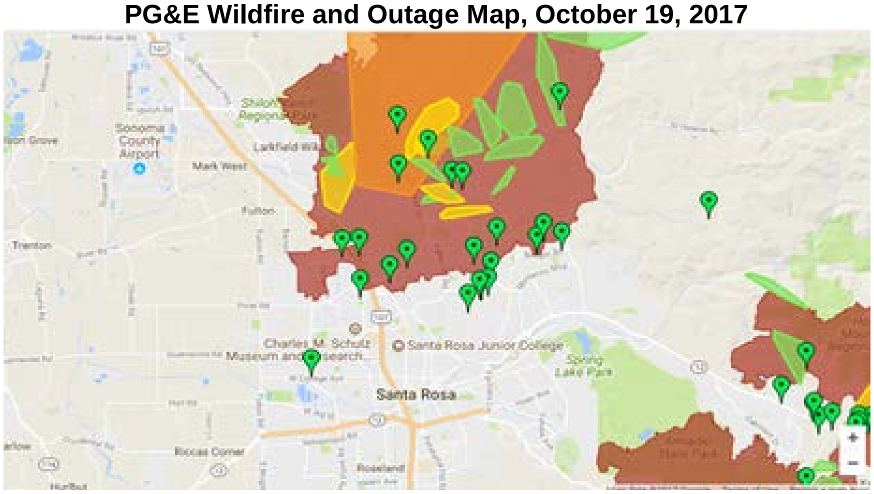
ATTACHMENT 4
Project Narrative Form

1. TECHNICAL MERIT AND NEED

Overview

The recent wave of wildfires in Santa Rosa and across California create a profound opportunity for the integration of microgrid architectures into our power distribution system. Our centralized grid has revealed its vulnerabilities to such climate change-induced events with power outages, both accidental and intentional, disrupting power to the very same areas requiring power to serve emergency workers and to house displaced victims of the fires[2]. Wildfires can destroy critical transmission and distribution interconnections in wilderness areas and can require utilities to disable circuits while assessments and repairs are made, further exacerbating the difficulties faced by affected communities. In the recent wildfires of October 2017, approximately 395,000 customers lost power[3], and its destructive power was felt within a mile of the Santa Rosa Junior College (SRJC) campus, the selected site for the proposed microgrid demonstration project. Over 50 of SRJC's faculty and over 300 students lost their homes, joining the hundreds of residents requiring emergency shelter and services. California's vulnerability to other extreme natural events, such as extreme storm events, coastal flooding, and earthquakes, combined with new national security threats to power infrastructure, make the need for a microgrid approach to power distribution all the more acute.

PG&E Wildfire and Outage Map, October 19, 2017



While microgrids can help with adaptation measures to our changing environment, they can also help to reduce the detrimental effects of electrical power generation from fossil fuel on our climate. California Assembly Bill 32 established aggressive greenhouse gas (GHG) emission reduction goals, targeting emissions rates at or below 1990 levels by 2020 and 80% below 1990 levels by 2050. Additionally, Senate Bill 350 requires retail sellers of electricity and local publicly owned utilities to increase their procurement of eligible renewable energy resources to 40% by the end of 2024 and to 50% by 2030[1]. Distributed solar photovoltaic (PV) systems have been, and will continue to be, increasingly deployed to meet these goals, but issues of daytime grid oversupply and meeting evening demand must be addressed to provide stable, reliable generation. Integration of distributed energy resources (DERs), such as energy storage and load

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[1] SB 350 (Statutes of 2015, chapter 547)

[2] http://www.pressdemocrat.com/news/7511690-181/51000-still-without-power-across?artslide=0

[3] https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/wildfires.page#updates

controls, along with PV in microgrid architectures can help overcome these challenges, but more real-world applications are needed to demonstrate financially viable configurations and control methodologies that benefit both the customer and the distribution utility.

The selected site for the proposed microgrid demonstration project is the 100+ acre Santa Rosa Junior College campus in Santa Rosa, California, located within Pacific Gas and Electric's (PG&E) service territory. SRJC is part of the Sonoma County Junior College District, one of the largest single college districts in the United States. This project will integrate three types of Distributed Energy Resource (DER) elements: PV generation, electrical energy storage, and load reduction devices and load control systems, all managed by a single microgrid controller. Realization of this project will lead to technological advancement and innovation, uncovering hidden value opportunities in the SRJC power system by optimizing generation and load flexibility, enhancing power quality of the surrounding grid using renewable resources, creating disaster-tolerant power resources for SRJC and its community, and opening new value stream capabilities for the Sonoma County Junior College District.

The inherent resiliency of the proposed microgrid will be a permanent installation on campus and deliver significant community benefits. The existing SRJC flexible feeder configuration, when combined with distributed generation, energy storage, and a demand control architecture, creates a high degree of flexibility and expandability. The shelter and maintenance facilities of the college, along with its proximity to critical facilities such as schools, State buildings, and an armory, provide compelling opportunities beyond the proposed project to build out a flexible microgrid-of-microgrids to serve the community. The variety of facilities across the SRJC campus could provide a wide range of emergency services to local residents in times of crisis if these facilities are supplied with reliable power. The potential value of this critical emergency services role was demonstrated during the devastating wildfires that impacted northern California and specifically Santa Rosa in October of 2017. The campus experienced electrical power outages during the critical first few days of these fires, crippling its ability to provide emergency services to the community. The proposed microgrid insures that power needs in times of crisis are met, with configurability to allow adaptation to unforeseen operational needs and challenges.

The proposed microgrid will address the college's environmental impact goals and related policy goals as well. The SRJC campus is currently primarily powered by fossil-derived energy sources, whereas the proposed microgrid would supply approximately 40% of the campus electricity demand with emissions-free PV solar energy. This aligns with the emissions standard set by Senate Bill 350. Further, the peak demand reduction and efficiency improvements provided by the microgrid as a complete system will further help to achieve the goals established in California Assembly Bill 32.

The project team, led by Santa Rosa Junior College and comprised of the Center for Sustainable Energy (CSE), WorleyParsons, and PXiSE Energy Solutions LLC (PXiSE), is uniquely qualified to undertake this effort. The team includes extensive expertise in microgrid design and regulations, solar PV and high-efficiency energy storage solutions, tariff analysis, engineering economic calculations surrounding project costs, return on investment and life-cycle cost analyses, as well as direct market experience deploying integrated pre-commercial solar and storage technologies and advanced control technology packages. Team members and support staff include highly qualified and experienced engineers; project managers; data analysts; and microgrid, solar, battery storage, and distributed energy control technology experts.

ATTACHMENT 4
Project Narrative Form

a. Provide a clear and concise description of the goals, objectives, technological or scientific knowledge advancement, and innovation in the proposed project.

Goals

The goals of the proposed project are to meet 40% of the campus electricity requirement with emissions-free PV solar power, to reduce the campus' peak load, to optimize energy use, to provide support services to the surrounding grid, and to create a highly resilient power system benefitting the campus and the community. In doing so, through use of the proposed system components, the project will demonstrate a campus microgrid strategy that provides enhanced economic value for DER assets, increased system reliability inside and surrounding the microgrid, reduced energy consumption and GHG, and creates a highly flexible, highly resilient power system capable of isolating and reconfiguring itself to provide maximum support to critical facilities during contingency operations. The project directly addresses the GFO requirements by creating a microgrid of multiple DER elements and load control devices for multiple buildings at a junior college campus in a wildfire-prone area of Northern California, integrated with and controlled by a highly advanced microgrid controller with unique high-speed control capabilities.

Objectives

The primary objectives of the project are to demonstrate the environmental, economic, and resiliency benefits of a highly flexible campus microgrid. Operational objectives encompass demonstration of power flow, load control, and energy storage in a large multi-building campus, operating at appropriate scale and in actual operating conditions. Specific objectives for this project include:

- Assessment of individual building and feeder loads
- Design of load shedding controls and hardware
- Integration of distributed PV power generation across multiple feeders
- Implementation of two varieties of energy storage, optimizing the utilization of energy capacity and power capabilities
- Demonstration of the unique capabilities of the PXiSE microgrid controller, a software-based solution housed in a common industrial computer, to provide sub-second real-time frequency and voltage support both locally and to the utility distribution grid
- Demonstrate economic value streams for the microgrid, such as demand response program participation
- Demonstration of advanced microgrid capabilities, such as adaptive load shedding and feeder reconfiguration, load management through integration with building energy systems, sub-second voltage disturbance mitigation, and "blinkless" transitioning to islanded operation and back to grid interconnected operation
- Validation of a microgrid business model, which can be replicated to similar campuses with viable funding sources and investment recovery strategies

The proposed project is further described in two variants, which are termed the Primary Application and Option 1.

- The Primary Application will achieve all of the above objectives as a single microgrid with distributed resources and flexible load shedding
- Option 1 adds increased flexibility, resiliency, and functionality by creating a microgrid of microgrids, allowing individual campus 12.47kV distribution feeders to isolate themselves from each other as independent microgrids or to combine into variable aggregations of resources and loads.

- Option 1 will demonstrate the value of isolating sections of the microgrid which may be damaged or require service during critical events such as fires on the campus or earthquakes and allow selective power diversion into critical loads and to multiple storage locations for maximum adaptability during rapidly changing crisis situations.

Technological or Scientific Knowledge Advancement

The proposed project will result in significant technological knowledge advancements in the high-speed control of microgrid storage and load mitigation resources, in the combination of storage technologies that are tailored for energy and power applications, in adaptive load management, and in the monetization of microgrid assets behind the meter, while providing enhanced community support facilities in times of need.

Innovation in the Proposed Project

The proposed project goes beyond the GFO requirements by demonstrating coordination of multiple large energy storage devices with different dynamic capabilities and by demonstrating a novel approach to stabilizing utility grid frequency locally, transforming the microgrid from a source of load transients to a point of stabilization reaching far beyond the point of interconnection. The PXiSE controller creates a system that is able to operate without spinning inertia while optimizing the control of distributed renewable energy resources and energy storage. This is particularly valuable on a regional, state or national level, providing a viable path to 100% renewables electricity. PXiSE can be deployed on a larger scale in a similar manner. It could manage an individual DER, island, regional, or national grid leveraging the same technology, since nothing about the control system is specific to this microgrid, and could function on a grid of any size with any combination of resources. The Primary Application will show the value of microgrid isolation and reconnection with no interruption of service to critical services, allowing long-term operation when utility outages are experienced. Option 1 expands this innovation with its microgrid-of-microgrids capabilities, allowing storage and generation sources to be matched and optimized for operation of critical loads for multiple days or potentially weeks when solar generation is available, and providing for up to four fully independent microgrids for enhanced resiliency.

b. Explain how the proposed project will lead to technological advancement and breakthroughs that overcome barriers to achieving the state's statutory energy goals.

The State of California is ambitiously working toward increasing the role of microgrids in California's grid. Microgrids are critical to goals of many legislative mandates such as Senate Bill (SB) 246 (Wieckowski, 2015[2]), which created the Integrated Climate Adaptation and Resiliency Program (ICARP). ICARP is designed to develop a cohesive and coordinated response to the impacts of climate change by creating a centralized resource of information and technical assistance to assist policymakers at all levels of local and state government when planning for implementing climate adaptation and resiliency projects. The forthcoming Microgrid Roadmap demonstrates the commitment to state mandated programs such as ICARP and to the State's top-level energy agencies. However, the value microgrids will provide to the grid, customers, or ratepayers through increased resiliency, clean energy, or grid stabilization is yet to be quantified. Additionally, it is not clearly understood how microgrids can tap into all existing value streams in order to recover the costs of the microgrid infrastructure. There are also issues relating to interconnection arrangements with utilities that need to be worked through and resolved, as well as new component technologies that must be proven in the field, allowing performance data to be gathered over time in the real-world context.

[2] SB 246 (Statute 2015, Chapter 606)

The proposed project plans to overcome these barriers by demonstrating a practical and scalable solution and quantifying the value that advanced microgrids provide to the grid, customer, and ratepayers by testing innovative technologies that coordinate and manage energy usage on the microgrid and provide capacity relief and voltage support to the local distribution grid. Beyond customer energy and demand management, the project will explore and, where appropriate, participate in additional value streams to demonstrate where microgrids can currently receive value and to illustrate what future programs or payment structures could exist to compensate microgrids for services provided. By better understanding and quantifying the financial and non-financial benefits that microgrids provide, as well as current and potential future value streams, this project will inform State and local-level regulators, utilities, project developers, and customers how to overcome existing cost, scale, and performance barriers to microgrid development. This project will be closely coordinated in collaboration with PG&E to improve interconnection protocols and will employ several advanced technologies, contributing to the body of data collected on these systems.

c. Summarize the current status of the relevant technology and/or scientific knowledge, and explain how the proposed project will advance, supplement, and/or replace current technology and/or scientific knowledge.

The current status of microgrid deployments is highly preliminary, with many deployments reliant on fossil fuel generation rather than renewables or lacking sufficient clean energy and power resources for extended operation. Many of these microgrids are limited to only a few controllable loads and a single point of isolation and lack the ability to show significant configuration adaptability. Present control technology responds on the order of seconds or minutes, leading to interruptions requiring black-starting and transient issues for sensitive loads. This also limits the potential application of the microgrid's resources to mitigate disturbances in the local distribution grid.

The proposed project will expand microgrid operations into the next level of their evolution, integrating high-speed localized microgrid control with a large multiplicity of load-controlled buildings, renewable generating sources, and various storage technologies through a robust and isolated control network. The Primary Application will reveal the benefits of localized high-speed control to the distribution system, opening the possibility to create new utility and wholesale market incentive structures to stabilize the grid at a local or regional level. This capability, when deployed in microgrids and distributed resources across the grid, will enable renewable penetration to much higher levels than otherwise achievable with conventional control techniques. The high-speed coordinated control of renewable assets and storage can coordinate and aggregate these non-co-located resources as a system, creating a virtual power plant of unlimited size and of no spinning inertia, capable of regulating power flows from variable generation even when all these resources come from a mix of 100% renewable sources.

Option 1 will further demonstrate the next generation of microgrid architecture with enhanced configuration adaptability, expanded energy storage, and broadened load and power flow controls. Additional energy storage provides expanded load capacity for peak loads when solar energy is diminished or absent and extends operations for a greater number of campus buildings for longer durations, achieving continuous operation when sufficient PV generation is available. Load shedding capabilities for this option are provided for every building and every feeder, allowing entire sections of campus to operate independently when needed and providing greater opportunity to keep distributed energy storage online and to divert power most efficiently, even when some areas of the campus are damaged or disabled.

The junior college campus provides an ideal venue to disseminate the lessons learned from the demonstration project, to educate policy makers and asset managers, and to train maintenance and installation personnel on the specific capabilities and operational requirements of an advanced microgrid. The college provides training for electricians and power professionals who would benefit for first-hand knowledge of this expanding field, enhancing employment opportunities. The Center for Sustainable Energy can leverage its deep experience in policy support, as well as education and outreach and workforce development to maximize the impact of this project and spread its benefits throughout the State and across the country.

d. Justify the need for EPIC funding, including an explanation of why the proposed work is not adequately supported by competitive or regulated markets.

The proposed project requires engineering efforts that are specific to establishing the first installation of the proposed architecture, and thus represent added cost that a commercially funded project would be unlikely to afford to maintain profitability. Metering and load shedding components must be identified, which can readily and reliably integrate in higher numbers than would be required in non-microgrid applications. Revenue streams will be demonstrated which, while lucrative, are new to college campuses and thereby have a higher perceived risk. The capabilities of the microgrid architecture to self-protect and maintain critical operation in a reliable manner must be demonstrated to justify capital expenditures which would otherwise be invested in less flexible, less clean technologies, such as back-up diesel generators.

EPIC funding for this project enables a highly competent and uniquely qualified team to be assembled, to provide a functional demonstration of value that helps to de-risk investment in such architectures, and provides for the demonstration of new value streams that have yet to be incentivized to inspire new approaches for achieving grid resiliency with high penetrations of renewable energy. The funding from EPIC will leverage the investment of the junior college in PV and storage to create expanded value from these assets and add greatly enhanced functionality that will benefit the faculty, students, community, and the ratepayers of California, and serve as a guiding example for the evolution of the power grid for the rest of the nation.

SRJC has received letters of Support from Sonoma Clean Power (CCA), Sonoma County Regional Climate Protection Authority, Sempra Utilities, California Community College Chancellor's Office, and Pacific Gas & Electric. All these organizations have unique missions and see this demonstration project as the future of energy sustainability, energy education, greenhouse gas reductions and smart grid infrastructure which they can draw on to support their own mission as well as the State of California's renewable energy goals.

e. Discuss the degree to which the proposed work is technically feasible and achievable.

There are a number of potential challenges in addressing the objectives of this PON, particularly engineering and design of smart grid controller algorithms. Additionally, energy modeling of system performance, microgrid shutdown operations and frequency control are unique challenges to this proposal. The project team has proposed an approach that is both technically feasible and achievable, leveraging SRJC's unique 12.47kV electrical infrastructure, and the current Measure H funded Photovoltaic and Battery Storage Project. SRJC's capital projects consulting firm (Facilities Planning & Program Services) FPPS has years of experience with cash flow management and large capital projects from past and current Bond Measures, which include 12.47kV electrical infrastructure improvement and the construction of a 140,000 square feet Library. SRJC has partnered with a number of highly qualified organizations for the proposed microgrid project. The WorleyParson's Group has a 130-year history of advance engineering in the field of energy generation, transmission and distribution. Their large portfolio of experience with their sizable engineering, procurement, and construction resources give them unique expertise to in leverage market partners, apply knowledge from grid and power plant design and to streamline design-to-construction processes for meeting aggressive timelines. PXiSE will serve as the microgrid controller for the SRJC demonstration Project. The PXISE controller offers advanced microgrid control, with additional frequency and voltage support benefits not available in any other microgrid software. Their advanced experience with time-synchronized high-speed grid control technology and access to Sempra's wealth of renewable energy project expertise with resources support from a large successful parent company, making them the perfect partner for advancing microgrid controller technology. CSE has successfully been awarded numerous EPIC grants and has years of experience working with the California Energy Commission (CEC), and California's Investor Owned Utilities (IOU). Their experience in energy engineering, project management, project reporting, and both measurement and verification provides invaluable expertise in rounding out the SRJC demonstration Microgrid Project. The specifics are outlined in more detail in the Technical Approach section below.

f. Provide a clear and plausible measurement and verification plan that describes how energy savings and other benefits specified in the application will be determined and measured.

The project includes the installation of high accuracy power meters at each of the 27 buildings on the microgrid, as well as on each feeder and on each PV and energy storage installation. Data from all of these meters will be transmitted over SRJC's secure internal network, along with the load data received from the Alerton energy management systems at each of these buildings, to the PXiSE microgrid controller. This data will be stored locally on the campus servers and accessed by CSE to assess individual building load profiles over the first year of the grant funded project. These load profiles will inform the configuration of the microgrid controller to optimize its adaptive load shedding capabilities for maximum utilization of energy from the energy storage system and PV when the campus or sections of the campus are islanded. This will also provide a detailed baseline of campus power usage to contrast against the operation after installation of microgrid components.

The microgrid will be operated for a year after installation completion within the grant term, and for at least an additional three years following the grant term. During the grant term, there will be a minimum of one intentional separation of the campus from the PG&E distribution system, demonstrating the adaptive load shedding as well as the coordinated control of multiple generating sources in the form of the energy storage devices. This data will be compiled into a report showing individual building performance as well as aggregated campus performance. Data for the three years following the grant will be compiled into standardized reports showing energy savings and outage times and islanded times for each campus building. Energy savings data will also be used to calculate net GHG reductions for the microgrid operation. Operations and maintenance costs will be tracked to monitor the system value proposition in practice.

In addition, there will be four demonstrations of the PXiSE controller's high-speed frequency and voltage control capabilities. Each of these demonstrations will last for one week, with operation of the energy storage to provide frequency stabilization to the local PG&E distribution system, as measured at the point of common coupling (PCC). High speed data capture by the installed power meters will be used to show effects on grid frequency before, during and after the testing, and during similar days without testing. These tests will be performed approximately every three months over the one year demonstration period. PG&E will be consulted to verify effects on the grid at nearby locations to illustrate the value of the operating mode. Energy delivered to and from the energy storage system will be recorded, and effects on campus energy costs as well as battery degradation will be used to illustrate the value proposition for this operating mode, enabling the development of incentives or tariffs to monetize this value in the future.

g. Provide information documenting progress towards achieving compliance with the California Environmental Quality Act (CEQA) by addressing the areas in Section I.D, Section III.D.4, and Section III.D.8

In order to be compliant with CEQA requirements should SRJC be awarded this grant in early January, the college will within 30 business days get approval from its Board of Trustees and file a Notice of Exemption with the County of Sonoma. The installation of the PV system and energy storage systems funded by Proposition H has been reviewed by the college's CEQA consultant, and already filed a notice of exemption back in May 2017. This grant proposal has been reviewed by the same CEQA consultant who has determined that the project is categorically exempt as a minor alteration to an existing facility, due to the only major construction event being the installation of battery storage in existing outdoor hardscape. **CEQA Exemption Type: Class 1, Existing Facilities; Section Number 15301: CEQA Guidelines Section 15301.**

h. Provide information described in Sections II.B.2.

The proposed microgrid is composed of three types of DER elements, which are PV generation, electrical energy storage, and load reduction devices and load control systems. A single microgrid controller from PXiSE controls all of the following energy assets for the Primary Application:

- Three PV installations totaling 2.78MW
- One "energy battery": a STEM 1MW, 2MWh lithium-ion battery system for demand charge management
- Two "power batteries" each 1MW, 1MWh lithium-ion battery systems for 2MW, 2MWh total, used for islanding transients and ancillary services
- Automated disconnect devices for isolation and load shedding of 21 of the 27 campus microgrid buildings
- Alerton building energy management systems (EMS) in each campus building for demand response participation and load shedding during islanded operation

Option 1 expands the configuration above with the addition of the following components:

- Five automated disconnect devices for the five 12.47KV feeders
- An additional 1MW, 1MWh energy storage system, as described above
- Additional microgrid control capabilities

The PV system will provide reductions in energy consumption, energy costs, and GHG impacts, and will be interconnected through a NEM 2.0 interconnection. The STEM energy storage system will be used to provide demand charge management and to supply energy during islanded operation. The automated disconnect devices and the Alterton EMS will be used in combination with the two "power battery" energy storage systems to reduce the load from the microgrid to the PG&E distribution system for participation in the PG&E Base Interruptible Program and the Scheduled Load Reduction Program. All energy storage will be independently metered by PG&E to ensure that energy storage discharge does not contribute to NEM export energy credits.

The power battery energy storage systems will also serve to demonstrate the capabilities of the PXiSE microgrid controller to provide real-time, closed loop frequency and voltage control support in direct response to local grid conditions. The PXiSE microgrid controller will use its breakthrough de-coupled voltage and frequency control for each of the power batteries to compensate for frequency and voltage excursions measured cycle-by-cycle at the point of interconnection, and responding within a few cycles. This allows the microgrid to operate as a zero-inertia generation resource, instantly responding and counteracting voltage and frequency excursions due to nearby load and supply changes and/or grid disturbances. These batteries will be interconnected through California Rule 21 requirements to allow power export to demonstrate this capability. While this additional grid benefit will not provide revenue during the project, it will provide a means to evaluate the effectiveness of this approach relative to present frequency control mechanisms, and quantify costs in energy and battery life to inform potential incentivizing rate structures.

All microgrid components will be permanently installed for operation by Santa Rosa Junior College at least until the end of the 10-year warranty or service contract periods of the energy storage systems. Automated data collection and reporting will be created by CSE for the college to ensure that reporting for 3 years beyond the grant term to the CEC has minimal labor burden, to comply with the reporting requirements of this GFO. PG&E interconnection requirements, including Rule 21, have been reviewed with PG&E to ensure interconnection at minimal cost and effort. Santa Rosa Junior College has confirmed CEQA exemption for this project, per Section I.D of the solicitation, as shown in the documentation included in this proposal.

All equipment purchase comprises 57% of requested EPIC funding, complying with the solicitation requirement for less than 70% of grant funding to be spent on equipment.

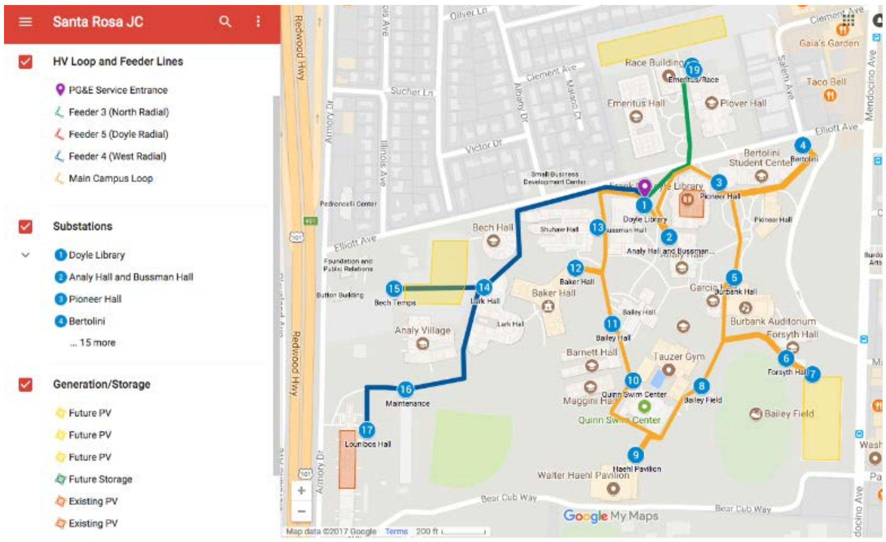
The microgrid control system features several levels of cyber-security. The Santa Rosa Junior College currently has a fiber optic backbone that is designed as an extended STAR topology to every building at the Santa Rosa Junior College. Over the next several years the college will implement a plan to change and upgrade its communication network into a ring topology fiber optic system, which will provide fault tolerance should any leg of the fiber system get cut or destroyed. This unique communication network system allows the microgrid system to be hardwired together on specific communication lines to allow seamless communication between DER devices and the district server which will host the PXiSE microgrid controller. This hardwire connection also prevents hacking and tampering of microgrid infrastructure from wireless and cellular network connections. The Santa Rosa Junior College will host the PXiSE microgrid controller as a virtual server within college's servers, which are protected by an advanced firewall. The only access into the server is through an assigned dedicated VPN. The college's firewall is The Palo Alto Networks Next-Generation Security Platform. This platform has four key characteristics that enable the prevention of successful cyberattacks:

1. **Natively integrated** technologies that leverage a single-pass architecture to exert positive control based on applications, users and content to reduce organizational attack surface, support open communication, orchestration, and visibility, and enable consistent security posture, providing the same protection on the endpoint, in the data center, on the network, in public and private clouds, and across SaaS environments.
2. **Automation** of protection by creating and reprogramming security postures in real-time across the network, endpoint and cloud environments to counter new threats, allowing teams to scale with technology, not people.
3. **Extensibility and flexibility** that allow for consistent protection as users move off physical networks – and as organizations expand – and adopt new technologies and architectures.
4. **Threat intelligence sharing** that enhances prevention and minimizes the spread of attacks by taking advantage of the network effects of automated sharing of protections across a global community.

Should the college have to disconnect from the "outside world" the campus network infrastructure will still be active and continue to function regardless of internet HUBs going down or Cell towers.

ATTACHMENT 4
Project Narrative Form

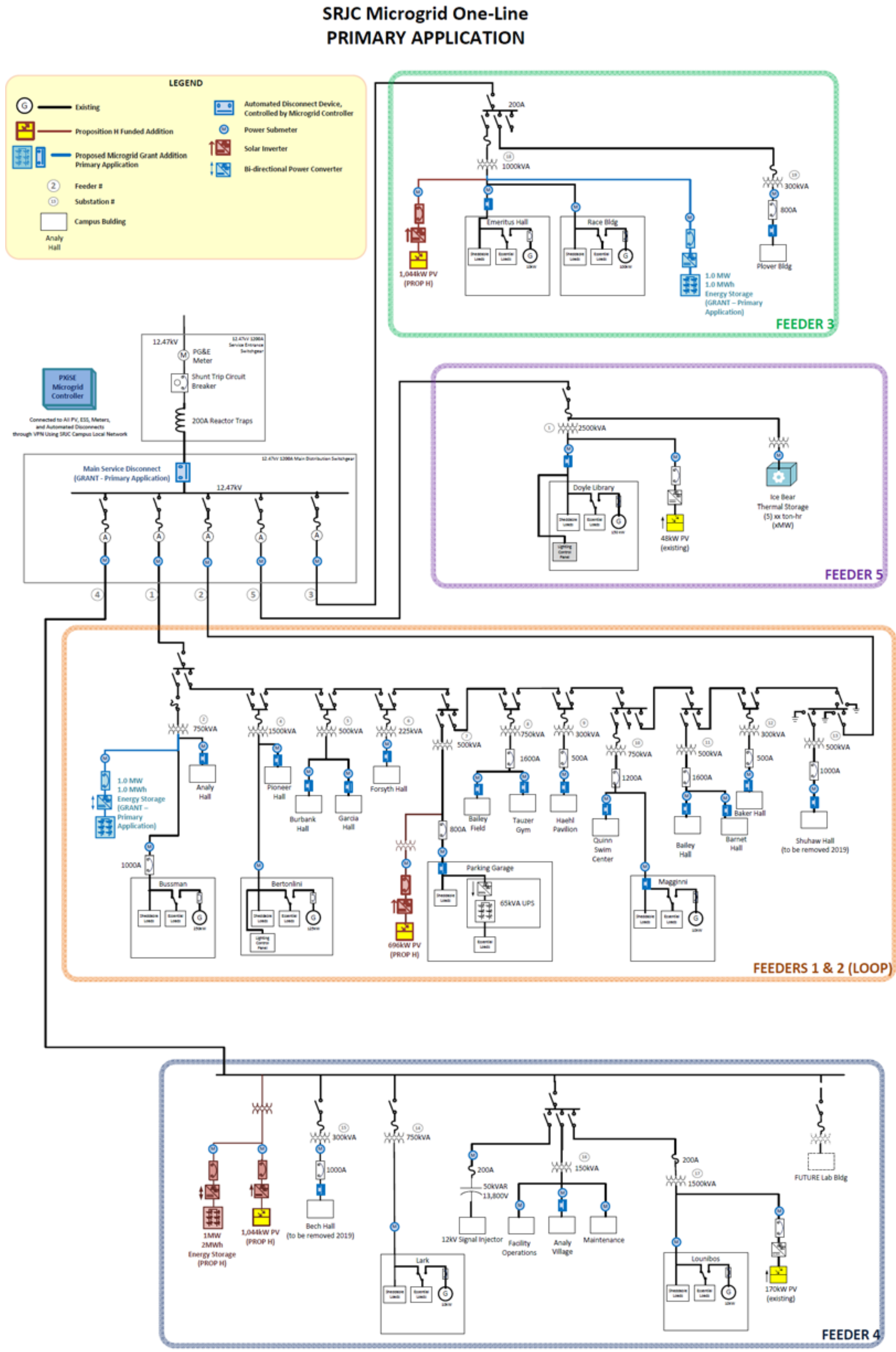
The campus owns and maintains the electrical infrastructure that serves 27 buildings on a 12.47kV star-connected feeder network, with a single point of interconnection to the PG&E distribution grid, and 223kW of distributed photovoltaic (PV) generation. Sonoma County's Measure H bond funds[3] have been committed to the installation of 2.7MW of PV distributed in 3 locations, and for 1MW / 2MWh of lithium-ion electrical energy storage at one of these locations (Bech Temps, substation 15 in the figure below.)



SRJC Campus 12.47kV Distribution Map, Showing Feeder Configuration, Transformer Substations, and Addition of Proposition H Funded PV and Energy Storage

This grant would fund the **Primary Application** to provide the two (2) new 1MW, 1MWh energy storage systems on feeder 3 and feeder 1, all new automated building service disconnects, all new power meters, and the PXiSE controller. The 27-building automated disconnects allow the campus buildings to be disconnected in stages, keeping up the maximum number of buildings for short disturbances of a few minutes to a couple of hours, and prolonging operation of critical buildings to enable overnight operation until PV generation can feed critical loads and replenish batteries sufficiently for continued overnight battery operation and daytime PV recharging. If the batteries near full state of charge while islanded, the PXiSE controller will begin disabling PV arrays to reduction generation, to match building loads and charging loads with PV production.

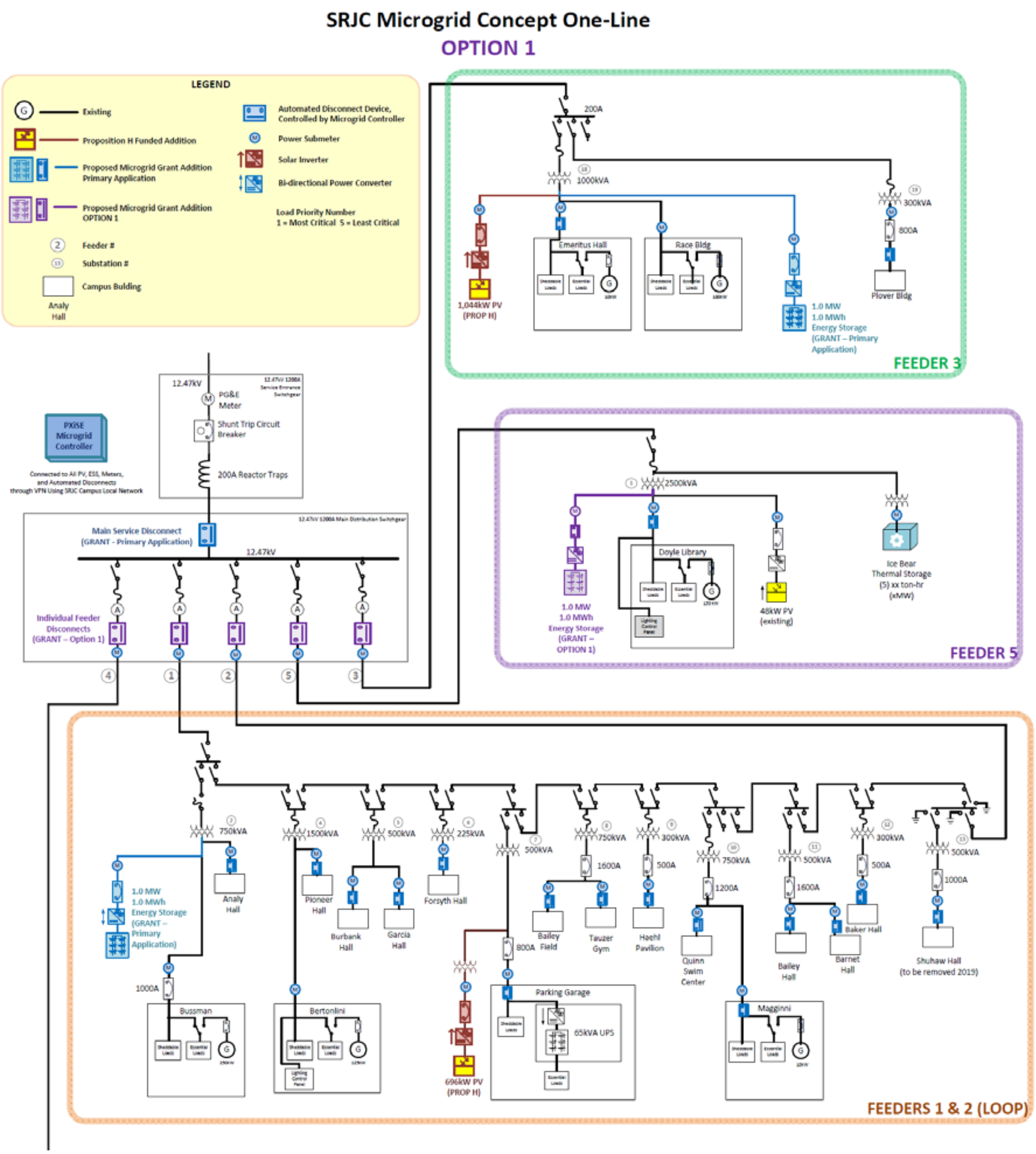
[3] https://bond.santarosa.edu/



SRJC Microgrid One-Line Drawing, Primary Application

ATTACHMENT 4
Project Narrative Form

Option 1 adds five feeder automated disconnects, allowing each feeder to disconnect from the others and from the utility interconnection, allowing flexibility for service and isolation from faults. An additional 1MW/1MWh of energy storage on feeder 5 is complemented by existing PV generation, making a total of 4 microgrids, each with its own generation and storage, capable of working together or independently.



SRJC Microgrid One-Line: OPTION 1

Addition of feeder disconnects and additional 1MW/1MWh of energy storage

(shown in purple elements)

These microgrid functions, along with PV energy production, and peak demand reduction will continue after the grant testing period. Additional value streams such as the Base Interruptible Program and the Scheduled Load Reduction Program will be continued unless more lucrative or beneficial programs arise. Closed-loop frequency regulation will not continue past the grant period, until a compensating rate structure arises which compensates for its costs.

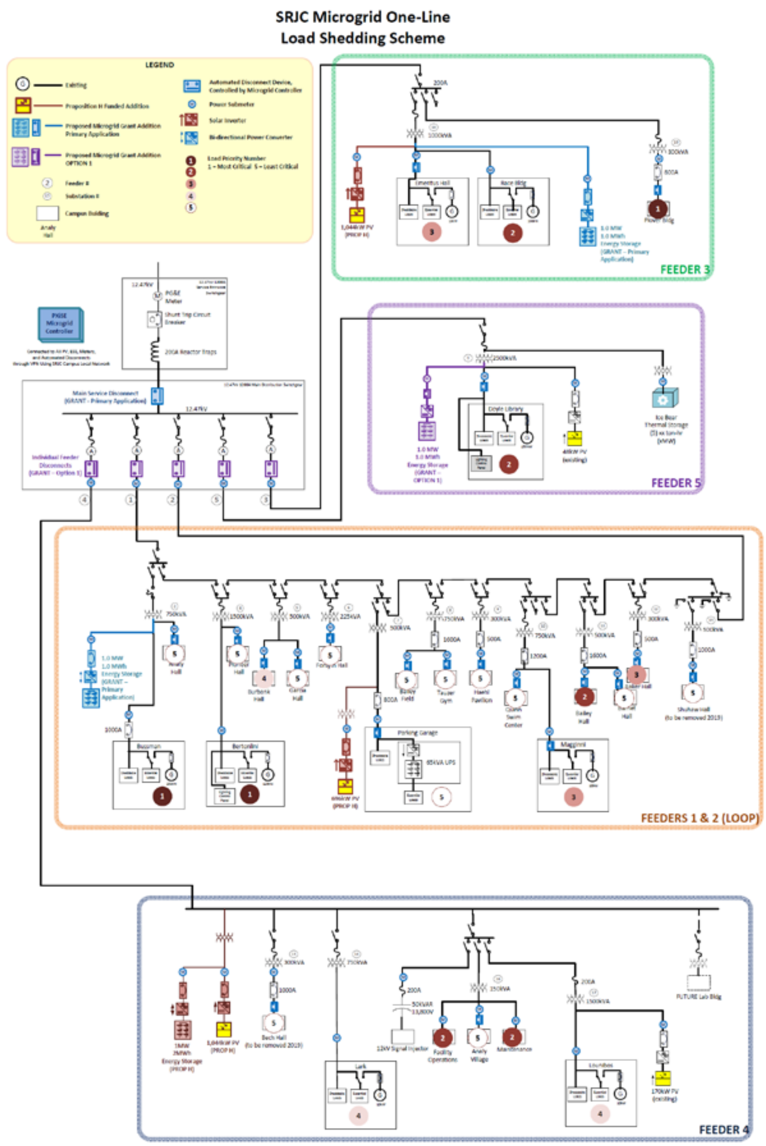
The PV system will produce approximately 40% of the electricity which the campus consumes in a year, based on 2016 consumption data. This will have proportionate effects on the GHG emissions of the SRJC power system, since the PV production will have zero GHG emissions, thereby effectively reducing GHG emissions from the campus electrical systems by about 40%.

The PXiSE microgrid controller will be installed at the SRJC campus data center, and will communicate with the active devices in the microgrid via the campus IT network described earlier. This network provides each building on the microgrid with a hardwired communication line to the campus server, such that if outside internet connections are lost, the server infrastructure will still operate and work as a localized system. Every active microgrid device (e.g. meters, inverters, or automated disconnect controllers) will be given an IP address and plugged in to the intranet via a Cat 5 or 6 cable.

The microgrid is designed to ensure resiliency of the entire campus for brief outages, and continuous islanded operation of critical buildings from PV and batteries alone. The exceptionally fast and low-latency communication of the PXiSE controller combined with the high control bandwidth inverters in the power battery energy storage system provides rapid coordinated control to insure “blinkless” transitioning from grid interconnected to islanded operation, managing internal DER power flows and load balancing within fractions of a second. The 2MW of power from these batteries is sufficient to carry the entire campus load, net of PV, 99.86% of the time, according to 2016 campus usage data from PG&E and projected PV output from PVwatts. The buildings will be prioritized from most to least critical, and disconnected and reconnected in groups according to battery state of charge and the priority assigned. Building HVAC loads can also be reduced through the energy management systems to further extend operation on battery power alone, all of which provides the adaptive load shedding strategy for islanded operation.

An **example load-shedding sequence** in islanded operation has been designed and evaluated based on estimated peak and average loads at each of the 27 campus buildings, based on building size, building type, and energy use intensity (EUI) according to EnergyStar metrics. This analysis shows that with fully charged energy storage systems and no PV generation, the entire campus can continue operation for one hour by batteries alone, providing ride-through for brief interruptions. If utility power does not return, non-essential buildings are dropped, and 30 minutes later buildings not essential for continuous “normal” operation of the campus are dropped. Fifteen minutes later, buildings which are not needed for emergency operations are disconnected, in two successive steps. This maintains 2 hours of operation in total for critical operations, corresponding to the maximum power outage time before SRJC cancels normal operations.

The final load of critical buildings only can then be carried for another 10 hours, or 12 hours in total, allowing PV to return to take on the load and recharge batteries. Precision control of voltage and frequency ensure seamless reconnection with the utility grid when returning to paralleled operation at any point in this sequence. Load is then gradually reintroduced following interconnection during this sensitive period. Moreover, the microgrid controller’s voltage and frequency firming operation helps to absorb grid shocks from other loads switching back onto the system, further enhancing system-wide stability at critical times. This load shedding scheme is illustrated in the diagram below, showing the load priority numbers of the campus buildings according to their emergency response personnel, and a table from the analysis showing the power and energy changes of the microgrid through successive load shedding steps.



Load Shed Step		Avg Load kW	Peak Load kW	PV kW	ESS kW	Load kWh/yr	PV kWh/yr	Normalized Load kWh/day	PV Generation (kWh/day)	Electricity Storage (kWh)	Net Load kWh/day after PV	Hrs of storage at avg load	Consumption Time at step (hrs)	kWh consumed	*hrs storage, net PV*
I	LPN 1 to 5 (all loads)	1,181	2,700	3,002	3,000	**10,351,851**	**4,421,009**	**28,342**	12,104	3,000	16,238	2.5	1.00	1,181	*4.4*
II	LPN 1 to 4	550	1,256	3,002	3,000	4,817,242	4,421,009	**13,189**	12,104	3,000	1,085	5.5	0.50	1,456	*66.4*
III	LPN 1 to 3	443	1,014	2,832	3,000	3,886,806	4,170,652	**10,641**	11,419	3,000	-777	6.8	0.25	1,567	*-92.6*
IV	LPN 1, 2	310	708	2,832	3,000	2,713,626	4,170,652	**7,430**	11,419	3,000	-3,989	9.7	0.25	1,644	
V	LPN 1 only	133	305	2,784	3,000	1,169,421	4,099,963	**3,202**	11,225	3,000	-8,023	22.5	10.00	2,978	

SRJC Microgrid One-Line: Load Shedding Scheme

Diesel and natural gas generators totaling 665kW exist at 8 buildings on the microgrid. Each generator is separated from the microgrid by an automatic transfer switch, and so have no interaction or consideration within the microgrid, unless the microgrid is no longer able to supply power, and the transfer switch local control takes over.

ATTACHMENT 4
Project Narrative Form

BUSINESS CASE: The 1MW/2MWh energy batteries will be used for peak demand reduction to reduce the campus demand charges. This, combined with the 2.7MW PV system energy production, is projected to reduce campus energy costs by $538,121/yr. The 2MW/2MWh power batteries will be used to participate in PG&E's demand response programs, namely the Baseload Interruptible Program (BIP) and the Scheduled Load Reduction Program (SLRP.) The BIP requires dedication of a fixed power capacity to be provided for up to four hours continuously, as does the SLRP. Half of the power battery capacity will be dedicated to this purpose, resulting in participation at 250kW. The BIP requires the system to perform a maximum of once per day, no more than 10 days per month or 180 hours per year. The program pays $8/kW, resulting in an annual revenue of $24,000/yr. The SLRP requires participation for up to 22 events from June to September, with a maximum of 90 events per year. This program pays $0.10/kWh that the participant's load is reduced, resulting in up to $9,000/yr of revenue for the campus.

The business model for the proposed microgrid project includes these available energy and power compensation value streams from the DER components, as well as values unique to the microgrid. The cost of a campus power outage derives from its inability to provide student services such as classes which drive its revenue. With an average revenue of $378,918/day, a three-day outage such as experience during the recent wildfires represents up to $1.14M of lost revenue costs. Power outages at the campus have been experienced several times in recent history before the wildfires, and for the purposes of the business case an average of three outages a year were assumed.

Additionally, the PXiSE controller's unique high-speed frequency support capability has the capability potential to provide localized frequency regulation support, providing benefits to the local grid distribution system and loads as well as the larger grid. In the first quarter of 2016 CAISO spent between $100k and $500k for daily regulation procurement costs (https://www.greentechmedia.com/articles/read/in-california-solar-and-wind-boosts-the-price-for-frequency-regulation#gs.oNkncLs) for 620MW to 800MW of regulation in the day-ahead market. Averaging this over the year leads to over $143,000/MW/yr for frequency regulation services. Given the enhanced local value of the PXiSE control this was taken as a conservative estimate for the business case, which assumes the ability to monetize this capability within five years from incentives or tariffs based on the learnings from this project.

For the grant funded project, this leads to an IRR of 2.5%. However, if this system is repeated after the demonstration at other campuses, an IRR of 8.6% is estimated, with an NPV of $12.77M based on a discount rate of 7%. This result is based on the elimination of costs specific to the grant such as testing and reporting, reductions in engineering costs from replication of system designs, and moderate reductions in battery and PV costs. This represents tremendous value for campuses of a similar size. In the State of California, there are over 418 colleges, universities, trade schools and community colleges, and 249 of them have over 1000 students. If systems of the same size or greater were applied to just 10% of these, a total value of $318M could be realized in the State of California alone. See the cash flow analyses below for the grant funded case, and the replicated case.

ATTACHMENT 4
Project Narrative Form

Pro Forma Cash Flows for SRJC Microgrid Business Case

	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Expenses	Unit Cost ($/yr)																									
EQUIPMENT																										
Prop H: PV + Energy Storage	$11,688,993	x																								
Energy Storage - Power Battery	$2,000,000	x										x										x				
Service Contract - Power Battery	$40,000	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
SRJC Distribution Upgrade Hardware	$775,600	x																								
Microgrid Controller	$402,300	x																								
LABOR																										
Grant activities	$833,376	x																								
Engineering	$484,474	x																								
Installation, Commissioning	$735,000	x																								
Operations	$28,800	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Total Expenses	-$16,988,543	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$2,068,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$2,068,800	-$68,800	-$68,800	-$68,800	-$68,800
Revenue																										
Prop H: PV + Energy Storage, PV energy	$538,121		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BIP	$24,000		x	x	x	x																				
Scheduled Load Reduction Program	$8,000		x	x	x	x																				
Avoided lost revenue due to outages (assume	$1,136,754		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Frequency support income	$143,498						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Total Revenue	$0	$1,707,875	$1,707,875	$1,707,875	$1,707,875	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373
	Net Cash Flow	-$16,988,543	-$15,349,468	-$13,710,393	-$12,071,319	-$10,432,244	-$8,682,671	-$6,933,098	-$5,183,525	-$3,433,952	-$1,684,380	-$1,934,807	-$185,234	$1,564,339	$3,313,912	$5,063,485	$6,813,057	$8,562,630	$10,312,203	$12,061,776	$13,811,349	$13,560,922	$15,310,494	$17,060,067	$18,809,640	$20,559,213
Discount rate	7.0%																									
NPV	-$37,309,180																									
IRR	2.5%																									
Payback period (ROI)																										

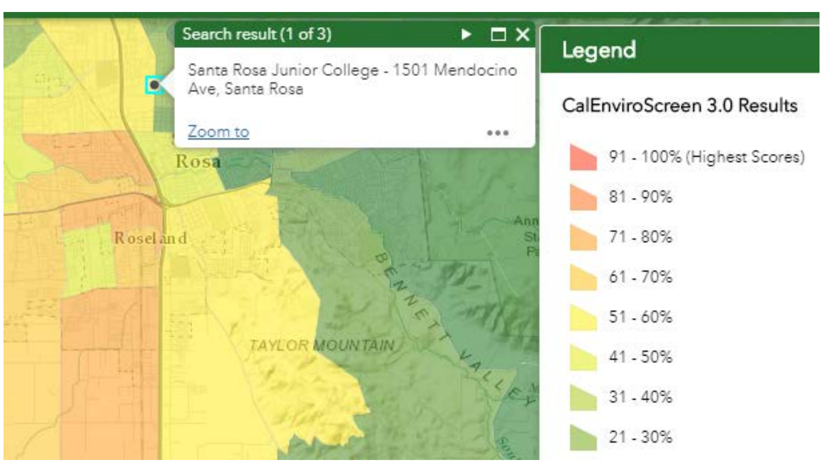
Scenario without Grant Costs

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Expenses																										
EQUIPMENT																										
Prop H: PV + Energy Storage	$10,037,736	x																								
Energy Storage - Power Battery	$1,180,960	x										x										x				
Service Contract - Power Battery	$40,000	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Distribution Upgrade Hardware	$775,600	x																								
Microgrid Controller	$402,300	x																								
LABOR																										
Grant activities	$0	x																								
Engineering	$242,237	x																								
Installation, Commissioning	$735,000	x																								
Operations	$28,800	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Total Expenses	-$13,442,653	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$1,249,760	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$68,800	-$1,249,760	-$68,800	-$68,800	-$68,800	-$68,800
Revenue																										
Prop H: PV + Energy Storage, PV energy savin	$538,121		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BIP	0		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Scheduled Load Reduction Program	0		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Avoided outage lost revenue	$1,136,754		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Frequency support income	$143,498		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Total Revenue	$0	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373	$1,818,373
	Net Cash Flow	-$13,442,653	-$11,693,080	-$9,943,507	-$8,193,935	-$6,444,362	-$4,694,789	-$2,945,216	-$1,195,643	$553,930	$2,303,502	$2,872,095	$4,621,668	$6,371,241	$8,120,814	$9,870,387	$11,619,959	$13,369,532	$15,119,105	$16,868,678	$18,618,251	$19,186,844	$20,936,416	$22,685,989	$24,435,562	$26,185,135
Post Grant Value Analysis																										
Discount rate	7.0%																									
NPV	$12,766,493																									
IRR	8.6%																									
Payback period (ROI)	9	years																								
# of applicable campuses (TAM)	249																									
total serviceable market (SAM)	10%																									
Total value	$317,885,683																									
Post Grant Assumptions																										
Years after Grant Submission	5																									
Battery cost reduction / yr	10%																									
Solar cost reduction / yr	3%																									
TOU incentive increase / yr	5%																									
eligible colleges	249.00																									
market penetration	10%																									
total value	$ 317,885,683																									

Pro Forma Cash Flows for Grant Funded and Replicated Microgrid Business Cases

Creating a microgrid at SRJC will also help to spread the benefits of EPIC funding to members of disadvantaged communities (DAC's) who may have less access to the benefits of renewable generation. While the campus itself is not within a DAC as identified by CalEnviroScreen 3.0, there are DAC's nearby the campus such as Roseland and Apple Valley that could take advantage of the microgrid during times of crises. In addition, the junior college serves a large number of students from DACs in the area.

CalEnviroScreen 3.0 of Area Surrounding SRJC



2. TECHNICAL APPROACH

a. Describe the technique, approach, and methods to be used in performing the work described in the Scope of Work. Highlight any outstanding features.

In the following sections, we describe our technique, approach and method to be used in performing each of the tasks described in the scope of work.

Task 1: Project Management

The Center for Sustainable Energy will provide project management services to SRJC for project reporting and coordination efforts required by the grant. SRJC will manage all financial considerations as the grant recipient, with responsibilities for reporting and administration of all funds from the Energy Commission for this grant.

Task 2: Baseline Measurement and Submetering

The project will add power metering to each of the 27 buildings that comprise the microgrid, to each of the five 12.47kV feeders, and will integrate the power metering from the PV and energy storage installations. Activities of this task include specification of the meters, design of power connections, design of installations, and installation of the meters. This task will commence at the start of the project, allowing campus power data to be collected as a baseline during the engineering and procurement tasks.

Task 3: Microgrid Modeling and Engineering

Microgrid energy flows and power performance will be modelled under a broad spectrum of operating conditions, and across time scales from minutes to years. Various power system modelling tools will be implemented, including Energy Toolbase, DER CAM, MATLAB and custom spreadsheet analysis tools. Actual baseline load profiles will be combined with dynamic component models of PV generation, energy storage and load shedding effects to evaluate storage utilization and load support. Calculated energy consumption will be used along with electricity rate information to determine energy costs and savings. Demand response program participation revenues will also be calculated. Microgrid simulation and modelling will facilitate the development, evaluation and optimization of control algorithm parameters to be utilized in the deployed microgrid controller. Configuration of all control communications elements will also be accomplished as part of this task, as will integration of the building Alerton energy management systems into the microgrid control. Building on the technical data monitoring described above, the cost-benefit analysis (CBA) of the system will likewise be updated at regular intervals to show performance on social, environmental, and economic metrics, using a California-customized CBA tool designed by the project team explicitly for this purpose. Once implemented, the microgrid controller will log grid performance data sixty times a second, as well as the commands that control the microgrid. This data can be analyzed and optimized.

Task 4: Electrical and Hardware Engineering

This task provides for the electrical, mechanical and civil engineering required to purchase and install the microgrid components. Electrical power interconnection devices such as switchgear, contactors, and other isolation devices will be specified, and their integration into the existing distribution system will be designed. The electrical and controls interconnection for the energy storage systems will be designed. The physical installation requirements for the energy storage systems will be addressed through mechanical and civil engineering of concrete pads, trenching for cabling, and all other placement and installation concerns.

Task 5: Procurement and Installation

WorleyParsons will provide all engineering services to create design documentation and RFP's for the construction and installation of the systems. SRJC will conduct a competitive bidding solicitation for the construction and installation work from local contractors, to insure lowest costs and maximum cost control. SRJC will procure all equipment required. SunPower will provide the EPC services for the Proposition H funded PV and STEM energy storage systems. SRJC will use its preferred subcontractor as an independent agent to commission these systems. Work schedules will be coordinated with SRJC to minimize impacts to campus daily operations.

Task 6: Microgrid Testing, Analysis and Reporting
CSE will provide the testing functions described in the Measurement and Verification plan in section 1f. This will include a baseline measurement of individual campus building loads, analyses of energy savings and GHG reductions from daily interconnected operation, power consumption and frequency effects from the four high-speed frequency control tests, monitoring and reporting of microgrid operation under test conditions and due to power outages. In addition to the reporting required by the grant and resulting from the testing in Task 6, the cost/benefit analysis report will be compiled to show all values presented by the microgrid to the campus and to the community. In addition, a standardized reporting method will be developed to allow the campus to easily provide performance reporting for the microgrid to the Energy Commission in the 3 years following the grant period. A template and materials lists to enable easy replication will also be created, as will an RFQ outline that will be made available to the California Community College system.

Task 7: Evaluation of Project Benefits
In three intervals, the benefits of the project will be assessed through completing a Project Benefits Questionnaire, which estimates benefits to college campuses and ratepayers, projected market penetration and economic development, baseline and projected energy use and cost, operating conditions, and emission reduction calculations.

Task 8: Technology/Knowledge Transfer Activities
CSE will use the information gathered during the design, installation, operation and testing of the microgrid to produce several webinars, white papers, and industry conference presentations on the learnings from the project throughout the grant period. In addition, CSE will work with SRJC to produce a training class for electrician students at SRJC to learn about microgrid installation and operation to provide them with unique and valuable job skills.

b. Describe how tasks will be executed and coordinated with various participants and team members.

SRJC has assembled and structured the project team to maximize efficiency and provide quality results. All subcontractors, including staff from CSE, WorleyParsons and PXiSE bring necessary technical expertise to the project and are comfortable with the team approach to complex project execution, wherein each party provides specific expertise in the context of the greater goal. All team members have extensive experience relevant to the microgrid demonstration project. Individual qualifications are documented in Tab 5 (Project Team) of this proposal.

c. **Identify and discuss factors critical for success, in addition to risks, barriers, and limitations. Provide a plan to address them.**

The following factors will be critical to a successful project.

Success Factor	Plan
Safety	Safety reviews in the design, implementation and testing phases.
On-time completion	Comprehensive, timely planning and consistent progress tracking
On-budget completion	Comprehensive planning, procurement tracking, and cost control integration
Technical performance	Engineering reviews in design, implementation, and testing phases

Economic performance	Performance reviews in design, implementation, and testing phases

The following risk factors will require thoughtful planning and committed partnerships to mitigate.

Category	Risk	Mitigation
Funding	**IF:** CEC does not award this proposal **THEN:** This project does not move forward and SRJC and the region will not realize the microgrid capability benefits	SRJC is partnering with WorleyParsons and CSE, which have been successful at executing many similar projects. Together they form an experienced team with proven expertise around microgrids, energy storage, complex decentralized energy sources, and leading control systems.
Funding	**IF:** Unforeseen cost overruns in the budget **THEN:** Project completion could be delayed or work could halt completely	Conduct iterative design process, producing 60%, 90%, and 100% cost estimates with early and repeated opportunities to amend system design to prevent/mitigate budget overruns. Also, the consortium of partners involved in this project includes within its network funding entities that are not part of the project but which can be accessed if needed to close any unforeseen funding gap with project finance at interest rates of 7.3%.
Regulatory	**IF:** PG&E does not grant permission for automated microgrid connection/disconnection **THEN:** SRJC and the region will not realize all of the microgrid benefits	Include early assessment of requirements, conduct repeated meetings with PG&E to coordinate progress, identify/engage stakeholders, engineer and deploy the microgrid to meet requirements.
Technical / Operational	**IF:** Untrained personnel gain physical access to the microgrid **THEN:** Proper operation of the microgrid system is compromised	Install the controller in the SRJC information technology server room, a secure location where access is already strictly controlled.
Operational	**IF:** Skilled personnel are not available to operate and maintain the microgrid **THEN:** SRJC will have to outsource the O&M of the system	Include an early assessment of internal/local personnel qualifications and availability during project planning, and/or pursue service agreement with qualified third-party service provider.
Safety / Operational	**IF:** Distribution grid maintenance personnel (PG&E or third party) are working on the grid infrastructure **THEN:** PG&E is responsible to ensure the section of the grid being maintained is not energized	Initiate a training and safety program for all maintenance employees and microgrid operations staff. Implement lock-out / tag-out process Allow remote and local control override for distribution grid switches and breakers.
System Integration	**IF:** Hardware, firmware, or software is late in shipping **THEN:** The project will be delayed	Follow formal Project Management process. Conduct 60%, 90%, and 100% design reviews to ensure key system integration points and equipment is identified early in design. Sequence construction tasks to complete preparatory work prior to system installation and commissioning.

Construction	**IF:** Field preparation work is not completed prior to equipment arrival **THEN:** The project will be delayed	Follow formal Project Management process. Sequence construction tasks to complete preparatory work prior to system installation and commissioning.

d. Describe how the knowledge gained, experimental results, and lessons learned will be made available to the public and key decision-makers.

The knowledge gained, experimental results, and lessons learned will be made available to the public and key decision-makers through webinars, articles, website content, and conference presentations at power industry, junior college association events and EPIC symposium and conference events. All partners involved in developing the project, as well as the end user (SRJC), routinely maintain information outlets on their websites and through established media channels and will publicize project information via these means. Project characteristics, findings and results will be organized in case study format and made available on the websites of the involved parties as downloadable pdf files. In addition, CSE will work with SRJC to produce a training class for electrician students at SRJC to learn about microgrid installation and operation to provide them with unique and valuable job skills.

e. Include a complete Scope of Work and Project Schedule, as instructed in Attachments 6 and 6a.

The Scope of Work and Project Schedule are provided as Attachments 6 and 6a.

f. Provide information described in Sections II.B.2.

See section 1h, earlier in this proposal.

3. IMPACTS AND BENEFITS TO CALIFORNIA RATEPAYERS

a. Explain how the proposed project will benefit California Investor-Owned Utility (IOU) electricity ratepayers with respect to the EPIC goals of greater reliability, lower costs, and/or increased safety).

This project will provide significant public benefits to California IOU electricity ratepayers by meeting EPIC goals including lowering costs for electricity, increasing reliable electricity supply, and reducing emissions.

<u>Greater Reliability</u>: The project will improve power quality on both the college campus and local distribution system through demonstration of dynamic frequency regulation and voltage control technologies. With the ability to provide both real and reactive power and to respond autonomously to changing grid needs, the project will be capable of providing grid stabilization to the local distribution feeder the campus is located in part of area. Additionally, the project will provide back-up to the Junior College in the event of an outage and could potentially provide black-start services for the grid. The project will provide unlimited renewable-based 100% reliability to certain critical loads on the campus in the event of grid outages of any duration, by matching local PV generation, battery energy storage, and loads to ensure an indefinite energy supply to these loads, while providing limited reliability over a range of time periods to other, less important loads within the microgrid.

<u>Lower</u> <u>Costs:</u> The project will lower customer costs by providing demand and energy mitigation and by providing other monetizable benefits, such as demand response participation. The microgrid would lower costs of lost operation for the Junior College by allowing the campus to remain operational in the event of an outage of the surrounding grid, and would lower peak demand charges and energy costs through on-site generation and storage even when the larger grid is operating normally. The successful demonstration of this project will both help project

developers refine products and customers better understand and utilize microgrid technologies, thus reducing costs of microgrid deployment. Additionally, the project will reduce costs for the utility and ratepayers by providing local voltage support and frequency regulation, allowing the distribution grid to rely less on centralized local power electronics to provide these services; the microgrid will also reduce peak demand, in turn reducing the stress to substations, transformers and wires, and thereby extending the life of the associated grid equipment.

Increased Safety: The project will provide back-up to the Junior College in the event of grid outages, improving the safety of staff, students, and potentially local residents. Additionally, as the project will provide improved grid reliability through voltage and frequency regulation, the microgrid will reduce the likelihood of the local distribution grid suffering an outage, improving the safety of local residents.

b. Provide clear, plausible and justifiable quantitative estimates of potential benefits to California IOU electricity ratepayers, including the following (as applicable): annual electricity and thermal savings (kilowatt-hours and therms), peak load reduction and/or shifting, energy cost reductions, greenhouse gas emission reductions, air emission reductions (e.g., oxides of nitrogen), and water use and/or cost reductions.

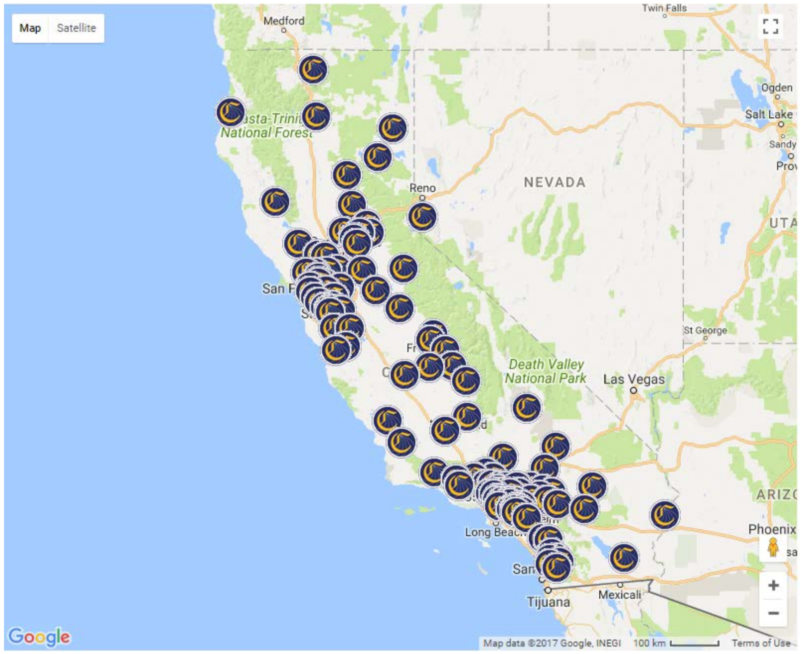
At the project site, the integrated suite of technologies is expected to reduce peak demand by up to 90% for a period of 30 minutes and overall annual electricity consumption by 4,421 MWh, or 57%, for a value of $571,121 per year. Further, the emissions-free electricity generation from the project could reduce CO2 emissions by 1,051 metric tons per year. Santa Rosa Junior College's recent 2015-16 fiscal year Scope 2 Greenhouse Gas Inventory was 7,277 metric tons of CO2 with around 41% of emissions from purchased electricity. As such, the project itself will reduce CO2 emissions attributable to electricity purchased by SRJC by approximately half, and will reduce SOx and NOx emissions by similar percentages.

As well as the reduced emissions from the project site, the microgrid will be used to participate in capacity support and energy support programs, which will extend the useful life of other grid equipment, and reduce the need for ramping up peaking power plants to meet peak demand in the area, thereby avoiding the costs and emissions associated with these inefficient generation sources. The value of these services total over $16,500 per year.

Beyond this project site, far more impact may be realized through replication of the project. The California Community College System is the largest educational system in the world with over 144 colleges with 72 distinct community college districts which serve over 2.1 million students. Counting private colleges as well, there are over 418 colleges in California, of which at least 249 have over 1,000 students, putting them in the ideal size range for replication of this project.

This demonstration project will not only provide a replicable microgrid design (microgrid controller, energy battery, power battery, load shedding through HVAC controls and photovoltaic Systems), but will also include the creation of a template and materials lists to enable easy replication, and will produce an RFQ outline that will be made available to the California Community College system. By making the process and design transparent and providing supporting materials to facilitate replication, this project will readily expand throughout the California Community College, providing grid resilience, emissions reductions, and grid services to local regions throughout the entire state.

Additionally, ability to provide grid services can generate needed revenue to improve on-going maintenance for persistent energy load reductions and power generation at community college institutions. This can create a multiplier effect, as cost savings and increased revenues are applied to further improve energy systems, driving progress toward the ultimate goal of emissions-free energy systems at every college campus in the state, and eventually, the nation.



Map of All Community Colleges in the California Community College System

In the near term, assuming an adoption rate of microgrids utilizing a similar suite of technologies at 10% of post-high school campuses over the next 10 years and applying similar energy and environmental benefits at each of these microgrids would result in 122 GWh of annual electricity savings and 26275 metric tons of annual CO2 reductions.

Long-term annual savings to California ratepayers include energy savings, demand savings, and system benefits to the macro grid. Benefits will accrue to customers in two categories: first, benefits directly to the customer in the form of a reduction in the utility bill (from energy and demand savings). Second, benefits through additional value streams, such as demand response, grid stabilization, or wholesale market participation, either real or simulated. Ratepayers will benefit through reduced system costs, improved reliability of the grid, and improved local air quality.

c. State the timeframe, assumptions, and calculations for the estimated benefits, and explain their reasonableness.

According to data provided by the CEC, electricity consumption for post-high school education is roughly 2,150 GWh, or 2.5% of total electricity use in California. The project team assumes that over the next 10 years 10% of post-high school campuses could adopt similar renewable generation, energy storage, and advanced microgrid controls on their campuses. Given the rapidly falling prices of solar PV and different energy storage technologies, it is reasonable to assume that at least 10% of these campuses would adopt these technologies over the next 10 years. Further, given the technological advancements of microgrids and microgrid controls, it is reasonable to assume that 10% of campuses could adopt these controls. However, this would largely depend on policy developments in California and whether microgrids are able to capture/monetize multiple value streams.

d. Identify impacted market segments in California, including size and penetration or deployment rates, and underlying assumptions.

ATTACHMENT 4
Project Narrative Form

The California Community College System is the largest educational system in the world with over 114 colleges with 72 distinct community college districts which serve over 2.1 million students. This demonstration project will provide a replicable micro-grid design (microgrid controller, energy battery, power battery, load shedding through HVAC controls and Photovoltaic Systems.) which if expanded throughout the California Community College can provide grid resilience, and grid services to local regions throughout the entire state. Additionally, grid services can provide needed revenue to improve ongoing maintenance for persistent energy load reductions and power generation at community college institutions.

<u>Microgrid Controls:</u> The rapid growth in DER is a major driving force in the microgrid market expansion. Microgrids are critical to realizing the full value of the underlying trend in DER expansion by coordinating and optimizing these resources and creating a better more reliable grid. Additionally, as DER continues to expand, the price of microgrid deployments continues to decrease, while the benefits they can deliver to customers and the larger grid increases. As an example of the opportunity at-hand, third-party analysis indicates annual vendor revenue in the global microgrid market will grow from $6 billion per year to $20-35 billion per year in 2020 (Navigant, 2016) (Transparency Market Research, 2016).

<u>Behind the Meter Energy Storage:</u> Behind-the-meter energy storage is experiencing rapid growth. More than 60 MW of capacity has been installed through the Self-Generation Incentive Program (SGIP) since 2009, with half of that capacity being installed in the past two years. Additionally, nearly 240 MW of behind-the-meter storage is currently being developed through the SGIP and will be interconnected to the grid by the end of 2018. Energy storage is seen as a prime technology for microgrids given its fast response times, demand and energy mitigation capabilities, ability to participate in multiple value streams, and potential of providing back-up power. Behind-the-meter storage will likely continue to increase its deployment rates as new value streams and use cases, such as microgrids, emerge.

<u>Solar PV:</u> Since 2004, California's solar market has exploded with exponential growth reaching nearly a quarter of a million installations and a total capacity of almost 6 gigawatts of customer sited solar. California has undertaken numerous forward thinking solar policies that have led to this growth beginning with the Net Energy Metering (NEM) tariff that credits solar customers for the excess electricity, incentive programs such as the California Solar Initiative (CSI) and SGIP which is allowing customers to now pair energy storage technology with onsite solar PV. California's public and private education sector, including community colleges, have been recipients of over 131 MWs of solar PV statewide through nearly 700 projects, which is only scratching the surface of California's potential for clean energy in the community college and public/private educational sector.

e. Discuss any qualitative or intangible benefits to California IOU electricity ratepayers, including the timeframe and assumptions.

The proposed project is expected to deliver a much-improved understanding of the benefits and barriers of expanding community and campus microgrid development in California. Specific qualitative and intangible benefits include:

- The project would provide a template for other campuses to create similar power system improvements
    - Most colleges are public entities (there are approximately 250 colleges, universities and trade schools with similarities to SRJC in CA), requiring RFP solicitation process, which adds 2 to 3 months to process
    - Colleges can do master RFQ's to desired level of detail, that any public agency can then use to solicit microgrid development projects

- The project would include creation of a list of specifications and requirements for other campuses to follow and build upon
- The project will be demonstrating the ability of PXiSE software and controls to manage multiple inverters to form grid with NO fossil generators, which if replicated across California, could allow CA to meet RPS goals with only renewables
- The microgrid would provide training and research opportunities for the students and faculty of SRJC and would serve to raise awareness for both students and the surrounding communities
- The establishment of the locally self-sufficient energy supply for critical loads would increase the safety and resilience of the local community and will have the ability to provide emergency services in the event of natural disasters, in a heavily fire-prone area
- The proof of concept provided by this project would support lowering of technical, institutional, and regulatory barriers to microgrid adoption in California

f. Provide a cost-benefit analysis that compares project costs to anticipated benefits Explain how costs and benefits will be calculated and quantified and the underlying assumptions.

Market Leverage: Matching funds of $8.45M for solar PV installation will be leveraged in this project to create a 100% renewably powered microgrid that will improve grid function and energy supply, reduce carbon emissions, and increase reliability for the site. The project will benefit manufacturers of solar, energy storage, and microgrid controls technologies and will help IOUs, CEC participants and DER Asset Owners through direct market feedback and learning from the field demonstration of PXiSE microgrid controls and STEM and the power battery energy storage technologies.

Return on Investment: The following components contribute to the project ROI:

- The Capacity Program “Baseload Interruptible Power (BIP)” pays an expected $8/kW allocated to the program; this project will allocate 500kW for an expected annual revenue of $24,000
- The Energy Program “Scheduled Load Reduction Program” pays an expected $0.10/kWh of load reduced; this project will allocate 250kW at 4 hours per day for an expected annual revenue of $9,000
- The solar PV component of the microgrid will produce an estimated 4,421,009 kWh/year with an expected annual value of $538,121
- Based on PG&E’s average CO2 emissions per kWh of delivered electricity, and the expected annual energy output of the microgrid’s PV system, an average of 1,051 metric tons of CO2 emissions will be avoided each year, which, at the current cap and trade price per metric ton of CO2 in California ($13.08/metric ton), has an annual value of approximately $13,745
- As well as reducing peak demand, the battery storage capacity also allows for charging during off-peak hours and discharging during peak hours (in the summer) or partial peak hours (in the winter), thereby giving the opportunity for energy arbitrage; although the theoretical maximum value of this arbitrage opportunity would not be realizable in practice, as an approximation of the value of this peak shifting, the cost difference between charging and discharging the batteries included in this project during these different time periods is $48,370.81 per year
- IOU grid savings (delayed or avoided grid upgrades of $0.16 to $0.31 per watt)
- Enabling the acceleration of higher penetration of these microgrid controls at similar campuses in California (there are approx. 250 community colleges in CA with similar characteristics as SRJC) by deployment of up to 3 MWh of energy storage paired with

solar and consistent DR capacity that would deliver a return of $463M from the $5M invested by the CEC grant funding.

Other quantifiable benefits that would be estimated for the project are:

- Energy Cost Savings (including reduction in generating costs; reduction in T&D losses; and by providing ancillary services such as voltage and frequency regulation, and black start support)
- Value of reliability to the college
- Power Quality (reduction in frequency of voltage sags and swells; reduction in the frequency of momentary outages (less than 5 min))
- Environmental Benefits (avoided emissions allowance costs for NOx, SOx; avoided emissions damages; avoided transmission and distribution losses)
- Benefits of avoiding major power outages (estimation of the monetary value to the college and surrounding community to having access to electricity)

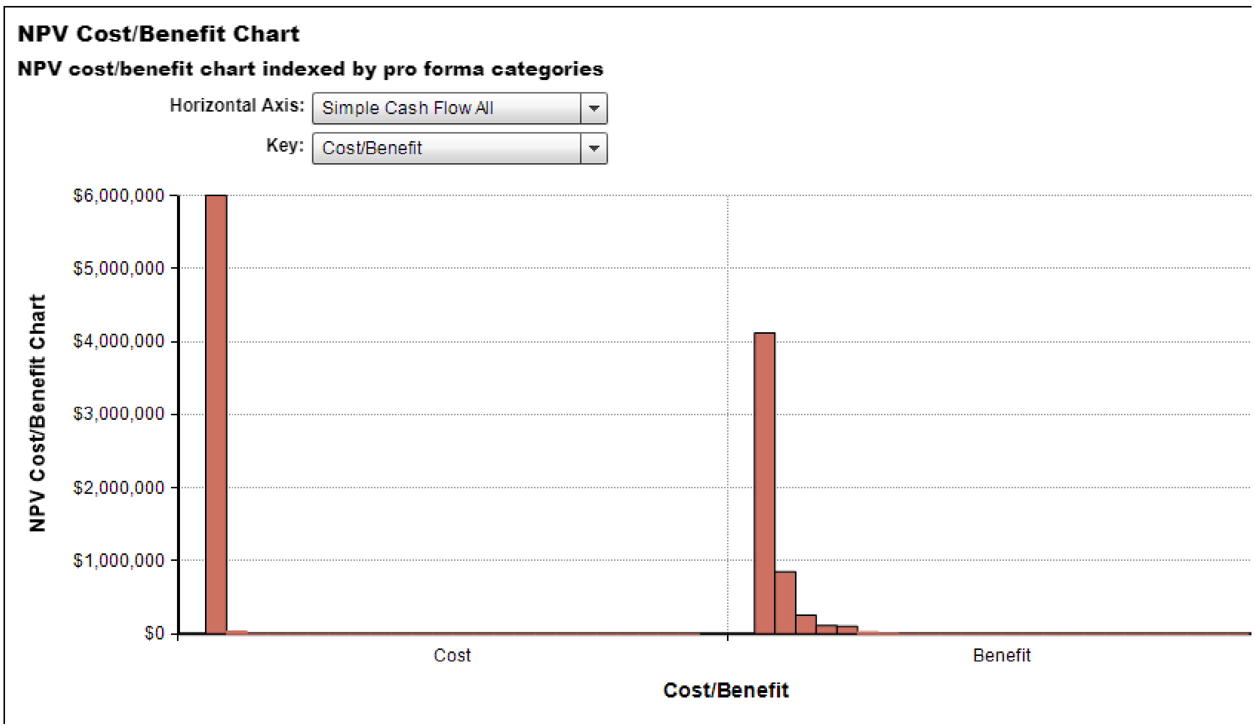
g. Provide information described in Sections II.B.3.

See sections 3a to 3h for additional information.

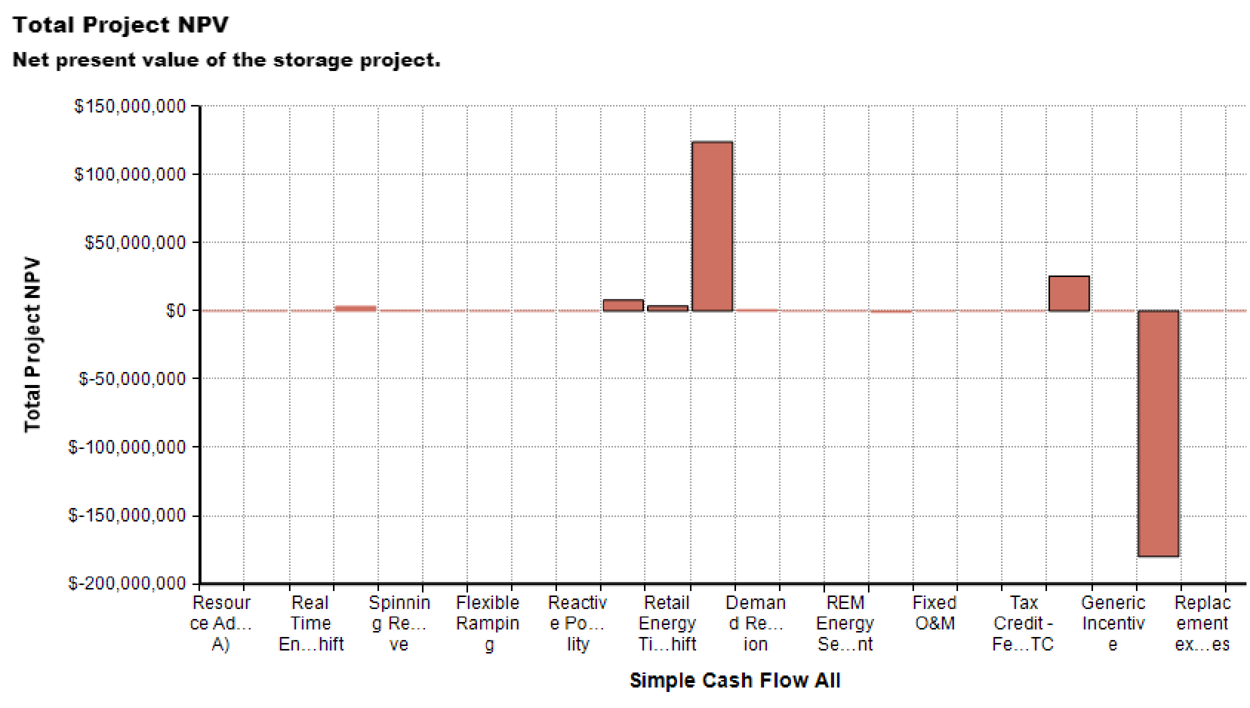
Per the solicitation requirements, StorageVET was utilized to to gauge the value of energy storage to this project.

The technical, use case, and financial assumptions for this analysis are included in Attachment 13, "**13_Att13_StorageVET_Assumptions_and_Use_Cases.docx**", as required by the solicitation.

NPV Cost/Benefit Chart



Total Project NPV



Net Cost of Capacity ($/kW-year): $101.1/kW-year (single number result)

Breakeven Capital Costs ($/KWh): $1,814 /kWh (single number result)

All analyses of storage and microgrid value are based on the following sources:

- Energy storage system data sheets for the power battery from established manufacturers including Solar Turbines and Dynapower
- Solar performance from PVwatts
- Campus electricity consumption from PG&E master meter interval data
- PV and energy battery system performance from SunPower proposal analysis
- Energy Toolbase calculations from the above data
- Custom spreadsheet calculations on the above data using Excel and Google Sheets

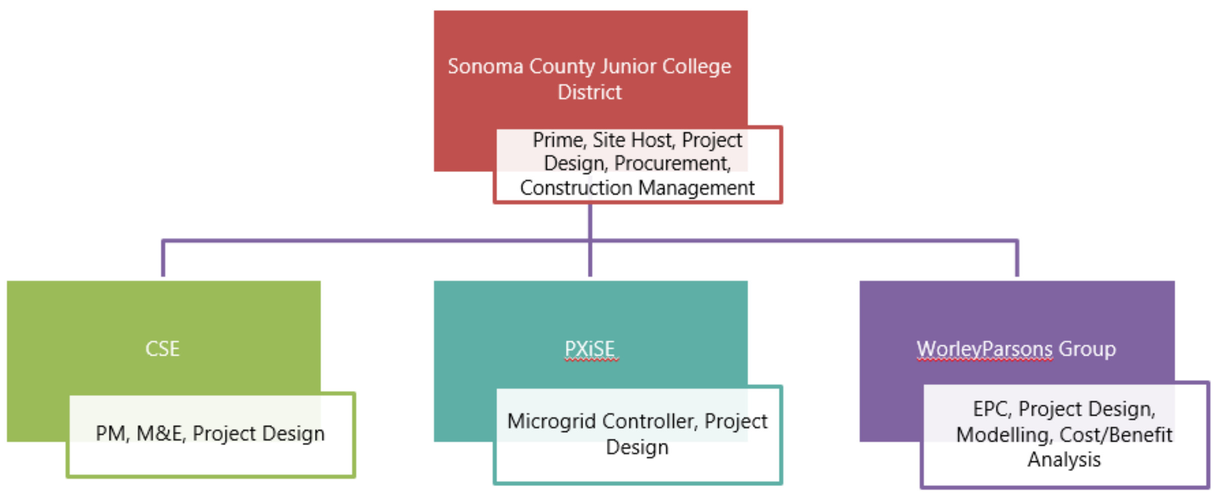
4. TEAM QUALIFICATIONS, CAPABILITIES AND RESOURCES

a. Describe the organizational structure of the applicant and the project team. Include an organizational chart that illustrates the structure.

Prime Organization Structure: Founded in 1918, Santa Rosa Junior College (SRJC) is the tenth oldest of California's 109 publicly funded two-year colleges. Its 100+ acre campus in Santa Rosa is part of the Sonoma County Junior College District, one of the largest single college districts in the United States. SRJC is committed to environmental protection through efficient energy management as a fundamental operational objective and integral to the strategy of fulfilling its educational mission. The district recognizes its responsibilities as a contributor to the community and that its operations and facilities impact the environment. Therefore the District's operational and planning decisions will incorporate the following: prudent use of energy resources, prevention and/or minimization of energy-related pollution and wastes, fostering a sense of personal responsibility for energy management, emphasize water conservation and environmental protection, continuous improvement in college energy management performance, and internal deployment of resources to reflect the District's commitment to environmental protection through efficient energy management and sustainable practices. This commitment is demonstrated through many technologies, including efficient HVAC systems, a cogeneration plant, and renewable energy generation, with solar PV on four campus structures.

Team Organization Structure: The team proposed herein is composed of four partners, including the Prime grant recipient. All firms and contractors (depicted in Figure 1) have been carefully selected to provide the breadth of expertise required to meet the work requirements under this GFO.

SRJC Microgrid Project Team Organization Chart



b. Summarize the qualifications, experience, capabilities, and credentials of the key team members.

Qualifications, experience, capabilities and credentials for each of the key team members above provided in Attachment 5. Organizational qualifications are provided below.

Founded in 1918, **Santa Rosa Junior College (SRJC)** is the tenth oldest of California's 109 publicly funded two-year colleges. Its 100+ acre campus in Santa Rosa is part of the Sonoma County Junior College District, one of the largest single college districts in the United States serving over 20,000 students. SRJC is committed to environmental protection through efficient energy management as a fundamental operational objective and integral to the strategy of fulfilling its educational mission. The district recognizes its responsibilities as a contributor to the community and that its operations and facilities impact the environment. The college's consulting team Facilities Planning & Program Services (FPPS) team and Facilities Operation team manage over $1.6 million gross square footage of Buildings; successfully managed Measure A, a $251 million-dollar general obligation bond; and is currently managing Measure H, a $410 million-dollar general obligation bond for infrastructure improvement, new buildings and existing building modification. Submitting proposal for the college and acting as college's representative, and project manager is David Liebman **Energy & Sustainability Manager/ Consultant Facilities Planning & Program Services Inc. (FPPS)**

The **Center for Sustainable Energy (CSE)** is a 501(c)(3) nonprofit, mission-driven organization whose goals are to transform and advance the market for clean and sustainable energy. The organization is governed by a Board of Directors comprised of sustainable energy experts. Our Executive Director, retired Rear Admiral Len Hering, brings more than thirty years' operational and strategic experience to the organization and currently oversees over 45 energy programs with a current annual budget of $144.5 million. The organization has a staff of approximately 150 full time employees including project managers, engineers, research and policy analysts and marketing staff. For two decades, CSE has managed numerous regional and statewide energy projects, applying their on the ground experience and stakeholder connections to facilitate the adoption of sustainable energy technologies and address market barriers.

WorleyParsons Group was established in Australia in 1896 and has over 120 years of continuous operation. The company currently has 23,100 employees working from 118 offices in 42 countries and 2016 revenues of nearly $6 Billion. WorleyParsons consistently delivers best-in-class services across all energy verticals, ranging from development of small renewable energy installations, to design, construction, and operation of full-scale nuclear power plants, and everything in between: microgrids, energy storage systems, CHP retrofits, and much more.

Andrea Ruotolo, PhD c., MSc. - Microgrid Specialist: Andrea brings over 10 years' experience in engineering, renewable energy systems, smart grids, distributed energy systems, and microgrids. She has been a lead member of the New York Prize Community Microgrids Initiative and project manager and microgrid lead within NY's "Reforming the Energy Vision" (REV).

PXiSE Energy Solutions, LLC is Sempra Energy wholly owned software company based in California. PXiSE is further developing and marketing advanced electric grid control solutions. The technical application implements fast, precise, time-synchronized, and de-coupled control of real and reactive power, and is embodied in the partnership's flagship product, Advanced Control Technology (ACT). This software is developed and made in California, and is the result of collaboration between California-based companies OSIsoft LLC (OSIsoft) and Sempra Energy (Sempra). PXiSE ACT's patented advanced control method will transform electric grid controls and address the integration challenges for DERs and microgrids, leading to rapid adoption and the accelerated proliferation of phasor-based control applications and high-speed data analytics.

c. Explain how the various tasks will be managed and coordinated, and how the project manager's technical expertise will support the effective management and coordination of all projects in the application.

SRJC will be the project lead and responsible for all deliverables and project outcomes, budgeting and reporting to the CEC. SRJC will implement subcontractor agreements with our proposal partners CSE, WorleyParsons and PXiSE for their portions of the overall scope of work. The proposed organization structure supports SRJC's project management best practices allowing for clear and streamlined communications as well as delineation of project responsibilities by support staff and subcontracting partners.

SRJC's organizational structure and staffing are designed for effective management and implementation of public work projects. The SRJC Capital Projects Team and Facilities Operation Team have years of experience with running capital projects utilizing both State and Local funding. This includes the past managing of Measure A, a $251 million dollar general obligations bond that let to 7 Brand New Buildings across two campuses and numerous campus infrastructure projects and the current management of Measure H, a $410 million-dollar general obligation bond. The capital projects team practices strict budgeting control through a dedicated capital projects budget coordinator, and transparency through its electronic procurement, budget and accounting system. All projects and budgets are audited yearly by State Auditors per California Law. Both the Capital Projects Team and Facilities Operation Team have assigned 4 Personnel for supporting this grant project. The College's current Energy & Sustainability Manager, a dedicated Energy and Sustainability Associate, Senior Capital Project Manager, and Facilities Project Coordinator/Head Electrician. Project teams meet weekly and are assigned specific deliverables to ensure completion of project milestones, review of all designs at 30% and 90% increments, inspection of work during construction, and project closeout. The college's process for capital projects minimizes change orders and minimizes cost over runs through strict procurement guidelines, cap on change orders per contract and close interaction between facilities operation technicians from design through construction.

Project Manager's Technical Expertise: David Liebman has over five years of experience implementing energy and sustainability projects inside California Public Agencies. He is currently Santa Rosa Junior College's Energy and Sustainability Manager and is managing over $35 million dollars' worth of Measure H Energy & Infrastructure Projects as well as $3 million dollars in State Allocated Prop 39 Funds. David holds a B.S. Energy Management & Design from Sonoma State University.

d. Describe the facilities, infrastructure, and resources available to the team.

Facilities Available to Team: SRJC is located in Santa Rosa, CA with three additional teaching sites in Petaluma, Windsor, and Forestville. All SRJC offices possess audio-visual conferencing capacity, high speed internet, and advance media display tools. The demonstration technologies will be deployed at Santa Rosa Junior College in Santa Rosa, California.

Infrastructure Available to Team: SRJC staff has access to numerous collaborative spaces: all office locations are equipped with video conferencing technology and cloud-based collaboration services. SRJC employs client/server, cloud-based secure enterprise applications, including CRM systems, and uses integrated financial and project management applications. SRJC IT and media department support the campus strategically and tactically, ensuring that staff has access to technology that meets and exceeds project requirements. All SRJC campuses are connected via secure network and have fiber internet connectivity. SRJC backs up its entire server in the cloud and have a mirrored server at two teaching sites. The college uses best practices to encrypt data as required for our students, staff and faculty. College employs an advanced firewall system, encryption, and user credentials in order to access the college network. SRJC also has a comprehensive disaster recovery and business continuity plan in place.

Resources Available to Team: The project team will have access to cross-functional support from SRJC's capital projects team, purchasing team, accounting department as well as faculty expertise and community network. SRJC also has a number of pre-qualified engineers for a number of related design and engineering services should they be needed.

e. Describe the team's history of successfully completing projects (e.g., RD&D projects) and commercializing and/or deploying results/products.

See Attachment 9, Reference and Work Product Form.

f. Identify past projects that resulted in a market-ready technology.

Examples of projects that resulted in market-ready technologies are provided in Attachment 9, Reference and Work Product Form.

g. Identify any collaboration with utilities, industries, or others. Explain the nature of the collaboration and what each collaborator will contribute.

The project has been reviewed with PG&E, and PG&E has provided a letter of support for this project. SRJC will work with PG&E to insure compliance with all interconnection requirements.

h. Demonstrate the financial ability to complete the project, as indicated by the responses to the following questions:

- Has your organization been involved in a lawsuit or government investigation within the past five years? **No**
- Does your organization have overdue taxes? **No**
- Has your organization ever filed for or does it plan to file for bankruptcy? **No**
- Has any party that entered into an agreement with your organization terminated it, and if so for what reason? **No**
- For Energy Commission agreements listed in the application that were executed (i.e., approved at a Commission business meeting and signed by both parties) within the past five years, has your organization ever failed to provide a final report by the due date indicated in the agreement? **No**

Letters of Support and Letters of Commitment are provided as Attachment 11.

5. BUDGET AND COST EFFECTIVENESS

a. Provide a budget by task.

Primary Application Budget

Task (by major task)	Task Description	Energy Commission Funds	Match Share	Total
1	Project Management	$ 280,780		$ 280,780
2	Baseline Measurement	$ 33,150		$ 33,150
3	Microgrid Modeling and Engineering	$ 194,550		$ 194,550
4	Electrical and Hardware Engineering	$ 316,459		$ 316,459
5	Procurement and Installation	$ 3,969,156	$ 8,689,759	$ 12,658,915
6	Testing	$ 91,820		$ 91,820
7	Reporting	$ 70,450		$ 70,450
8	Knowledge Transfer, Educational Outreach	$ 42,640		$ 42,640
	TOTAL	$ 4,999,005	$ 8,689,759	$ 13,688,764

ATTACHMENT 4
Project Narrative Form

Option 1 Budget

Task (by major task)	Task Description	Energy Commission Funds	Match Share	Total
1	Project Management	$ 280,780		$ 280,780
2	Baseline Measurement	$ 33,150		$ 33,150
3	Microgrid Modeling and Engineering	$ 194,550		$ 194,550
4	Electrical and Hardware Engineering	$ 516,459		$ 516,459
5	Procurement and Installation	$ 5,769,156	$ 8,689,759	$ 14,458,915
6	Testing	$ 91,820		$ 91,820
7	Reporting	$ 70,450		$ 70,450
8	Knowledge Transfer, Educational Outreach	$ 42,640		$ 42,640
	TOTAL	$ 6,999,005	$ 8,689,759	$ 15,688,764

b. Justify the reasonableness of the requested EPIC funds relative to the project goals, objectives, and tasks.

The total project costs associated with the proposed scope of work include project management, microgrid design and engineering, testing, data collection and analysis, knowledge dissemination and evaluation of project impacts. SRJC will provide **$8,689,759 in match funding**, which **represents more than 173% of the requested grant funds for the Primary Application, and 104% of the requested funds for Option 1**. This match funding is comprised of $8,450,759 which fully committed to payment for the SunPower 2.7MW PV arrays and the STEM 1MW/2MWh energy storage system, for the portion spend during the grant period, plus $200,000 for permitting costs, and $39,000 cost share for metering which had been previously allocated to future submetering efforts. The requested EPIC funds are reasonable given the fact that they represent true costs of creating, installing and implementing new microgrid control architectures and strategies in alignment with the CEC's Microgrid Roadmap, and that they provide for a substantial contribution of match funding.

c. Justify the reasonableness of costs for direct labor, non-labor (e.g., indirect overhead and general and administrative costs, and subcontractor profit), and operating expenses by task.

SRJC is showing hours contributed to this project by internal staff but is not charging those hours to CEC. This is because existing staff salaries cover time for project management and facilities operations. All staff members who will be supporting this project have received permission from staff supervisors for allocated hours. This will help keep project costs down. SRJC is a public agency that follows California Public Contract code and California Community College Education Code. All public work projects are required to be prevailing wage and college internal staff report contractor's prevailing wage to the Department of Industrial Relations. SRJC Board policy also caps all professional service reimbursables to 5%.

d. Explain why the hours proposed for personnel and subcontractors are reasonable to accomplish the activities in the Scope of Work (Attachment 3).

As the lead agency on this project, SRJC will manage its subcontractors as well as their work products and performance, while meeting and exceeding all of the contractual obligations between SRJC and the Energy Commission. Therefore, the total number of hours proposed for SRJC personnel are reasonable, over an anticipated 33-month period, to successfully accomplish this ambitious project. Furthermore, SRJC has worked diligently throughout the proposal development and preparation period in order to ensure that the hours and costs for services in support of the project goals provided by subcontractors are reasonable and justifiable. Project management services will also be provided by CSE.

e. Explain how the applicant will maximize funds for technical tasks and minimize expenditure of funds for program administration and overhead.

SRJC will be managing and directly overseeing each of the technical tasks contained within the Scope of Work. Subsequently, SRJC staff will be monitoring and auditing its subcontractors' expenditure of funds attributed to administration and overhead. Internally, SRJC has established professional project management principles that include detailed tracking of project goals and metrics, strict budget control and ongoing client reporting. SRJC project managers have access to electronic purchasing system which shows and track all expenditures and encumbrances with established project budget. All invoices and requisitions for PO go through a strict control process for review to make sure project is on budget and needed expense is reasonable.

6. EPIC FUNDS SPENT IN CALIFORNIA

Over 98% of requested funds will be spent in California. This information is included in Tab B-4 of Attachment 7, Budget Form.

7. MATCH FUNDING

Match Funding Commitment Letter: The match commitment letters provided meet the requirements of Attachment 11.

Match Funding Pledged in Attachment 1: The match funding pledged in Attachment 1, Application Form of $8,650,759 is equal to the sum of the match commitments pledged by Santa Rosa Junior College in their commitment letter.