DOCKETED

Docket Number:	19-ERDD-01
Project Title:	Research Idea Exchange
TN #:	247134
Document Title:	PG&E responses to RFI on Potential EPIC BTM Zero Emission Backup Technologies
Description:	N/A
Filer:	System
Organization:	PG&E
Submitter Role:	Public
Submission Date:	10/31/2022 12:33:33 PM
Docketed Date:	10/31/2022

Comment Received From: PG6E
Submitted On: 10/31/2022
Docket Number: 19-ERDD-01

PG&E responses to RFI on Potential EPIC BTM Zero Emission Backup Technologies

Additional submitted attachment is included below.

Pacific Gas and Electric Company

Licha Lopez
CEC Liaison
State Agency Relations

1415 L Street, Suite 280
Sacramento, CA 95814
(202)903 4533
Elizabeth.LopezGonzalez@pge.com

October 31, 2022

California Energy Commission
Electric Vehicle Charging Infrastructure Program
Docket Number 19-ERDD-01
715 P Street
Sacramento, CA 95814

Re: Pacific Gas and Electric Company Responses to the CEC's Potential Solicitation Behind-the-Meter Zero-Emission Backup Technologies (Docket Number 19-ERDD-01)

Pacific Gas and Electric Company (PG&E) appreciates the California Energy Commission's (CEC) efforts in developing a potential future solicitation focused on research needed to develop emerging solutions to enable plug-and-play, zero-emission resiliency at reduced costs through standardized design. PG&E also appreciates the opportunity to provide response to the general questions that will help structure solicitations related to this topic, and provides the following feedback:

1. *What are key barriers to behind the meter (BTM) zero-emission renewable backup for critical loads? Is the lack of standardized solutions a primary barrier for permitting and interconnection?*

   PG&E considers that the primary barriers to BTM zero-emission back up for critical loads are the following:

   - Cost of sales, design, finance, permitting, interconnection, and installation: For instance, one home battery may cost approximately $5,000 in terms of hardware, but the final installation cost may go up to $15,000 once all other costs and labor are considered.
   - Customer opportunity costs: A customer may not invest in zero-emission renewable back up when they have an existing lower-cost generator.
   - Cost of code compliant interconnection: Customers are required to cover related costs to comply with interconnection. These costs include transfer switch, autotransformer, consumption meter, upgrade to main panel and utility service.
   - Lack of supply: Customers and companies are facing a shortage of batteries (energy storage), which is driven by the adoption of electric vehicles (EVs) and the ongoing supply chain challenges (chip shortage).
   - Overall, BTM backup is a small market compared to other end-uses of lithium-ion battery storage – a clear signal is needed to spur development of lower cost higher scale solutions.
   - Packaging cost and integration include both battery cells and home battery products. The market of these batteries is small compared to that one of EVs, so despite approximate $100 to $200 per kilowatt hour (kWh) cell prices, packaged product comes to $1,000/kWh.

- Split-incentive: Many customers reside in rental facilities and the landlord would have to authorize or fund a zero-emission backup system.
- Customer Premise: Many customers (especially low-income) have structural issues with their premises, which would need to be addressed prior to installing a permanent storage solution for backup.
- To address the above-mentioned challenges PG&E proposes the following solutions:
    - Low cost / high volume programs for utilizing EV batteries in vehicle-to-grid (V2G). For example, utility or state programs targeting over 100,000-unit orders of V2G chargers would drive low cost and scale.
    - Moving the transfer switch and consumption meter directly into the utility smart meter with a common communication port and a pair of lugs for conductors, thereby eliminating the cost of main panel upgrade, component install cost, and associated add-on-hardware.
    - Require energy storage (either from vehicles or from home batteries). When purchasing solar either de facto by reducing the net energy metering (NEM) compensation without storage or by directly requiring it to gain interconnection approval.
    - Ensure that California has a coordinated strategy for leveraging public funds (Federal and State funds) to support customers (especially low-income) to deploy zero-emission backup. This may support deployment at scale.

2. *What are the current opportunities for standardizing design of how BTM backup systems interconnect with the distribution grid while enhancing safety and managing operational constraints?*

PG&E considers two opportunities for standardizing the BTM backup systems interconnection as follows:

- Near-term opportunities:
    - PG&E would propose a standardized test scope and coordinate alignment amongst the three California's investor-owned utilities (IOUs); and/or the CEC to test the safe transition to island and return to parallel (not covered by UL 1741), provide lab space or certification program for vendors to test to.
    - Standardized communication for V2G direct current (DC) and a campaign among charger providers to incentivize interoperability of V2G wall chargers to V2G enabled vehicles – active approach either to adopt the Society of Automotive Engineers (SAE) J2847-2 for bi-directional or apply the bi-directional methods to Deutsches Institute for Normung (DIN) 70121 and the International Organization for Standardization (ISO) 15118-2.
- Longer-term opportunities:
    - Update standards (UL or otherwise) required as part of Rule 21 for the safe transition and return to parallel.
    - Require ISO 15118-20 for bi-directional vehicles (This may not be near term).

3. *If the CEC issues a solicitation in this research space, should there be carve outs for specific technologies or technology bundles targeting specific performance metrics (e.g., separate groups each targeting a technology such as critical load panels, switchgears, and multi-mode inverters)? How should technologies be bundled, and what metrics should be targeted?*

PG&E recommends that technologies should be bundled by asset class (solar, storage, vehicle) and customer class (residential, commercial, utility).

PG&E also recommends that minimum requirements/capability should be met to unlock tiers of incentive (e.g. mobile temporary backup, critical load backup, whole home backup):

- Bias towards whole home type solutions
- Bias towards multiple use assets (e.g. battery is able to provide resiliency and participate in reliability programs).

As for metrics, PG&E recommends the following:

- Fully loaded coast per kilowatt hour
- Cost to install
- Cost of hardware
- Total Addressable Market (TAM) and Serviceable Available Market (SAM).

4. *If the solicitation included multiple groups, how should those groups be structured? Some examples below:*
    a. *Multiple-group solicitation:*
        i. *One group for Applied Research and Development (ARD) projects that would pilot emerging technology in a controlled environment and engage with stakeholders, including CBOs and municipalities.*
        ii. *Another group for Technology Deployment and Demonstration (TDD) projects that would roll-out and implement technology mature enough to seek rapid-deployment for near-term benefits.*
    b. *Multiple-group solicitation in which each group is defined by a particular site characteristic or use case. Examples could include: urban and rural, residential and commercial, various climate zones.*

Under multiple-group solicitation in option (a) above, the CEC should only support TDD to specifically launch technologies into market with commercial adoption targets (i.e. end-to-end program to get 100,000 V2G chargers in market)

Under option (b) above, the CEC should structure multiple groups based on customer segment types, for example:

- Apartment renters – portable partial home backup.
- Single family homeowners – fixed whole home backup.
- Small business – sub-categories by businesses need and type.

The CEC should potentially look at rural customers separately. Economics for rural customers is different (e.g. different costs to serve, different potential behind microgrids/islanding, different wildfire risk profile) and the customers are different.

5. *EPIC 4 Initiative 15 mentions specific potential research areas for BTM backup technologies, listed below. What is the current state of each technology, and what research and design considerations are required to advance the technology and market readiness of each?*
    a. *Customary electrical equipment, such as critical load panels and meters, that are integrated with multi-mode inverters with enhanced islanding functions.*
    b. *Standardized switchgears and/or integrated power centers that can be rapidly deployed at several locations with minimal alterations.*
    c. *Multi-mode or hybrid inverters with built-in battery storage backup system capabilities.*

Current state of each technology:

a. Integrated multi-mode inverters with enhanced islanding functions exist as proprietary solutions where a single manufacturer provides both the islanding device and the inverter for the full level of functionality. There are some options to leverage backup meter devices or third-party transfer switches with a backup inverter, but these options generally do not offer the full level of capability as a fully integrated manufacturers solution (e.g. seamless transition is not possible with a non-proprietary solution in any of the offers available today).

b. Standardized switch gears, which apply to the front-of-the-meter side of the system do not exist in abundance today, although PG&E is working on a repeatable configuration for secondary transformer islanding. This project should be exiting development at the end of 2022.
c. The industry seems to be transitioning towards multi-mode inverters that support solar, storage, and in some cases, vehicles. That being said, many of the alternating current (AC) coupled energy storage inverters do not and likely will not support various multi-port links.

In terms of opportunities, PG&E offers the following comments:

Utility smart meter with integrated isolation device, meter point, communication port, and 200A lugs would (likely) solve the install/interconnection challenges in a lowest cost form factor. This solves the standardized switch gear, meter, load panel, etc. referenced above as well as the safe transition testing from islanded to parallel. Also allows for connection to the distributed energy resources (DER).

Multi-port inverters can connect via communication port to utility smart meter. Would cover solar, storage, and vehicle.

Without the above-mentioned improvements, the industry will need to continue to build their own transfer switch and meter solutions often requiring panel upgrades and additional hardware cost that provides little actual value to the balance of system.

6. *What is the current Technology Readiness Level (TRL), or state of technology, for meter collars (i.e., electrical equipment that plug-in directly between a meter and its meter socket) that streamline the integration of solar PV, battery energy storage, electric vehicle charging, and other DERs?*
   a. *What research is needed to advance the TRL of this technology towards commercialization?*
   b. *How broad is the market – are multiple technology vendors developing this technology?*
   c. *What design considerations and advanced functionality may be useful enhancements to this technology going forward?*
   d. *What would be the highest-impact demonstration use cases for which advanced meter collar functionality could be validated in the field?*

PG&E offers the same response as in question five above. A transition to a utility meter collar tie-in would reduce the cost of systems and increase ease of adoption significantly. The specification of this meter collar would need to be worked out between the joint IOUs and the industry with a specific emphasis on communication standards, functionality, appropriate certification, and compliance, etc.

7. *Would integrating multi-mode inverters and islanding functions into critical load panels increase system reliability and ease installation while reducing overall system costs and complexity? What design considerations, technology development, and performance metrics are necessary to achieve this?*

No. The integration of multi-mode inverters and islanding functions into critical load panels will not increase system reliability, will not ease installation, and will not reduce system cost and complexity.

In general, if the goal is to make a home resilient, then critical load type configurations for homes are not worth the effort in isolating loads and added labor / panel boards versus backing up the entire home. As the cost of storage drops this will increasingly be the case. There is a slight savings in hardware cost and an increase in labor cost to do partial home backup.

However, if it is desired for the grid to leverage BTM storage during reliability events, then it may be worth to incur those additional costs to isolate loads, such that the customer can more easily shed their non-critical loads at the peak. A more comprehensive potential cost/benefit analysis may be warranted.

Partial home backup makes less sense in a V2G future (since the vehicle battery is significant in size) and we should increasingly head towards V2G as the primary backup source where possible due to much greater cost effectivity (cost per kWh backup) versus other solutions.

8. *What would be the most strategic form of implementation for the next generation of critical/smart load panels?*
   a. *Specifically designed to power essential loads and/or small devices during a grid outage?*
   b. *Built-in switchgear to facilitate islanding of a mini-microgrid?*
   c. *Facilitate ease of retrofitting existing, older buildings that have outdated/legacy electrical panels?*
   d. *Other potential areas not covered above?*

PG&E offers the same response as in question seven above. Focusing on critical load panel backup is spending money on labor and devices that manage a reduced level of support for the customer. It likely makes more sense to focus on increasing battery capacity (to drive economies of scale) or bringing in the vehicle home backup. Smart panels can potentially facilitate load shifting or shedding of non-critical loads, either during reliability events and/or during the daily system peak. There may be configurations which provide grid value exceeding the incremental cost of implementing a smart panel, which could be a cost-efficient place to start.

9. *What is the current state of technology for portable battery storage systems that can serve as a direct replacement for portable diesel generators?*
   a. *What design considerations or modifications are necessary to allow the portable battery storage system to charge directly from the rooftop solar PV during a local grid outage with plug-and-play functionality?*

Currently, portable batteries are generally not designed/intended for providing sustainable power to the home.

PG&E's current portable battery programs focus on providing customer resiliency on a limited basis. For example, the Portable Battery Program focuses on providing back up power specifically for customers' medical devices but does not provide broader whole home resiliency. PG&E is interested in exploring ways to evolve and move away from greenhouse gases (GHG) emitting backup generation to other clean DER alternatives – both mobile/portable and fixed solutions.

PG&E is interested in exploring new battery storage technologies for these DERs – perhaps beyond the current lithium-ion powered batteries. PG&E is also interested in analyzing the performance of various DERs to help come up with a benchmark to the industry – performance, safety, construction, battery cell quality for both portable and permanent battery storage. As the utility industry moves toward electrification, we are focused on more integrated offerings that could be tested – SPAN / smart panels, microinverters, smart thermostats, battery storage, EV-2-Home, PV, etc. Also, considering the challenges around cost effectiveness of these measures – to see if and how we can scale them in the future.

10. *What are some examples of emerging technology solutions not previously mentioned in this RFI that could streamline interconnection and permitting for BTM solar-paired energy storage or other zero-emission backup power? To what extent have these technologies been validated in the field?*

No response provided.

11. *What BTM renewable backup power technology is mature enough to move forward from pilot-scale (ARD) to technology demonstration-scale (TDD)?*

PG&E believes that both vehicle home backup TDD and utility interconnection device integrated into a next generation smart meter TDD are mature to move forward from pilot-scale to technology demonstration.

12. *What applications or use cases might be the best fit or highest priority for achieving easily replicable solutions with maximum impact? For example:*
    - *a. Multifamily housing and community centers.*
    - *b. Emergency facilities in wildfire-prone areas.*
    - *c. Manufactured homes.*
    - *d. Critical loads in common areas affected by Public Safety Power Shutoffs.*
    - *e. Homes in under-resourced communities with outages higher than the utility average and/or that are subject to extreme heat conditions.*

The priorities should be on use cases where resilience holds greatest value per dollar spent. The California Public Utilities Commission (CPUC) is exploring value of resiliency in Resilience and Microgrids working group (R.19-09-009, Track 5). PG&E recommends the CEC be aligned with findings from that Order Instituting Rulemaking (OIR).

The CEC also should focus on use cases where resiliency solutions are addressing a long-term problem. For example, if customers will become more resilient via other means (e.g. undergrounding), it may make less sense to pursue customer-specific BTM backup power for those customers.

In addition, the CEC should focus on use cases where batteries can safely discharge back to the grid during peak hours. This can lower costs and scale more readily versus use cases that do not provide value to the grid (see responses to questions 7 and 8).

Finally, PG&E recommends that storage needs be considered in conjunction with electrification. Electric loads will likely be higher in the future as adoption rates for heat pumps for water/space heating and EVs increase. Storage and electrical panels should be sized with that in mind.

13. *What are the most significant barriers (technical, cost, design, permitting, etc.) to integrating BTM backup power in the various sectors (e.g., residential, rural) and use cases mentioned above? What unknowns can be illuminated through research? Please be as specific and concise as possible in your response.*

PG&E offers the same answer as in question number one.

See discussion regarding rural areas in response to question four. In addition, PG&E adds that rural areas have additional challenges:

- Require backup for both homes and well pumps

- Wide variety of existing backup generation – some standalone generators, some semi-integrated (e.g. with manual switch), some portable – can add complexity to installation
- Some batteries require high-speed internet for firmware updates and/or battery control, but high-speed internet may not be readily available
- May be out of scope for this research, but qualifications of local contractors/installers to install and troubleshoot batteries would likely inform costs

Another barrier to integrating BTM backup power in low-income areas is that products are not currently priced or targeted towards this segment. This research could focus on lowering costs, simplifying installations, etc, to support deployment at scale.

14. *What factors need to be considered when deploying BTM generation at different climate zones and environments? How might technology solutions vary depending on the climate zones in which they are sited? What research is needed for modular, standardized BTM generation equipment to address the unique needs of California's various climate zones?*

To deploy BTM generation the CEC should size around cooling load and cooling degree days.

In addition, the CEC should consider wildfire risk. There are wildfire prone areas that may correlate to more frequent outages and therefore more storage needs. Wildfire smoke also may require HVAC use for air filtration, even if cooling is not needed.

15. *What are the most significant barriers to integrating BTM zero-emission backup power in under-resourced communities (low-income, disadvantaged, tribal)? What technology solutions or research areas could overcome these barriers?*

The most significant barrier to integrating BTM zero-emission backup is the lack of access to bi-directional vehicles or places to interconnect a bi-directional charger (e.g. it will probably never be easy to place a bi-directional charger on a MUD).

Multi-unit dwellings (MUDs) in general are difficult to backup due to the location of panel boards and in-unit wiring – portable type battery solutions are probably the best bet.

Not necessarily for under-resourced – but for vulnerable customers it is essential that storage can support medical equipment. There needs to be additional research around technologies and/or financial structures that makes both manufacturers and end-users comfortable with batteries powering medical equipment.

In PG&E's assessment, market actors are currently not focused on under-resourced communities. Could focus on lowering costs, simplifying installations, and other costs to support deployment at scale.

16. *How can BTM generation (with optionally paired storage and additional DERs) be designed and streamlined to be more effectively deployed at multitenant rental properties?*
    a. *What ownership structure mechanisms would need to be put in place and how would this ensure that tenants receive benefits?*
    b. *Please list any examples of real-world implementations, including both good examples worth replicating and cautionary tales worth learning from.*

To do BTM generation at scale at multi-tenant rental properties can be very challenging because of a lack of repeatable configurations and access, as well as different ownership and tenant structures within the building.

PG&E appreciates the opportunity to provide the above responses and the feedback on this potential research solicitation and welcomes the opportunity to further collaborate with the CEC in this topic and overcoming the challenges.

Please do not hesitate to contact me if you have any questions.

Sincerely,

/s/

Licha Lopez