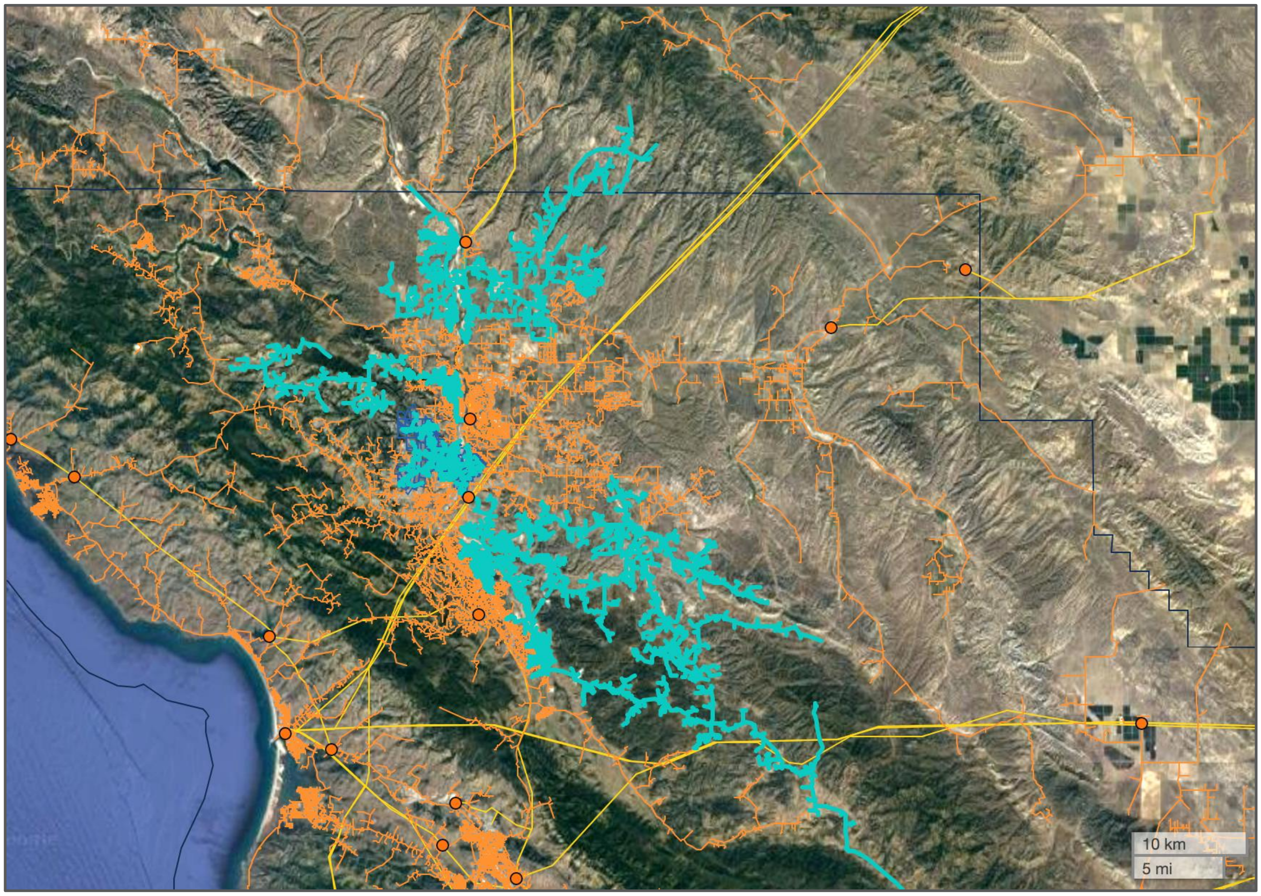
# Behind-the-Meter Solar plus Storage Adoption Propensity Analysis

Estrella Substation and Paso Robles Area Reinforcement Project

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***Cover Photo Credit:*** *Kevala Analytics' Network Assessor Tool showing distribution lines and substations within the Paso Robles Distribution Planning Area in San Luis Obispo County, California.*

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# Acronyms and Abbreviations

| | |
|---|---|
| $/W | dollars per watt |
| AMI | Advanced Metering Infrastructure |
| Alternative Battery Storage #1 | Battery Storage to Address Transmission Objective |
| Alternative Battery Storage #2 | Battery Storage to Address Distribution Objective |
| Alternative Battery Storage #3 | Behind-the-Meter Battery Storage |
| Applicants | HWT and PG&E |
| ASR | Alternatives Screening Report |
| BES | Bulk Electric System |
| BESSs | battery energy storage systems |
| BTM | behind-the-meter |
| Category B | Criteria for system performance following the loss of a single BES element |
| Category C | Criteria for system performance following the loss of two or more BES elements |
| C&I | commercial and industrial |
| CAISO | California Independent System Operator |
| CEC | California Energy Commission |
| CEQA | California Environmental Quality Act |
| CPUC | California Public Utilities Commission |
| DA | Day Ahead |
| DDOR | Distribution Deferral Opportunities Report |
| DEIR | Draft environmental impact report |
| DER | Distributed Energy Resource |
| DPA | Distribution Planning Area |
| feeders | distribution lines |
| FOM | front-of-the-meter |
| GNA | Grid Needs Assessment |
| Horizon | Horizon Water and Environment, LLC |
| HWT | Horizon West Transmission, LLC |
| IEPR | Integrated Energy Policy Report |
| IRP | Integrated Resource Planning |
| ITC | investment tax credit |
| Kevala | Kevala Analytics, Inc. |
| kV | kilovolt |
| kW | kilowatt |

| | |
|---|---|
| kWh | kilowatt hour |
| MW | megawatts |
| MWh | megawatt-hours |
| NEM | net energy metering |
| NERC | North American Electric Reliability Corporation |
| N-1 | A single contingency involving the loss of a single BES element |
| N-2 | A multiple contingency involving the simultaneous loss of two BES elements |
| N-1-1 | A multiple contingency involving the consecutive loss of two single BES elements that are not physically or electrically connected |
| PEA | proponent’s environmental assessment |
| PG&E | Pacific Gas & Electric Company |
| Proposed Project | Estrella Substation and Paso Robles Reinforcement Project |
| PV | photo voltaic |
| P1 | A single contingency |
| P6 | A multiple contingency with two overlapping singles |
| RFP | Request for Proposals |
| RT | real time |
| SGIP | self-generation incentive program |

# 1. Executive Summary and Report Purpose

Kevala Analytics, Inc. (Kevala) prepared this report for the California Public Utilities Commission (CPUC) Energy Division to supplement the March 2019 Draft Alternatives Screening Report (ASR) prepared by Horizon Water and Environment, LLC (Horizon). The Draft ASR was prepared in support of the CPUC's California Environmental Quality Act (CEQA) review of the Estrella Substation and Paso Robles Area Reinforcement Project (Proposed Project) proposed by Horizon West Transmission, LLC (HWT) (formerly NextEra Energy Transmission West, LLC) and Pacific Gas & Electric Company (PG&E) (together, the "Applicants"). The Draft ASR and detailed information about the Proposed Project and application to the CPUC are provided here:

www.cpuc.ca.gov/environment/info/horizonh2o/estrella/index.html.

The Draft ASR included a brief description of a potential behind-the-meter (BTM) battery storage alternative (*Alternative Battery Storage #3*)[1] but stated that the feasibility of this alternative was "to be determined." The BTM solution would include the application of Distributed Energy Resources (DERs)[2]. The purpose of this report is to provide further data about the potential for BTM resources (including solar photovoltaic) to serve as an alternative to components of the Proposed Project.

BTM (customer-side) battery energy storage systems (BESSs), including when paired with BTM solar systems, can reduce loading on electric grid facilities in the Paso Robles area such that the need for components of the Proposed Project can be avoided or deferred. This report identifies the amount of electric capacity that could be provided by BTM resources based on Kevala's big data approach to adoption propensity analysis. This information is necessary for the CPUC to determine whether the amount could be sufficient to address the transmission and distribution needs that would otherwise be addressed by the Proposed Project.

Kevala's analysis applied a bottom-up economic propensity for adoption model to identify likely adopters of BTM resources within PG&E's Paso Robles Distribution Planning Area (DPA). Low, medium, and high adoption scenarios were considered to provide a reasonable range of potential BTM solar plus storage adoption, as well as inform the possible development and use of customer incentives to help ensure BTM adoption occurs as required for the Draft ASR's Battery Storage #3 alternative. The issuance of a Request for Proposals (RFP) and development of a BTM storage program

1 Alternative Battery Storage #1 and #2 would use front-of-the-meter resources to address the Proposed Project's transmission and distribution needs, respectively. Alternative Battery Storage #3 would use BTM resources to address one or both needs.

2 DERs are small-scale generation or storage facilities that can serve as alternatives to or an enhancement of traditional electric grid facilities.

including economic incentives is one potential pathway for achieving the required BTM resources adoption in the target area.

The model indicates that under the low adoption scenario, there is potential for adoption of 88 megawatts (MW) of solar and 125 MW and 240 megawatt-hours (MWh)[3] of battery storage across residential, commercial, and industrial customers within the Paso Robles DPA (see **Table 7).** Under the high adoption scenario, this potential is 100 MW of solar and 175 MW / 343 MWh of battery storage. For Paso Robles distribution lines (feeders),[4] specifically, there is potential for 48.5 MW / 90.6 MWh under the low adoption scenario, and 69.2 MW / 136 MWh under the high adoption scenario (see Table 7).

Based on the original distribution need presented by the Applicants in their 2017 application to the CPUC (A.17-01-023) (roughly 4.3 MW of additional capacity over the next ten years), Kevala observes that this BTM adoption potential could provide more than enough load reduction to defer the need for the distribution components of the Proposed Project for many years (i.e., build-out of the distribution transformers and electrical lines from Estrella Substation). Only 8.3 percent of the identified BTM adoption potential around Paso Robles Substation would need to be realized to meet the 4.3 MW DPA-wide capacity need. However, based on subsequent filings regarding distribution system capacity need (i.e., PG&E's 2019 Grid Needs Assessment [GNA] and Distribution Deferral Opportunities Report [DDOR] filings pursuant to the CPUC Distribution Resources Plans proceeding [R.14-08-013]), BTM resources alone may not be able to solve all of the specific capacity needs.

The latest filings indicate that 5.9 MW of additional capacity is required to address needs for Paso Robles Feeder 1104 (1.2 MW, 8 hours), San Miguel Substation Transformer Bank 1 (3.6 MW, 9 hours), and Templeton Substation Transformer Bank 3 (1.1 MW, 3 hours) (see **Table 2**) (PG&E 2019a). Kevala's propensity for adoption analysis indicates that BTM resources have potential to directly solve the grid need identified at Templeton Substation Transformer Bank 3 and Paso Robles Feeder 1104 (although a front-of-the-meter [FOM; utility-side] storage facility may also be a good approach for this feeder), and that BTM resources could partially mitigate the grid need at San Miguel Substation Transformer Bank 1. A FOM solution could be paired with BTM resources to address the remaining capacity needs at San Miguel Substation.

With respect to the transmission components of the Proposed Project, Kevala observes that the modeled BTM adoption potential (if fully realized) could fully meet the 65 MW capacity need at Paso Robles Substation (as identified by ZGlobal, Inc. [ZGlobal] and described in the Draft ASR). However, individual BTM resources would only provide up

[3] Battery storage is rated in terms of capacity and energy. Capacity is defined in megawatts and energy is defined in megawatt hours. For example, a storage facility capable of providing 10 MW of capacity for two hours is rated to provide 20 MWh (i.e., 10 x 2) of energy.

[4] Feeders are electrical lines that transfer electricity from substations to customers.

to 2 hours of energy at full output, and even when paired with FOM resources, would not likely be able to address the 11 hours that could be needed if an outage of a transmission resource were to occur during peak summertime loading conditions and lasted at least a day. Furthermore, the California Independent System Operator (CAISO) explained that the need could extend for multiple days depending on how long it would take to resolve the outage or secondary, back-to-back outages that could occur (CAISO 2019). CPUC Energy Division verified that even if BTM and FOM resources could provide the 11 hours of daily capacity required during an outage event lasting for at least 24 hours, the resources could not fully recharge to address an outage that continued for a second day or longer (Rahman 2019).

Hence, Kevala finds that BTM resources, in combination with FOM resources, have the potential to cost-effectively avoid or defer the distribution components of the Proposed Project. The FOM resources might include battery storage or a transformer upgrade at an existing substation site, for example. Kevala's model results, in combination with power flow modeling by ZGlobal, indicates that BTM resources would not be able to avoid or defer transmission components of the Proposed Project, even when combined with FOM resources.

# 2. Estrella Project Objectives and Alternatives Explored

The objectives of the Proposed Project, as defined by the CPUC for their review of alternatives pursuant to CEQA, are as follows:

- Transmission Objective: Mitigate thermal overload and low voltage concerns in the Los Padres 70 kilovolt (kV) system during Category B[5] contingency scenarios, as identified by the CAISO in its 2013 - 2014 Transmission Plan.

[5] The CAISO uses the North American Electric Reliability Corporation (NERC) reliability standards to analyze the need for transmission system upgrades. The NERC standards provide criteria for system performance requirements that must be met under a varied but specific set of operating conditions, and prior to 2012, included the following categories:

- Category A – System Performance Under Normal Conditions
- Category B – System Performance Following Loss of a Single Bulk Electric System (BES) Element
- Category C – System Performance Following Loss of Two or More BES Elements
- Category D – System Performance Following Extreme BES Events

The latest adopted NERC TPL-001-4 transmission reliability standard applies new terminology; P0 through P7 define different scenarios based on the initial system condition and nature of the event (e.g., loss of generator, transmission circuit, bus section fault, etc.). The Category B contingencies identified for the Proposed Project would equate to a P1 (single contingency), while the Category C3

- Distribution Objective: Accommodate expected future increased electric distribution demand in the Paso Robles DPA, particularly in the anticipated growth areas in northeast Paso Robles.

## 2.1 Transmission Objective and DER Alternatives

The Draft ASR (CPUC 2019a) identified Alternative Battery Storage #1 as a potential way to address the Transmission Objective of the Proposed Project. This alternative would include one or more FOM BESSs, sized from 65 MW to 120 MW, as shown in Table 3-4 of the Draft ASR. To address the N-1 (i.e., P1 or Category B) scenarios identified by CAISO (i.e., loss of either the Paso Robles-Templeton 70 kV Transmission Line or Templeton Transformer Bank #1), 65 MW of storage sited at or near Paso Robles Substation would be needed. To address the N-1-1 (i.e., P6 or Category C3) scenario (loss of both Templeton-Gates and Templeton-Morro Bay 230 kV Transmission Lines)[6], roughly 120 MW of total storage would be needed and could be split between Paso Robles Substation and Templeton Substation (CPUC 2019a).

Alternative Battery Storage #1 in the Draft ASR also considered different scenarios on the duration of a potential P1 or P6 contingency. Alternative Battery Storage #1C modeled a duration of 24 hours for solving the P1 contingency; under this scenario, FOM BESS(s) at or near Paso Robles Substation would need to be able to provide 11 hours of power, for a total of 65 MW/715 MWh. The Draft ASR found that this size BESS(s) would require roughly 7 acres; however, since publication of the Draft ASR, advances in battery storage technology have reduced the space/footprint needed for facilities substantially (roughly 40 percent), such that roughly 4.2 acres would be needed.

PG&E, HWT, and CAISO all commented on the Draft ASR that the Alternative Battery Storage #1 was infeasible due to the inability for a FOM BESS to recharge during high loading conditions, such as to be able to address long duration outages (i.e., possibly multiple days) or to be in an adequate state of charge after an initial outage to solve a subsequent outage(s) (PG&E 2019b; HWT 2019; CAISO 2019). PG&E, in its comments on the Draft ASR and in subsequent discussions, indicated that an outage of the Paso

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contingencies would equate to a P6 (multiple contingency; two overlapping singles) (NERC No Date). The NERC standards allow for load to be dropped for a P6 contingency, but not for a P1 contingency.

NERC also refers to single contingencies (i.e., loss of a single BES element) as N-1 events. A multiple contingency where both BES elements fail at the same time (e.g., two circuits on the same pole line fail when a pole is hit by a vehicle) is known as an N-2 event. A multiple contingency involving the consecutive loss of two single BES elements that are not physically or electrically connected is known as an N-1-1 event. The Category B/P1 contingencies identified for the Proposed Project would be N-1 events, whereas the Category C3/P6 contingency would be an N-1-1 event.

[6] While the Draft ASR modeled the energy capacity needed to address the N-1-1/P6/Category C3 contingencies, the Draft ASR noted that CAISO's transmission planning standards allow for non-consequential load to be shed following such contingencies, thus they are not considered the primary drivers of the Proposed Project.

Robles-Templeton 70 kV Transmission Line could last more than 24 hours. In its response to CPUC's Data Request #3, PG&E provided information on unplanned outages within its service territory, which showed that transmission system outages lasting longer than 24 hours have occurred, with the longest duration outage lasting 178 days (PG&E 2019c, 2019d). ZGlobal confirmed the recharging issues brought up by the Applicants and CAISO, and acknowledge that a FOM BESS solution alone, given existing and projected loading patterns in the Paso Robles DPA, could not achieve the Transmission Objective of the Proposed Project.

BTM resources could potentially change the calculation with respect to an FOM BESS solution to the Transmission Objective by meeting some of the localized electrical demand that otherwise would need to be met through an FOM BESS during an outage. This analysis considered the potential feasibility of Alternative Battery Storage #1 with inclusion of potential BTM adoption in the Paso Robles DPA.

## 2.2 Distribution Objective and DER Alternatives

The Draft ASR identified Alternative Battery Storage #2, which would include FOM BESSs to address the Distribution Objective of the Proposed Project. These BESSs would be connected to the distribution system (e.g., feeders in the Paso Robles area) and could be sited at the same locations identified for Alternative Battery Storage #1. The Draft ASR considered the hosting capacity of feeders within the Paso Robles DPA forecasted to be overloaded and determined that up to 16.8 MW of energy storage capacity could be connected to feeders with minimal grid improvements required (see Table 3-6 in the Draft ASR) (CPUC 2019a). While specific deployment of BESSs would depend on site availability, this amount of storage could potentially solve the roughly 4.3 MW capacity need over 10 years originally identified in the Applicants' application to the CPUC, shown Table 3-7 of the Draft ASR. Additionally, the Draft ASR identified Alternative Battery Storage #3, which would include BTM resources that could be deployed on their own to address distribution needs or in tandem with FOM storage under Alternative Battery Storage #1.

Subsequent to the release of the Draft ASR, PG&E's 2019 GNA/DDOR filings identified the Estrella Substation (distribution components only) as a Candidate Deferral Opportunity, or a project that could potentially be deferred through DERs. The GNA/DDOR, which was established through the CPUC Distribution Resources Plan proceeding (R.14-08-013), identifies grid needs that could be met through DERs, and ranks Candidate Deferral Opportunities through three qualitative prioritization metrics (cost effectiveness, forecast certainty, and market assessment), such as to assign a tier[7]. **Table 1** shows PG&E's 2019 DDOR prioritization metrics for the distribution components of the Estrella Substation.

**Table 1**. PG&E 2019 DDOR Filing Prioritization Metrics - Estrella Substation

| Tier | Candidate Deferral | In-Service Date | Cost of the Project[1] | Deficiency (MW) | Prioritization Metrics | | |
|---|---|---|---|---|---|---|---|
| | | | | | Cost Effectiveness | Forecast Certainty | Market Assessment |
| 3 | Estrella Substation | 2024 | $18.5 million | 19.4 | Moderate | Low | Low |

Note: 1. The transmission components of the Proposed Project were not included in the $18.5 million cost estimate because only the CPUC-jurisdictional costs are required to be included in PG&E's GNA/DDOR filing.

*Source: PG&E 2019a*

The designation of "low" forecast certainty is due to the target in-service date of the Proposed Project (2024), which increases the forecast uncertainty and indicates that it might be more appropriate to consider the candidate deferral in future GNA/DDORs. The designation of "low" market assessment is due to the long duration requirement of some of the facility needs associated with the Proposed Project. Table 2 shows the specific facility needs that would be addressed by the Proposed Project and which could potentially be met through DERs, as reported in PG&E's 2019 DDOR.

[7] PG&E uses a 4-tier system, where each tier represents PG&E's proposed priority ranking of those Candidate Deferral Opportunities likelihood of success for DER sourcing (PG&E 2019a). The 4-tier prioritization system is as follows:

- Tier 1: Relatively High Ranking
- Tier 2: Relatively Moderate Ranking
- Tier 3: Relatively Low Ranking
- Tier 4: Already Sourced Elsewhere

**Table 2.** PG&E 2019 DDOR - Specific Facility Capacity and Reliability Needs Addressed by the Proposed Project That Could Potentially be met through DERs

| Facility | Need Date | Distribution Service Required | Day Ahead (DA) or Real Time (RT)[1] | Grid Need (MW) | Months of Forecast Need Occurrence | Occurrences per Year | Time Period | Duration (hours) |
|---|---|---|---|---|---|---|---|---|
| Paso Robles Feeder 1104 | 2019 | Capacity | DA | 1.2 | Jul-Aug | 21 | 2PM-10PM | 8 |
| San Miguel Transformer Bank 1 | 2019 | Capacity | DA | 3.6 | Jul-Sep | 122 | 6AM-10PM | 9 |
| Templeton Transformer Bank 3 | 2023 | Capacity | DA | 1.1 | Jul-Aug | 23 | 12PM-3PM | 3 |
| Cholame Between X14 and R96 | Existing need[2] | Reliability / Other | RT | 1.5 | Apr-Oct | 8 | 12AM-12AM | 4 |
| Cholame Substation DA | Existing need[2] | Reliability / Other | DA | 3.5 | Apr-Oct | 1 | 12AM-12AM | 48 |
| Cholame Substation RT | Existing need[2] | Reliability / Other | RT | | Apr-Oct | 8 | 12AM-12AM | 24 |
| L/S R78 – Templeton Feeder 2109 | Existing need[2] | Reliability / Other | RT | 8.5 | Apr-Oct | 8 | 12AM-12AM | 4 |

Note:

1. For DA needs, DER providers would receive advance notice when a service is needed. For RT requirements, notice is available only minutes before the need.
2. The need has existed for at least 10 years according to PG&E's data response to Energy Division. PG&E does not have plans to address the need at this time regardless of whether Estrella Substation is constructed.

*Source: PG&E 2019a, PG&E 2019e*

The three reliability needs related to Cholame Substation shown in Table 2 were not included in PG&E and HWT's 2017 application to the CPUC or the 2018 GNA/DDOR filing. Energy Division staff learned that these needs are contingent on the outage of a radial 70-kV power line that supplies the substation. Pursuant to CAISO planning standards, load shedding would be allowed in this instance.[8] The Templeton reliability need relates to the length of Feeder 2109, but PG&E does not have a planning standard based on length.[9] Accordingly, only the capacity-related grid needs are evaluated in this report. These considerations will be further discussed in the Final ASR, which will be included in the CPUC's Draft Environmental Impact Report (DEIR) in 2020.

Much of the reason for the Estrella Substation's relatively low ranking in terms of Candidate Deferral Opportunity prioritization (see Table 1) is due to the fact that the Cholame and Templeton reliability needs were included in the calculation, as well as the assumed 2024 in-service date. Energy Division staff requested that, for comparative purposes, PG&E reconsider the Estrella Substation's deferral prioritization without including the four reliability needs and assuming a 2022 need date instead of 2024. PG&E's 2024 assumption is not entirely appropriate for the analysis given that some of the grid needs that would be addressed by the proposed substation already exist as of 2019 and have existed for a number of years (e.g., more than 10 years). PG&E has not yet prioritized these needs for mitigation, and it remains unclear whether PG&E would mitigate them if the Estrella Substation were not approved for construction. With the change in assumptions, the Estrella Substation would be a Tier 1 Candidate Deferral Opportunity, as shown in **Figure 1**, and possibly the most cost-effective candidate of the deferral options identified in the PG&E's 2019 GNA/DDOR.

This report evaluates whether BTM resources could address the Distribution Objective of the Proposed Project, including the distribution capacity needs identified through PG&E's 2019 GNA/DDOR. The analysis considers whether BTM resources on their own could address the distribution capacity needs and/or defer portions of the Proposed Project, or be deployed in tandem with FOM storage under Alternative Battery Storage #2.

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[8] PG&E stated, "A single line outage of the 70-kV line to Cholame 70 kV Substation results in the loss of power to the substation and the direct loss of about 12 MW of current customer load which creates a customer reliability issue for those customers. PG&E does not have any plans at this time to solve the Cholame 70 kV N-1 issue whether the proposed Estrella Substation is constructed or not. The single line outage does not result in any impacts to the transmission system and as such does not result in any NERC or CAISO reliability standards violations" (PG&E 2019e).

[9] "PG&E is aware of no distribution planning standard that determines whether a feeder is too long to provide reliable service" (PG&E and HWT 2018).

| Tier | Candidate Deferral | In Service Date | Deficiency (MW) | Prioritization Metrics | | |
|---|---|---|---|---|---|---|
| | | | | Cost Effective-ness | Forecast Certainty | Market Assess-ment |
| 1 | Alpaugh New Feeder | 2022 | 4.4 | | | |
| | Calflax Bank 2 | 2023 | cc | | | |
| | Santa Nella New Bank & Feeder | 2022 | 9.3 | | | |
| | Estrella Substation (hypothetical) | 2022 | 5.9 | | | |
| 2 | Camp Evers 2107 | 2022 | 0.9 | | | |
| | FMC 1102 | 2023 | 0.8 | | | |
| | Brentwood 2105 | 2022 | 1.2 | | | |
| 3 | Pueblo Bank 3 | 2022 | 23.2 | | | |
| | Oceano 1106 | 2022 | 1.2 | | | |
| | Rosedale2102 | 2022 | 1.8 | | | |
| | Rob Roy 2105 | 2022 | 3.0 | | | |
| | Peabody 2106 | 2022 | cc | | | |
| | Madison 2101 | 2022 | cc | | | |
| | Martin SF H 1108 | 2022 | 1.0 | | | |
| | Martin SF H 1107 | 2022 | 1.8 | | | |
| | Avenal 2101 | 2022 | cc | | | |
| | Edenvale 2108 | 2022 | 1.5 | | | |
| | Dairyland 1110 New Feeder | 2022 | 4.5 | | | |

Notes: Blue = relatively more likely to be deferrable. Magenta = some red flags that indicate they are unlikely to be successfully deferred now, but closely monitor status and project conditions and re-evaluate for a future date. Red = multiple major red flags indicate it is not likely that a deferral solution would be successfully sourced.

*Source: PG&E 2019e*

**Figure 1.** Estrella Substation Candidate Deferral Prioritization Assuming Capacity Needs Only and 2022 Need Date (i.e., In-service Date)

# 3. Methodology

This analysis uses an adoption propensity approach to identify economically feasible adoption of BTM resources at the customer-sited level (i.e., at existing residential and commercial and industrial [C&I] buildings or properties). BTM resources included solar plus storage and storage-only systems. Adoption propensity is based on an individual customer's load profile, payback period for investment in BTM resources, Value of Lost Load, and other factors. The analysis included evaluation of full 8760 time-series load profiles (i.e., 365 days times 24 hours per day) for approximately 75,000 customer meters.

BTM storage systems function by either directly reducing the customer's own grid consumption (i.e., discharging to meet the customer's electrical demand, especially during peak demand periods), or sending excess stored power back to the grid, often in response to a price or event signal. When paired with solar, BTM storage can store excess solar generation to be used when solar goes offline (or, "when the sun goes down"). This allows solar plus storage customers to further reduce consumption from the grid during times of peak demand, and likely save costs on their electricity bill through time-of-use rate arbitrage.

## 3.1 Approach

Kevala used its Network Assessor platform to ingest data provided by PG&E and run advanced analytics related to grid infrastructure, load, generation, and price. At a high level, Kevala's Network Assessor platform ingests and employs data across the following three key areas (see also **Figure 2**):

- **Load.** Load data are typically provided as time series datasets, which are generally incompatible with geospatial data, as the volume of data associated with time series is much larger than geospatial data systems are often capable of processing. Kevala ingested PG&E-provided metered data to generate an 8760 time series load profile, aggregated to the feeder level.

- **Generation.** This includes both data at the bulk power level, as well as DERs, such as all known installed DG, nameplate capacity, and associated feeder. Kevala uses this dataset to estimate local energy supply and forecasted production profiles. In aggregate, this information additionally factors into analyses such as hosting capacity analysis.

- **Infrastructure.** For this project, Kevala used PG&E-provided geospatial files on electric infrastructure.

The result of this data ingestion process is a 1:1 map of the electric grid, with granularity down to the parcel level. In this way, Network Assessor is both a platform for accessing data and a technology to support grid modernization functions, including circuit modeling, DER value and solutions analysis, load modeling, rate impacts, and DER forecasting and adoption propensity.

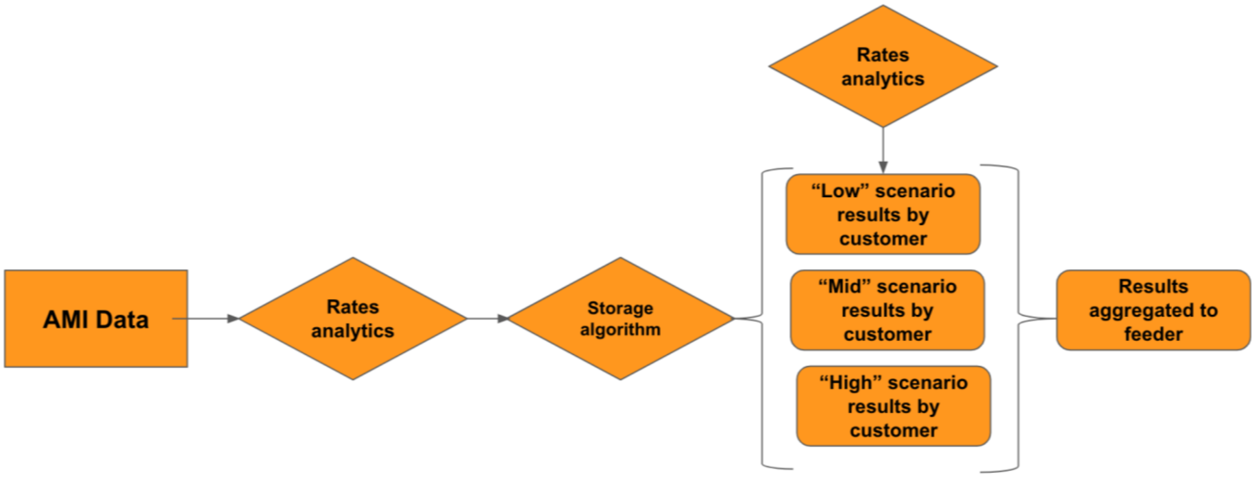


**Figure 2.** Kevala's Data Analysis Approach

As shown in Figure 2, the Advanced Metering Infrastructure (AMI) (i.e., load) data fed the rates analytics and storage algorithm, which ultimately identified economically-efficient BTM adoption customers under "low", "medium", and "high" scenarios, which were based on the number of outages customers faced in a given year (see detailed information in **Table 3**). Results were then aggregated to the feeder-level.

Separate analyses were performed for residential customers and C&I customers. Whereas the residential analysis considered the potential for new customers to adopt solar plus storage systems, as well as the potential for existing residential solar owners to adopt an incremental BTM storage system; the C&I analysis looked solely at the potential for customers without existing DER to adopt new BTM storage systems, incentivized largely by a desire to reduce demand charges.

The analysis was conducted on historical AMI data for the 2017 calendar year. Actual solar growth was backed out of the total adoption propensity from 2018 and 2019 using the net energy metering (NEM) Currently Interconnected Data Set (California Distributed Generation Statistics 2019). Consideration of DER growth forecasts is discussed in Section 3.3.

## 3.2 Inputs and Assumptions

To conduct the BTM analysis, Kevala modeled performance of BTM storage resources at the customer level, optimizing size to meet payback period requirements. Inputs used in the analysis (e.g., performance and cost of battery storage systems, and current policies and incentive structures) are consistent with those used by the CPUC in the 2019 - 2020 Integrated Resource Planning (IRP) process. Table 3 summarizes the inputs and assumptions used in the residential and C&I analyses.

**Table 3.** Summary of Inputs and Assumptions

| Input | Residential Analysis | Commercial & Industrial Analysis |
|---|---|---|
| Rate | Customers subject to PG&E's 2019 time-of-use rate:<br>Peak: 4pm - 9pm<br>Seasonal: May 1 - October 31 | Customers subject to appropriate PG&E rate based on load. Customer is subject to demand charges. |
| Solar system size, performance, and cost | Photo voltaic (PV) kilowatt (kW) size is optimized based on household energy consumption.<br>PV performance is modeled using NREL PV Watts<br>PV system cost is aligned with IRP assumptions on dollars per watt ($/W) for 2019 | N/A |
| Storage system size, performance, and cost | 7 kW/13.5 kilowatt hour (kWh) lithium ion<br>Customer adoption of # of batteries is optimized based on historic load and payback period.<br>Storage performance uses estimates used in the 2019 IRP, including:<br>10 year warranty<br>85% round trip efficiency<br>0% degradation rate<br>Storage system total cost (hardware plus installation) is $9,376, calculated based on IRP "mid cost option" assumption for storage costs for 2019 | Customer adoption of kW/kWh size is optimized to minimize customer demand charges while meeting the payback period requirements (10 years).<br>Storage performance uses estimates used in the 2019 IRP, including:<br>10 year warranty<br>85% round trip efficiency<br>0% degradation rate<br>Storage system total cost (hardware plus installation) is based on the formula used to develop the IRP "mid case" assumption for storage costs for 2019-2020 (CPUC 2019b). |

| Input | Residential Analysis | Commercial & Industrial Analysis |
|---|---|---|
| Policy assumptions | Customers are eligible to benefit from the solar investment tax credit (ITC) and self-generation incentive program (SGIP), following current program incentive levels and rules for enrollment.<br>Customers are eligible to benefit from NEM programs as they are currently administered, aligned with 2019 Integrated Energy Policy Report (IEPR) “mid PV” scenario. | Customers are eligible to participate through SGIP, based on current incentive levels in PG&E territory.<br>Customers are not additionally incentivized through participation in other markets (e.g., demand response). |
| Payback period | 10 years or below | N/A |
| Value of Lost Load 2 | Low, medium, and high scenarios are tested at a value of $5/kWh<br>Low: four, 4-hour outages<br>Medium: six, 4-hour outages<br>High: eight, 4-hour outages | $5/kWh for large C&I customers (100 kW peak demand)<br>$9/kWh for medium C&I customers (50 kW peak demand)<br>Low, medium and high scenarios run as follows:<br>Low: four, 4-hour outages<br>Medium: six, 4-hour outages<br>High: eight, 4-hour outages |

<u>Notes:</u>

Aligned with CPUC IRP 2019-2020 inputs and assumptions for the “mid cost option” unless otherwise noted and explained (CPUC 2019b).

The Value of Lost Load is an economic indicator used to assign a dollar cost to the interruption of electricity delivery. This can represent the cost consumers are willing to pay to avoid an outage or public safety power shutoff. Publicly available studies on this value ranges from $5 - $20/kWh. This analysis used a Value of Lost Load on the low side of stated ranges. The CPUC’s new resiliency and microgrids proceeding (R.19-09-009) is expected to provide guidance regarding this assumption.

## 3.3 Integrated Energy Policy Report (IEPR), DER Forecasts, and Economic Propensity

The responsibility of developing load and DER forecasts is shared among the investor owned utilities in California (e.g., PG&E) and the California Energy Commission (CEC). On a biennial basis, the CEC prepares the IEPR, informed by stakeholders, which includes a top-down forecast of load and DER across the state. PG&E then conducts a load forecast and DER forecast disaggregation process to provide feeder-specific estimates of load and DER impact. This process uses the IEPR system-level forecast and assumptions as inputs, while PG&E is responsible for identifying the best options for disaggregation. Forecast disaggregation is the process of taking a system-level forecast, and determining where on the grid those forecasts will likely occur.

Energy storage forecast estimates are a new component of the IEPR as of the 2019 - 2020 report. PG&E and HWT's 2017 application to the CPUC for the Proposed Project applied the 2016 IEPR to estimate the impacts of DERs and thus does not include feeder-specific impacts for energy storage. PG&E currently uses a proportional allocation technique to disaggregate storage, expecting high locational correlation with known energy storage projects based on SGIP data, proportional to load. As energy storage technology is a nascent and growing market, it is expected that DER forecast and disaggregation techniques will improve in time as available datasets on adoption and performance increase.

At the time of this analysis and report, feeder-specific DER forecasts for battery storage, based on the utility's disaggregation process, have not been published by PG&E, as they are still under development. Thus, it is not feasible to compare feeder-specific future storage forecasts with these analysis results, and "back out" estimates to avoid double counting. This is a recommended step in advance of conducting a targeted procurement, when considering the BTM alternative.

Finally, it is important to understand the difference between a DER forecast and an economic propensity analysis. A forecast identifies what is *likely to occur* given a set of factors, such as, but not limited to, historic adoption rates, cost of technology, cost of energy, demographics, financial ability to adopt, and consumer adoption behavior. The analysis documented in this report is not a forecast; it is an economic propensity analysis. Economic propensity analyses simply identify customers for which it would make economic sense to adopt a technology, not necessarily what is *likely to occur*.

# 4. Results and Discussion

## 4.1 BTM Adoption Propensity

Detailed results for the BTM adoption propensity analysis (disaggregated by feeder) are provided in **Appendix B**. **Table 4** summarizes the results for all customer types in the Paso Robles DPA.

**Table 4.** Summary Results for the BTM Adoption Propensity Analysis - All Customer Types in the Paso Robles DPA

| Scenario | BTM Adoption Propensity | | | |
|---|---|---|---|---|
| | Solar (MW) | Battery Storage (MW) | Battery Storage (MWh) | Total # of Customers |
| Low | 88 | 125 | 240 | ~17,000 |
| Medium | 92 | 138 | 272 | ~19,000 |
| High | 100 | 175 | 343 | ~21,000 |

As shown in Table 4, across the Paso Robles DPA, there is substantial potential for BTM adoption. Under the low scenario, roughly 17,000 customers (residential and C&I) meet the criteria for economically-efficient adoption and/or which could potentially be effectively incentivized to BTM resources adoption through a RFP process. If all of these customers adopted BTM solar and/or storage technology at the parameters used in the study, this would equate to 88 MW of solar and 125 MW / 240 MWh of storage. Under the high scenario, approximately 21,000 economically-efficient potential adopters were identified, equating to 100 MW of solar and 175 MW / 343 MWh. **Table 5** breaks down the summary results from Table 4 by substation within the Paso Robles DPA (i.e., BTM resources at customer sites along feeders associated with a given substation).

**Table 5.** BTM Adoption Propensity Results by Substation

| | Substation | | | | |
|---|---|---|---|---|---|
| | **Atascadero** | **Paso Robles** | **San Miguel** | **Temple-ton** | **Total** |
| ***Low Scenario*** | | | | | |
| # of Customers | 3,269 | 6,589 | 909 | 6,643 | 17,347 |
| Solar (MW) | 17 | 32 | 5 | 34 | 88 |
| Storage (MW) | 23 | 48 | 6 | 47 | 124 |
| Storage (MWh) | 44 | 91 | 13 | 92 | 242 |
| ***Medium Scenario*** | | | | | |
| # of Customers | 3,514 | 7,141 | 949 | 7,145 | 18,749 |
| Solar (MW) | 17 | 34 | 5 | 36 | 92 |
| Storage (MW) | 28 | 51 | 7 | 51 | 137 |
| Storage (MWh) | 55 | 101 | 15 | 102 | 273 |
| ***High Scenario*** | | | | | |
| # of Customers | 4,041 | 8,468 | 970 | 7,617 | 21,096 |
| Solar (MW) | 19 | 39 | 5 | 37 | 100 |
| Storage (MW) | 33 | 69 | 8 | 64 | 175 |
| Storage (MWh) | 64 | 136 | 17 | 126 | 343 |

As shown in Table 5, the greatest BTM adoption potential is associated with the Paso Robles and Templeton substations. At Paso Robles Substation (i.e., along feeders connected to Paso Robles Substation), under the low scenario, there is potential for adoption of 32 MW of solar and 48 MW / 91 MWh of storage. Under the high scenario, this increases to 39 MW of solar and 69 MW / 136 MWh of storage.

In general, the majority of the total adoption propensity (MW) was driven by residential customers adopting new solar plus storage systems. Residential customers with existing solar systems adopting new storage, and new C&I storage customers, played less of a role. One primary reason for this is that there are many more residential customers without existing solar relative to other categories of potential BTM adopters. Even though C&I customers represented a smaller portion of potential BTM adopters, the average payback period for those identified was shorter than it was for residential customers. **Table 6** shows BTM adoption propensity results for C&I customers under the low scenario, disaggregated by substation.

**Table 6.** C&I Customer BTM Adoption Propensity by Substation - Low Scenario

| Substation | # of Commercial Customers | # of Industrial Customers | Total Storage Amount | | Average Payback Period (Years) | Percentage of Total C&I Customers |
|---|---|---|---|---|---|---|
| | | | MW | MWh | | |
| Atascadero | * | * | * | * | 6.7 | 3% |
| Paso Robles | 52 | 140 | 1.8 | 4.2 | 6.4 | 7% |
| San Miguel | * | * | * | * | 5.6 | 9% |
| Templeton | 47 | 163 | 2.1 | 5.1 | 6.5 | 6% |
| **Totals / Averages** | **116** | **383** | **4.6** | **11** | **6.3** | **6%** |

Note: *Redacted customer counts and associated data. Checking with PG&E to confirm whether this data is confidential due to low customer counts in the Commercial or Industrial categories.

As shown in Table 6, a greater number of industrial customers were identified as economically-efficient BTM adopters compared to commercial customers. The area with the greatest C&I BTM adoption potential was that served by Templeton Substation (2.1 MW / 5.1 MWh), followed by Paso Robles Substation (1.8 MW / 4.2 MWh). In general, the analysis found that, under the low scenario, a relatively small proportion (6 percent) of total C&I customers were good candidates for BTM adoption.

Finally, looking specifically at Paso Robles feeders (i.e., feeders connected to Paso Robles Substation), Table 7 shows that there is relatively substantial BTM adoption potential for customers along feeders in target areas for future distribution service from the Estrella Substation.

**Table 7.** BTM Storage Adoption Propensity for Paso Robles Feeders - Low and High Scenarios

| Feeder | Low Scenario | | | High Scenario | | |
|---|---|---|---|---|---|---|
| | **# of Customers** | **MW** | **MWh** | **# of Customers** | **MW** | **MWh** |
| Paso Robles 1101 | 123 | 0.8 | 3.6 | 151 | 1.1 | 2.5 |
| Paso Robles 1102 | 676 | 4.8 | 9.3 | 881 | 7.3 | 14.3 |
| Paso Robles 1103 | 1,112 | 9.7 | 15.1 | 1,324 | 10.9 | 21.5 |
| Paso Robles 1104 | 624 | 4.5 | 8.8 | 843 | 6.7 | 13.3 |
| Paso Robles 1106 | 1,737 | 12.2 | 23.6 | 2,325 | 18.8 | 36.5 |
| Paso Robles 1107 | 918 | 6.6 | 12.9 | 1,123 | 9.5 | 18.7 |
| Paso Robles 1108 | 1,399 | 9.9 | 19.2 | 1,822 | 14.9 | 29.2 |
| **Total:** | **6,589** | **48.5** | **90.6** | **8,468** | **69.2** | **136** |

## 4.2 Implications for Alternative Battery Storage #1 and the Transmission Objective

As discussed under Section 2.1, the Draft ASR considered the potential for an FOM BESS to solve the Transmission Objective for the Proposed Project. This alternative was identified as Alternative Battery Storage #1. Using the BTM adoption propensity results from Section 4.1, ZGlobal, Inc. (ZGlobal) re-ran its model to determine the effects of the potential BTM storage on the requirements for an FOM BESS under Alternative Battery Storage #1. ZGlobal's updated analysis generally found that the BTM storage at Paso Robles Substation would equate to a one-for-one reduction in the amount of FOM transmission level storage needed to mitigate the P1 and/or P6 outages (ZGlobal 2019) (see **Table 8**). The BTM storage connected to Templeton Substation feeders would not be helpful in addressing the two P1 contingencies (since these involve loss of power to Paso Robles Substation), but would help with the P6 contingency (i.e., loss of both the Templeton-Gates and Morro Bay-Templeton 230 kV lines), although not quite at a one-to-one ratio.

**Table 8.** FOM Storage Requirements to Address Critical Outages under Alternative Battery Storage #1 with Inclusion of BTM Storage

| Scenario | FOM Storage Connected at Paso Robles Substation (MW) | BTM Storage Connected at Paso Robles (MW) | BTM Storage Connected at Templeton (MW) | Total Storage (MW) |
|---|---|---|---|---|
| ***Outage: Paso Robles – Templeton 70 kV Transmission Line (P1)*** | | | | |
| No BTM Scenario | 65 | - | - | 65 |
| Low BTM Scenario | 18.9 | 48.5 | N/A | 67.4 |
| Medium BTM Scenario | 16.5 | 51.1 | N/A | 67.6 |
| High BTM Scenario | 0.0 | 69.2 | N/A | 69.2 |
| ***Outage: Templeton 230/70 kV Transformer Bank #1 (P1)*** | | | | |
| No BTM Scenario | 45 | - | - | 45 |
| Low BTM Scenario | 0.0 | 48.5 | N/A | 48.5 |
| Medium BTM Scenario | 0.0 | 51.1 | N/A | 51.1 |
| High BTM Scenario | 0.0 | 69.2 | N/A | 69.2 |
| ***Outage: Morro Bay – Templeton and Templeton – Gates 230 kV Transmission Lines (P6)*** | | | | |
| No BTM Scenario | 120 | - | - | 120 |
| Low BTM Scenario | 29.1 | 48.5 | 47.2 | 124.8 |
| Medium BTM Scenario | 22.7 | 51.1 | 51.3 | 125.1 |
| High BTM Scenario | 0.0 | 69.2 | 64.2 | 133.4 |

Note: Used Base Case: CAISO 2018/2019 TPP for 2023 Central Coast & Los Padres Area

*Source: ZGlobal 2019*

As shown in Table 8, under the high BTM adoption scenario, BTM storage alone could completely solve (for a limited duration) all three of the identified critical outages associated with the Proposed Project (note: only the P1 contingency outages are be required to be solved). This would result in avoiding the need for any FOM storage under Alternative Battery Storage #1 to meet the Transmission Objective but for the long duration required (i.e., 11 hours each day for multiple days).

If the duration were shorter, the P1 contingency involving loss of the Templeton 230/70 kV Transformer Bank #1 might be solvable by BTM storage under the low or medium scenarios. Meanwhile, for the P1 contingency involving loss of the Paso Robles – Templeton 70 kV Transmission Line, BTM storage under the low and medium BTM adoption scenarios could substantially reduce the amount of FOM storage needed to address the contingency (18.9 MW of FOM storage needed under the low scenario and 16.5 MW of storage needed under the medium scenario). ZGlobal's modeling did show that with increasing use of BTM resources, there would be a need for reactive support at Paso Robles Substation, either in the form of capacitors or reactive support from the BTM storage itself (ZGlobal 2019).

The findings in Table 8 indicate that BTM storage alone or in combination with FOM storage could potentially solve the critical outages and meet the Transmission Objective of the Proposed Project for a few hours. Assuming that BTM and/or FOM storage resources are charged and available at the time a transmission-level outage occurred, these resources could discharge to meet the electrical demands on the system, thereby preventing a blackout or other grid failure.

However, batteries can only discharge for so long without being recharged and thus could not solve a longer term or indefinite transmission-level outage as described by the CAISO (Section 2.1, above), particularly if there is no charging window within the load pattern (i.e., point during the day or night at which load is below the threshold where supplemental power would be needed). In the case of the Paso Robles Substation, if power supply is lost from the south (through the loss of either the Paso Robles – Templeton 70 kV Transmission Line or Templeton Transformer Bank #1), the northern line from San Miguel is the only remaining transmission-level power source, which can supply roughly 20 MW of power. During peak summer loading conditions, load demand on the Paso Robles Substation may not drop below 20 MW even during the night-time, leaving no potential charging window for battery storage facilities.

As indicated in Table 3, the residential BTM adoption propensity analysis assumed that customers would be adopting market-ready products (expected 7 kW/13.5 kWh size), which typically supply about 2 hours of power at sustained maximum output. If a given residential customer were to minimize their electricity usage during an outage condition, these BTM storage units could meet basic demands for substantially longer. Even still, at some point the residential and/or C&I BTM storage resource would need to recharge, and thus would no longer be able to support Paso Robles Substation while restoration work is being done on the incapacitated transmission system components, or be in an adequate state of charge to potentially help solve a subsequent outage. As explained by CAISO in its comments on the Draft ASR: "following an initial discharge, the battery will need the ability to be charged to be available in subsequent days either in the event of a long duration outage or in preparation for a subsequent outage to meet the reliability requirements in the area (CAISO 2019)."

Overall, while the BTM adoption propensity results shown in Section 4.1 suggest that BTM storage could greatly reduce or completely avoid the amount of FOM storage needed under Alternative Battery Storage #1, BTM storage would be subject to the same duration limitations and would not fully address the concerns raised by CAISO, PG&E, and HWT. These findings indicate that Alternative Battery Storage #1 be insufficient to meet the transmission-level objective, whether or not BTM resources were procured alongside (i.e., under Alternative Battery Storage #3). Likewise, the findings indicate that using BTM resources alone to meet the Transmission Objective under Alternative Battery Storage #3 would be insufficient.

## 4.3 Implications for Alternative Battery Storage #2 and the Distribution Objective

As discussed in Section 2.2, the Draft ASR considered the potential for FOM storage to address the Distribution Objective of the Proposed Project (Alternative Battery Storage #2). The Draft ASR found this alternative to be potentially feasible on its own merits, but the amount of FOM storage needed could be reduced through deployment/adoption of BTM resources. Additionally, BTM resources on their own (i.e., Alternative Battery Storage #3) could potentially fully meet the distribution needs of the Paso Robles DPA that would be addressed through the Proposed Project.

Based on the BTM adoption propensity results (Section 4.1), potential BTM adoption could far exceed the overall Paso Robles DPA capacity needs identified in the Applicants' proponent's environmental assessment (PEA) Appendix G (PG&E and HWT 2018) of 4.3 MW over 10 years. BTM storage can reduce peak load by charging during off-peak hours and discharging during peak hours to meet load demands. Particularly with inclusion of solar (which generates electricity and could directly charge associated BTM storage facilities), these BTM resources could reduce or avoid the forecasted overload conditions identified in the PEA Appendix G.

Although future load conditions would depend on where future development projects and other new load sources occur in the Paso Robles area, Table 7 shows that there is adoption potential along all feeders that connect to Paso Robles Substation. In particular, Paso Robles Feeder 1107, which passes through two of the anticipated growth areas in Golden Hill Industrial Park and near the Paso Robles Airport, has potential for BTM storage adoption of 9.5 MW / 18.7 MWh under the high scenario. Similarly, Paso Robles Feeder 1102 also passes through the Golden Hill Road area and has potential for adoption of 7.3 MW / 14.3 MWh of BTM storage under the high scenario. Capturing this BTM potential would directly reduce loading on these circuits, although BTM resources adoption along any of the Paso Robles feeders would help mitigate cumulative loading on the substation.

With respect to the 2019 GNA/DDOR, the amount of BTM resources adoption identified in Section 4.1 would exceed the identified needs for Paso Robles 1104 and Templeton Bank 3 in the PG&E filings. When taking into account the duration of the need associated with San Miguel Bank 1, the amount of BTM storage adoption potential (as expressed in MWh) would not fully meet this need. **Table 9** provides a comparison of the BTM storage adoption propensity results to the specific facility capacity needs in the 2019 DDOR.

**Table 9.** Comparison of BTM Storage Adoption Propensity Results to the Identified Capacity Needs in PG&E's 2019 DDOR

| | Paso Robles 1104 | San Miguel Bank 1 | Templeton Bank 3 | Total |
|---|---|---|---|---|
| ***Grid Needs Summary*** | | | | |
| Grid Need (MW) | 1.2 | 3.6 | 1.1 | 5.9 MW |
| Months | Jul – Aug | Jul – Sep | Jul – Aug | n/a |
| Calls/Year | 21 | 122 | 23 | n/a |
| Time Period | 2 pm – 10 pm | 6 am – 10 pm | 12 pm – 3 pm | n/a |
| Duration (Hours) | 8 | 9 | 3 | n/a |
| Total Grid Need (MWh) | 9.6 | 32.4 | 3.3 | 45.3 MWh |
| ***BTM Storage Adoption Propensity*** | | | | |
| Low Scenario (MWh) | 8.8 | 11.3 | 30.9 | 51 MWh |
| Medium Scenario (MWh) | 9.8 | 13.5 | 34.2 | 57.5 MWh |
| High Scenario (MWh) | 13.3 | 15.4 | 42.2 | 70.9 MWh |

*Source: PG&E 2019a*

As shown in Table 9, the BTM storage adoption propensity numbers (expressed in MWh) for Paso Robles 1104 under both the medium and high scenarios would be sufficient to meet the total grid need (MW x Hours). In other words, the BTM storage resources, assuming they were fully charged at the start of the peak period and could be subsequently discharged in a coordinated fashion (a master control system may be required for this), could provide sufficient power over the course of the peak period (lasting from 2 p.m. – 10 p.m. during July to August on Paso Robles 1104) to meet demand. The timing of the duration requirement (July to August) on Paso Robles 1104 indicates that the solar plus storage profile is suitable for meeting this need.

Similarly, for Templeton Bank 3, the BTM storage adoption propensity under all scenarios considered would be sufficient to meet the total grid need. The time period associated with the Templeton Bank 3 grid need would only last 3 hours (from 12 p.m. to 3 p.m. during July to August), and thus the total grid need would only amount to 3.3 MWh, which is far less than the BTM storage that could potentially be achieved in this area. Under the low scenario, only about 23 percent of the identified economically-efficient customers would need to adopt BTM storage to meet the duration requirement.

Due to the grid need of 3.6 MW at San Miguel Bank 1 and long duration of the potential need (6 a.m. to 10 p.m.), BTM resources alone would not be able to fully meet this need. Even under the high scenario (15.4 MWh), the BTM resources would not be sufficient to meet the total need (32.4 MWh). The shortfall could potentially be made up with FOM storage at or near San Miguel Substation. There appears to be available space at the substation site according to recent aerial imagery.

Overall, the analysis shows that BTM resources could potentially meet future expected load demand in the Paso Robles DPA. The total BTM adoption propensity for the Paso Robles DPA under the high scenario (100 MW of solar, 175 MW / 343 MWh of storage) would far exceed the projected increased load demand (4.3 MW over 10 years), as reported in the PEA Appendix G. However, when looking at specific facility capacity needs identified in the 2019 GNA/DDOR, BTM resources on their own could only meet two of the three needs. For the third need, FOM resources would also be required. All of this suggests that BTM resources could not on their own fully meet the Distribution Objective of the Proposed Project, but could be deployed alongside FOM storage to meet this objective.

# 5. Recommendations

The analysis in this report is considered adequate for assessing the potential feasibility of Alternative Battery Storage #3 (on its own and in tandem with the other DER alternatives being considered for the Proposed Project pursuant to CEQA). CPUC's DEIR will evaluate the potential environmental impacts associated with implementing Alternative Battery Storage #3 and will further describe the mechanisms by which BTM resources adoption could be encouraged and facilitated (e.g., through a targeted RFP). Should Alternative Battery Storage #3 be selected by the Commission for implementation, Kevala recommends several additional studies to further refine the potential BTM resources program in advance of any targeted procurement efforts that may occur. These include:

A. **Re-run the Analysis Closer to Procurement with Latest Available Data:** As load growth becomes more certain, the analysis should be re-run in advance of any targeted procurement efforts using data sources such as the latest GNA/DDOR filed, address-specific information on existing DER projects, and the most recent customer-specific AMI data.

B. **Consider Likely Adoption:** An adoption propensity study evaluates where adoption is economically efficient but does not consider other factors that impact a customer's ability to adopt, such as socioeconomics in the study area, expected perception or understanding of battery storage technology, efficacy of outreach and marketing programs, available roof space, etc. (Kevala's study does consider homeownership). These factors are considered when conducting a DER growth forecast and should be considered in advance of targeted BTM resource procurement to further refine the BTM program approach and identify the likely needed level of incentive. When possible, these should align with likely adoption factors used by either the CEC or investor owned utilities.

C. **Further Refine the Value of Lost Load**: Currently, there is no singular or universally agreed upon Value of Lost Load. A conservative value was modeled for this study at different outage frequencies. The appropriate value requires further research. Guidance is expected from the CPUC's resiliency and microgrid proceeding (R.19-09-009). The Value of Lost Load assumption can have a significant effect on the perceived cost-effectiveness of BTM resources and associated economic propensity for adoption.

D. **Consider Solar Adoption for C&I Customers:** The model assumed that C&I customers would place the highest value on BTM storage resources, absent solar, for demand charge reduction purposes, and did not consider potential solar plus storage adoption for these customers. Residential customers, by comparison, are not subject to demand charges. Under residential time-of-use rates, solar plus storage (together) is most cost effective. The model could be updated to consider the value of solar plus storage for specific types of C&I customers in the Paso Robles DPA, e.g., wineries.

E. **Evaluation of BTM Storage Growth Forecasts and Location-Specific Allocation, Using Existing and Available Data:** At the time of this analysis and report, feeder-specific forecasts for BTM storage have not yet been published by PG&E. Thus, it is not feasible to compare feeder-specific storage forecasts with the propensity for adoption results and "back out" estimates to avoid double counting. Provided that such forecasts are available in the future (e.g., in PG&E's 2020 GNA filing), this refinement to the propensity for adoption results should occur in advance of conducting a targeted procurement for BTM resources.

   Currently, utilities provide annual DER growth forecasts as total MW reduction on peak, rather than by estimated customer adoption. "Backing out" future DER growth additionally requires understanding of the hours in which DERs are contributing to net load, and their impact on feeder-specific peak load—in short, the "shape" of hourly DER generation. Providing only the total MW reduction on peak does not allow for scenario-based evaluation of changing DER behavior, such as the impact of promoting workplace charging, changing retail rate structures, or offering capacity payments for grid services.

   Understanding where current DER adoption has occurred can be very informative to disaggregation and allocation efforts, from the system level down to the feeder-specific level. Where this location-specific data can be made available, such as SGIP program data, California Solar Initiative program data, Demand Response participation data, or state-incentivized Energy Efficiency adoption data, it can be used to further identify DER growth allocation and likely participating customers.

F. **Evaluation of Current Policies and Incentives:** To align with existing modeling inputs the CPUC currently uses for its IRP modeling, Kevala's model uses the performance assumptions for storage and total cost of PV + plus storage, including the application of NEM policy and SGIP incentives as these policies and incentives are currently administered. In advance of conducting a targeted procurement, these inputs may need to be adjusted to reflect the most current policies and costs.

G. **Carefully Consider RFP Requirements:** To ensure operational needs and performance requirements are met, a BTM resources program will require the development of some type of distribution capacity-based demand response program to ensure that resources are available when an event is called. The RFP to procure the required BTM resources should consider the following:

1. *Aggregators Available: Who might procure and aggregate resources?* The RFP should focus on aggregators capable of delivering the quantified net load impacts. It would need to consider the methods available in the service area that could be used to coordinate the BTM DERs such that the desired responses are adequate and reliable.

2. *Incentive Structure:* The adoption propensity analysis considered a Value of Lost Load in low, medium, and high scenarios, which may be used as indicators of the incentive levels required to procure the required BTM resources. Value of Lost Load is an economic value that may be considered by a customer acting on social or emotional responses to risk, but may not translate to a direct willingness-to-pay without extrinsic factors.

3. *Timing of DER and Type of Response to Calls:* The PG&E's 2019 GNA/DDOR identifies the capacity need within the day-ahead market, meaning that participants would receive advance notice when the service is needed, unlike real-time requirements. An RFP should consider when notice would be provided, and whether the required duration for each distribution need would require the BTM storage resource to charge off-peak from the grid to meet that need. The RFP should also consider how and when aggregated resources must behave and respond to meet the full required duration.

# 6. Conclusions

This report uses Kevala's big data analysis capability to analyze BTM solar plus storage adoption propensity in the Paso Robles DPA in support of the CPUC's CEQA analysis of the Proposed Project. The analysis finds that up to 100 MW of solar and 175 MW / 343 MWh of storage could be efficiently adopted under the high scenario. This amount of BTM resources exceeds the overall capacity needs in the DPA, and the amount of storage that could potentially be adopted at Paso Robles Substation and Templeton

Substation would be sufficient to fully meet demand *for given period of time* during one of the critical outages identified by the CAISO (see Transmission Objective).

However, batteries can only provide power for a certain period of time before needing to recharge. As such, BTM storage could only supply power for so long (standard residential storage products can sustain maximum output for 2 hours), and therefore could not solve a transmission outage for an extended period, even when paired with FOM storage (e.g., under Alternative Battery Storage #1). PG&E indicated that an outage of the Paso Robles – Templeton 70 kV Transmission Line or Templeton Transformer Bank #1 could last for multiple days, and therefore a battery solution would need to have a recharging window to be viable, but such a window would not be available under the outage conditions. For these reasons, BTM resources, even when paired with FOM storage, are not considered a feasible option for addressing the Transmission Objective of the Proposed Project.

Similarly, BTM resources on their own could not fully meet the Distribution Objective due to the duration requirements identified in the 2019 DDOR. While BTM resources could meet the capacity needs for Paso Robles Feeder 1104 and Templeton Bank 3, they could not fully meet the need for San Miguel Bank 1. Strategically placed FOM storage facilities could address this shortfall. Thus, Alternative Battery Storage #3 deployed in tandem with Alternative Battery Storage #2 could feasibly meet the Distribution Objective of the Proposed Project. When looking strictly at overall capacity requirements, the total potential BTM resources adoption far exceeds the stated total 4.3 to 5.9 MW deficiency in the DPA, lending further support for BTM resources as a feasible alternative.

From a practical perspective, customers in the Paso Robles area DPA may want to consider their annual energy use in light of this study with the help of an industry supplier or expert. As of 2019, about 17,000 customers (residential and C&I) of the roughly 75,500 customers studied meet the criteria for economically-efficient adoption of BTM resources. BTM storage can be cost-effective for certain C&I customers with payback times as low as 4.8 years for some but on average about 6.3 years. This applies to 4 percent to 6 percent of the roughly 13,500 C&I customer meters studied, and their BTM storage adoption could reduce peak loads in the Paso Robles area by about 4.6 MW / 11 MWh (under the low scenario) if called upon. For about 20 percent of the roughly 62,000 residential customer meters studied, payback time for solar plus storage is expected to be fewer than 10 years, and these payback periods are expected to improve in the coming years as the cost of storage continues to decline.

Kevala’s conservative assumption regarding Value of Lost Load, which affects BTM adoption efficiency, should also be revisited in light of the CPUC’s new resiliency and microgrid proceeding (R.19-09-009) and many other associated, ongoing proceedings, including the Distribution Resources Plan proceeding (R.14-08-013) and Wildfire Mitigation Plans proceeding (R.18-10-007). Assumptions about how customers value lost load (i.e., keeping the lights on during a potential power loss event) impacts the payback period calculations for BTM systems. In addition, this study informs the ongoing discussions about location-specific targeting of DER to meet specified grid needs.

# 7. References

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# Appendix A.
## Distribution Need Comparison

**Table A-1.** Comparison of Distribution Needs Identified in PG&E and HWT's 2017 Application and the 2018 and 2019 GNA / DDORs

| Facility | Forecasted Overload / Distribution Need | | | | |
|---|---|---|---|---|---|
| | 2017 Application to CPUC and Data Responses to Energy Division | 2018 PG&E GNA / DDOR | | 2019 PG&E GNA / DDOR | |
| | | Web Portal Download, "Planned Investment" (MW) | Candidate Deferrals (MW, hours) | Estrella "Planned Investment" (MW) | Estrella Candidate Deferral (MW, hours) |
| Paso Robles 1102 | Yes | n/a | n/a | n/a | n/a |
| Paso Robles 1103 | n/a | 1.88 | 0.42, 2 hours | n/a | n/a |
| Paso Robles 1104 | n/a | n/a | n/a | 1.15 | 1.2, 8 hours |
| Paso Robles 1107 | Yes | 0.25 | 0.25, 2 hours | n/a | n/a |
| Paso Robles 1108 | Yes | 0.18 | 0.18, 1 hour | n/a | n/a |
| San Miguel 1104 | Yes | 0.28 | 0.28, 2 hours | n/a | n/a |
| San Miguel Bank 1 | n/a | 1.53 | 1.53, 6 hours | 1.68 | 3.6 MW, 9 hours |
| Templeton 2109 | Yes | n/a | n/a | n/a | n/a |
| Templeton 2113 | Yes | n/a | n/a | n/a | n/a |
| Templeton Bank 2 | n/a | 0.75 | 0.75, 2 hours | n/a | n/a |
| Templeton Bank 3 | n/a | n/a | n/a | 0.12 | 1.1, 3 hours |
| L/S R78 - Templeton 2109 | n/a | n/a | n/a | 8.5 | 8.5, 4 hours |

| Facility | Forecasted Overload / Distribution Need | | | | |
|---|---|---|---|---|---|
| | | 2018 PG&E GNA / DDOR | | 2019 PG&E GNA / DDOR | |
| | 2017 Application to CPUC and Data Responses to Energy Division | Web Portal Download, "Planned Investment" (MW) | Candidate Deferrals (MW, hours) | Estrella "Planned Investment" (MW) | Estrella Candidate Deferral (MW, hours) |
| Cholame (between X14 and R96) | n/a | n/a | n/a | 1.5 | 1.5, 4 hours |
| Cholame Sub DA | n/a | n/a | n/a | 3.5 | 3.5, 48 hours |
| Cholame Sub RT | n/a | n/a | n/a | | 3.5, 24 hours[b] |
| **Totals** | **4.3[a]** | **4.9** | **3.4 MW** | **16.5** | **19.4 MW** |

Notes:

a. Only the total was provided by PG&E.

b. The 3.5 MW value is only counted once in the 19.4 MW total.

# Appendix B.
## Detailed BTM Adoption Propensity Results

**Table B-1.** BTM Adoption Propensity Results for Low, Medium, and High Scenarios – All Customer Types

| | LOW SCENARIO | | | | MEDIUM SCENARIO | | | | HIGH SCENARIO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Feeders** | **Custo-mers** | **Solar (MW)** | **Storage (MW)** | **Storage (MWh)** | **Custo-mers** | **Solar (MW)** | **Storage (MW)** | **Storage (MWh)** | **Custo-mers** | **Solar (MW)** | **Storage (MW)** | **Storage (MWh)** |
| Atascadero 1101 | 1,439 | 7.2 | 10.0 | 19.4 | 1,547 | 7.6 | 11.0 | 21.3 | 1,741 | 8.0 | 14.2 | 27.7 |
| Atascadero 1102 | 472 | 2.5 | 3.3 | 6.4 | 502 | 2.5 | 7.1 | 13.7 | 595 | 3.0 | 4.7 | 9.2 |
| Atascadero 1103 | 1,358 | 7.0 | 9.6 | 18.6 | 1,466 | 7.3 | 10.4 | 20.3 | 1,705 | 8.3 | 13.8 | 26.8 |
| Paso Robles 1101 | 123 | 0.4 | 0.8 | 1.7 | 128 | 0.4 | 0.9 | 2.1 | 151 | 0.5 | 1.1 | 2.5 |
| Paso Robles 1102 | 676 | 3.3 | 4.8 | 9.3 | 746 | 3.5 | 5.4 | 10.6 | 881 | 3.8 | 7.3 | 14.3 |
| Paso Robles 1103 | 1,112 | 5.7 | 9.7 | 15.1 | 1,213 | 6.1 | 8.6 | 16.6 | 1,324 | 7.0 | 10.9 | 21.5 |
| Paso Robles 1104 | 624 | 3.4 | 4.5 | 8.8 | 682 | 3.6 | 4.9 | 9.8 | 843 | 4.3 | 6.7 | 13.3 |
| Paso Robles 1106 | 1,737 | 8.0 | 12.2 | 23.6 | 1,881 | 8.5 | 13.4 | 26.0 | 2,325 | 10.1 | 18.8 | 36.5 |
| Paso Robles 1107 | 918 | 4.6 | 6.6 | 12.9 | 981 | 4.7 | 7.1 | 14.2 | 1,123 | 5.0 | 9.5 | 18.7 |
| Paso Robles 1108 | 1,399 | 6.6 | 9.9 | 19.2 | 1,512 | 6.9 | 10.8 | 21.4 | 1,822 | 8.0 | 14.9 | 29.2 |
| San Miguel 1104 | 466 | 2.5 | 3.3 | 6.5 | 495 | 2.6 | 3.7 | 7.8 | 442 | 2.2 | 4.1 | 8.6 |
| San Miguel 1105 | 348 | 1.8 | 2.5 | 4.8 | 376 | 1.8 | 2.7 | 5.4 | 421 | 2.4 | 3.4 | 6.8 |
| San Miguel 1106 | 53 | 0.3 | 0.4 | 0.7 | 56 | 0.3 | 0.4 | 0.8 | 58 | 0.4 | 0.5 | 1.0 |
| San Miguel 1107 | 42 | 0.2 | 0.3 | 0.6 | 48 | 0.2 | 0.3 | 0.6 | 49 | 0.2 | 0.4 | 0.8 |

| Feeders | LOW SCENARIO | | | | MEDIUM SCENARIO | | | | HIGH SCENARIO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Custo-mers | Solar (MW) | Storage (MW) | Storage (MWh) | Custo-mers | Solar (MW) | Storage (MW) | Storage (MWh) | Custo-mers | Solar (MW) | Storage (MW) | Storage (MWh) |
| Templeton 2108 | 894 | 4.4 | 6.3 | 12.3 | 956 | 4.5 | 6.8 | 13.3 | 1,139 | 6.0 | 9.3 | 18.2 |
| Templeton 2109 | 1,473 | 7.2 | 10.7 | 20.9 | 1,576 | 7.5 | 11.6 | 23.4 | 1,565 | 7.5 | 13.8 | 27.6 |
| Templeton 2110 | 997 | 5.1 | 7.0 | 13.7 | 1,077 | 5.3 | 7.7 | 15.1 | 1,126 | 5.1 | 9.3 | 18.3 |
| Templeton 2111 | 1,037 | 5.9 | 7.3 | 14.2 | 1,122 | 6.1 | 8.0 | 15.6 | 1,231 | 6.2 | 10.4 | 20.2 |
| Templeton 2112 | 284 | 1.7 | 2.0 | 4.2 | 300 | 1.8 | 2.2 | 4.8 | 302 | 1.3 | 2.5 | 5.3 |
| Templeton 2113 | 1,958 | 10.2 | 13.8 | 26.7 | 2,115 | 10.7 | 15.0 | 29.4 | 2,255 | 11.1 | 18.9 | 36.9 |
| **Totals** | **17,410** | **88** | **125** | **240** | **18,779** | **92** | **138** | **272** | **21,098** | **100** | **175** | **343** |

**Table B-2.** BTM Adoption Propensity Results for Residential Customers

| Feeders | LOW SCENARIO | | | | MEDIUM SCENARIO | | | | HIGH SCENARIO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Custo-mers | Solar (MW) | Storage (MW) | Storage (MWh) | Custo-mers | Solar (MW) | Storage (MW) | Storage (MWh) | Custo-mers | Solar (MW) | Storage (MW) | Storage (MWh) |
| Atascadero 1101 | 1,425 | 7.2 | 10.0 | 19.2 | 1,532 | 7.6 | 10.8 | 20.8 | 1,726 | 8.0 | 14.1 | 27.1 |
| Atascadero 1102 | 463 | 2.5 | 3.2 | 6.2 | 493 | 2.5 | 7.0 | 13.5 | 586 | 3.0 | 4,7 | 9.0 |
| Atascadero 1103 | 1,346 | 7.0 | 9.5 | 18.3 | 1,453 | 7.3 | 10.2 | 19.7 | 1,692 | 8.3 | 13.6 | 26.2 |
| Paso Robles 1101 | 78 | 0.4 | 0.6 | 1.1 | 83 | 0.4 | 0.6 | 1.1 | 106 | 0.5 | 0.8 | 1.6 |
| Paso Robles 1102 | 658 | 3.3 | 4.6 | 8.9 | 728 | 3.5 | 5.2 | 9.9 | 863 | 3.8 | 7.1 | 13.7 |
| Paso Robles 1103 | 1,100 | 5.7 | 9.6 | 14.9 | 1,201 | 6.1 | 8.5 | 16.3 | 1,312 | 7.0 | 10.8 | 21.2 |

| Feeders | LOW SCENARIO | | | | MEDIUM SCENARIO | | | | HIGH SCENARIO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Custo-mers | Solar (MW) | Storage (MW) | Storage (MWh) | Custo-mers | Solar (MW) | Storage (MW) | Storage (MWh) | Custo-mers | Solar (MW) | Storage (MW) | Storage (MWh) |
| Paso Robles 1104 | 597 | 3.4 | 4.2 | 8.1 | 655 | 3.6 | 4.6 | 8.9 | 816 | 4.3 | 6.4 | 12.4 |
| Paso Robles 1106 | 1,712 | 8.0 | 12.0 | 23.1 | 1,856 | 8.5 | 13.1 | 25.2 | 2,300 | 10.1 | 18.5 | 35.7 |
| Paso Robles 1107 | 893 | 4.6 | 6.3 | 12.1 | 955 | 4.7 | 6.7 | 13.0 | 1,097 | 5.0 | 9.1 | 17.5 |
| Paso Robles 1108 | 1,359 | 6.6 | 9.5 | 18.4 | 1,472 | 6.9 | 10.4 | 20.0 | 1,782 | 8.0 | 14.4 | 27.9 |
| San Miguel 1104 | 416 | 2.5 | 2.9 | 5.6 | 438 | 2.6 | 3.1 | 6.0 | 385 | 2.2 | 3.5 | 6.8 |
| San Miguel 1105 | 339 | 1.8 | 2.4 | 4.6 | 367 | 1.9 | 2.6 | 5.0 | 412 | 2.4 | 3.3 | 6.4 |
| San Miguel 1106 | 50 | 0.3 | 0.4 | 0.7 | 53 | 0.3 | 0.4 | 0.7 | 55 | 0.4 | 0.5 | 0.9 |
| San Miguel 1107 | 42 | 0.2 | 0.3 | 0.6 | 48 | 0.2 | 0.3 | 0.7 | 49 | 0.3 | 0.4 | 0.8 |
| Templeton 2108 | 869 | 4.4 | 6.1 | 11.7 | 931 | 4.6 | 6.6 | 12.7 | 1,114 | 6.0 | 9.1 | 17.5 |
| Templeton 2109 | 1,417 | 7.2 | 9.9 | 19.2 | 1,517 | 7.5 | 10.7 | 20.6 | 1,506 | 7.5 | 12.9 | 24.8 |
| Templeton 2110 | 975 | 5.1 | 6.8 | 13.2 | 1,055 | 5.3 | 7.4 | 14.3 | 1,104 | 5.1 | 9.1 | 17.6 |
| Templeton 2111 | 1,026 | 5.9 | 7.2 | 13.9 | 1,111 | 6.1 | 7.8 | 15.1 | 1,220 | 6.2 | 10.2 | 19.7 |
| Templeton 2112 | 232 | 1.7 | 1.6 | 3.1 | 247 | 1.8 | 1.7 | 3.3 | 249 | 1.3 | 2.0 | 3.9 |
| Templeton 2113 | 1,914 | 10.2 | 13.4 | 25.8 | 2,064 | 10.7 | 14.5 | 28.0 | 2,204 | 11.1 | 18.4 | 35.5 |
| **Totals** | **16,912** | **87.9** | **120.3** | **228.5** | **18,255** | **92.0** | **132.1** | **254.8** | **20,576** | **100.2** | **168.8** | **326.0** |

**Table B-3.** BTM Adoption Propensity Results for C&I Customers

| Feeders | LOW SCENARIO | | | MEDIUM SCENARIO | | | HIGH SCENARIO | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Custo-mers** | **Storage (MW)** | **Storage (MWh)** | **Custo-mers** | **Storage (MW)** | **Storage (MWh)** | **Custo-mers** | **Storage (MW)** | **Storage (MWh)** |
| Atascadero 1101 | * | 0.02 | 0.12 | * | 0.18 | 0.53 | * | 0.18 | 0.53 |
| Atascadero 1102 | * | 0.06 | 0.14 | * | 0.06 | 0.19 | * | 0.06 | 0.19 |
| Atascadero 1103 | * | 0.14 | 0.33 | * | 0.20 | 0.61 | * | 0.20 | 0.61 |
| Paso Robles 1101 | 45 | 0.28 | 0.67 | 45 | 0.32 | 0.96 | 45 | 0.32 | 0.96 |
| Paso Robles 1102 | 18 | 0.20 | 0.43 | 18 | 0.22 | 0.67 | 18 | 0.22 | 0.67 |
| Paso Robles 1103 | * | 0.11 | 0.25 | * | 0.12 | 0.35 | * | 0.12 | 0.35 |
| Paso Robles 1104 | 27 | 0.28 | 0.70 | 27 | 0.30 | 0.91 | 27 | 0.30 | 0.91 |
| Paso Robles 1106 | 25 | 0.24 | 0.54 | 25 | 0.27 | 0.81 | 25 | 0.27 | 0.81 |
| Paso Robles 1107 | 25 | 0.35 | 0.81 | 26 | 0.40 | 1.21 | 26 | 0.40 | 1.21 |
| Paso Robles 1108 | 40 | 0.39 | 0.87 | 40 | 0.45 | 1.36 | 40 | 0.45 | 1.36 |
| San Miguel 1104 | 50 | 0.36 | 0.82 | 57 | 0.61 | 1.82 | 57 | 0.61 | 1.82 |
| San Miguel 1105 | * | 0.11 | 0.26 | * | 0.13 | 0.40 | * | 0.13 | 0.40 |
| San Miguel 1106 | * | 0.03 | 0.05 | * | 0.03 | 0.08 | * | 0.03 | 0.08 |
| San Miguel 1107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Templeton 2108 | 25 | 0.21 | 0.53 | 25 | 0.22 | 0.67 | 25 | 0.22 | 0.67 |

| Feeders | LOW SCENARIO | | | MEDIUM SCENARIO | | | HIGH SCENARIO | | |
|---|---|---|---|---|---|---|---|---|---|
| | Custo-mers | Storage (MW) | Storage (MWh) | Custo-mers | Storage (MW) | Storage (MWh) | Custo-mers | Storage (MW) | Storage (MWh) |
| Templeton 2109 | 56 | 0.80 | 1.77 | 59 | 0.94 | 2.81 | 59 | 0.94 | 2.81 |
| Templeton 2110 | 22 | 0.22 | 0.52 | 22 | 0.25 | 0.74 | 22 | 0.25 | 0.74 |
| Templeton 2111 | * | 0.14 | 0.34 | * | 0.16 | 0.49 | * | 0.16 | 0.49 |
| Templeton 2112 | 52 | 0.42 | 1.03 | 53 | 0.48 | 1.45 | 53 | 0.48 | 1.45 |
| Templeton 2113 | 44 | 0.36 | 0.86 | 51 | 0.48 | 1.44 | 51 | 0.48 | 1.44 |
| **Totals** | **499** | **4.69** | **11.01** | **520** | **5.83** | **17.49** | **520** | **5.83** | **17.49** |

Note: *Redacted customer counts and associated data. Checking with PG&E to confirm whether this data is confidential due to low customer counts on these feeders.

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