Esparto-Capay Multi-Community Microgrid

Project Proposal

Valley Clean Energy (VCE[1]), Smarter Grid Solutions (SGS), Emeren (formerly ReneSola Power), and Pacific Gas and Electric (PG&E)[2] share a long history of supporting renewable energy development and are conscious of the effects climate change will have on communities in California.

VCE, working collaboratively our above mentioned partners, propose to retrofit the design and operation of a large solar Photovoltaic (PV) and Battery Energy Storage System (BESS) project to create the Esparto-Capay Multi-Community Microgrid (ECMCM). The ECMCM will serve five(5) existing Community Resilience Centers (CRC's), in addition to maintaining power to large portions of the local community. The ECMCM will provide over 5,000 disadvantaged and low-income community members of the Capay Valley (see *Figure 1*) access to over **65 megawatt-hour (MWh)** of backup renewable energy without paying for a single generator, battery, or solar panel. The proposed PV+BESS project is now before the Yolo County Board of Supervisors for consideration. Action by the Board is expected by May 2023.

Figure 1: Capay Valley Map

[1] VCE is a community choice aggregator (CCA) that is governed by an eight member Board of Directors consisting of city council members and board of supervisors from its member agencies. See www.valleycleanenergy.org for more information.
[2] See "ECMCM Project Team Resumes" and "ECMCM SGS Microgrid Case Studies"

Since 2020, Emeren has been developing a community solar and storage project near Madison, California called the "Gibson Project". The Gibson Project is a ground mounted, single axis tracker system and has a combined **20MW** of solar photovoltaic assets and a **65MWh** Lithium-Ion Battery Energy Storage System. The system power purchaser or "offtaker" is VCE. This project has been submitted and studied under the Wholesale Distribution Tariff (WDT) with the intent to provide clean renewable energy and resource adequacy during peak loading conditions on PG&E's Madison 2101 Circuit. While the exact capital expenditure cost of the system is subject to non-disclosure, National Renewable Energy Laboratory (NREL) indices[3] for this size/scale project suggest a price range between **$40 – $60 million.**

Access to the following Gibson Project resources[4] during power outages are being provided by Emeren at no cost to the project.

- Solar Photovoltaic System (38,464) Trina Solar modules
- Energy storage: (21) Sungrow Power Supply Battery Containers
- Inverters: (4) Sungrow SG3600U-MV Inverters

The Gibson Project has completed PG&E's interconnection study process and is currently working with Yolo County to attain a conditional use permit, which Emeren expects to attain in May 2023.

Utility Infrastructure

PG&E currently operates the Community Microgrid Enablement Program (CMEP)[5] which allows for third party assets to support communities using utility infrastructure during outages for projects that meet the following criteria:

- ✓ Within PG&E's Service Territory
- ✓ Serves at least one customer in a Tier 2 or 3 High Fire Threat District or has been subject to Public Safety Power Shutoff Events
- ✓ Includes at least one Critical Facility and One Additional Customer within the Electrical Boundary
- ✓ Single, Controllable, Energy producing resource that does not exceed 20MW
- ✓ Letter of support from a Community Choice Aggregator

[3] https://www.nrel.gov/docs/fy21osti/79236.pdf
[4] See "ECMCM_Retrofit_Preliminary SLD"
[5] https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/community-microgrid-enablement-progam.page

Once these conditions are met, CMEP allows utility infrastructure to be used during a power outage to support local communities. PG&E, in its Letter of Support[6] for the project, confirm that the ECMCM meets these criteria and can participate in CMEP.

PG&E has provided a preliminary budgetary figure of $650,000[7] in utility infrastructure upgrades to enable the ECMCM to serve the Esparto Capay Valley region.

Project Area Selection

As noted previously, the ECMCM will connect several California Climate Investments Priority Populations (CCIPP) to the Gibson Project's energy assets via PG&E's Madison 2101 circuit. Madison 2101 is a 26 mile long, 21kV / three phase, overhead utility distribution line as shown in *Figure 2* below.

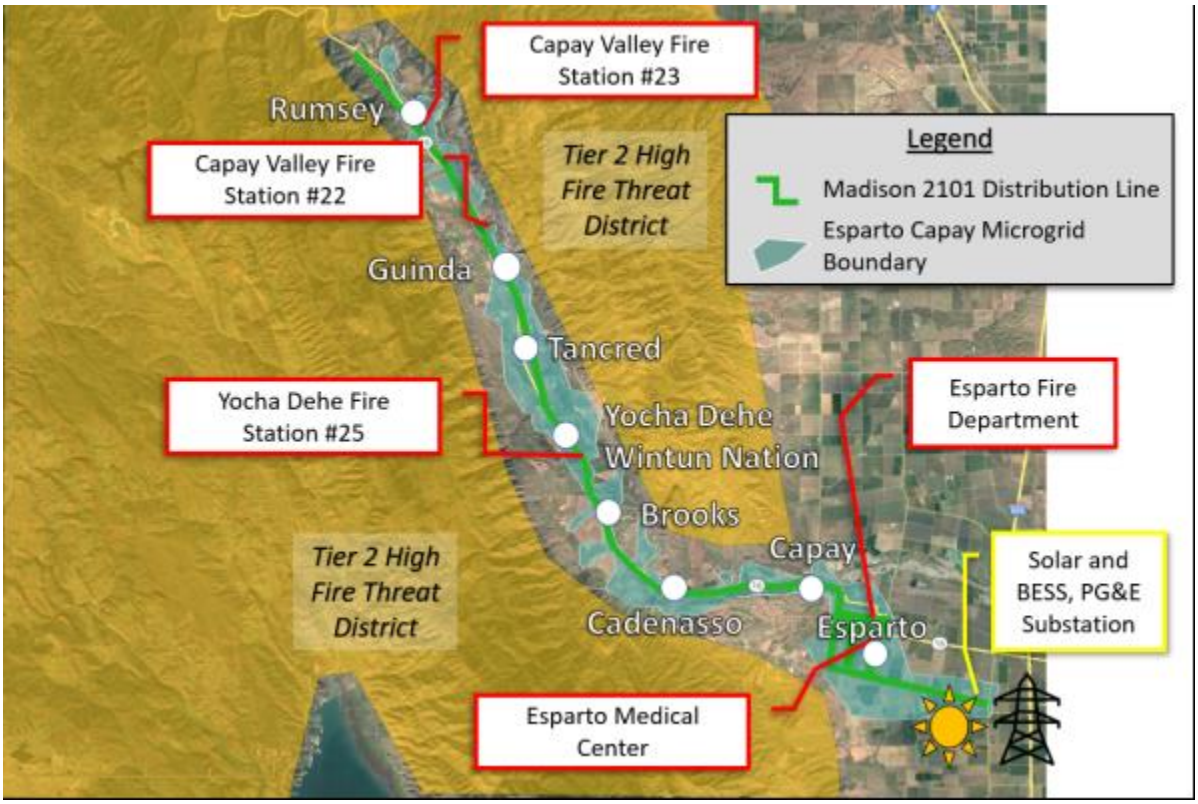

Figure 2: Esparto Capay Multi-Community Microgrid Vicinity Map

This area was selected because the Madison 2101 circuit serves several Yolo County Designated evacuation rally points that double as CRC's during an emergency. These CRC's include:

1. Capay Valley Fire Station #23: 3794 CA-16, Guinda, CA 95637
2. Capay Valley Fire Station #22: 7447 CA-16, Guinda, CA 95637

[6] See "ECMCM_PG&E Letter of Support"
[7] See "ECMCM_PG&E Budget"

3. Yocha Dehe Fire Station #25: 14170 Golf Course Dr, Capay, CA 95607
4. Esparto Community Medical Center: 17050 S Grafton St, Esparto, CA 95627
5. Esparto Fire Department: 16960 Yolo Ave, Esparto, CA 95627
   (Note that the Gibson Project is located at 29509 Highway 16, Madison, CA 95653)

The Yolo County unincorporated communities served by Madison 2101 circuit include:

- Rumsey
- Guinda
- Tancred
- Brooks
- Yocha Dehe Wintun (Nation Federally Recognized Tribal Nation)
- Cadenasso
- Capay
- Esparto

Note in *Figure 2* on Page 3 that the entire Capay Valley is surrounded by a Tier 2 High Fire Threat Zone and during an evacuation, the identified CRC's serve as critical places of refuge for Yolo County community members to organize, receive medical treatment, and be transported out of the valley.

Each CRC has a corresponding evacuation zone associated as defined by the Yolo County Office of Emergency Services website[8] as shown in *Figure 3*.

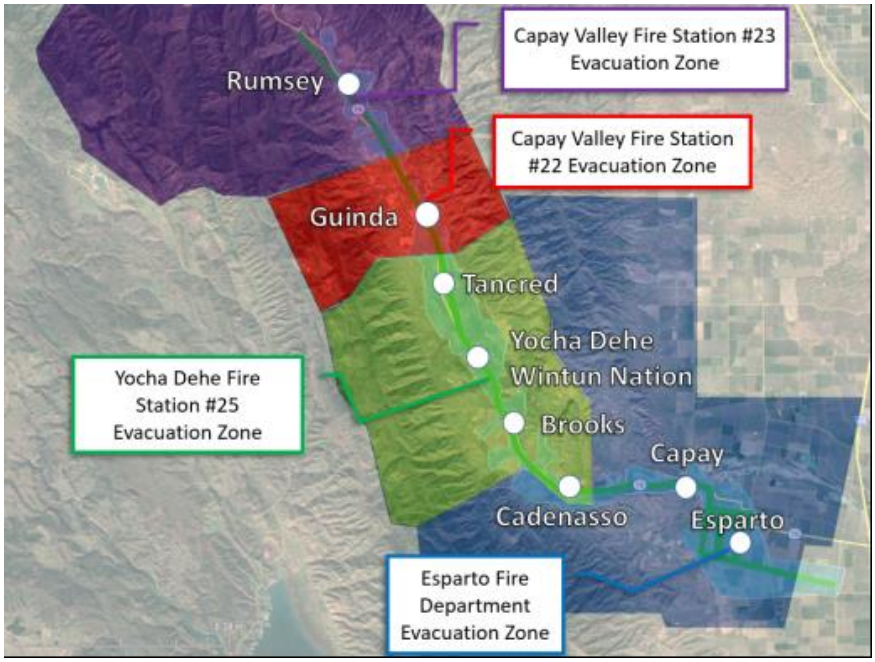

Figure 3: Yolo County Evacuation Rally Point Zone Map

[8] https://yolo.maps.arcgis.com/apps/webappviewer/index.html?id=5458e2e8c8c54e19923da248ac3add0c/

Community Demographics

These communities share a common census tract, 6113011500, which per Cal EnviroScreen 4.0 counted **5,722** residents who identify in the following racial categories:

- 53.6% (3,068) Hispanic
- 40.5% (2,317) White
- 2.3% (130) Asian American
- 3.6% (204) Other

Given the inclusion of the Yocha Dehe Wintun Nation in the census tract, it's expected that a significant portion will include Tribal members who live and work in the area.

The entire area served by the ECMCM qualifies as a CCIPP low-income community and the project scope includes the entire Yocha Dehe Wintun Nation, which is classified as disadvantaged, low income, and vulnerable. The CCIPP category of each Capay Valley community is illustrated in *Figure 4*.

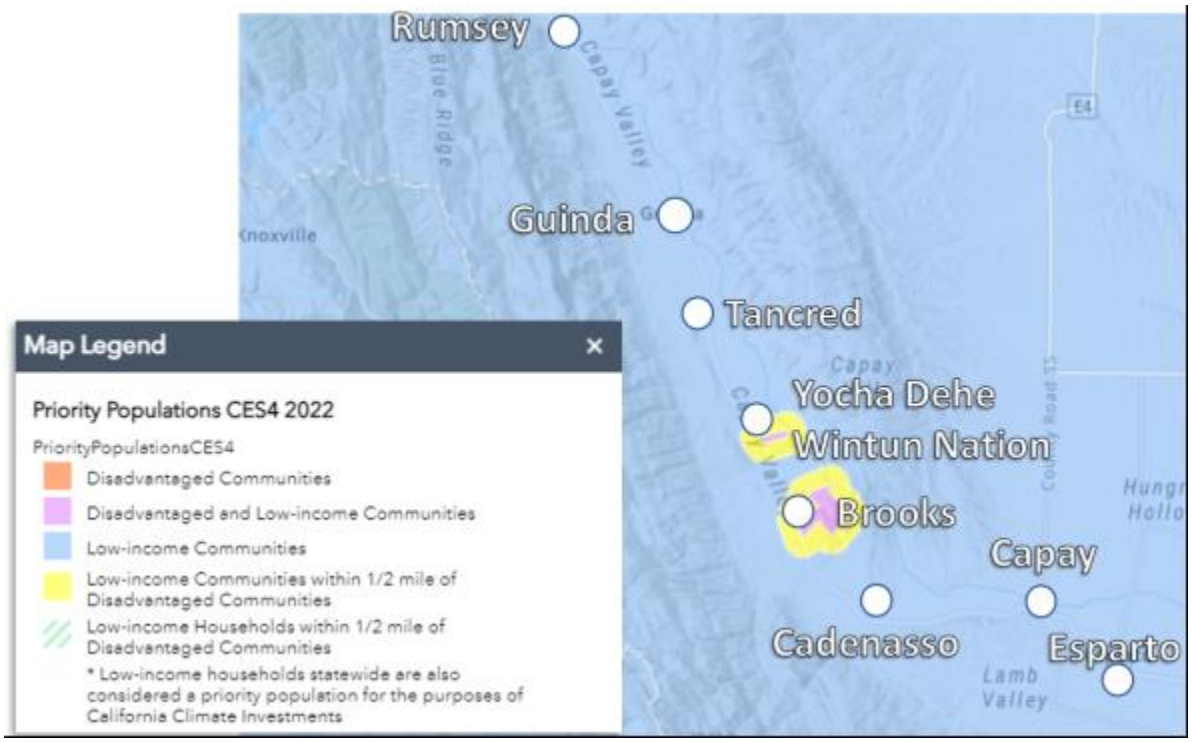

Figure 4: Capay Valley California Climate Investments Priority Populations 2022 CES 4.0

Work Plan

The current Gibson Project design is "grid interactive" and as required by the Interconnection Agreement with PG&E, must de-energize during outages. To retrofit the project and create a microgrid, the Gibson Project must be upgraded to operate as a stand-alone electrical island during power outages, thus creating the ECMCM. This plan to enable the ECMCM breaks down into the following tasks:

Task 1: Microgrid Study: To achieve the required level of automation and compliance with PG&E engineering and protection standards, the ECMCM must undergo a degree of additional engineering study to ensure proper configuration, setting, and integration with PG&E systems. This study will include detailed assessments of the following parameters:

Study objective- Identify the required capacity of grid forming inverter systems required to establish and operate an autonomous, stable microgrid, under dynamic electrical conditions. The scope of the study includes the following discrete parameters:

- Transient event analysis
- Block load switching
- Generation source loss
- Loss of communications protocols
- Fault ride through settings
- Black start switching sequence requirements considering transformer inrush requirements
- Requirements for soft-starting of the microgrid through voltage ramp up using the grid forming BESS inverter systems;
- Optimal BESS and PV set point control during islanded operation;
- Necessary integrations with PG&E's system
- Outage history Analyses
- Battery Rate of charge during projected outages
- Sections of the Madison 2101 circuit that will be served
- Optimal switching arrangement that aligns with local evacuation procedures (so that the most critical loads remain energized the longest)
- System Island to Grid and Grid to Island Parameters
- Power flow analysis based on switching parameters and system models provided by PG&E
- Control architecture and connectivity requirements at each inverter
- Communication infrastructure needed to facilitate system operation
- Software hosting considerations, in local hardware or in the cloud
- Considerations for any solar or storage already on the Madison 2101 circuit

Deliverable: Document "ECMCM Microgrid Configuration Study"
Timeframe: 3-4 Months

Task 2: Microgrid Controller - design, configure, and implement the microgrid control system, Strata Resilience[9]. Subtasks include:

- Production of a Project Initiation Document
- **Deliverable – Document "Functional Specification"**
- **Deliverable – Document "Control Architecture Specification"**
- **Deliverable – Document "Technical and Installation Drawings"**
- **Deliverable – Document "Acceptance Test Specification"**
- **Deliverable – Document "User Guide"**
- Build and Configuration of the ECMCM microgrid controller;
- Conduct Pre-Factory Acceptance Tests (pre-FAT), in accordance with the relevant parts of IEEE 2030-8, using a Control (Hardware in the Loop) HIL approach;
- Conduct Factory Acceptance Testing (FAT), in accordance with the relevant parts of IEEE 2030-8, using a Control (Hardware in the Loop) HIL approach;
- Assistance with site installation;
- **Deliverable – Document "Factory Acceptance Testing Report"**
- **Deliverable – Document "Site Acceptance Testing Report"**
- Conduct one week of training on-site during the site acceptance testing.

Deliverable: ECMCM Microgrid Controller
Timeframe: 5-6 Months

Task 3: Gibson Site Retrofit - Engineer, procure, and install new grid forming inverter hardware and supporting devices that allow ECMCM to island. Subtasks include:

- Develop electrical, structural, and civil design documents
- Submission to Yolo County for Permitting and Approval
- Equipment Procurement - Grid Forming Inverter
- Equipment Procurement - Switchgear/Panelboard/Cables
- Construction, Trenching, and Cabling
- Install Electrical Equipment
- Site Commissioning

Deliverable: Gibson Site is retrofitted with grid forming inverters
Timeframe: 12-18 months *(Parallel to the Gibson Project Schedule, see Table 1 below)*

Task 4: Utility Infrastructure Upgrades - PG&E installs identified upgrades to support the Esparto Capay Multi-Community Microgrid.

Deliverable: Madison 2101 is upgraded to support ECMCM
Timeframe: 12-18 months

[9] See "ECMCM_SGS Proposal"

Project Schedule

Table 1 outlines the current milestone schedule for the Gibson Project. We expect the Gibson Project to serve as the "critical path" and all required retrofit tasks upgrades to be completed in parallel with a full microgrid deployment being available to serve the region by **9/30/25**.

Table 1: Gibson Project Schedule

Milestone	Expected Date for Completion
Execute Interconnection Agreement	3/15/2023
Procure major equipment	12/1/2023
Obtain federal and state discretionary permits	5/2/2023
Expected Construction Start Date	6/1/2024
Guaranteed Construction Start Date	9/1/2024
Expected Commercial Operation Date	6/1/2025
Guaranteed Commercial Operation Date	**9/30/2025**

Project Budget

See "ECMCM 2023_CRC_Project_Budget_Template"

Community Need / Benefit

Capay Valley Communities prepare for Climate Change – In addition to aiding residents during an evacuation, the ECMCM will support the broader electrical grid during times of strained supply. If PG&E implements rotating blackouts[10] or California Independent Service Operator (CAISO) needs to release capacity during energy flex alerts[11], the ECMCM will relieve grid strain to neighboring communities and the CAISO transmission network.

During any outage of flex event, the ECMC will serve nearly all of the PG&E customers connected to the Madison 2101 with priority given to locations serving the following functions:

- Cooling Centers
- First Aid/Medical Care
- Heating Centers
- Food Distribution
- PPE Distribution
- Backup Power

[10] A rotating outage is an electric power outage that rotates from area to area, see https://www.pge.com/en_US/residential/outages/planning-and-preparedness/safety-and-preparedness/find-your-rotating-outage-block/find-your-rotating-outage-block.page
[11] https://www.flexalert.org/

- Support of Emergency Operations
- Electric Vehicle Charging

Another benefit of the renewable energy provided by the ECMCM is the reduced dependance on standby diesel, natural gas or gasoline powered generators. This diminishes greenhouse gas (GHG) emissions caused by fossil fuels and creates a cleaner environment for the local community. Additionally, it allows for fossil fuel services to be diverted to other communities, thereby lessening the fuel strain on other unincorporated communities throughout Yolo County during prolonged emergency events.

The ECMCM will be capable of serving community members less than 12-months after project completion. Once engineered, procured, and constructed, the project will go through a brief commissioning and testing period, usually 30-60 days, and then may start serving residents of the Esparto-Capay Valley region.

Increased Power Outages Tied to Climate Change

In response to increased fire risk due to effects of climate change, utilities are changing protection devices to more sensitive, "fast trip", modes under a program called "PG&E's Enhance Powerline Safety Settings" or EPSS[12]. While potentially decreasing fire risk, the EPSS program causes more circuits will be de-energized more frequently. As detailed below, the Esparto Capay Valley region has been especially impacted by the EPSS program.

On a monthly basis, PG&E publishes a document called the "EPSS Outage Monthly Report". It details the location, duration, and scope outages caused by the EPSS program throughout PG&E's service territory. This report shows that over the course of 2022, the Madison 2101 circuit endured (15) total outages, which ties it for **4th across *all* PG&E circuits** as shown in Table 2.

Table 2: PG&E Outage Summary, 2022

	Row Labels	Count of Outages
Rank		
1	APPLE HILL 2102	19
1	CAMP EVERS 2106	19
2	PENRYN 1105	17
3	SILVERADO 2105	16
4	MADISON 2101	15
4	CAMP EVERS 2105	15
4	GREEN VALLEY 2101	15
4	NARROWS 2105	15
5	HICKS 2101	14
5	JAMESON 1105	14
5	MC ARTHUR 1101	14
5	PANORAMA 1102	14

[12] https://www.pge.com/en_US/residential/outages/enhanced-powerline-safety-settings/enhanced-powerline-safety-settings.page

A more detailed analysis of the EPSS Report shows that anywhere between seven (7) and seventy-four (74) "Life Support" functions endured the aforementioned fifteen (15) outages that ranged between 0.3 hours to 10.9 hours as shown in *Table 3*.

Table 3: Madison 2101 Outage Summary

Outages	County	Circuit	Life_Suppo	Critical_Custome	CAIDI	Average Hours
22-0045080	Yolo	MADISON 2101	8	15	337	5.6
22-0062695	Yolo	MADISON 2101	8	15	452	7.5
22-0064081	Yolo	MADISON 2101	74	47	654	10.9
22-0066612	Yolo	MADISON 2101	0	0	16	0.3
22-0066890	Yolo	MADISON 2101	7	6	255	4.3
22-0069086	Yolo	MADISON 2101	7	6	125	2.1
22-0073222	Yolo	MADISON 2101	7	6	341	5.7
22-0075396	Yolo	MADISON 2101	7	6	293	4.9
22-0076103	Yolo	MADISON 2101	8	15	259	4.3
22-0091104	Yolo	MADISON 2101	7	6	188	3.1
22-0102085	Yolo	MADISON 2101	7	6	131	2.2
22-0102446	Yolo	MADISON 2101	7	6	148	2.5
22-0105433	Yolo	MADISON 2101	8	6	231	3.8
22-0120473	Yolo	MADISON 2101	8	6	109	1.8
22-0123908	Yolo	MADISON 2101	9	15	181	3.0

While a detailed accounting of these customers is unknown, we plan to work with local community organizations to identify as many "Life Support" and "Critical Customers" as possible. Once identified on the circuit topology, their electrical service locations can be prioritized within the ECMCM operating scheme, providing a 100% renewable energy backstop to the EPSS program's negative effects.

Clean Energy Resilience

Per PG&E's Integrated Capacity Analysis[13], the Madison 2101 circuit has an average loading between 2 - 4 MW at any point during the year. The proposed 12MW grid forming inverter[14] can facilitate the circuit's peak load of just over 8MW as shown in *Figure 5*.

[13] https://www.pge.com/en_US/for-our-business-partners/distribution-resource-planning/distribution-resource-planning-data-portal.page
[14] Sungrow SC5000U-MV *or approved equivalent*. See: https://en.sungrowpower.com/upload/documentFile/DS_SC5000U-MV%20datasheet_V1.1_EN.pdf.pdf

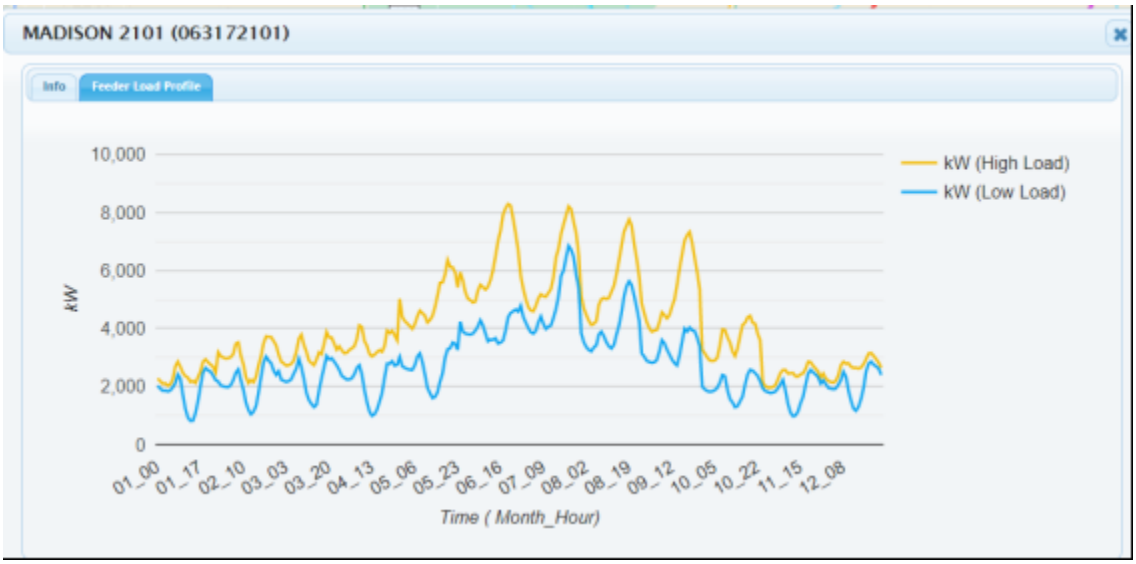

Figure 5: Madison 2101 Distribution Load Profile

This confirms that the Esparto-Capay Community Microgrid can sustain the entire distribution circuit for anywhere from **7 to 26 hours** without having to recharge using the PV array.

Conclusion

On behalf of the project team, Valley Clean Energy appreciates the California Department of Food and Agriculture's consideration of the Esparto Capay Multi-Customer Microgrid project. If awarded, the requested funds will enable the project to:

- Serve (5) Community Resource Centers
- Serve 5,700 residents of a CCIPP designate *Priority Population* including a mix of low-income and disadvantaged communities
- Serve unincorporated communities disproportionately impacted by climate change, which is causing increased wildfire risk and increasing power outages.
- Retrofit a large solar and storage project valued between $40-60 million to enable it to serve the local community with renewable energy.
- Implement minimal grid and site level upgrades to accommodate the ECMCM
- Perform grid level studies to properly configure system automation and controls
- Engage with local community leaders and organizations to understand and configure operation of the ECMCM to best serve the most critical areas of the community.

We look forward to discussing the project in further detail with the CDFA and would welcome a meeting to discuss any questions or concerns.