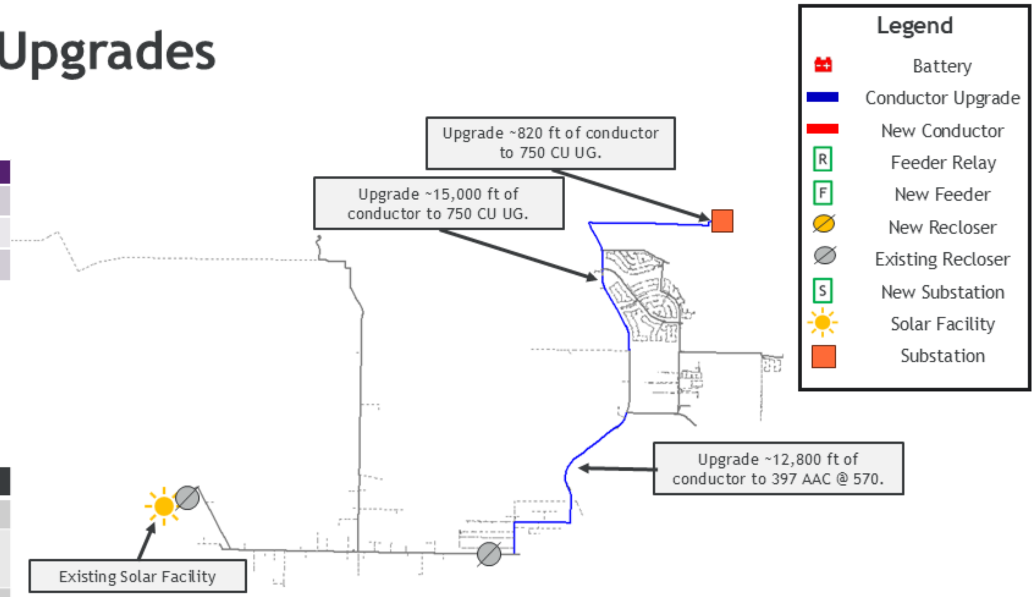
Feedor Observations

- The feeder getaway is 750 CU (Double Circuit) conductor rated at 480A. The feeder conductor is 750 AL/DB rated at 460A and is the limiting factor for hosting capacity for PROG13.
- The existing large-scale PV facility is located a long distance from the substation. This distance is contributing to a greater amount of line losses which improves the feeder hosting capacity.

PROG13 - Feeder Upgrades

Hosting Capacity	
Base HC	3.25 MW
Max HC	4.51 MW
HC Increase	1.26 MW

Reverse Flow Limits
Max HC



System Improvement	Cost
Upgrade ~820 ft of 750 CU Dbl Ckt to 750 CU UG from Progress Substation to Underground Structure PB5317S	$497,451
Upgrade ~15,000 ft of 750 AL UG to 750 CU UG from Underground Structure PB5317S to Pole D06D051	$4,024,505
Upgrade ~12,800 ft of 397 AAC to 397 AAC @ 570 from Pole D07B005 to Pole D08A099	$1,408,756
TOTAL	$5,930,712

Financial Analysis	
HC Increase	1.26
Cost ($)	5,930,712
Hosting Capacity Benefit Cost	0.21
Holistic System Benefit Cost	0.61

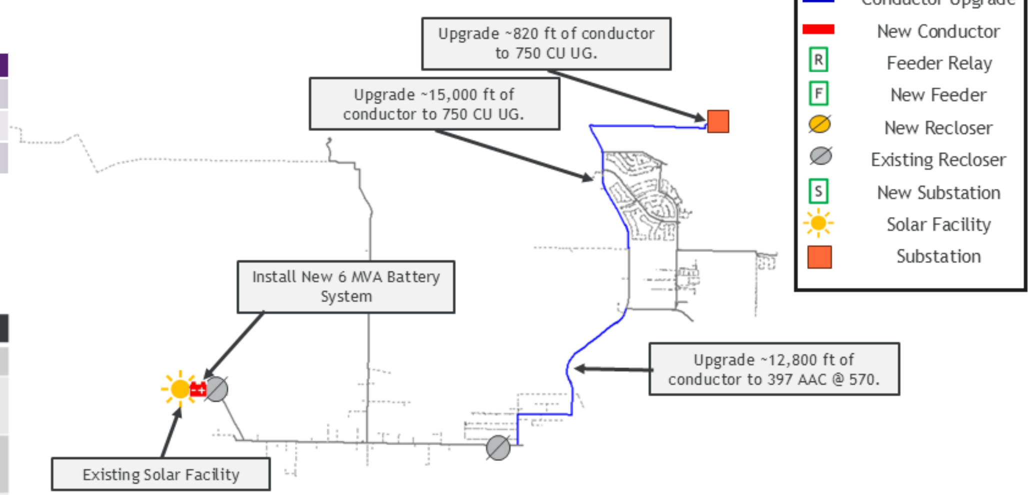
1898 & co.

PROG13 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	3.25 MW
Max HC	6.12 MW
HC Increase	2.87 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Upgrade ~820 ft of 750 CU Dbl Ckt to 750 CU UG from Progress Substation to Underground Structure PB5317S	$497,451
Upgrade ~15,000 ft of 750 AL UG to 750 CU UG from Underground Structure PB5317S to Pole D06D051	$4,024,505
Upgrade ~12,800 ft of 397 AAC to 397 AAC @ 570 from Pole D07B005 to Pole D08A099	$1,408,756
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$20,230,712



Financial Analysis	
HC Increase	2.87
Cost ($)	20,230,712
Hosting Capacity Benefit Cost	0.14
Holistic System Benefit Cost	0.69

1898 & co.

124

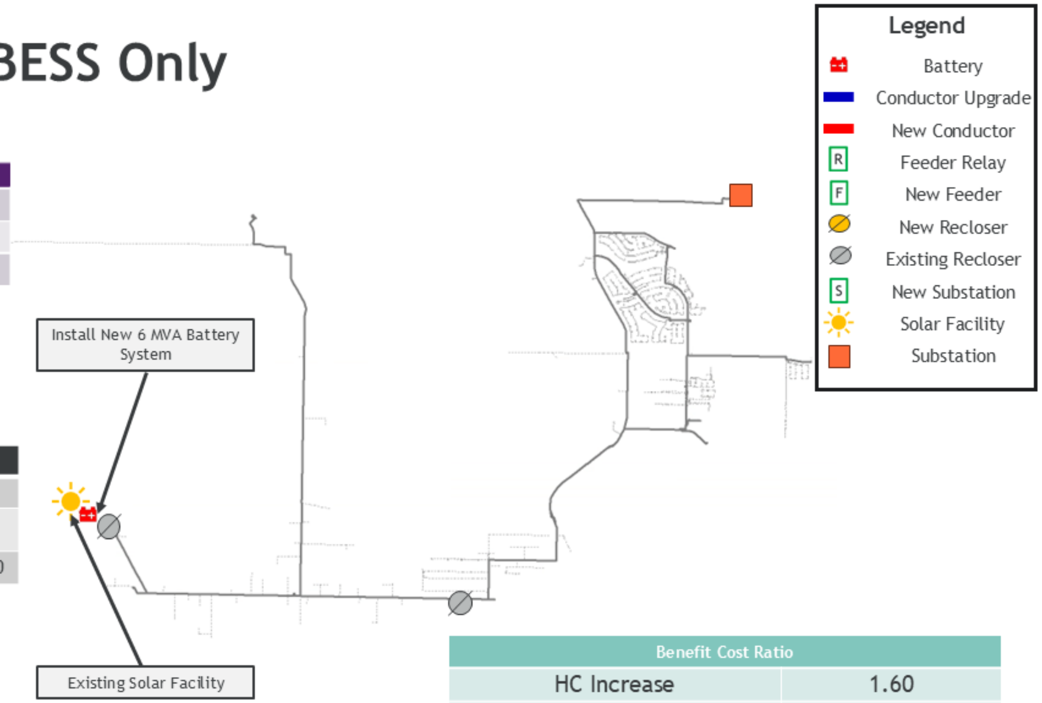
Confidential Information

PROG13 - 2 MVA BESS Only

Hosting Capacity	
Base HC	3.25 MW
Max HC	4.85 MW
HC Increase	1.60 MW

Reverse Flow Limits Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,300,000



Benefit Cost Ratio	
HC Increase	1.60
Cost ($)	14,300,000
Hosting Capacity Benefit Cost	0.11
Holistic System Benefit Cost	0.97

1898 & Co.

125

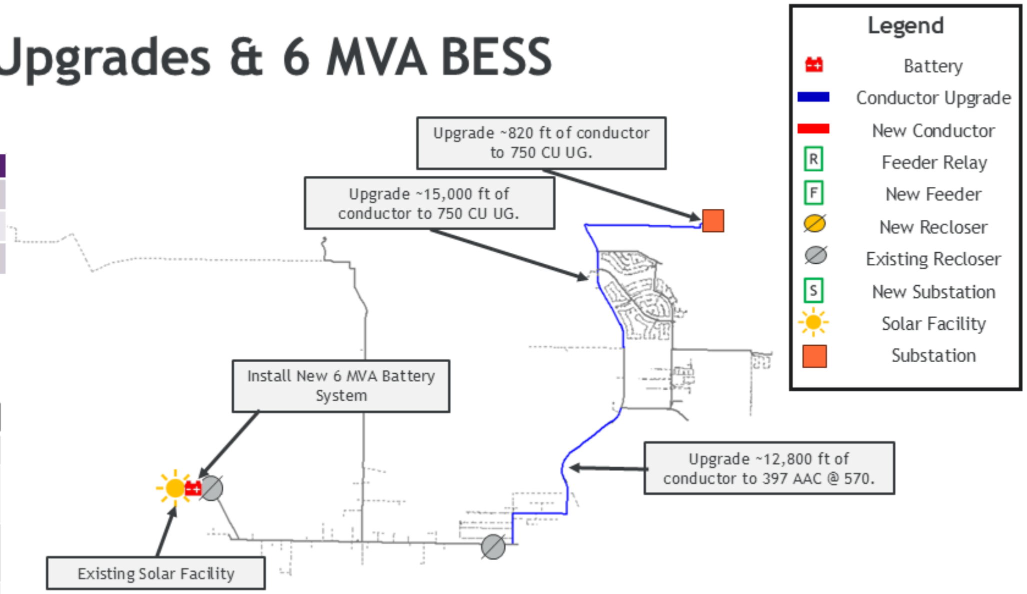
Confidential Information

PROG13 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	3.25 MW
Max HC	7.39 MW
HC Increase	4.14 MW

Thermal Loading Limits
Max HC

System Improvement	
	Cost
Upgrade ~820 ft of 750 CU Dbl Ckt to 750 CU UG from Progress Substation to Underground Structure PB5317S	$497,451
Upgrade ~15,000 ft of 750 AL UG to 750 CU UG from Underground Structure PB5317S to Pole D06D051	$4,024,505
Upgrade ~12,800 ft of 397 AAC to 397 AAC @ 570 from Pole D07B005 to Pole D08A099	$1,408,756
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$20,280,712



Financial Analysis	
HC Increase	4.14
Cost ($)	20,280,712
Hosting Capacity Benefit Cost	0.2
Holistic System Benefit Cost	1.15

1898 co.

Confidential Information

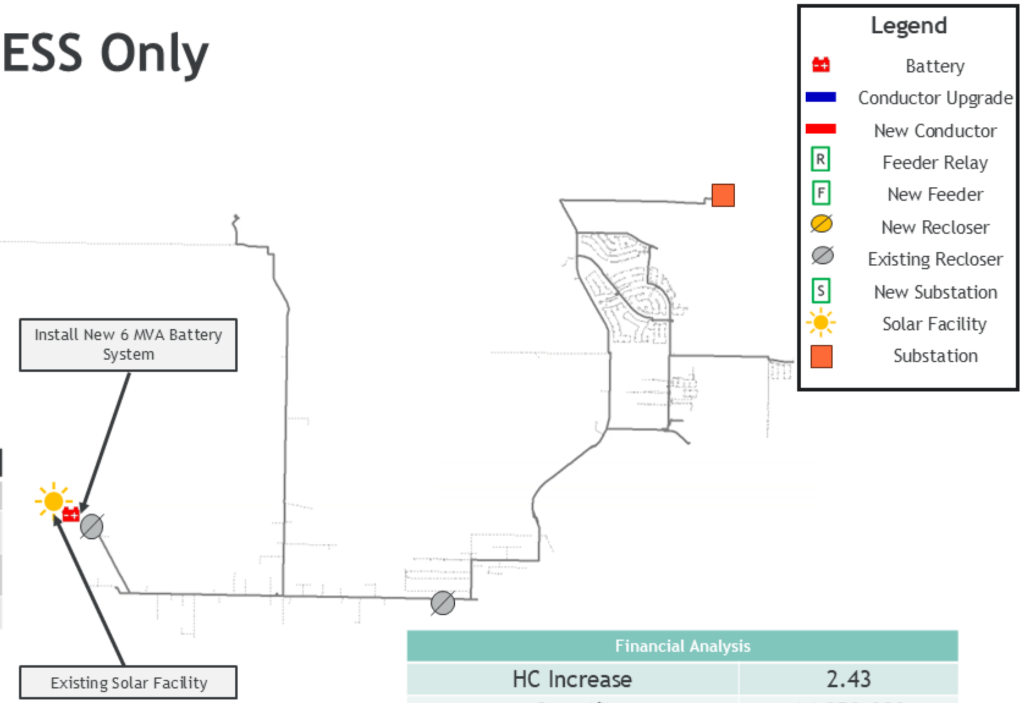
126

PROG13 - 6 MVA BESS Only

Hosting Capacity	
Base HC	3.25 MW
Max HC	5.68 MW
HC Increase	2.43 MW

Thermal Loading Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,350,000



Financial Analysis	
HC Increase	2.43
Cost ($)	14,350,000
Hosting Capacity Benefit Cost	1.62
Holistic System Benefit Cost	0.17

1898 & co.

Confidential Information

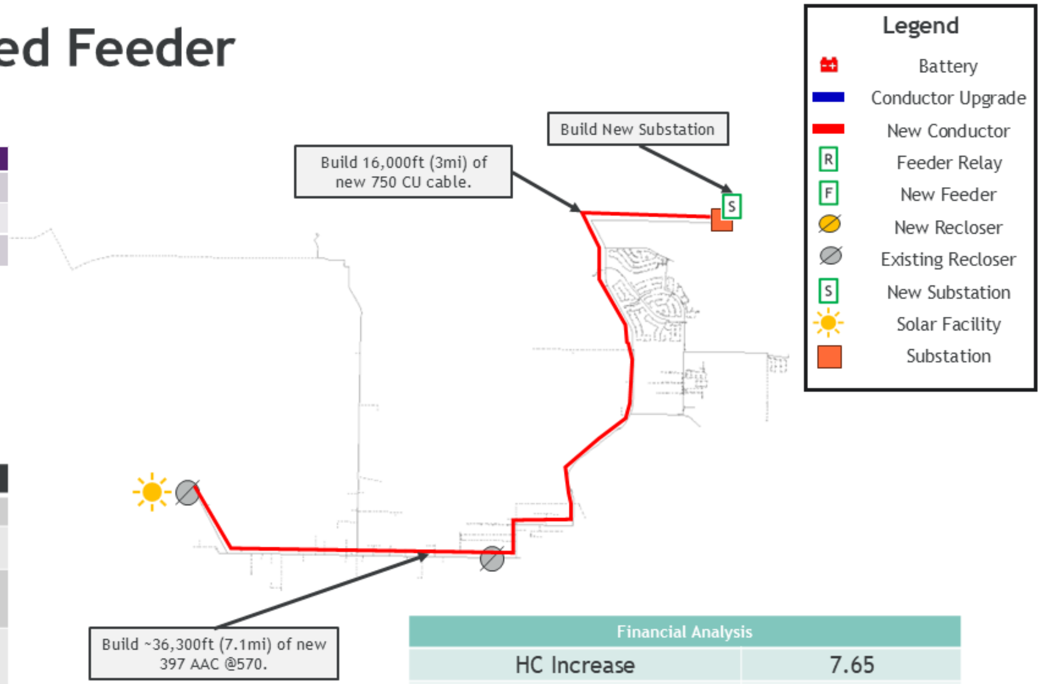
127

PROG13 - Dedicated Feeder

Hosting Capacity	
Base HC	3.25 MW
Max HC	10.9 MW
HC Increase	7.65 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~16,000ft (3mi) of new 750 CU cable from the Progress 13 Substation to a new riser pole.	$7,125,148
Build ~36,300ft (7.1mi) of new 397 AAC @570. Utilize double circuit construction along the existing path of Progress 13 main line conductor.	$4,421,682
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$19,546,830



Financial Analysis	
HC Increase	7.65
Cost ($)	19,546,830
Hosting Capacity Benefit Cost	0.39
Holistic System Benefit Cost	0.2

1898 & Co.

Confidential Information

128

PROG13 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	3,255	4,506	1,251	$5,930,712	0.21	0.61
Feeder Upgrades with 2 MVA BESS	3,255	6,120	2,865	$20,230,712	0.14	0.69
2 MVA BESS Only	3,255	4,850	1,595	$14,300,000	0.11	0.97
Feeder Upgrades with 6 MVA BESS	3,255	7,391	4,136	$20,280,712	0.20	1.15
6 MVA BESS Only	3,255	5,680	2,425	$14,350,000	0.17	1.62
Dedicated Feeder	3,255	10,901	7,646	$19,546,830	0.39	0.2

The 6 MVA BESS only solution is proposed for Progress Feeder 13. Installing the BESS only will reduce the overall project cost if feeder upgrades were included. The existing large-scale PV is located at the far end of the feeder and contributed to a significant feeder upgrade cost.

SCEN12 Analysis

Confidential Information

130

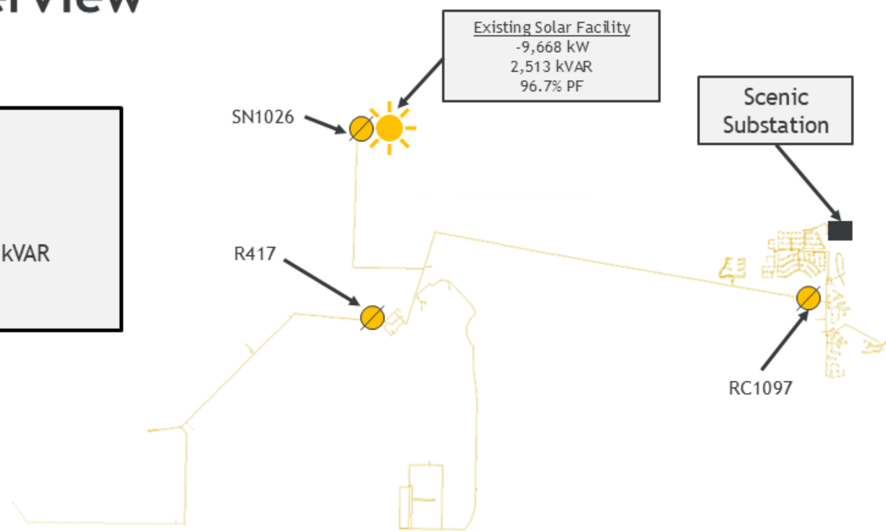
SCEN12 - Feeder Overview

Feeder Data

- Feeder Rating: 9,936 kVA
- Existing Generation: 10,728 kVA
- daylight Minimum Load: -8,421 kW
- daylight Minimum Gross Load: 936 kW / 528 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	SCEN12 Breaker	600
Recloser	R417	140
Recloser	RC1091	325
Recloser	SN1026	525

Existing generation capacity exceeds the feeder rating.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,421	4,696	9,641	-87	445	438	434	121.1	122.7	97.0

1898 & co.

Confidential Information

131

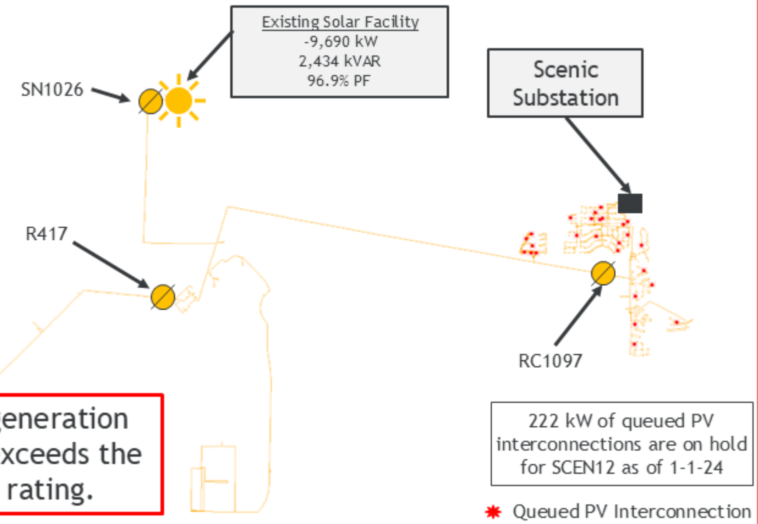
SCEN12 - Feeder Overview with Queued Solar as of 1-1-24

Feeder Data

- Feeder Rating: 9,936 kVA
- Existing Generation: 10,674 kVA
- daylight Minimum Load: -8,632 kW
- daylight Minimum Gross Load: 936 kW / 528 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV
- Queued Solar Projects: 35
- Total Queued AC Inverter Nameplate: 222 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	SCEN12 Breaker	600
Recloser	R417	140
Recloser	RC1091	325
Recloser	SN1026	525

The feeder can serve queued PV interconnection requests without violations.



Existing generation capacity exceeds the feeder rating.

222 kW of queued PV interconnections are on hold for SCEN12 as of 1-1-24

✱ Queued PV Interconnection

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,632	4,704	9,830	-88	454	449	440	121.1	122.8	98.9

1898 & co.

Confidential Information

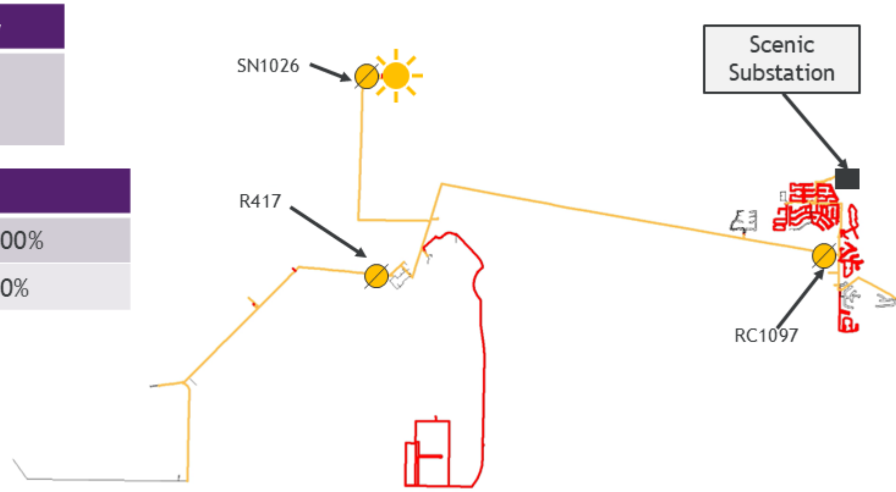
132

SCEN12 - Maximum Hosting Capacity Base Case w/ Queued PV

Maximum Hosting Capacity
1.30 MW

Limiting Factors	
Thermal Loading Violation	100%
Voltage Violation	0%

Hosting Capacity (MW)	
Purple	10-15
Blue	5-10
Green	3-5
Yellow	1-3
Red	0.5-1
Black	0-0.5



Feeder Observations

- The feeder getaway is at 460A and is limiting the hosting capacity available for SCEN12.
- The distance of the large-scale PV facility from the substation results in some losses which improves hosting capacity.

1898 & co.

Confidential Information

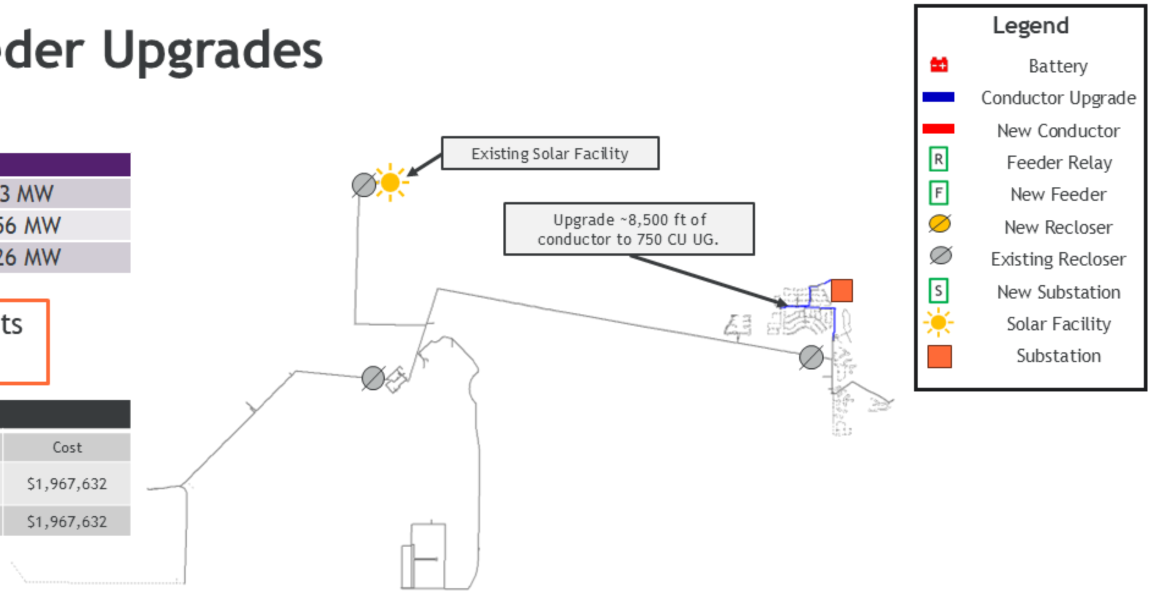
133

SCEN12 - Feeder Upgrades

Hosting Capacity	
Base HC	1.3 MW
Max HC	2.56 MW
HC Increase	1.26 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Upgrade ~8,500 ft of 750 AL Db to 750 CU UG from Underground Structure PB5317S to Pole D13B008	$1,967,632
TOTAL	$1,967,632



Financial Analysis	
HC Increase	1.26
Cost ($)	1,967,632
Hosting Capacity Benefit Cost	0.64
Holistic System Benefit Cost	1.84

134

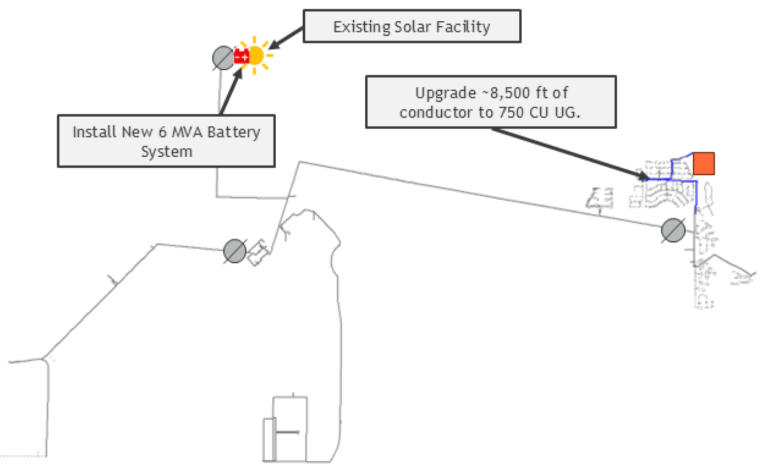
Confidential Information

SCEN12 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	1.3 MW
Max HC	4.18 MW
HC Increase	2.88 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Upgrade ~8,500 ft of 750 AL Db to 750 CU UG from Underground Structure PB53175 to Pole D13B008	$1,967,632
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$16,267,632



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	2.88
Cost ($)	16,267,632
Hosting Capacity Benefit Cost	0.18
Holistic System Benefit Cost	0.86

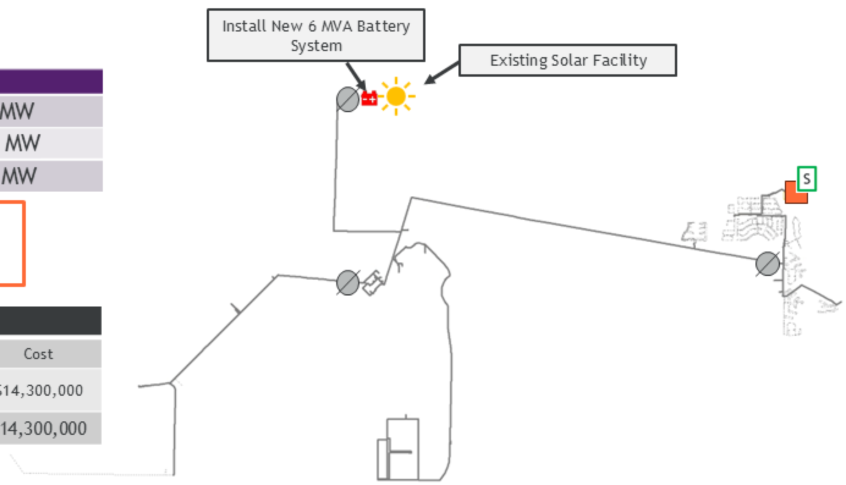
1898 & Co.

SCEN12 - 2 MVA BESS Only

Hosting Capacity	
Base HC	1.3 MW
Max HC	2.91 MW
HC Increase	1.61 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,300,000



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	1.61
Cost ($)	14,300,000
Hosting Capacity Benefit Cost	0.11
Holistic System Benefit Cost	0.97

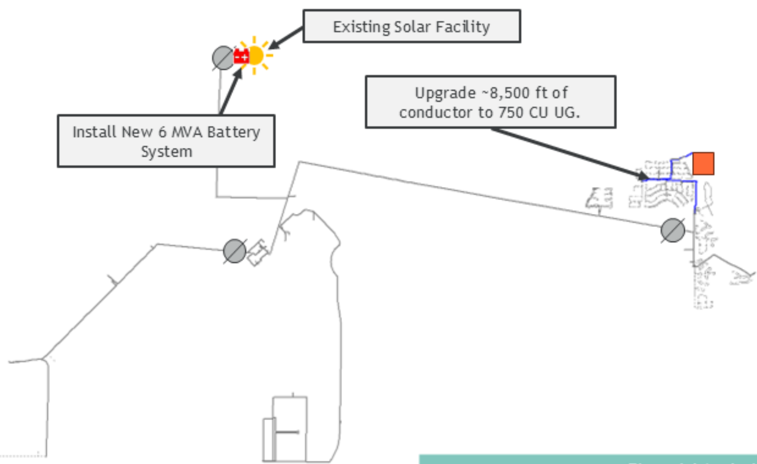
1898 & Co.

Confidential Information

SCEN12 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	1.3 MW
Max HC	6.45 MW
HC Increase	5.15 MW

Thermal Loading Limits
Max HC



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

System Improvement	Cost
Upgrade ~8,500 ft of 750 AL Db to 750 CU UG from Underground Structure PB5317S to Pole D138008	$1,967,632
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$16,317,632

Financial Analysis	
HC Increase	5.15
Cost ($)	16,317,632
Hosting Capacity Benefit Cost	0.32
Holistic System Benefit Cost	1.43

1898 co.

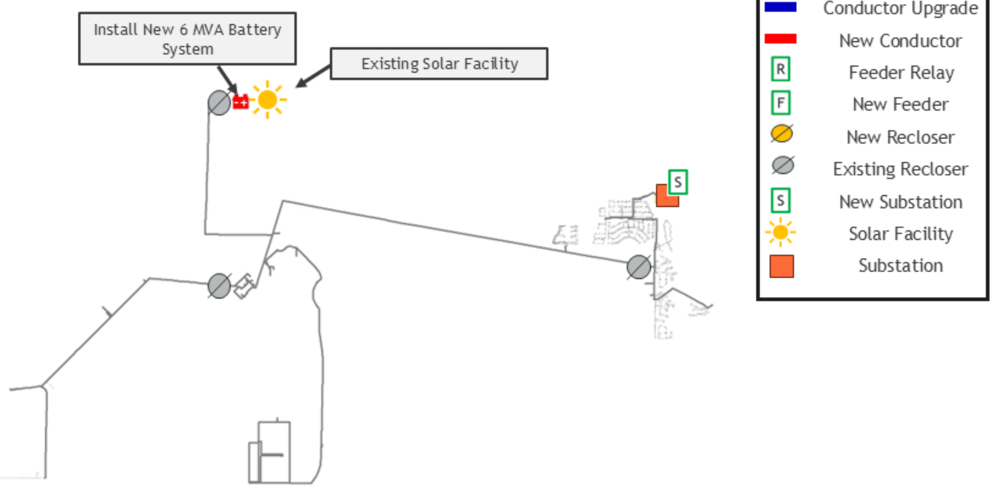
137

Confidential Information

SCEN12 - 6 MVA BESS Only

Hosting Capacity	
Base HC	1.3 MW
Max HC	4.48 MW
HC Increase	3.18 MW

Thermal Loading Limits
Max HC



System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,350,000

Financial Analysis	
HC Increase	3.18
Cost ($)	14,350,000
Hosting Capacity Benefit Cost	0.22
Holistic System Benefit Cost	1.61

1898 & co.

Confidential Information

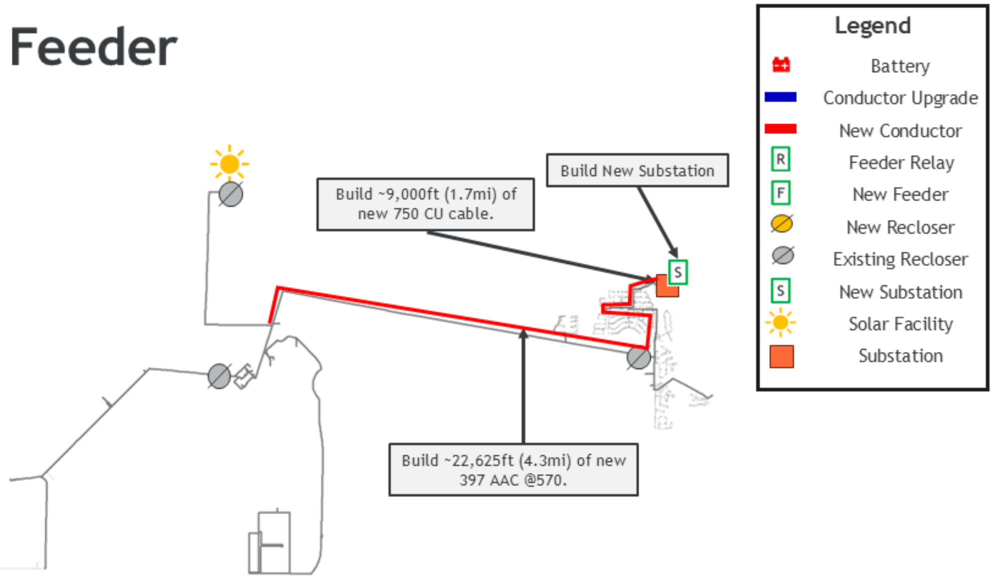
138

SCEN12 - Dedicated Feeder

Hosting Capacity	
Base HC	1.3 MW
Max HC	9.91 MW
HC Increase	8.61 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~9,000ft (1.7mi) of new 750 CU cable from the Scenic 12 Substation to a new riser pole.	$2,712,850
Build ~22,625ft (4.3mi) of new 397 AAC @570. Utilize double circuit construction along the existing path of Scenic 12 main line conductor.	$3,227,345
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$13,940,195



Financial Analysis	
HC Increase	8.61
Cost ($)	13,940,195
Hosting Capacity Benefit Cost	0.62
Holistic System Benefit Cost	0.29

1898 & co.

Confidential Information

139

SCEN12 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	1,297	2,559	1,262	$1,967,632	0.64	1.84
Feeder Upgrades with 2 MVA BESS	1,297	4,179	2,882	$16,267,632	0.18	0.86
2 MVA BESS Only	1,297	2,910	1,613	$14,300,000	0.11	0.97
Feeder Upgrades with 6 MVA BESS	1,297	6,453	5,156	$16,317,632	0.32	1.43
6 MVA BESS Only	1,297	4,480	3,183	$14,350,000	0.22	1.61
Dedicated Feeder	1,297	9,906	8,609	$13,940,195	0.62	0.29

The Feeder Upgrades only solution is proposed for Scenic Feeder 12. Focusing on feeder upgrades first will provide an increase to hosting capacity while limiting the overall project cost. If rising PV penetration on Scenic Feeder 12 requires additional hosting capacity, a 6 MVA BESS could be constructed on this feeder after constructing feeder upgrades.

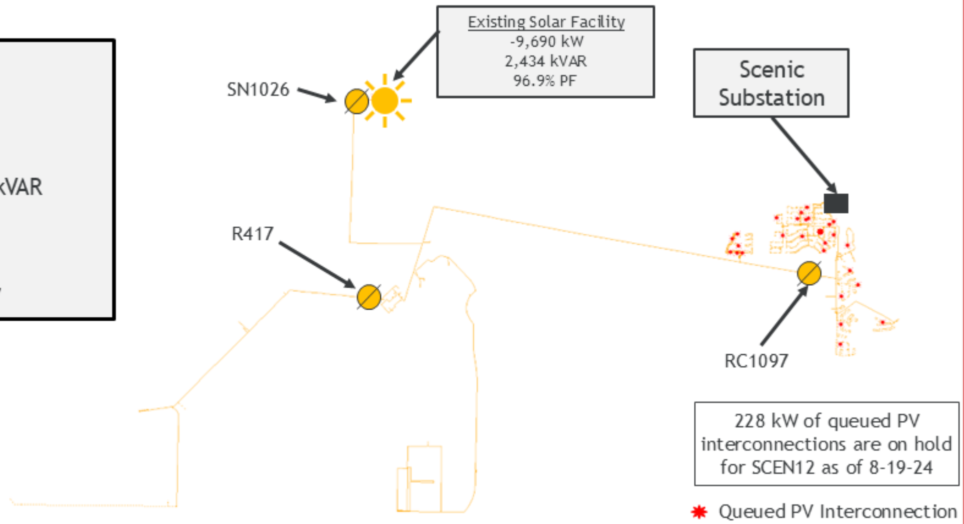
SCEN12 - Feeder Overview with Queued Solar as of 8-19-24

Feeder Data

- Feeder Rating: 9,936 kVA
- Existing Generation: 10,680 kVA
- daylight Minimum Load: -8,644 kW
- daylight Minimum Gross Load: 936 kW / 528 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV
- Queued Solar Projects: 36
- Total Queued AC Inverter Nameplate: 228 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	SCEN12 Breaker	600
Recloser	R417	140
Recloser	RC1091	325
Recloser	SN1026	525

The feeder can serve queued PV interconnection requests without violations.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,644	4,705	9,841	-88	454	450	440	121.1	122.8	98.9

1898 & co.

141

Confidential Information

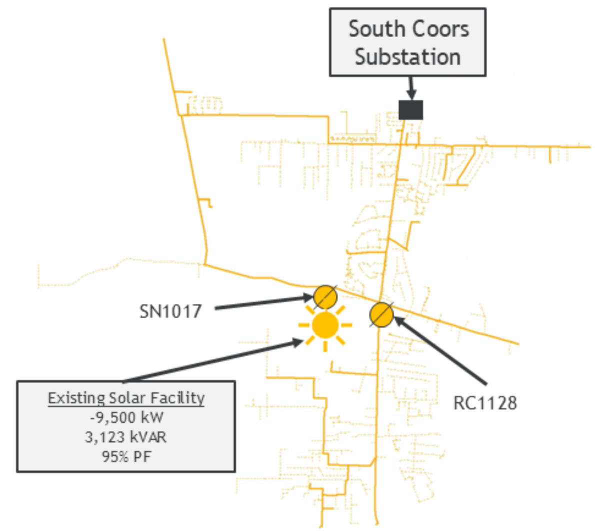

SOCO12 Analysis
1898 & Co.
Confidential Information
142

SOCO12 - Feeder Overview

Feeder Data

- Feeder Rating - 9,288 kVA
- Existing Generation - 10,708 kVA
- Minimum Daylight Load: -7,707 kW
- Minimum Daylight Gross Load- 2,143 kW / 957 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	SOCO12 Breaker	600
Recloser	RC1128	290
Recloser	SN1017	625



Existing generation capacity exceeds the feeder rating.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-7,707	3,546	8,484	-91	381	392	387	121.6	123.0	97.0

1898 & co.

Confidential Information

143

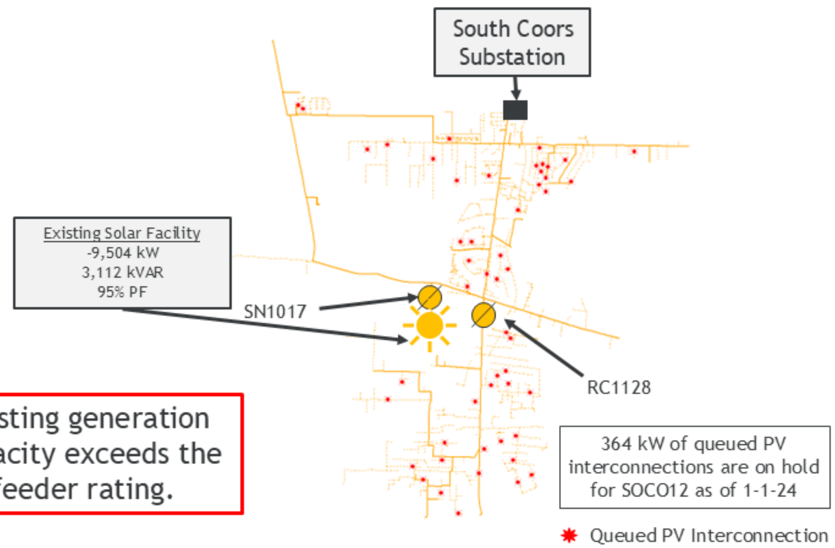
SOCO12 - Feeder Overview with Queued Solar as of 1-1-14

Feeder Data

- Feeder Rating - 9,288 kVA
- Existing Generation - 11,063 kVA
- Minimum Daylight Load: -8,067 kW
- Minimum Daylight Gross Load- 2,143 kW / 957 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV
- Queued Solar Projects: 55
- Total Queued AC Inverter Nameplate: 364 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	SOCO12 Breaker	600
Recloser	RC1128	290
Recloser	SN1017	625

The feeder can serve queued PV interconnection requests without violations.



Existing generation capacity exceeds the feeder rating.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,067	3,561	8,818	-91	401	404	400	121.8	123.5	98.2

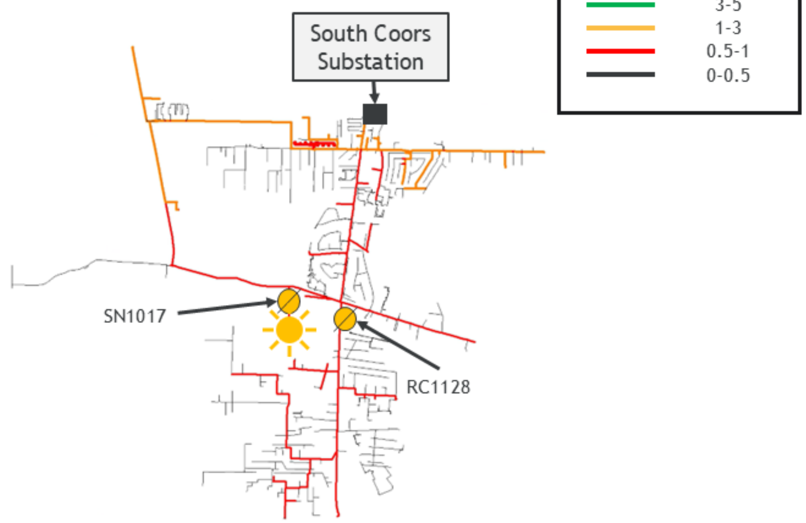
1898 & Co.

144

SOCO12 - Maximum Hosting Capacity Base Case w/ Queued PV

Maximum Hosting Capacity
1.22 MW

Limiting Factors	
Thermal Loading Violation	100%
Voltage Violation	0%



Feeder Observations

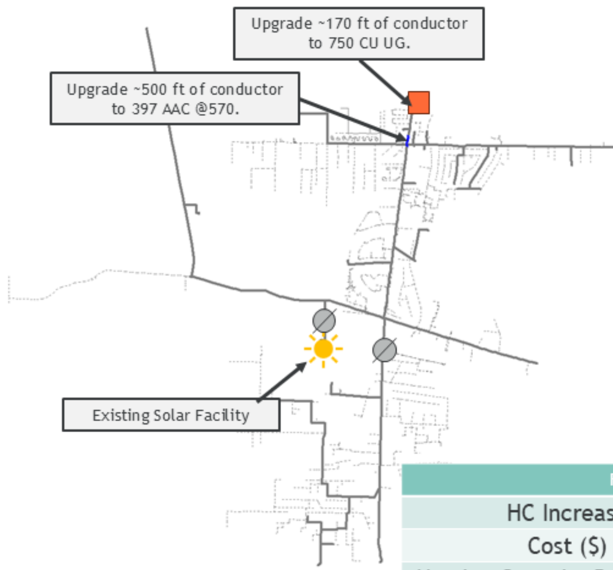
- The feeder getaway is 750 AL (Riser) and should be upgraded to the maximum PNM standard 750 CU getaway cable.
- The existing generation exceeds feeder rating. Minimum daylight gross load is necessary to keep feeder within planning criteria.
- Some hosting capacity is remaining on this feeder as enough generation is consumed by local customer load. Queued PV customers may be able to interconnect to this feeder.

SOCO12 - Feeder Upgrades

Hosting Capacity	
Base HC	1.22 MW
Max HC	3.17 MW
HC Increase	1.95 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Upgrade ~170 ft 750 AL Riser to 750 CU UG South Coors Substation to Pole D19D104	$78,185
Upgrade ~500 ft 397 AAC to 397 AAC @570 from Pole D20B342 to Pole D20B339	$105,430
TOTAL	$183,615



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	1.95
Cost ($)	183,615
Hosting Capacity Benefit Cost	10.58
Holistic System Benefit Cost	20.07

1898 & Co.

Confidential Information

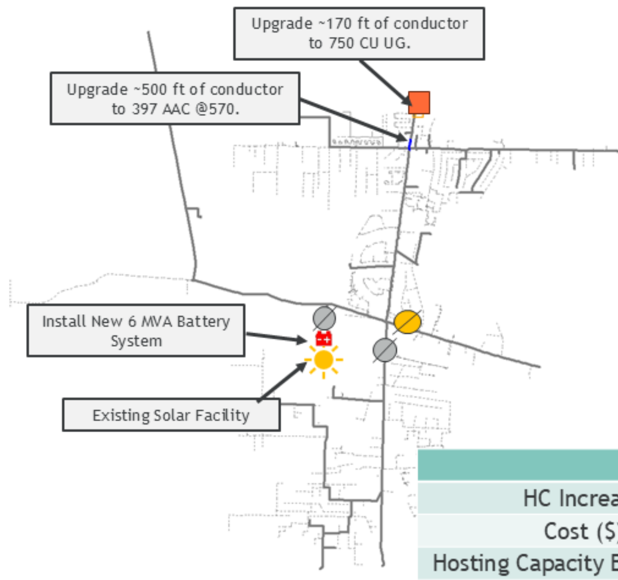
146

SOCO12 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	1.22 MW
Max HC	5.01 MW
HC Increase	3.79 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Upgrade ~170 ft 750 AL Riser to 750 CU UG South Coors Substation to Pole D19D104	$78,186
Upgrade ~500 ft 397 AAC to 397 AAC @570 from Pole D20B342 to Pole D20B339	$105,430
Install new recloser	$150,000
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,633,616



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	3.79
Cost ($)	14,633,616
Hosting Capacity Benefit Cost	0.26
Holistic System Benefit Cost	0.96

1898 & Co.

Confidential Information

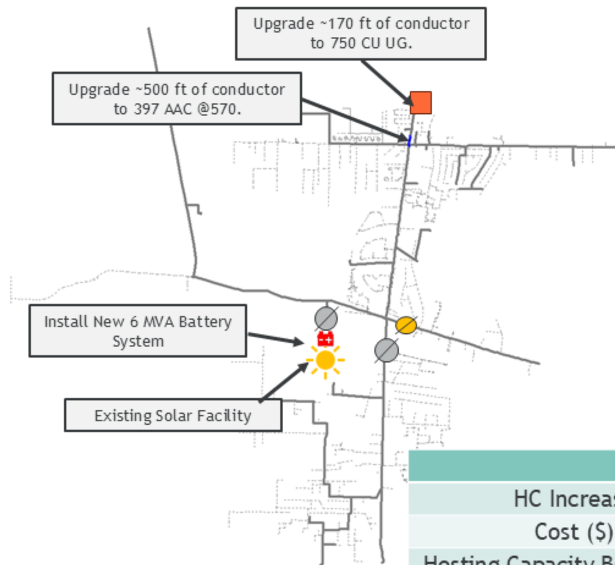
147

SOCO12 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	1.22 MW
Max HC	6.52 MW
HC Increase	5.3 MW

Thermal Loading Limits
Max HC

System Improvement	
	Cost
Upgrade ~170 ft 750 AL Riser to 750 CU UG South Coors Substation to Pole D19D104	$78,186
Upgrade ~500 ft 397 AAC to 397 AAC @570 from Pole D20B342 to Pole D20B339	$105,430
Install new Recloser	$150,000
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,683,616



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	5.3
Cost ($)	14,683,616
Hosting Capacity Benefit Cost	0.36
Holistic System Benefit Cost	1.59

1898 & Co.

148

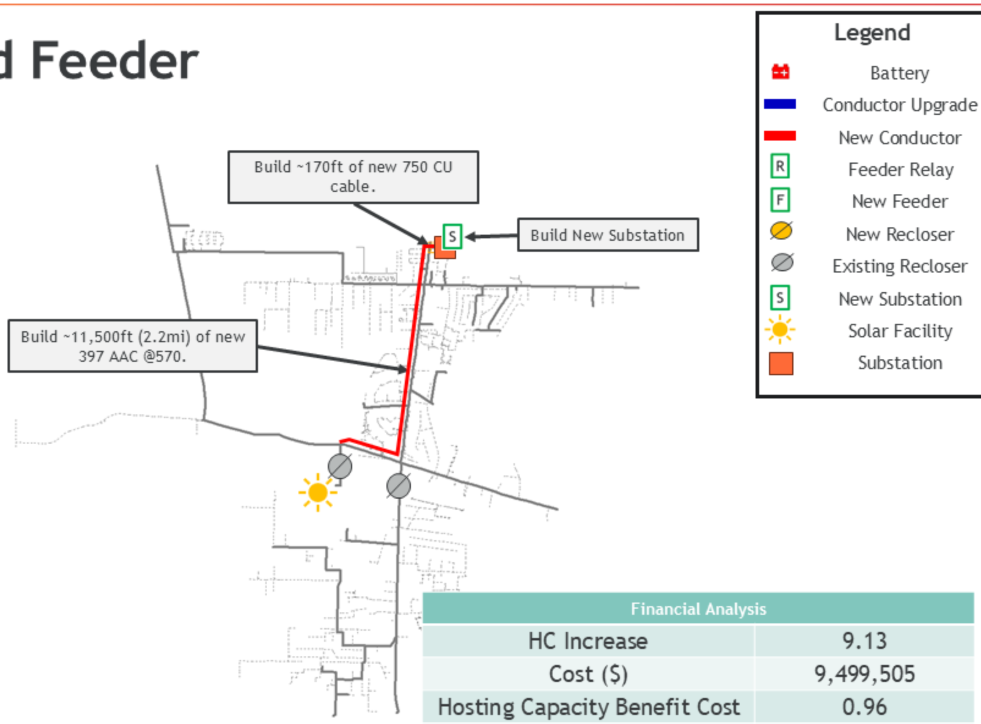
Confidential Information

SOCO12 - Dedicated Feeder

Hosting Capacity	
Base HC	1.22 MW
Max HC	10.35 MW
HC Increase	9.13 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~170ft of new 750 CU cable from the South Coors 12 Substation to a new riser pole.	$73,015
Build ~11,500ft (2.2mi) of new 397 AAC @570. Utilize double circuit construction along the existing path of South Coors 12 main line conductor.	$1,426,490
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$9,449,505



Financial Analysis	
HC Increase	9.13
Cost ($)	9,499,505
Hosting Capacity Benefit Cost	0.96
Holistic System Benefit Cost	0.43

1898 & Co.

149

Confidential Information

SOCO12 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	1,224	3,167	1,943	$183,615	10.58	20.07
Feeder Upgrades with 2 MVA BESS	1,224	5,011	3,787	$14,633,616	0.26	0.96
2 MVA BESS Only*	-	-	-	-	-	-
Feeder Upgrades with 6 MVA BESS	1,224	6,515	5,291	$14,683,616	0.36	1.59
6 MVA BESS Only*	-	-	-	-	-	-
Dedicated Feeder	1,224	10,350	9,126	$9,499,505	0.96	0.43

*This scenario was not applicable to this analysis.

A 6 MVA BESS has been constructed and is installed on South Coors Feeder 12. When this BESS is in operation it will provide an increase to hosting capacity on this feeder.

1898 & Co.

SOCO12 - Feeder Overview with Queued Solar as of 8-19-24

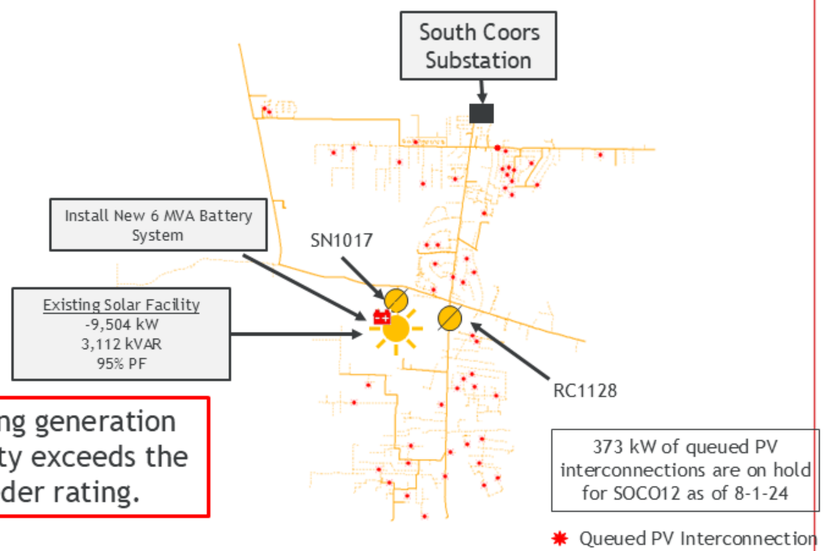
Feeder Data

- Feeder Rating - 9,288 kVA
- Existing Generation - 11,063 kVA
- Minimum Daylight Load: -8,022 kW
- Minimum Daylight Gross Load- 2,143 kW / 957 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV
- Queued Solar Projects: 56
- Total Queued AC Inverter Nameplate: 373 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	SOCO12 Breaker	600
Recloser	RC1128	290
Recloser	SN1017	625

The feeder can serve queued PV interconnection requests without violations.

Existing generation capacity exceeds the feeder rating.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,022	3,571	8,827	-91	402	404	400	121.8	123.5	98.1

1898 & co.

Confidential Information

151

STPE12 Analysis

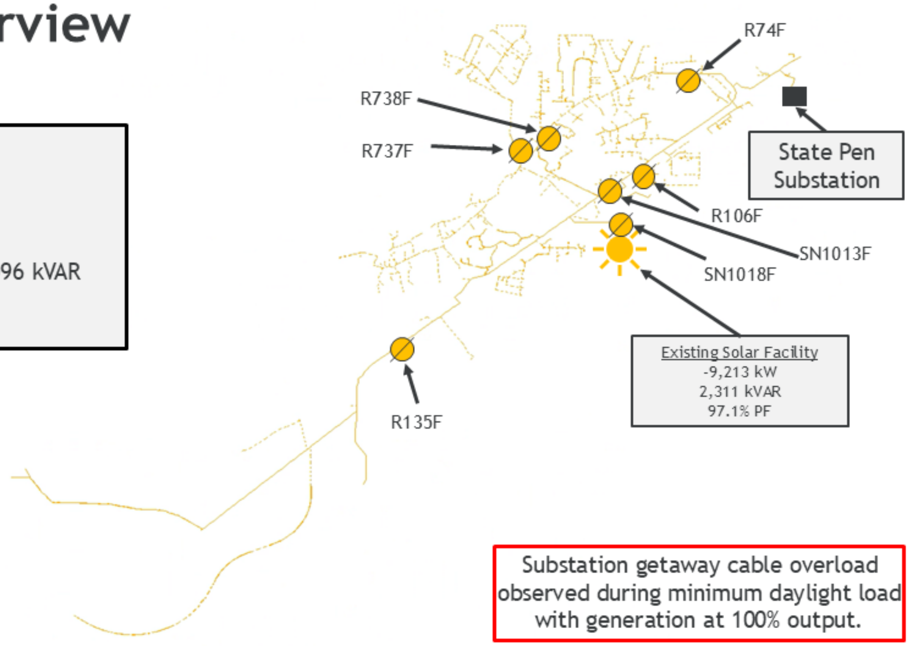
Confidential Information

152

STPE12 - Feeder Overview

Feeder Data

- Feeder Rating - 8,208 kVA
- Existing Generation - 10,066 kVA
- Daylight Minimum Load: -7,839 kW
- Daylight Minimum Gross Load: 1,390 kW / 1,096 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV



Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	STPE Breaker	600
Recloser	R135F	190
Recloser	R74F	300
Recloser	R106F	200
Recloser	R737F	200
Recloser	R738F	300
Recloser	SN1018F	500
Recloser	SN1013F	600

Substation getaway cable overload observed during minimum daylight load with generation at 100% output.

Base Case Load Flow Analysis (Minimum daylight Load)

kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-7,839	3,780	8,703	-90	387	376	426	119.9	124.3	112.0

1898 & Co.

Confidential Information

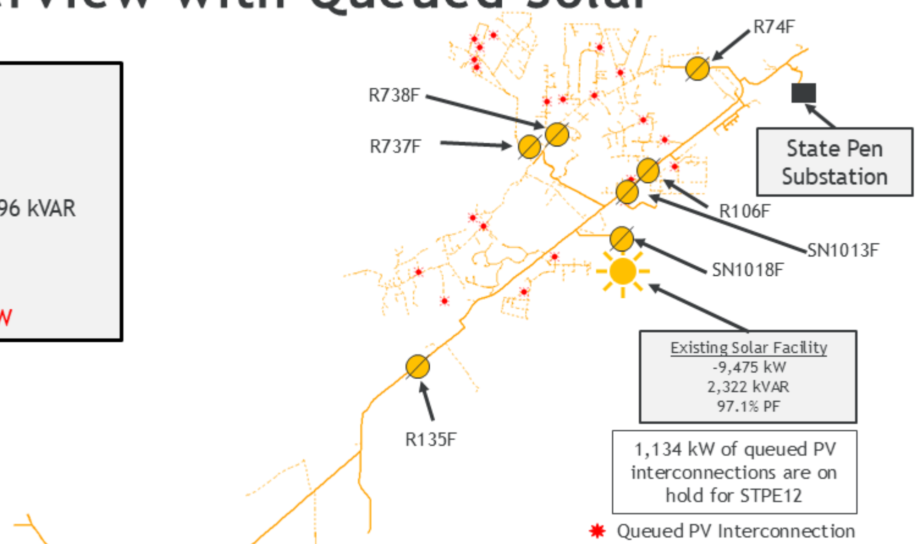
153

STPE12 - Feeder Overview with Queued Solar

Feeder Data

- Feeder Rating - 8,208 kVA
- Existing Generation - 11,175 kVA
- Daylight Minimum Load: -8,903 kW
- Daylight Minimum Gross Load: 1,390 kW / 1,096 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV
- Queued Solar Projects: 23
- Total Queued AC Inverter Nameplate: 1,134 kW

The feeder CANNOT serve queued PV interconnection requests without violations.



Substation getaway cable overload observed during minimum daylight load with generation at 100% output.

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,903	3,941	9,736	-91	433	424	473	120.6	124.7	124.6

1898 co.

Confidential Information

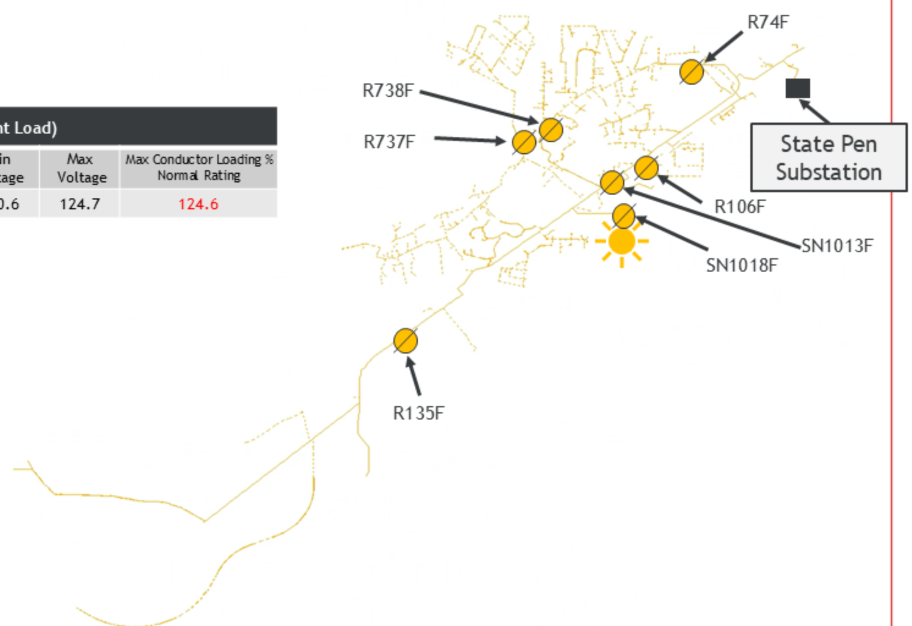
154

STPE12 - Maximum Hosting Capacity Base Case w/ Queued PV

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,903	3,941	9,736	-91	433	424	473	120.6	124.7	124.6

Feedor Observations

- There is ZERO hosting capacity available in this feeder in the base case scenario.
- A 124.6% thermal overload is observed at the feeder getaway if generation is at full output and is coincident with minimum daylight load. The getaway is 750AL DblCkt which has a rating of 380A or 8,208 kVA.



1898 & Co.

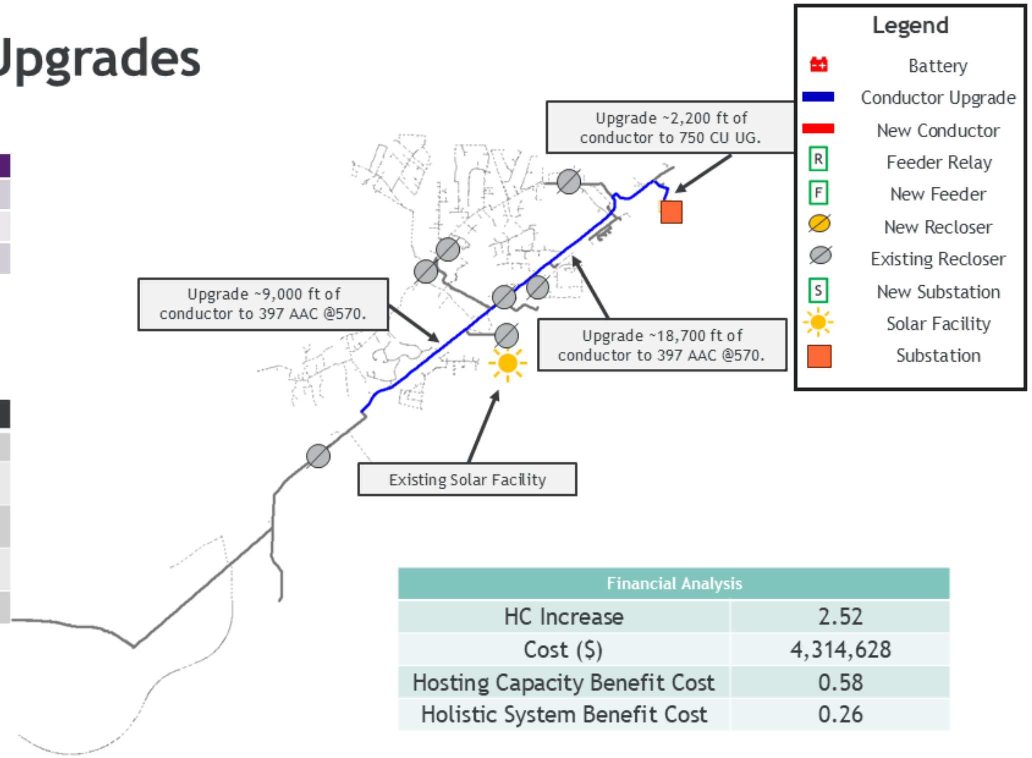
Confidential Information

STPE12 - Feeder Upgrades

Hosting Capacity	
Base HC	0 MW
Max HC	2.52 MW
HC Increase	2.52 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Upgrade ~2,200 ft of 750 AL Dbl Ckt to 750 CU UG from State Pen Substation to Pole V63C007	$1,265,993
Upgrade ~18,700 ft of 397 AAC to 397 AAC @570 from Pole V63C007 to Pole U64C015	$2,058,103
Upgrade ~9,000 ft of 2/0 ACSR to 397 AAC @570 from Pole U64C015 to Pole T65D008	$990,532
TOTAL	$4,314,628



Financial Analysis	
HC Increase	2.52
Cost ($)	4,314,628
Hosting Capacity Benefit Cost	0.58
Holistic System Benefit Cost	0.26

1898 & co.

Confidential Information

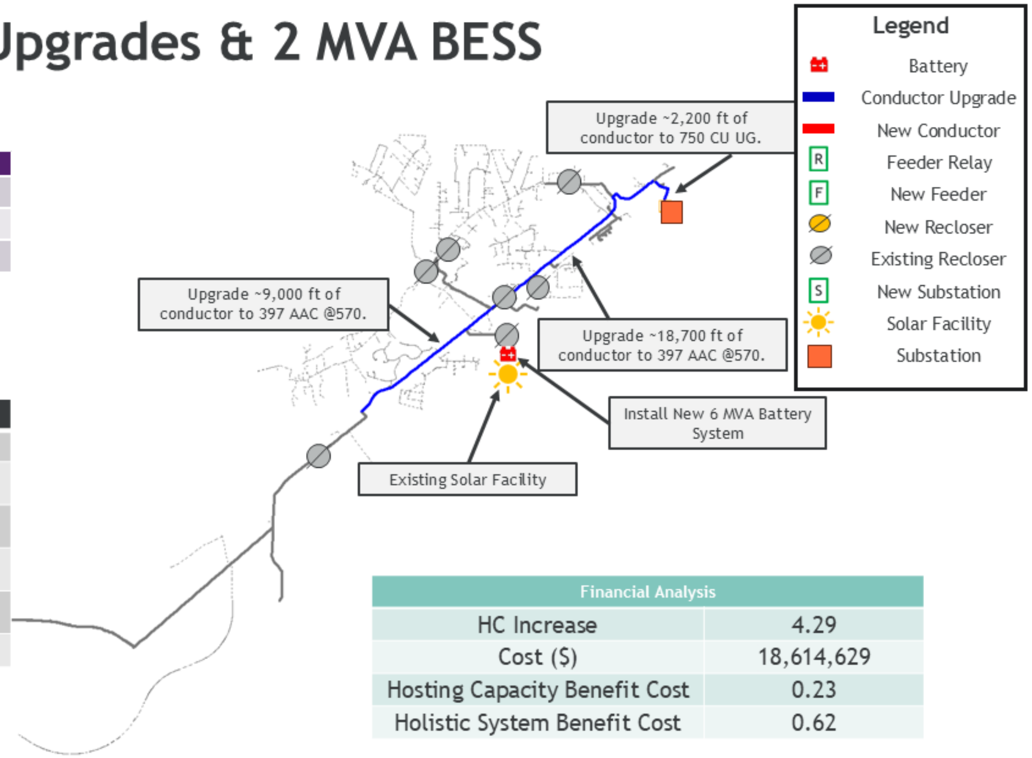
156

STPE12 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	0 MW
Max HC	4.29 MW
HC Increase	4.29 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Upgrade ~2,200 ft of 750 AL Dbl Ckt to 750 CU UG from State Pen Substation to Pole V63C007	$1,265,993
Upgrade ~18,700 ft of 397 AAC to 397 AAC @570 from Pole V63C007 to Pole U64C015	$2,058,104
Upgrade ~9,000 ft of 2/0 ACSR to 397 AAC @570 from Pole U64C015 to Pole T65D008	$990,532
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$18,614,629



Financial Analysis	
HC Increase	4.29
Cost ($)	18,614,629
Hosting Capacity Benefit Cost	0.23
Holistic System Benefit Cost	0.62

1898 & co.

Confidential Information

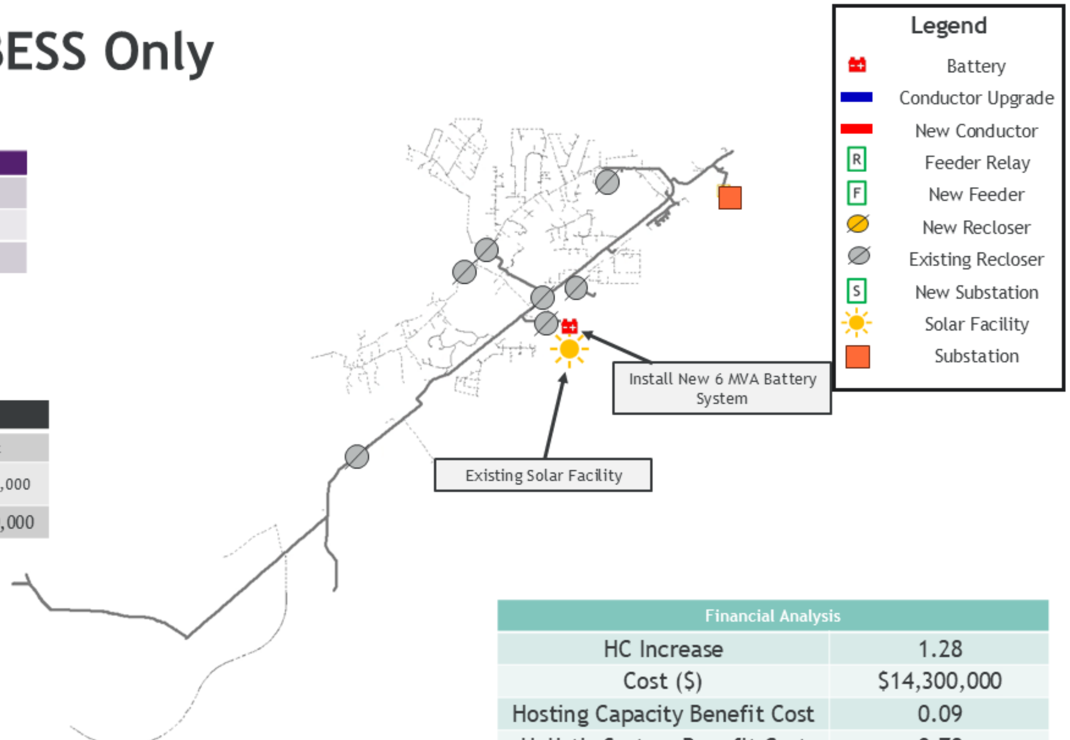
157

STPE12 - 2MVA BESS Only

Hosting Capacity	
Base HC	0 MW
Max HC	1.28 MW
HC Increase	1.28 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,300,000



Financial Analysis	
HC Increase	1.28
Cost ($)	$14,300,000
Hosting Capacity Benefit Cost	0.09
Holistic System Benefit Cost	0.78

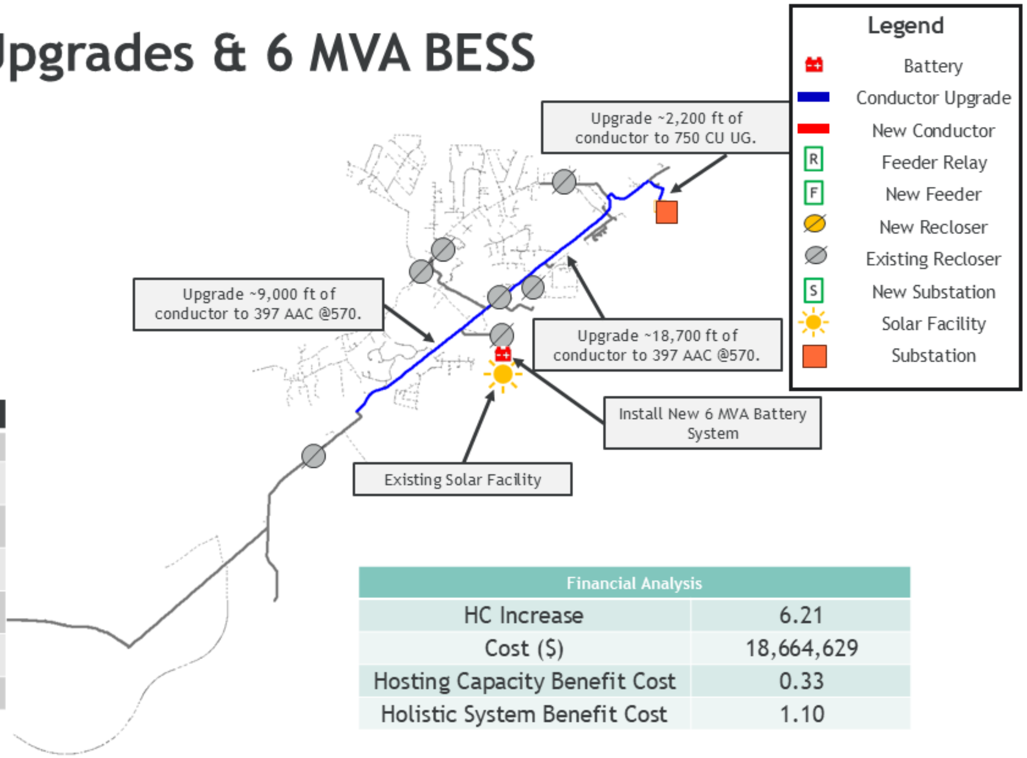
1898 & co.

STPE12 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	0 MW
Max HC	6.21 MW
HC Increase	6.21 MW

Thermal Loading Limits
Max HC

System Improvement	Cost
Upgrade ~2,200 ft of 750 AL Dbl Ckt to 750 CU UG from State Pen Substation to Pole V63C007	$1,265,993
Upgrade ~18,700 ft of 397 AAC to 397 AAC @570 from Pole V63C007 to Pole U64C015	$2,058,104
Upgrade ~9,000 ft of 2/0 ACSR to 397 AAC @570 from Pole U64C015 to Pole T65D008	$990,532
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$18,664,629



Financial Analysis	
HC Increase	6.21
Cost ($)	18,664,629
Hosting Capacity Benefit Cost	0.33
Holistic System Benefit Cost	1.10

1898 & Co.

Confidential Information

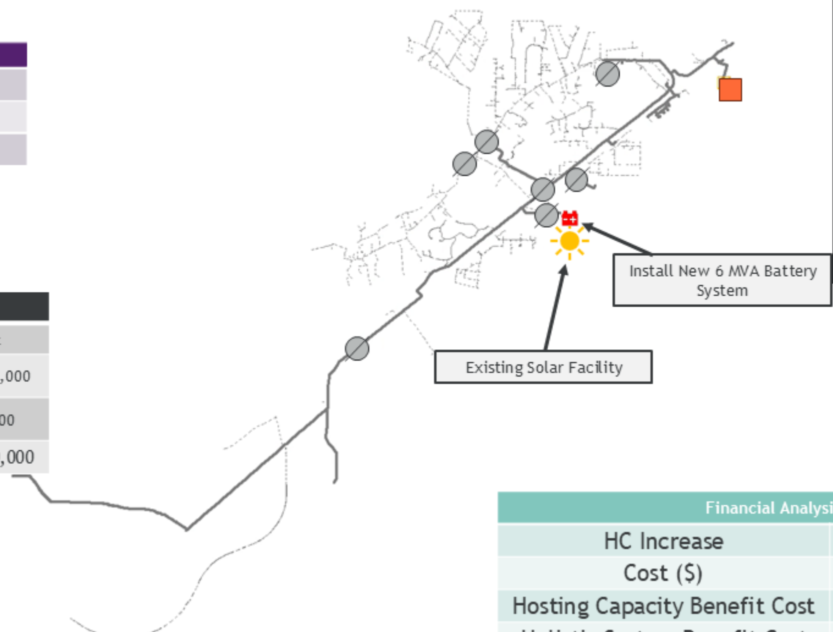
159

STPE12 - 6MVA BESS Only

Hosting Capacity	
Base HC	0 MW
Max HC	1.60 MW
HC Increase	1.60 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,350,000



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	1.60
Cost ($)	$14,350,000
Hosting Capacity Benefit Cost	0.11
Holistic System Benefit Cost	1.08

1898 & Co.

160

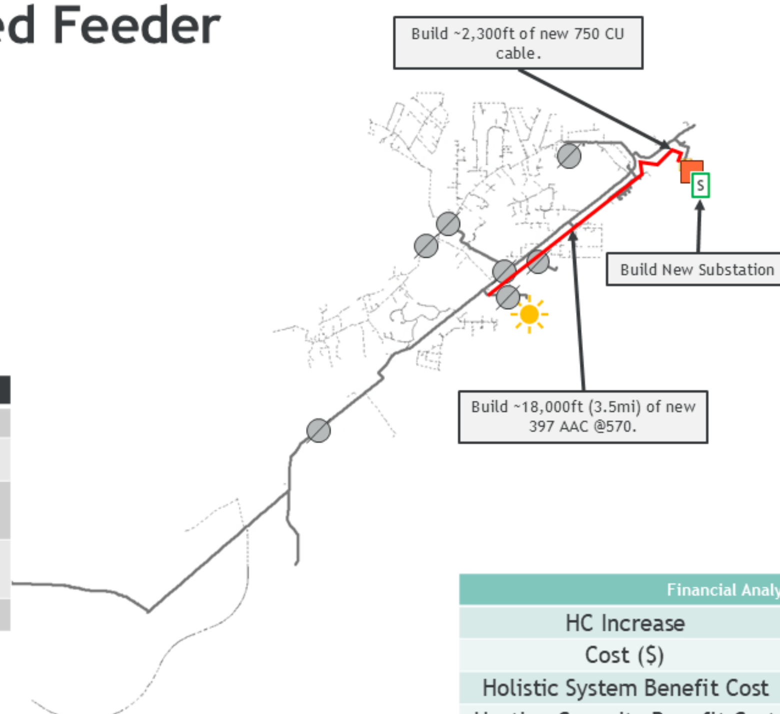
Confidential Information

STPE12 - Dedicated Feeder

Hosting Capacity	
Base HC	0 MW
Max HC	9.59 MW
HC Increase	9.59 MW

Reverse Flow Limits
Max HC

System Improvement	Cost
Build ~2,300ft of new 750 CU cable from the State Pen 12 Substation to a new riser pole.	$1,332,805
Build ~18,000ft (3.5mi) of new 397 AAC @570. Utilize double circuit construction along the existing path of State Pen 12 main line conductor.	$2,439,767
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$11,772,572



Financial Analysis	
HC Increase	9.59
Cost ($)	$11,772,572
Holistic System Benefit Cost	0.81
Hosting Capacity Benefit Cost	0.33

1898 & Co.

Confidential Information

161

STPE12 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	Thermal Violation	2,520	2,520	$4,314,628	0.58	0.26
Feeder Upgrades with 2 MVA BESS	Thermal Violation	4,289	4,289	$18,614,629	0.23	0.62
2 MVA BESS Only	Thermal Violation	1,280	1,280	$14,300,000	0.09	0.78
Feeder Upgrades with 6 MVA BESS	Thermal Violation	6,207	6,207	$18,664,629	0.33	1.10
6 MVA BESS Only	Thermal Violation	1,600	1,600	$14,350,000	0.11	1.08
Dedicated Feeder	Thermal Violation	9,590	9,590	$11,772,572	0.81	0.33

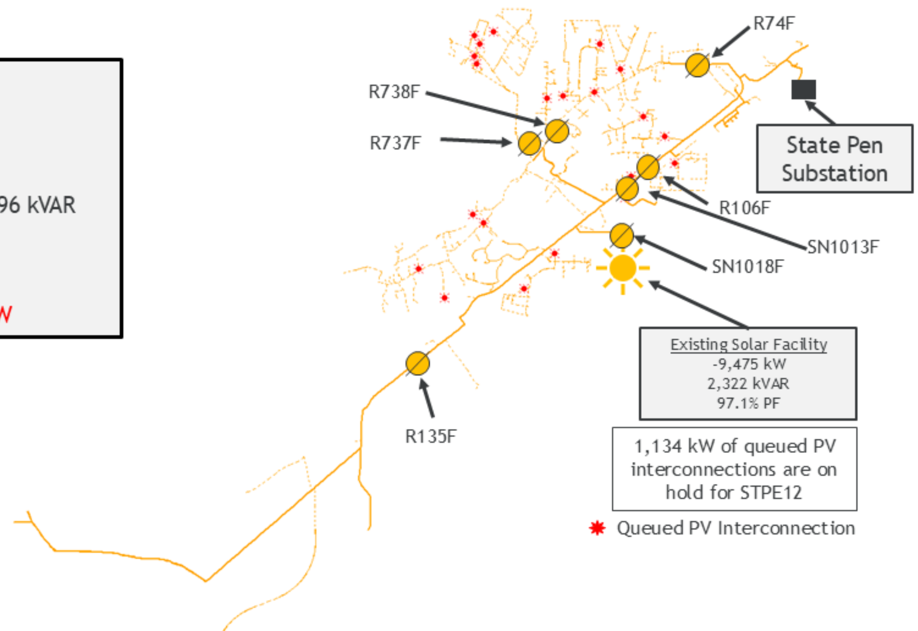
The Feeder Upgrades and 6 MVA BESS solution is proposed for State Pen Feeder 12. Feeder upgrades should be performed first for this feeder and as PV penetration increases or as the system requires more energy storage, a 6 MVA BESS can be constructed to continue increasing hosting capacity on State Pen Feeder 12.

STPE12 - Feeder Overview with Queued Solar with Conductor Upgrades and 6 MVA BESS Solution Constructed

Feeder Data

- Feeder Rating - 11,231 kVA
- Existing Generation - 11,175 kVA
- Daylight Minimum Load: -3,401 kW
- Daylight Minimum Gross Load: 1,390 kW / 1,096 kVAR
- Substation LTC Setpoint - 122 V
- Primary Voltage - 12.47 kV
- Queued Solar Projects: 23
- Total Queued AC Inverter Nameplate: 1,134 kW

The feeder can serve queued PV interconnection requests without violations.



Feeder Upgrades & 6 MVA BESS Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-3,401	2,745	4,370	-78	189	184	226	119.2	122.0	86.9

1898 & co.

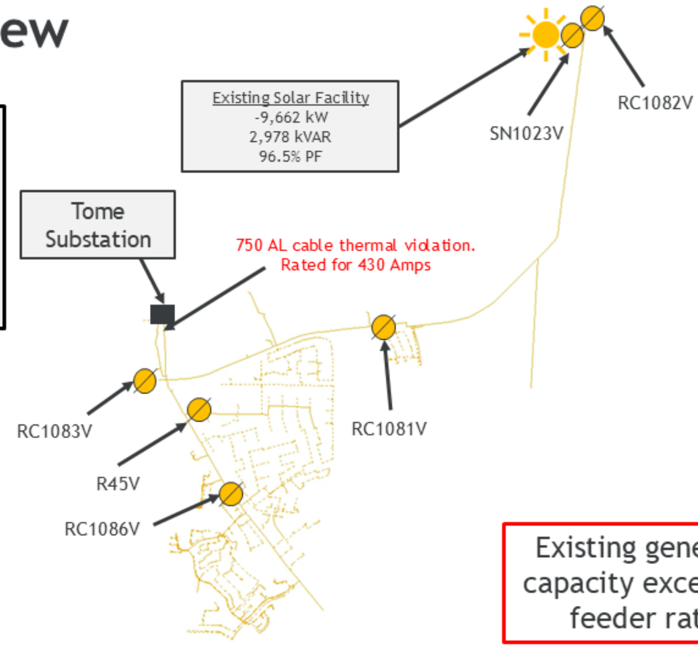
TOME12 Analysis

Confidential Information 164

TOME12 - Feeder Overview

Feeder Data

- Feeder Rating: 9,288 kVA
- Existing Generation: 10,698 kVA
- Minimum Daylight Load: -8,442 kW
- Minimum Daylight Gross Load: 946 kW / 1,532 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV



Existing generation capacity exceeds the feeder rating.

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	TOME12 Breaker	600
Recloser	R45V	200
Recloser	RC1081V	325
Recloser	RC1082V	300
Recloser	RC1083V	450
Recloser	RC1086V	200
Recloser	SN1023V	515

Base Case Load Flow Analysis (Minimum daylight Load)

kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,442	1,765	8,624	-98	407	386	385	120.5	123.2	110.0

1898 & co.

Confidential Information

165

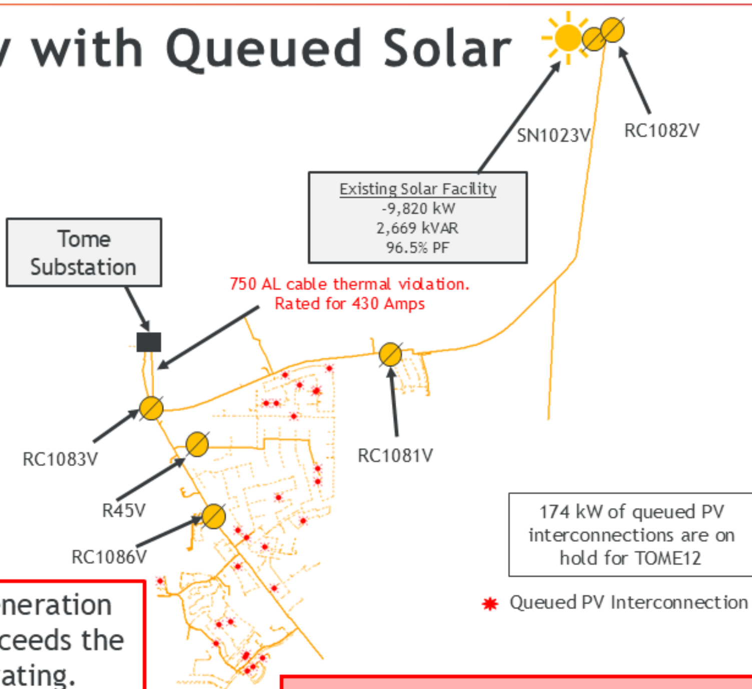
TOME12 - Feeder Overview with Queued Solar

Feeder Data

- Feeder Rating: 9,288 kVA
- Existing Generation: 10,852 kVA
- Minimum Daylight Load: -8,593 kW
- Minimum Daylight Gross Load: 946 kW / 1,532 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 29
- Total Queued AC Inverter Nameplate: 174 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	TOME12 Breaker	600
Recloser	R45V	200
Recloser	RC1081V	325
Recloser	RC1082V	300
Recloser	RC1083V	450
Recloser	RC1086V	200
Recloser	SN1023V	515

Existing generation capacity exceeds the feeder rating.



Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,593	1,720	8,768	-98	418	390	390	120.6	123.2	111.6

The feeder CANNOT serve queued PV interconnection requests without violations.

1898 & co.

166

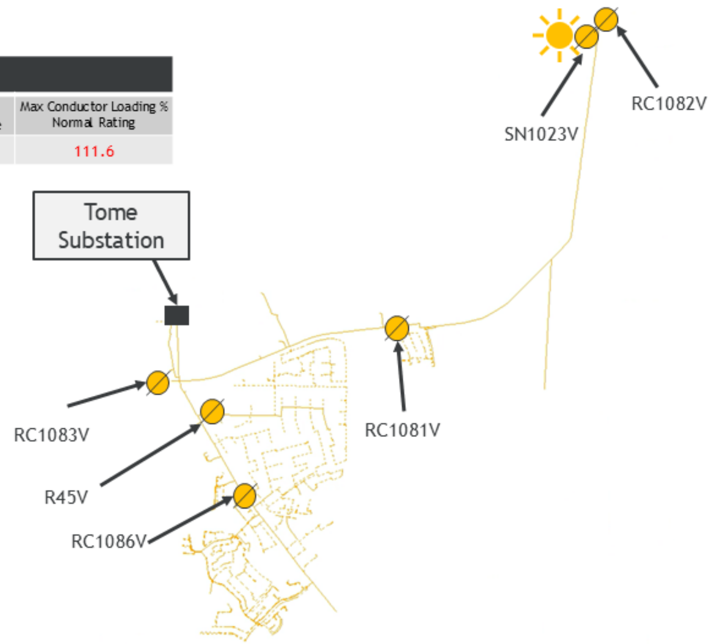
Confidential Information

TOME12 - Maximum Hosting Capacity Base Case w/ Queued PV

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-8,593	1,720	8,768	-98	418	390	390	120.6	123.2	111.6

Feeder Observations

- There is ZERO hosting capacity available in this feeder in the base case scenario.
- The existing generation exceeds the feeder rating.
- A 111.6% thermal overload is observed at the feeder getaway if generation is at full output and is coincident with minimum daylight load. The getaway is 750AL (Riser) which has a rating of 430A or 9,827 kVA.



1898 & Co.

Confidential Information

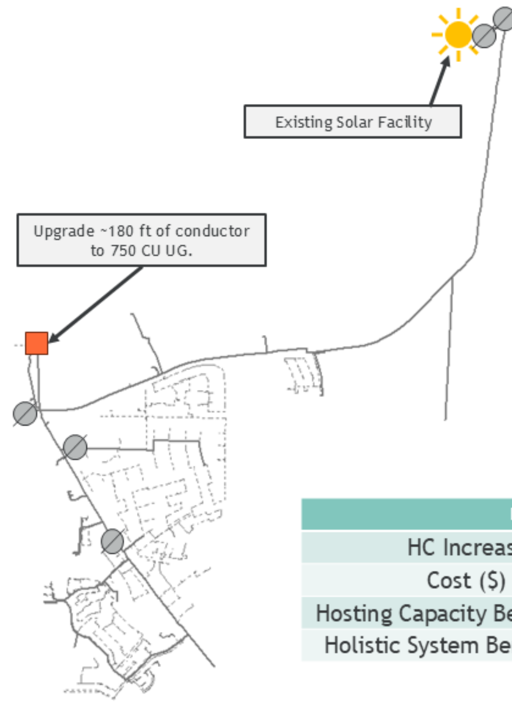
167

TOME12 - Feeder Upgrades

Hosting Capacity	
Base HC	0 MW
Max HC	2.62 MW
HC Increase	2.62 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Upgrade ~180 ft of 750 AL (RISER) to 750 CU UG from SW4837V (PME-9) to Pole D36A159	$82,117
TOTAL	$82,117



Legend
- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	2.62
Cost ($)	82,117
Hosting Capacity Benefit Cost	31.91
Holistic System Benefit Cost	39.92

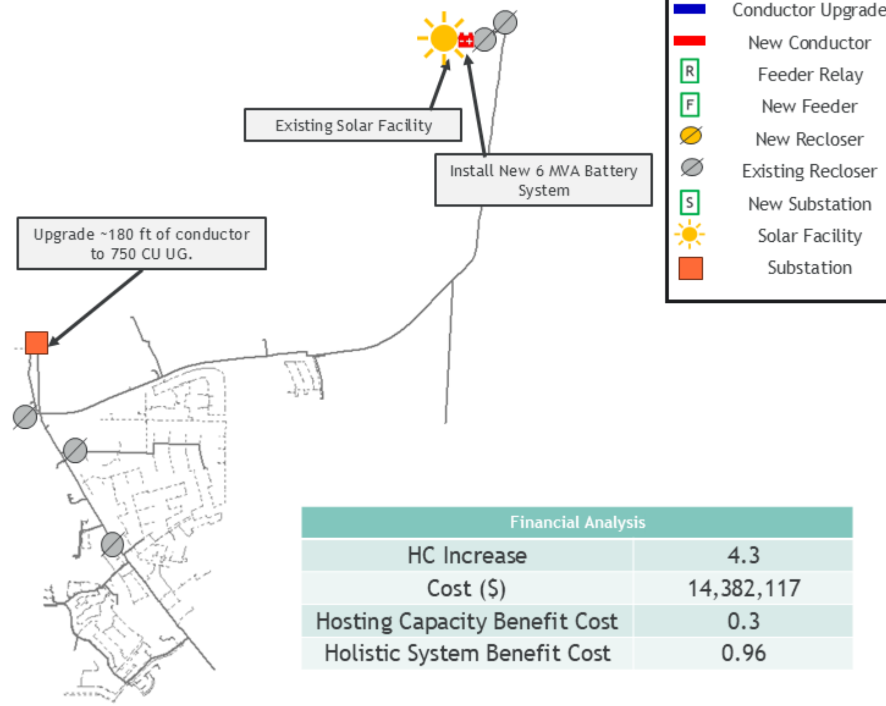
168

TOME12 - Feeder Upgrades & 2 MVA BESS

Hosting Capacity	
Base HC	0 MW
Max HC	4.3 MW
HC Increase	4.3 MW

Reverse Flow Limits Max HC

System Improvement	
	Cost
Upgrade ~180 ft of 750 AL (RISER) to 750 CU UG from SW4837V (PME-9) to Pole D36A159	$82,117
Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
TOTAL	$14,382,117



Financial Analysis	
HC Increase	4.3
Cost ($)	14,382,117
Hosting Capacity Benefit Cost	0.3
Holistic System Benefit Cost	0.96

1898 & Co.

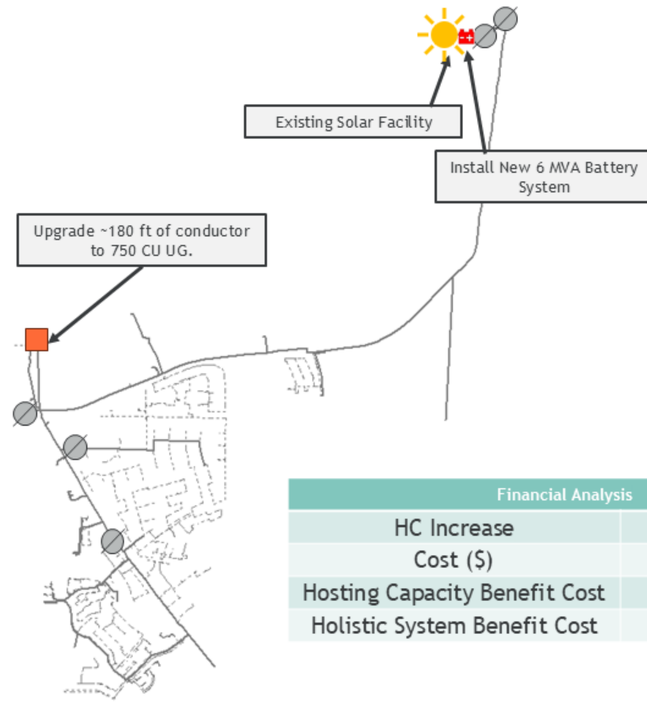
Confidential Information

TOME12 - Feeder Upgrades & 6 MVA BESS

Hosting Capacity	
Base HC	0 MW
Max HC	6.46 MW
HC Increase	6.46 MW

Thermal Loading Limits
Max HC

System Improvement	Cost
Upgrade ~180 ft of 750 AL (RISER) to 750 CU UG from SW4837V (PME-9) to Pole D36A159	$82,117
Install New 6 MVA Battery (Operating at 6 MVA Charging/Discharging)	$14,300,000
Communication Upgrade for sophisticated BESS control schemes	$50,000
TOTAL	$14,432,117



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- Solar Facility
- Substation

Financial Analysis	
HC Increase	6.46
Cost ($)	14,432,117
Hosting Capacity Benefit Cost	0.45
Holistic System Benefit Cost	1.59

1898 & co.

Confidential Information

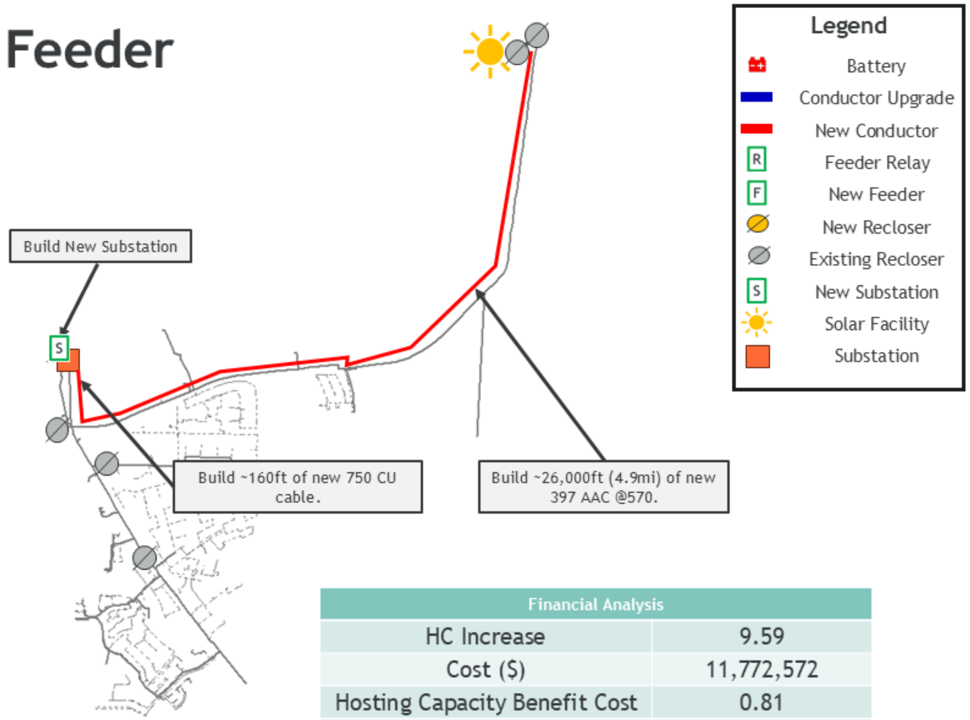
170

TOME12 - Dedicated Feeder

Hosting Capacity	
Base HC	0 MW
Max HC	9.59 MW
HC Increase	9.59 MW

Reverse Flow Limits
Max HC

System Improvement	
	Cost
Build ~160ft of new 750 CU cable from the New Tome Substation to a new riser pole.	$69,407
Build ~26,000ft (4.8mi) of new 397 AAC @570. Utilize double circuit construction along the existing path of TOME12 main line conductor.	$3,703,165
Build a New Substation Transformer - Including transformer, switchgear, and feeder relaying equipment.	$8,000,000
TOTAL	$11,772,572



Financial Analysis	
HC Increase	9.59
Cost ($)	11,772,572
Hosting Capacity Benefit Cost	0.81
Holistic System Benefit Cost	0.33

1898 & Co.

Confidential Information

171

TOME12 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Feeder Upgrades	Thermal Violation	2,620	2,620	$82,117	31.91	39.92
Feeder Upgrades with 2 MVA BESS	Thermal Violation	4,299	4,299	$14,382,117	0.30	0.96
2 MVA BESS Only*	-	-	-	-	-	-
Feeder Upgrades with 6 MVA BESS	Thermal Violation	6,460	6,460	$14,432,117	0.45	1.59
6 MVA BESS Only*	-	-	-	-	-	-
Dedicated Feeder	Thermal Violation	9,590	9,590	$11,772,572	0.81	0.33

*This scenario was not applicable to this analysis.

A 6 MVA BESS has been constructed and is installed on Tome Feeder 12. When this BESS is in operation it will provide an increase to hosting capacity on this feeder.

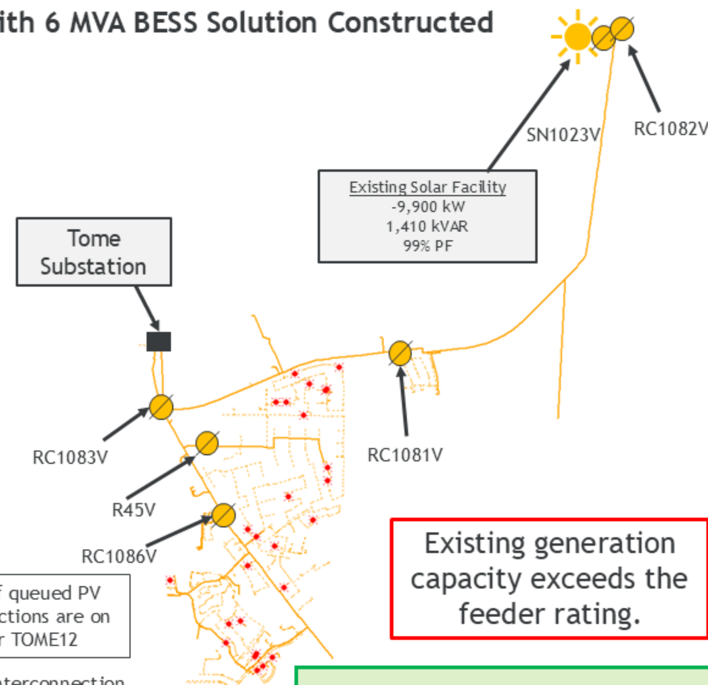
1898 & Co.

TOME12 - Feeder Overview with Queued Solar with 6 MVA BESS Solution Constructed

Feeder Data

- Feeder Rating: 9,288 kVA
- Existing Generation: 10,852 kVA
- Minimum Daylight Load: -3,531 kW
- Minimum Daylight Gross Load: 946 kW / 1,532 kVAR
- Substation LTC Setpoint: 122 V
- Primary Voltage: 12.47 kV
- Queued Solar Projects: 29
- Total Queued AC Inverter Nameplate: 174 kW

Protection & Equipment Pickup/Ratings		
Device	Name	Pick Up Rating (A)
Breaker	TOME12 Breaker	600
Recloser	R45V	200
Recloser	RC1081V	325
Recloser	RC1082V	300
Recloser	RC1083V	450
Recloser	RC1086V	200
Recloser	SN1023V	515



174 kW of queued PV interconnections are on hold for TOME12

✱ Queued PV Interconnection

Existing generation capacity exceeds the feeder rating.

6MVA BESS Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-3,531	-1,233	3,740	94	188	161	162	120.9	122.4	88.4

The feeder can serve queued PV interconnection requests without violations.

1898 & co.

Confidential Information

173

1898andco.com

Alamogordo Feeder A10012 Hosting Capacity Improvement Solution

PNM Exhibit EH-3

Is contained in the following 8 pages.

Alamogordo12 Analysis

1898 & Co.

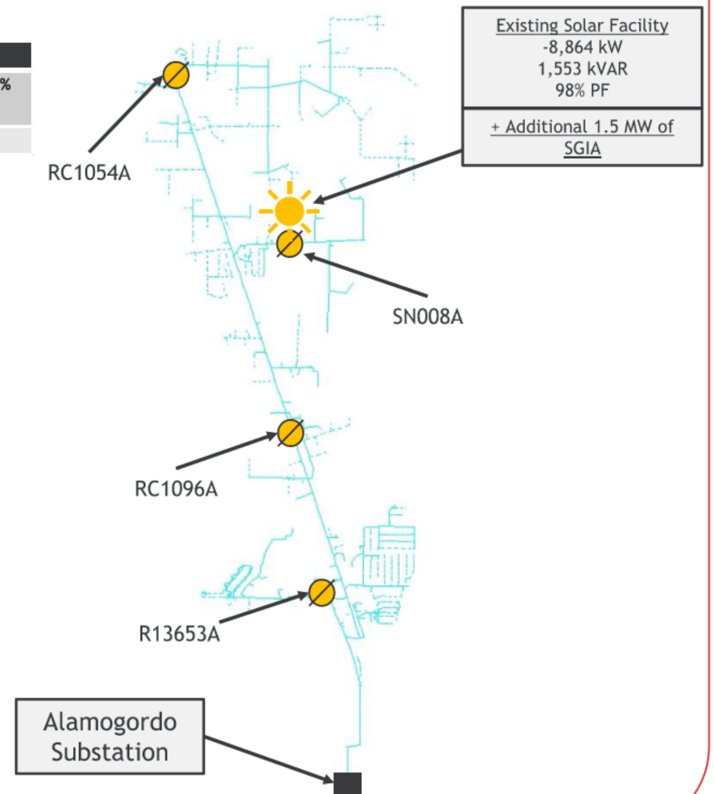
A10012 - Feeder Overview

Base Case Load Flow Analysis (Minimum daylight Load)									
kW	kVAR	kVA	PF %	Phase A Amps	Phase B Amps	Phase C Amps	Min Voltage	Max Voltage	Max Conductor Loading % Normal Rating
-7,928	3,496	8,664	-91	387	385	383	123.0	125.0	77.4

Protection Devices		
Device	Name	Pick Up Rating (A)
Breaker	A10012 Breaker	600
Recloser	R13653A	400
Recloser	RC1054A	375
Recloser	RC1096A	500
Recloser	SN008A	450

Feeder Data

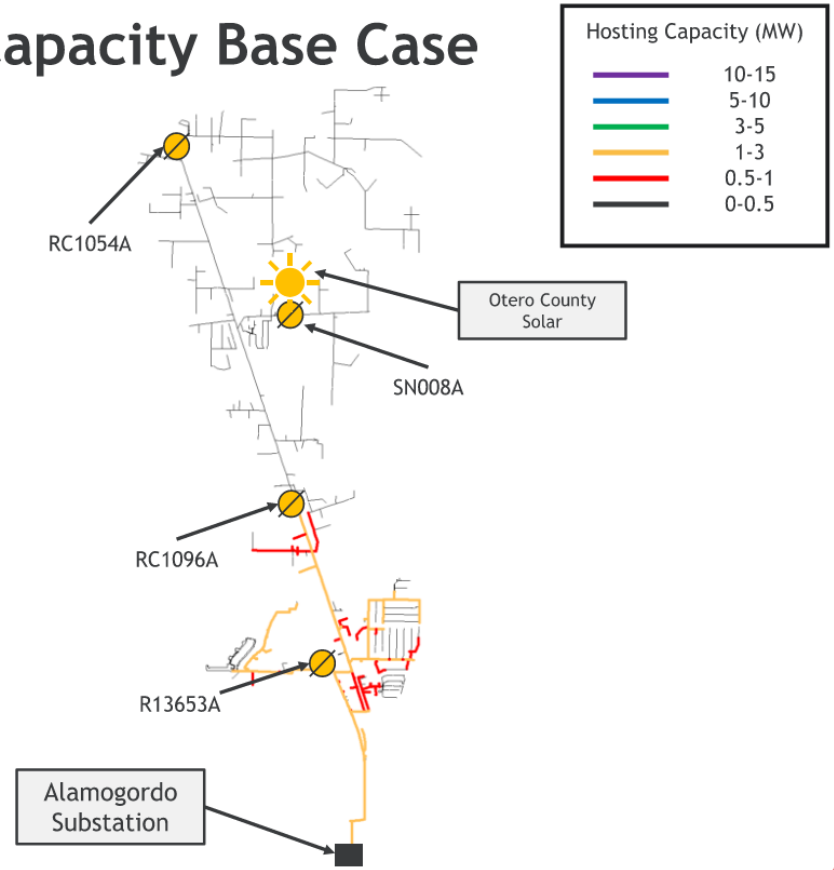
- Feeder Rating: 11,663 kVA
- Existing Generation: 11,574 kVA
- Minimum Daylight Load: -9,263 kW
- Minimum Daylight Gross Load: 1,629 kW / 1,876 kVAR
- Substation LTC Setpoint: 125 V
- Primary Voltage: 12.47 kV



A10012 - Maximum Hosting Capacity Base Case

Maximum Hosting Capacity
3.75 MW

Limiting Factors	
Thermal Loading Violation	87%
Voltage Violation	13%



1898 & Co.

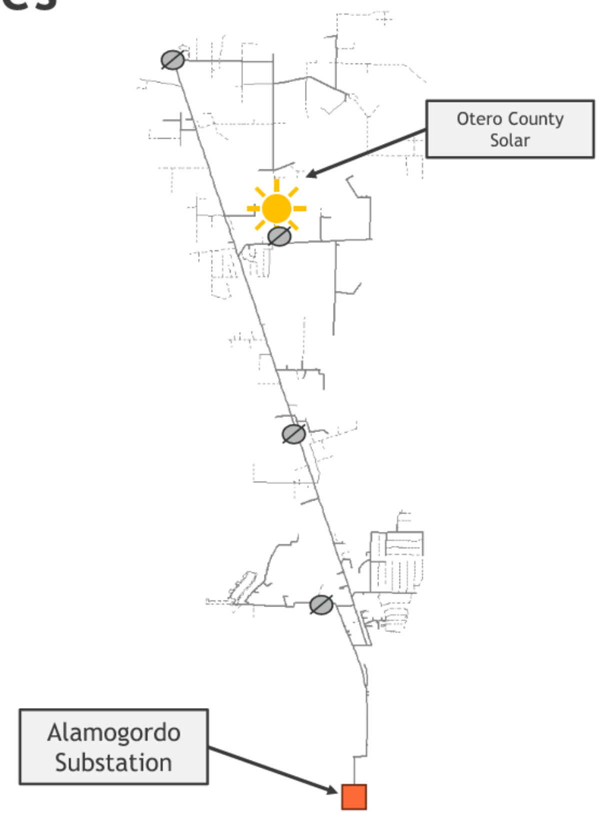
A10012 - Feeder Upgrades

System Improvement	
Improvement Details	Cost
No Applicable Traditional System Upgrades	-
TOTAL	-

Hosting Capacity	
Base HC	3.75 MW
Max HC	3.75 MW
HC Increase	0 MW

Benefit Cost Ratio	
HC Increase	0 MW
Cost ($)	0
Hosting Capacity Benefit Cost	-
Holistic System Benefit Cost	-

Reverse Flow Limits
Max HC



Legend

- Battery
- Conductor Upgrade
- New Conductor
- Feeder Relay
- New Feeder
- New Recloser
- Existing Recloser
- New Substation
- New XFMR
- Solar Facility
- Substation

1898 & co.

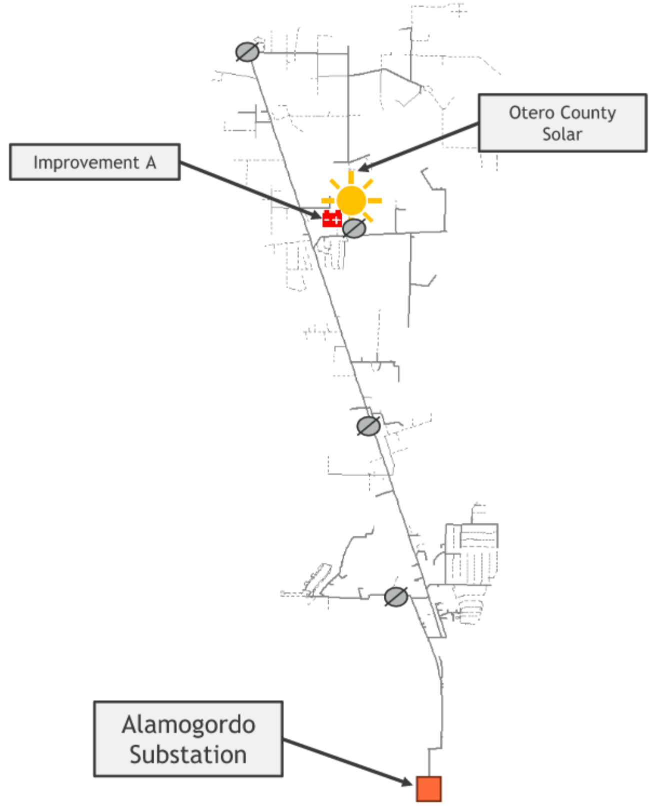
A10012 - Feeder Upgrades & 2 MVA BESS

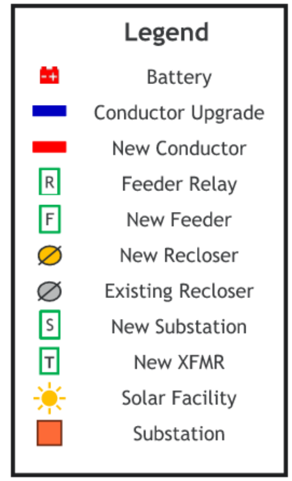
System Improvement		
	Improvement Details	Cost
A	Install New 6 MVA Battery (Operating at 2 MVA Charging/Discharging)	$14,300,000
	TOTAL	$14,300,000

Hosting Capacity	
CS Base HC	3.75 MW
Max HC	5.55 MW
HC Increase	1.8 MW

Benefit Cost Ratio	
HC Increase	1.8 MW
Cost ($)	14,300,000
Hosting Capacity Benefit Cost	0.13
Holistic System Benefit Cost	0.88

Reverse Flow Limits
Max HC





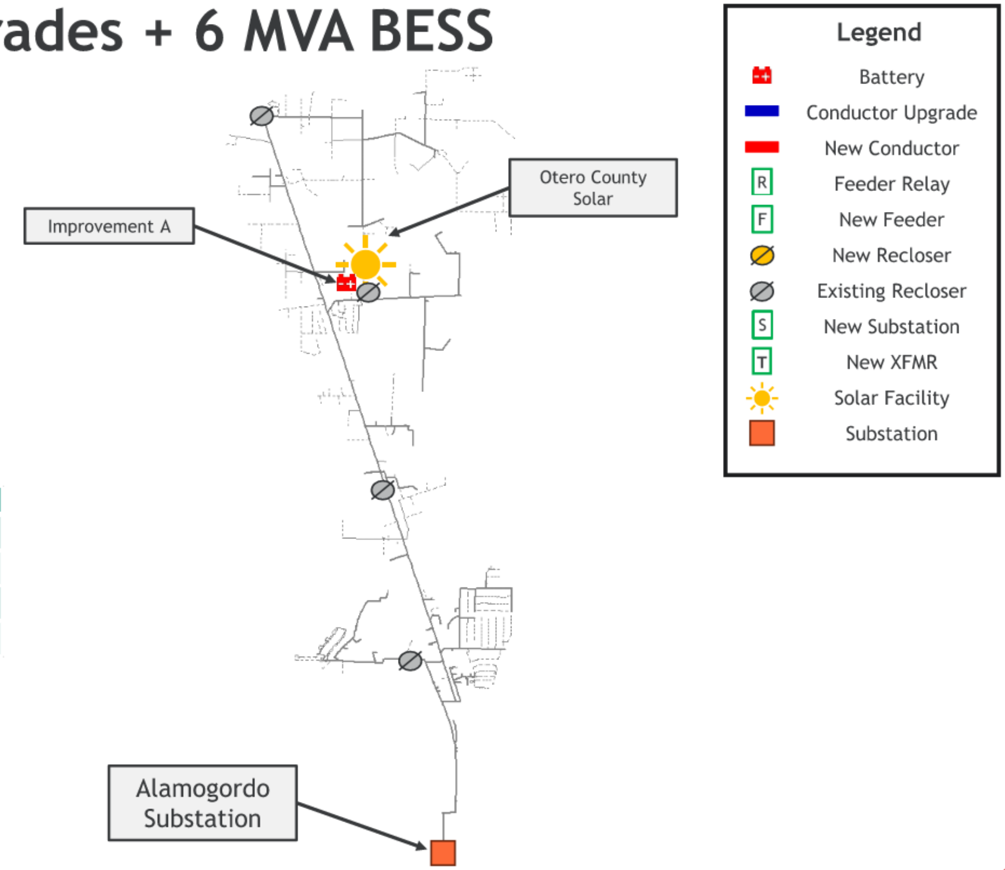
A10012 - Feeder Upgrades + 6 MVA BESS

System Improvement		
	Improvement Details	Cost
A	Install New 6 MVA Battery + Control Scheme (Operating at 6 MVA Charging/Discharging)	$14,350,000
	TOTAL	$14,350,000

Hosting Capacity	
CS Base HC	3.75 MW
Max HC	9.33 MW
HC Increase	5.58 MW

Benefit Cost Ratio	
HC Increase	1.8 MW
Cost ($)	14,350,000
Hosting Capacity Benefit Cost	0.39
Holistic System Benefit Cost	1.79

Reverse Flow Limits
Max HC

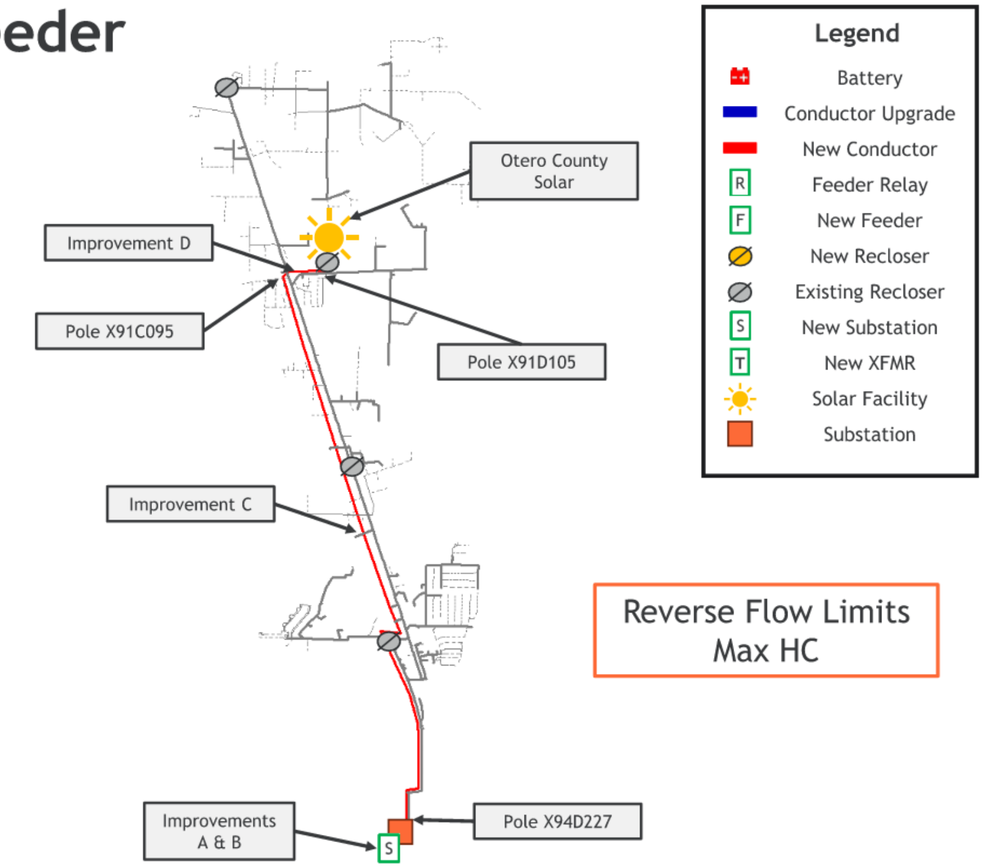


A10012 - Dedicated Feeder

System Improvement		
	Improvement Details	Cost
A	Upgrade the Substation Transformer - Including switchgear, and feeder relaying equipment if necessary.	$8,000,000
B	Build ~200 ft of 477 AAC from New Substation to Pole X94D227.	$4,613,746
C	Build ~26,000 ft of 477 AAC from Pole X94D227 to Pole X91C095.	
D	Build ~2,000 ft of 397 AAC @ 570 from Pole X91C095 to X91D105.	
	TOTAL	$12,613,746

Hosting Capacity	
CS Base HC	3.75 MW
Max HC	12.14 MW
HC Increase	8.39 MW

Benefit Cost Ratio	
HC Increase	8.39 MW
Cost ($)	12,613,746
Hosting Capacity Benefit Cost	0.66
Holistic System Benefit Cost	0.68



Reverse Flow Limits Max HC

A10012 - Hosting Capacity Analysis Summary

Hosting Capacity Improvement Solution	Base Case Hosting Capacity kVA	New Maximum Hosting Capacity kVA	Net Hosting Capacity Increase kVA	Capital Project Cost	Net Hosting Capacity Increase (kVA) over Cost ($K)	Holistic System Benefit Cost Ratio Score
Baseline	3,753	3,753	0	-	-	-
Feeder Upgrades	3,753	3,753	0	-	-	-
Feeder Upgrades + 2MVA BESS	3,753	5,548	1,795	$14,300,000	0.13	0.88
Feeder Upgrades + 6MVA BESS	3,753	9,331	5,577	$14,350,000	0.39	1.79
Dedicated Feeder	3,753	12,137	8,384	$12,613,746	0.66	0.68

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF PUBLIC SERVICE COMPANY OF NEW MEXICO'S APPLICATION FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT, OWN, AND OPERATE 30 MEGA WATTS OF BATTERY ENERGY STORAGE FACILITES	)	**Case No. 25-000__-UT**
PUBLIC SERVICE COMPANY OF NEW MEXICO	)	

AFFIDAVIT

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

ERFAN HAKIMIAN, Director of Transmission/Distribution Planning and Contracts for Public Service Company of New Mexico, upon being duly sworn according to law, under oath, deposes and states: I have read the foregoing **Direct Testimony of Erfan Hakimian,** and it is true and accurate based on my own personal knowledge and belief.

DATED this 6th day of August, 2025.

/s/ *Erfan Hakimian*
ERFAN HAKIMIAN

GCG #533973