Technical Appendix:

SECTION 1: OVERALL PROJECT SUMMARY AND APPROACH
Referenced in Transformative Impact Section 1c, page 8:

Cost Projections for HVAC Heat Pump and Heat Pump Water Heaters
Higher market demand will reduce costs by 30-40% for heat pump HVAC systems and 50-55% for heat pump water heaters by 2050. The PFRIP heat pump installations will act as a demand signal to boost the regional supply chain, ultimately reducing costs.

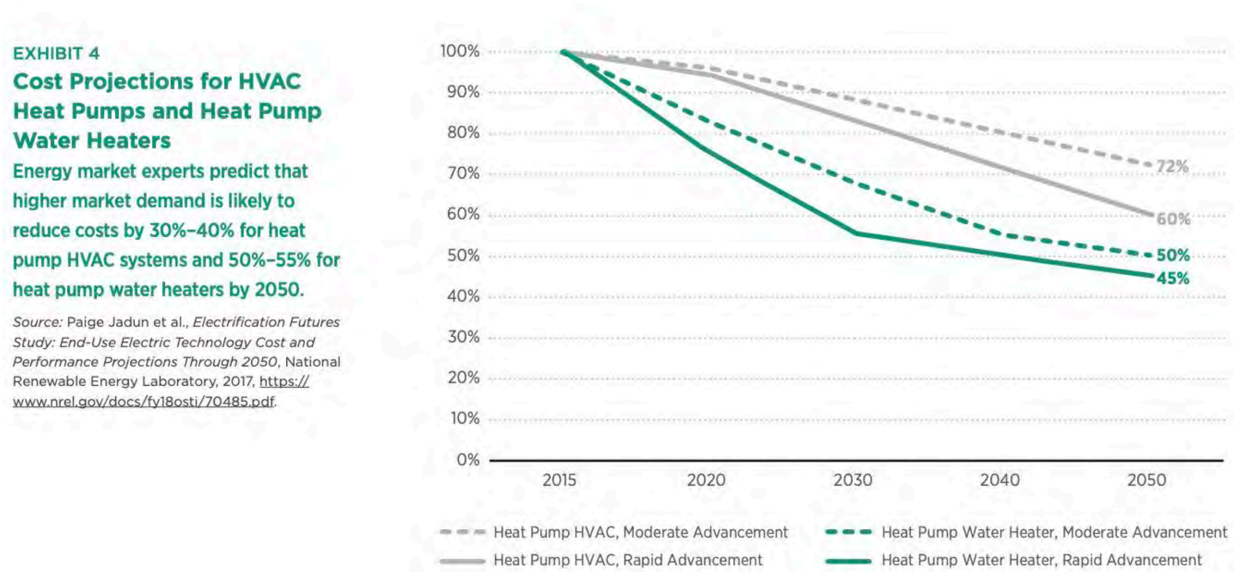

Figure T1: *Source:* Feinstein, Laura. 2024. "Closing the Electrification Affordability Gap." SPUR. Exhibit 4, Page 15. https://www.spur.org/publications/spur-report/2024-02-26/closing-electrification-affordability-gap.

SECTION 2: IMPACT OF GHG REDUCTION MEASURES
a. Magnitude of GHG Reductions from 2025 through 2030

According to the San Benito County and Santa Clara County MSA Priority Climate Action Plan (PCAP), the MSA has 630 municipally owned buildings totaling 53,200 square feet (sqft) of estimated building space with collective GHG reduction potential of at least 32,970 MT CO^2 for the 2025-2030 period. Buildings account for 43% of greenhouse gas emissions in Santa Clara County, with 23% of that coming from natural gas appliances. Details about the accounting methods used in the PCAP can be found in the attached PCAP copy. Figure T2 shows the relevant table listing in the PCAP, Figure T3 shows the relevant page, and Figure T4 shows the relevant assumed building counts and square footage.

Pilot implementation will achieve widescale decarbonization of major appliances and additional decarbonization via microgrid resiliency technology and EV charger infrastructure at 62 very large facilities in Santa Clara County. Based on the PCAP, each building has an average 2025-2030 period reduction potential of 52.33 MT CO^2. However, using a per sqft estimate, PFRIP measures implemented can reduce greenhouse gas emissions by up to 0.62 MT CO^2 per sqft for the 2025-2030 period. Based on the San José HPWH cohort of known building gross floor area (GFA), the PFRIP Coalition has potential GHG reduction of over 2,100,860.18 MT CO^2. These GHG Reduction calculations are available in the *GHGcalcs_SVCE _PFRIP.xlsx*, Tab entitled "PCAP Calculations".

Priority Measures

Table 2 San Benito and Santa Clara County MSA PCAP Priority Measures

Priority Measure		Cumulative GHG Emission Reductions ($MT\ CO_2e$) 2030	2050	Implementing Agency or Agencies	Geographic Scope
Building Energy					
BE-1	Regional Holistic Building Decarbonization Program for Low-and-Moderate Income Occupant Housing	136,404	1,277,330	BayREN, ABAG, AMBAG, BAAQMD, CCAs, Santa Clara County, San Benito County, Habitat for Humanity, Rebuilding Together, Association for Energy Affordability, Rising Sun Center for Opportunity, Pacific Gas & Electric	San Benito County and Santa Clara County
BE-2	Establish a Public Facility Community Resiliency and Implementation Fund	32,970	655,774	Cities, Counties	San Benito County and Santa Clara County
BE-3	Establish Commercial, Agricultural, and Industrial Buildings Decarbonization Program to Support Non-Residential Decarbonization With Incentives and Technical Support	838,126	27,859,310	AMBAG, County of Santa Clara	San Benito County and Santa Clara County
Transportation					
T-1	Develop Safe, Accessible, Clean, and Equitable Multi-Modal Mobility Hubs	144,770	362,891	MTC, VTA	San Benito County and Santa Clara County
T-2	Implement the VTA Visionary Transit Network	9,256	200,461	VTA, Sa	San Benito County and Santa Clara County
T-3	Create a Regional Bike Lane Fund to Build a Bike-Ped Highway	356	5,096	County of San Benito, County of Santa Clara, VTA	San Benito County and Santa Clara County

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Figure T2: PCAP Table 2 showing the relevant calculated emissions reductions potentials for PFRIP which is line-item BE-2 “Establish a Public Facility Community Resiliency and Implementation Fund”.

BE-2 Establish a Public Facility Community Resiliency and Implementation Fund

Measure Description

This measure will establish a fund and procedure to cover the costs and coordinate installation of carbon free equipment in publicly owned and/or operated community-serving and critical facilities including fire stations, libraries, resilience centers, aquatic centers and more. Publicly owned facilities often face a large backlog of deferred maintenance on equipment that serves the broader community, and the increased upfront costs of electrification can make decarbonization projects infeasible. Electrification of public facilities in LIDAC communities will be prioritized as a pilot program. As part of the pilot program, a coalition of municipalities will implement decarbonization projects, host training for contractors, identify contracting, permitting, and technical challenges, and develop a program to address hurdles for electrification of publicly owned facilities. Public facilities (including both city and county owned and/or operated buildings) serve a wide range of communities including LIDACs but often lack the funding required to decarbonize their operations. The Public Facility Resiliency Fund would provide financial support to bridge the funding gap between like for like replacements of gas infrastructure or appliances and upgraded electric infrastructure, appliances, publicly owned or operated electric vehicle infrastructure, and microgrid resilience technology. The pilot will achieve building a portfolio of large building greenhouse gas (GHG) reduction infrastructure measures; assessing their actual performance at GHG reduction; engaging disadvantaged and vulnerable communities directly benefiting from the public improvements and accurately assessing equitable enhancements; and providing workforce development and training to achieve high quality jobs with union options that other regional communities throughout the nation can learn about through web based development information and case studies.

Table 4 Measure BE-2

Establish a Public Facility Community Resiliency and Implementation Fund	
Cumulative GHG Emissions Reductions (2030)	32,970 MT CO_2e
Cumulative GHG Emissions Reductions (2050)	655,774 MT CO_2e
Implementing Agency/Agencies	Cities, Counties
Milestones for Obtaining Implementing Authority	Authority already obtained
Implementation Schedule and Milestones	• 2025-2027: Implement identified municipal building decarbonization retrofits and continue to identify municipal buildings to decarbonize throughout the MSA. • 2026-2045: Implement additional municipal building decarbonization retrofits • 2030: Decarbonize 29% of identified municipal buildings • 2045: Decarbonize 95% of identified municipal buildings
Geographic Location	Cities, San Benito County and Santa Clara County
Funding Sources	Some regional, state, and federal funds are available for electrification of municipal facilities. However, there is not sufficient funding for electrification of critical facilities in San Benito and Santa Clara Counties.
Metrics for progress tracking	• Number of buildings retrofitted • Number of carbon-free appliances purchased or installed • Average energy savings per building • Average energy cost savings per building
Applicable Sector	Building Energy

Figure T3: Page 19 of the PCAP describes the PFRIP project objectives and lists the relevant GHG reductions potentials.

Measure 2: Municipal Resilient Facility Community Benefit Fund

GHG Emission Reductions from Natural Gas Avoided

Estimate Number of Municipal Buildings in SB and SCC	Number of Municipal Buildings in SB and SCC to be Decarbonized	Municipal Building Type	Source for Buildings Estimate	Square Footage
	181	Public Order and Safety - Average	SB County and incorporated city buildings sourced from SB Coutny's website (https://www.countyoffice.org/ca-san-benito-county-fire-departments/) and grouped by NAICS code. Number of SCC County buildings sourced from PG&E municipal electricity accounts and distributed to NAICS code using SB's distribution. Number of San Jose buildings by NAICS code sourced from City. Number of incorporated buildings estimated by assuming 6 buildings per incorporated city (14 cities) and distributed to NAICS codes using SB'd distribution.	
	181			
	181			
191	181			18,900
	178	Public Assembly - Average		
	178			
	178			
187	178			14,700
	239	Office - Government		
	239			
	239			
252	239			19,600

Figure T4: PCAP emissions reductions documentation, Appendix B, page 169. The PCAP assumes a total building count of 630 buildings and 53,200 sqft of building space.

The PCAP emission potential benefits were calculated using IPCC recommended methods and under an EPA-approved QAPP. However, due to the stringent timeline associated with the CPRG program, this analysis used a very conservative estimate of countywide *building* counts and square footages that did not include other types of public facilities, such as pools, park bathrooms, or pump stations, that are included in PFRIP, and assumes only 6 buildings per municipality, based on public records that are often inaccurate, particularly for GFAs. The City of San José manages over 200 buildings alone, and 400 energy consuming facilities totaling over 5 million sqft. The PCAP estimated emissions based on an average per building energy usage and local utility provider fuel mix specifications rather than through benchmarking individual publicly owned assets.

According to the Natural Resources Defense Council (NRDC)[1], heat pump water heater conversion can reduce onsite emissions by up to 50-70%. Microgrids can provide the potential for full electrification of a building combined with power savings during times of peak grid demand, such as summer and fall 5-9 pm hours, or during times when the grid is typically gas power plant fed, such as 12-4 am.

Wishing to address some of these assumptions that were not addressed under the PCAP, and to get a baseline GHG reduction based on actual building performance, the City of San José conducted a benchmarking analysis to scope the GHG reduction potential for the pilot portfolio utilizing the EPA's ENERGY STAR Portfolio Manager (ENERGY STAR) and real building energy usage values on a subset of available buildings' energy data. 12 months of electricity and gas utility data from each of the City of San José's 50 planned heat pump retrofit sites were entered to ENERGY STAR for the calendar years of 2022 and 2023 to provide annual 2022 and 2023 Direct GHG Emissions (Metric Tons CO2e) and Indirect (Location-Based) GHG Emissions (Metric Tons CO2e) value for each building as calculated by ENERGY STAR Portfolio Manager. Data was exported from ENERGY STAR and applied to the heat pump water emissions reductions factor of 50% for each location to achieve an expected annual emissions reduction. In a few instances 2023 data was not fully available, so 2022 values were substituted where available. The City of San José benchmarks its buildings as individual Parent Properties including all meters contained within the building and does not utilize Parent-Child relationships for large campuses, such as Happy Hollow Park and Zoo-Kelley Park complex. For this reason, some properties with multiple buildings will have multiple Portfolio Manager IDs. A total of 55 properties are displayed on the output due to this method of benchmarking. The appendix spreadsheet provides details about the calculations and includes the ENERGY STAR data output including relevant building ENERGY STAR IDs and denoted substituted values. This conservative assessment assumed that all HPWH replacements will be completed by 2029, with only one year of operation for the period, and 50% GHG reduction. According to the NRDC, these retrofits could hold 70% reductions and per work plan, ~24 units per year will be installed starting in 2025, creating additional years of expected GHG savings for the 2025-2030 period that will be assessed in the project performance evaluation led by SPUR and displayed in real-time through the project website sponsored by the City of San José.

b. Magnitude of GHG Reductions from 2025 through 2050

According to the PCAP, the MSA's 630 municipally owned buildings covering 53,200 square feet (sqft) have a collective GHG reduction potential of at least 655,774 MT CO^2 for the 2025-2050 period, providing an average per building reduction estimate of 1040.91 and per sqft reduction of 12.33 MT CO^2.

Pilot implementation will achieve widescale decarbonization of major HVAC and heating appliances and additional decarbonization via microgrid resiliency technology and EV charger infrastructure at 62 facilities in Santa Clara County. Based on the PCAP, measures implemented can reduce greenhouse gas emissions by up to 64,536 MT CO^2 for the 2025-2050 period. However, based on the San José HPWH cohort of known building gross floor area (GFA), the PFRIP Coalition has potential GHG reduction of over 41,786,153.49 MT CO^2.

[1] Electric Heat Pumps Can Slash Emissions in California Homes (nrdc.org)

San José ENERGY STAR analysis supports the hypothesis that the annual emissions reduction potential from these measures could be much greater than indicated in the PCAP, as emissions reductions for the San José subset of heat pump water heater replacements alone showed potential direct GHG savings of at least 30987.5 MTCO2 for 2025-2050, plus indirect GHG emissions savings of 45,788.75 MTCO2 by 2050, or 76,776.25 MT CO^2.

c. Cost Effectiveness of GHG Reductions

Cost effectiveness values were calculated using the EPA's required cost effectiveness calculation equation applied to 1) whole cost of all PFRIP measures (including all budget categories) divided by the Sum of Quantified GHG reductions from 2025-2030 according to the PCAP and 2) whole cost of San José heat pump conversions (including all budget categories) alone divided by the Sum of Quantified GHG reductions from 2025-2030 according to the ENERGY STAR analysis. GHG Reduction calculations are available in the spreadsheet attachment *GHGcalcs_SVCE _PFRIP.xlsx*, under the tab entitled "Cost Effectiveness".

Cost effectiveness of GHG reductions = (Requested CPRG funding) / (Sum of Quantified GHG reductions from CPRG funding from 2025-2030)

SECTION 3: ENVIRONMENTAL RESULTS – OUTPUTS, OUTCOMES, AND PERFORMANCE MEASURES

a. Expected Outputs and Outcomes

i. GHG Reduction Performance:

Expected Outputs were taken directly from the PCAP. Expected Outcomes include those from the PCAP plus additional outcomes devised by the Coalition and supported by advisement and cost estimates from TRC through their association with SPUR.

b. Performance Measures and Plan

i. GHG Reduction Performance:

The GHG Performance plan was devised by the Coalition and advised by TRC through their association with SPUR, who provided a Letter of Commitment and the following technical resources:

<u>Approach and Methodology</u>

TRC's measurement and verification (M&V) plan follows a three-step process outlined in the figure T5 below. The plan will be international performance measurement and verification protocol (IPMVP) compliant; and establish baseline operation at project onset, complete a mid-project M&V analysis at one year of operation, and a final analysis after two years of operation. Facilities that will not be able to have full term assessments will be modelled based on minimum two-month temporary metering and profiles of like counterparts within the project's portfolio or other similar existing facilities.

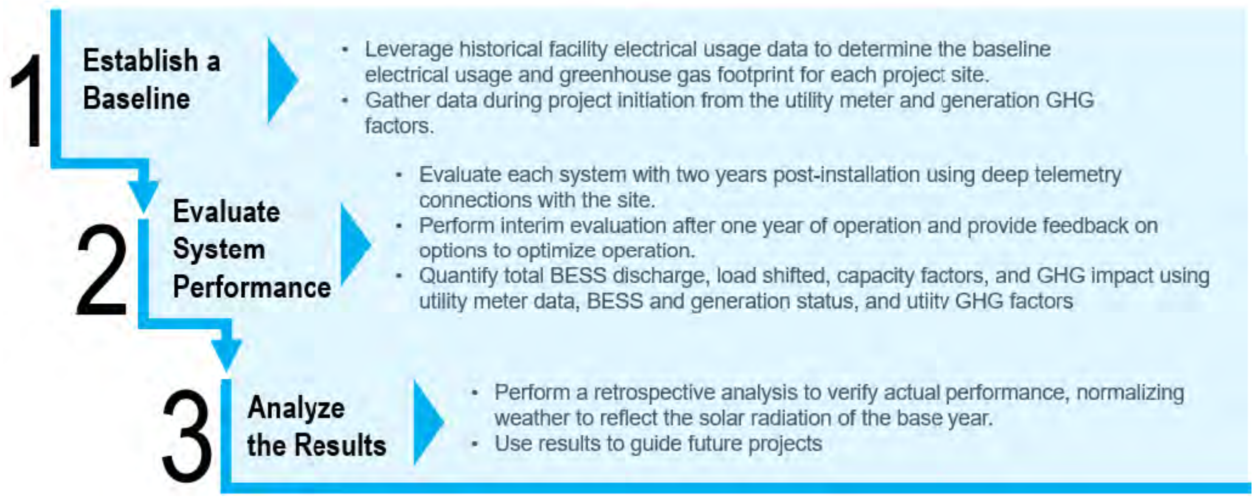

Figure T5: The M&V three step process

*K*ey baseline and ex post data sources are outlined below:

Baseline	• **Utility meter**. This data is critical for determining energy flow across the system boundary. We will acquire data from the utility through Share My Data platforms, UtilityAPI, or TRC's Green Button solution. Experience has taught us that multiple solutions are often needed. Although consistency is desired, expediency is more important, and historical utility data is the key to accurate system sizing. • **GHG factors.** Our analysis will accommodate TOU factors as well as average value. The finer the time resolution, the more accurate our GHG impact analysis.
Ex Post Data Sources	Due to the interaction between the PV systems, BESS[2], and other installed technologies, we typically base verification activities on at least a full year of post-installation data. Grant requirements will extend data collection for a full two years. Data sources include: • **Utility meter.** As with baseline data collection, we will need to remain flexible in our data sources. Baseline and Ex Post sources will remain consistent for each project. • **BESS & generation status.** During project design we will ensure we will have access to deep telemetry into the operation and status of all generation and storage assets at the project sites. • **Submeters.** TRC will rely upon submeters for projects with limited compartmentalized scope.

Through M&V activities, the project team will know actual asset performance and have the data to support future planning activities.

ii. Work Plan Performance: Design Guidelines and Evaluation

The Design Parameters Performance was devised by ProspectSV, and advised its consulting team, Point Energy Innovations and IDeAs Consulting.

Problems / Challenges:
New regulations are driving decarbonized buildings and EV fleets, which requires additional power that existing local power capacities, infrastructure and electrical grids cannot always support.

[2] Battery Energy Storage System

Significant increases in severe weather phenomena and natural disasters significantly impact communities, especially underserved and low-income communities. Infrastructure failures, electricity transmission losses, threats of cyber-attacks, and high maintenance & costs are additional challenges with centralized grid and power delivery. Building new infrastructure would be highly expensive compared to modifying existing facilities to provide protection and service to vulnerable populations.

Gap / What is needed:
Microgrids offer integrated renewable energy and storage to provide power in the event of grid failure, and effective infrastructure that can address both electric building and fleet operations. These systems reduce grid energy consumption and when paired with more efficient electric systems (heating, water heating) can provide significantly reduced operating costs to the site. For facilities vulnerable to grid downtime (fire stations, factories, schools, shared workspaces, etc.) this approach protects critical infrastructure for continuity of operations, maximum productivity, etc. For public facilities, this approach can also provide a Community Safe Haven via energy resilience that enables essential services to remain operational during emergencies. This can include critical emergency functions in buildings and vehicle charging capabilities.

Critical Project Elements:
Accomplishing this goal is a highly complex matter that requires not only appropriate engineering decisions, but also appropriate economic tradeoffs to provide optimal use of resources. Critical aspects of the design include:

- Establish a clear hierarchy of fuel switching measures that enable resiliency capabilities, including on-site solar and battery storage, switching of natural gas systems such as heating, water heating, and cooking to electric alternatives, system controls and other features
- Appropriately sizing system replacements so as not to overspend on components and limit overall project scope - heat pump, battery, and other systems are commonly oversized resulting in higher than necessary project budgets at the expense of a deeper set of alternatives
- Clear, consistent implementation documentation and qualifications-based selection of design and build teams for lowest risk implementations

Current infrastructure:
Legacy facility systems are fed directly from electric, gas, and water utilities (Figure T6). Each are vulnerable to a utility system failure:

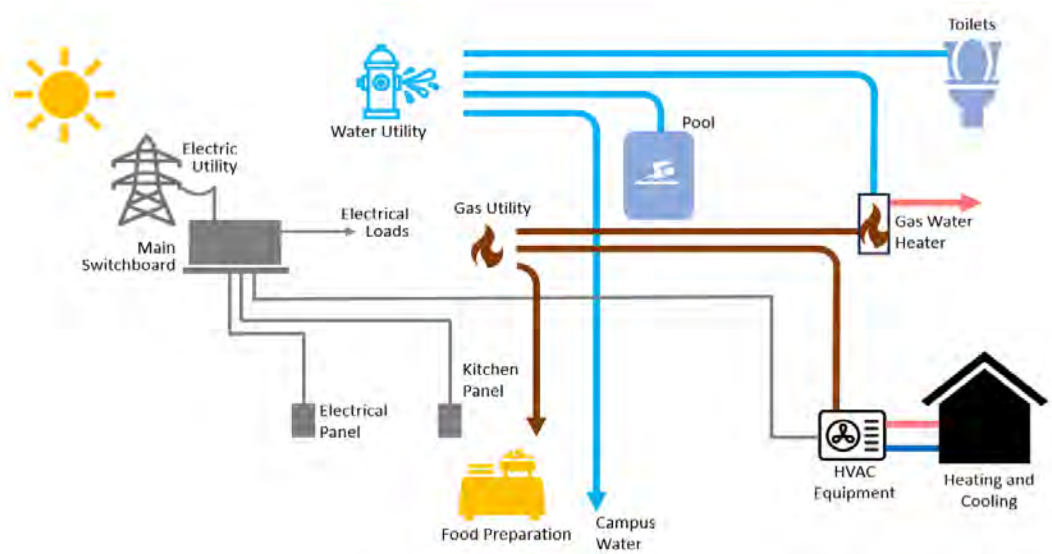

Figure T6 – Typical facility infrastructure using electric, gas, and water utilities.

A trend is to electrify gas equipment and deploy photovoltaics, batteries and EV charging as part of the electrical system, creating opportunity to reduce energy bills by generating electricity from PV as well as reducing peak period energy and power use with the battery. These systems are required by code for new construction in California, and now require power supplies for electric vehicles, represented by the green system in Figure T7.

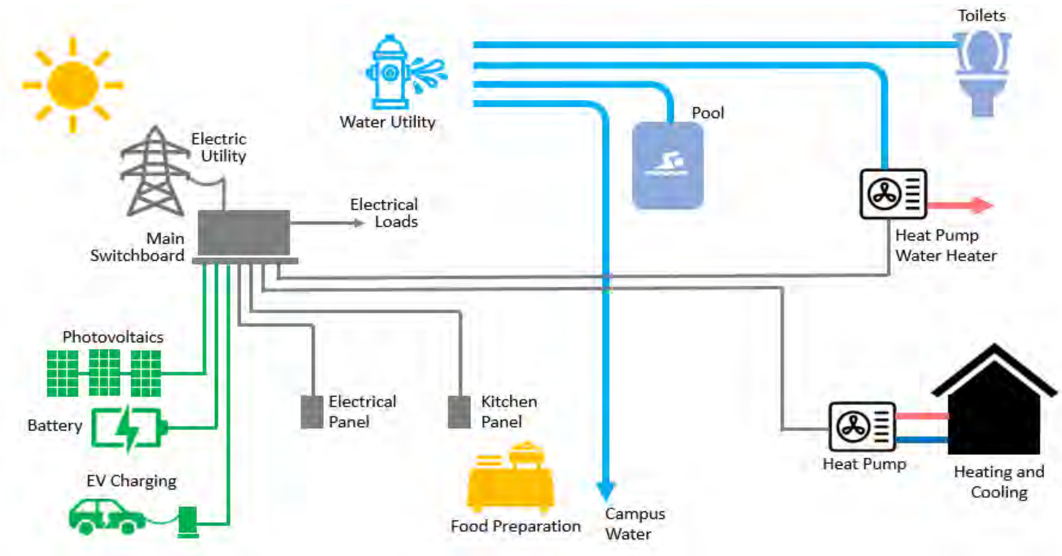

Figure T7 – Typical California code compliant systems.

Concept Solution:
With minor adjustments, these new systems can be modified to create a microgrid, able to provide resilience by isolating itself and providing its own power in the event of a power outage (Figure T8).

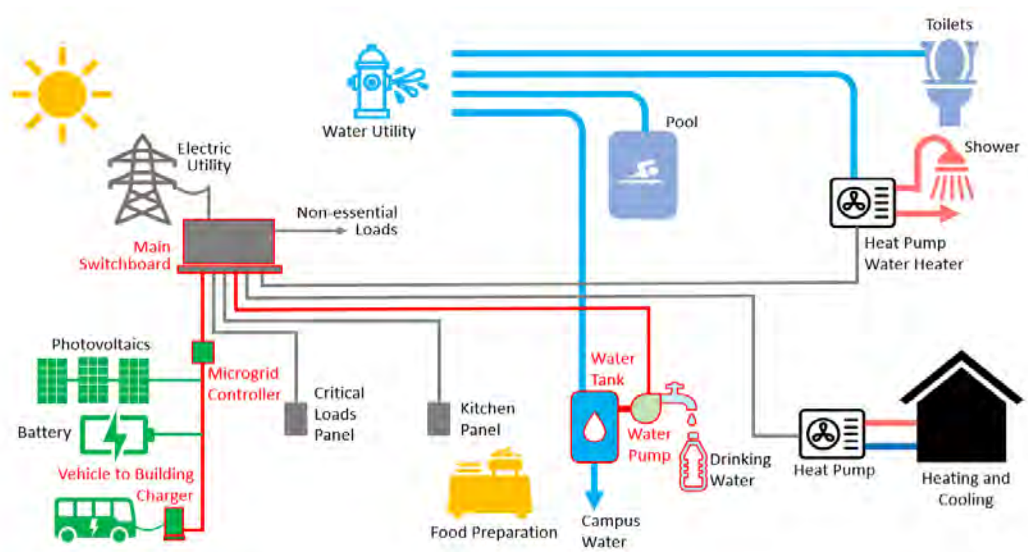

Figure T8 – Simple microgrid upgrades for resilience.

Controls in the building can also provide power to critical systems during grid outages or even supply the entire site. This makes the available PV and energy storage resources available during power outages or in the event of a natural disaster. The simple addition of a water storage tank can ensure a supply of fresh drinking water in the event that city water service is disrupted. This solution would preserve critical building / system functionality and leverage solar PV and battery resources for resilience.

How It Works:
The solar PV and battery storage systems would be designed for two performance scenarios:

1. Under normal conditions, renewable electricity is supplied to the campus and the grid. Batteries are used to manage peak demand for the campus. Systems are sized to offset peak utility pricing period energy use and provide demand response. During power failures or disasters, the microgrid would enable operation independent of the grid in "island" mode and support critical functions. The solar PV and battery would power the critical loads, enabling accommodations, meal preparation and workspace for emergency relief workers. Depending on the weather and time of year, the system would have the potential to run for long periods of time (Figure T9).

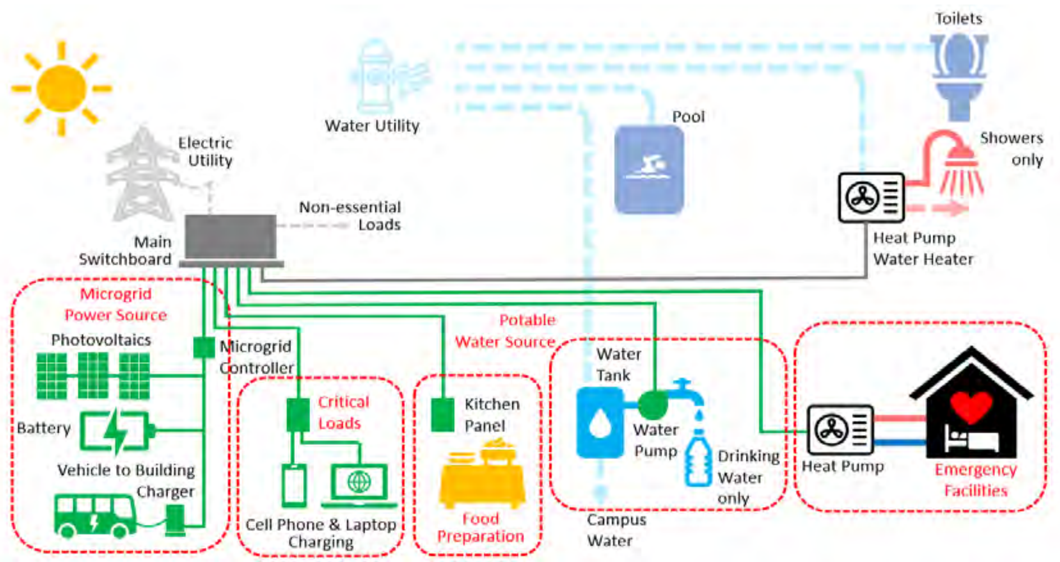

Figure T9 – PV/Storage systems in island mode.

2. On sites with access to a swimming pool, such as a school or community center, a further enhancement could be to add piping and equipment to use pool water both for toilet flushing and for hot showers - *subject to approval by the authority having jurisdiction* (Figure T10).

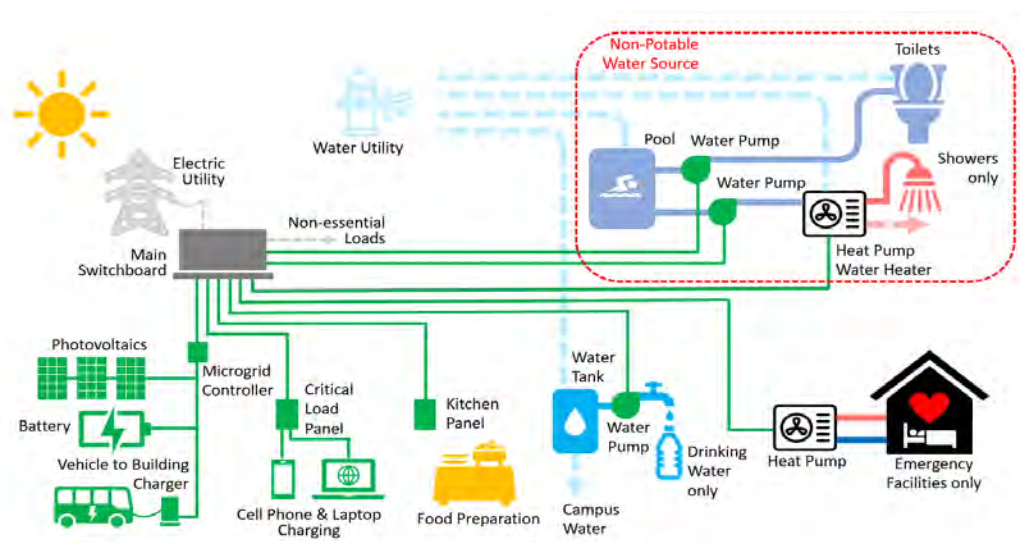

Figure T10 –Facilities with pool facilities may have additional enhancements.