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Community Distributed Energy Resources Interconnection Challenges and Opportunities Report

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EXECUTIVE SUMMARY

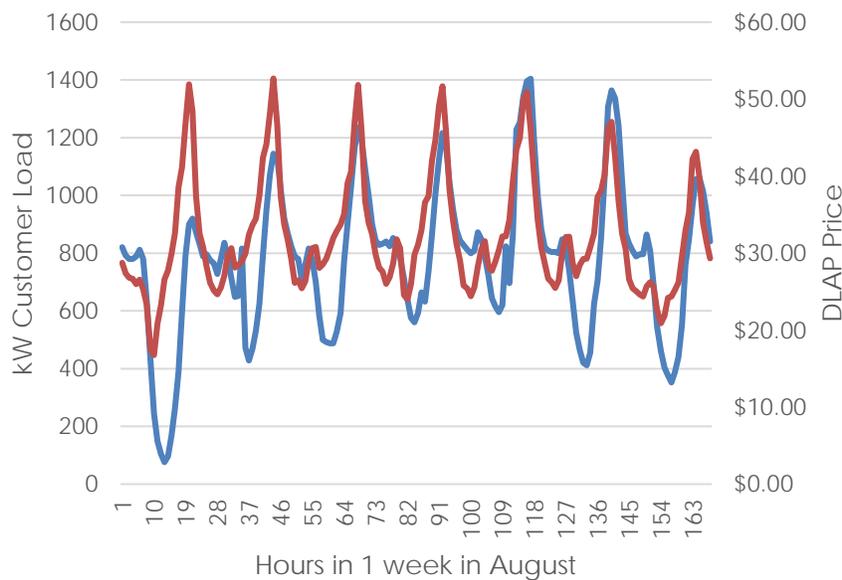
This Report summarizes the Southern California Edison interconnection process for commercial-scale battery storage that is relevant to the City of Lancaster's Green District Program, which focuses on battery installations intended for peak shaving and not for export. The report outlines the application details, including location information, host generating and electrical facilities, generators, and opportunities to apply for both battery and solar applications. It also provides some of the challenges and opportunities for interconnecting battery storage.

CHAPTER 1: How to apply for interconnection for commercial-scale battery storage

Background

Lancaster Choice Energy (LCE) and the project team are seeking to install energy storage as part of a Green District Program for up to 1.5-2MW of combined peak load reduction to selected commercial customers. As such, these will ensure stability and allow LCE to avoid having to procure at the DLAP price. By mitigating loads and discrete LCE customers, the batteries could be used to both offset SCE demand charges and reduce system load peaks during SubLAP (SLAP) price spikes, which require LCE to procure costly electricity when under-procured. Figure 1 demonstrates one such customer cost scenario.

Figure 1: DLAP Price Coincidence with Large User Load Peaks



Credit: ZNE Alliance analysis, 2017.

Interconnection Process Requirements – Green District¹

Distributed energy projects can interconnect to the distribution grid in numerous ways depending on the specific use case of the resource, its size, and a host of other factors. Larger, more complex projects may interconnect through Rule 21 or WDAT, but less complex projects will traditionally interconnect under a net energy metering tariff. This section will provide an overview of the process and requirements for Avenue I to interconnect to SCE's distribution grid.

Rule 21 Pre-Application Report Request

The project team expects these storage applications will qualify to interconnect under the Standard Net Energy Metering tariff. Since this program is in the planning phase and there is no meter installed, a net energy metering application cannot yet be initiated. Per the recommendation of SCE representatives, LCE should begin by submitting the optional Rule 21 pre-application report request, Form 19-922. Upon doing so, a field engineer will be assigned to the project that can provide pertinent system electrical data, as well as highlight anticipated issues, typical upgrades, and more.² The applicant must provide a \$300 fee and the application will take approximately 20 days to review.

Electric data provided includes information about the capacity of the substation expected to serve the proposed site, information about the circuit, as well as technical details about the proposed point of interconnection.³ In having this information available during the construction phase may prevent delays throughout the project waiting to schedule site visits by SCE engineers. Further, should the project in fact require upgrades and need to interconnect under a different tariff such as Rule 21, the City of Lancaster will have this information in advance of the interconnection process and be able to plan accordingly.

Interconnection Process Overview

The interconnection process for connecting electrochemical (battery) storage to SCE's distribution grid is determined by the specific use case of the battery. Under some circumstances, commercial customers will use their batteries for on-site peak shaving to reduce their demand charges and save money during time-of-use or critical peak pricing. These projects, considered non-export, use Rule 21 Form 14-732 in order to apply for interconnection. The following will provide an overview of the various components of the application so as to inform the reader the necessary information one needs prior to submitting an interconnection application to Southern California Edison (SCE).

¹ Perry, Tamara, Webster, Brett, Hedberg, Garrett, Tanzer, Joe, Nabahani, Sammy, O'Keefe, Tim, Pike, Ed. (Energy Solutions), 2017. *Lancaster Advanced Energy Community Avenue I Technical Design*. California Energy Commission. EPC-15-069.

² Private phone call with SCE. February 2018.

³ *Rule 21 - Optional Pre-Application Report Request*. Southern California Edison. 2014.

Structure of the Application

The application is broken up into four parts: 1) Instructions, 2) Information on location and relevant parties, 3) Description of host's generating and electrical facilities, and 4) Description of generators.

Part 1: Instructions

The first section of the application is divided into four parts that intend to provide the applicant with an understanding of what is required not only to complete the document, but also additional steps needed to complete the interconnection process. It provides an overview of applicability for completing this specific form, as well as the amount due to SCE for the evaluation of the interconnection request. The applicant must also provide the following along with Form 14-732 where applicable:

- 1) A single line diagram of the electrical system and its components
- 2) Site plans and diagrams
- 3) Photo of the AC disconnect (when required)
- 4) Photo of the switchgear, switchboard, or cut-sheet drawings showing the point of interconnection (if point of interconnection is on utility side of main circuit breaker)
- 5) Meter socket cut sheets of net generation output meter socket (required if there is on-site distributed generation subject to alternate tariff)
- 6) Transformer nameplate information (if transformers are used for interconnecting facility to distribution grid)
- 7) Transfer switch description, capacity rating, and technical description of how it will be used (if transfer switch is used to interconnect to grid)
- 8) Protection diagrams, relay settings, and description of how protection screen is supposed to function (if protective relays are used to control interconnection)⁴

Part 2: Information on location and relevant parties

The second section asks for information regarding the electric account, contact information, 3rd-party ownership information (if relevant), as well as various acknowledgements with respect to what is required of the interconnection agreement. It also asks whether the applicant intends to use the cost envelope option for any relevant system upgrades. The cost envelope option sets a 25% cap above or below the expected cost of any system upgrades. For example, the utility expects system upgrades to be

⁴*Generating Facility Interconnection Report - Form 14-732*. Southern California Edison. 2016.

\$100,000, but the actual costs reach \$150,000. The amount an applicant owes would be capped at \$125,000⁵. Should the applicant elect not to use the cost envelope option, the applicant will bear responsibility for any amount in excess of the estimate amount for any distribution system modifications and interconnection studies.⁶

If the applicant does elect to go with the cost envelope option, which may or may not be required depending on the size of the battery and if any infrastructure investments are required, additional information is needed. Specifically, the applicant must provide descriptions of the following:

- 1) The final location of Point of Common Coupling
- 2) The final location of the Point of Interconnection
- 3) Service voltage confirmation
- 4) Confirmation that technical data is correct
- 5) Site drawing
- 6) Noting any limitations or constraints having to do with the siting of conductors/equipment between the point of interconnection and common coupling.⁷

Part 3: Description of host's generating and electrical facilities

The third section asks the applicant to provide information on how the facility will be operated (See figure 1). There are three options for usage: parallel operation, momentary parallel (MP) operation, or isolated operation. How the system is intended to operate determines what information needs to be provided in subsequent sections.

⁵ *Generator Interconnection Cost Envelope Option*. Pacific Gas & Electric. Retrieved at https://www.pge.com/pge_global/common/pdfs/solar-and-vehicles/net-energy-metering/Cost-Envelope-Option.pdf

⁶ *Generating Facility Interconnection Report – Form 14-732*. Southern California Edison. 2016. Retrieved at <https://www.sce.com/nrc/TM2/PDF/14-732.pdf>

⁷ *Generating Facility Interconnection Report – Form 14-732*. Southern California Edison. 2016. Retrieved at <https://www.sce.com/nrc/TM2/PDF/14-732.pdf>

Figure 2: Operating modes of generating facility



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GENERATING FACILITY INTERCONNECTION APPLICATION

A. (MP&I)	Indicate the operating mode of the Generating Facility	operating mode options: __1 __2 __3 (Choose one)
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Instructions and Notes

Choose from the following operating mode options:

1. **Parallel Operation:** The Generating Facility will interconnect and operate "in parallel" with SCE's Distribution System for more than one (1) second.
2. **Momentary Parallel (MP) Operation:** The Generating Facility will interconnect and operate on a "momentary parallel" basis with SCE's Distribution System for a duration of one (1) second or less through transfer switches or operating schemes specifically designed and engineered for such operation.
3. **Isolated Operation:** The Generating Facility will be "isolated" and prevented from becoming interconnected with SCE's Distribution System through a transfer switch or operating scheme specifically designed and engineered for such operation.

Different operating modes of generating facilities. Credit: *Generating Facilities Interconnection Form 14-732. Southern California Edison, 2016*

For usage in shaving load, the battery will operate in parallel with SCE's distribution system, thus all subsequent information on the application must be filled out. Further, the applicant must select one of seven types of interconnection agreements depending on the specific use case. Based on reviewing the SCE interconnection queue for battery projects, it is expected that the most common use case will be completing form 14-731, which is the Generating Facility Interconnection Agreement for non-exporting facilities. If there will be NEM-eligible distributed generation on-site, the applicant can complete a separate multiple tariff interconnection agreement (Form 14-773). The caveat is that both the solar PV and battery storage need to be behind the same point of common coupling.⁸ Figure 2 below shows the various interconnection agreements depending on use case and ownership structure of assets.

⁸ *Generating Facility Interconnection Report – Form 14-732. Southern California Edison Retrieved at <https://www.sce.com/nrc/TM2/PDF/14-732.pdf>*

Figure 3: Potential interconnection agreements for applications to complete

Instructions and Notes

Sample agreements are available from SCE for review. Choose from the following eight (8) agreement options:

Customer Owned Generating Facility

1. **A Generating Facility Interconnection Agreement (Non-Export) (Form 14-731)** that provides for parallel operation of the Generating Facility, but does not provide for exporting power to SCE's Distribution System.
2. **Export Addendum to Generating Facility Interconnection Agreement for Non-Export Generating Facilities Exporting One Megawatt or Less (Form 14-931)** This addendum must be executed in concert with Agreement 1 (Form 14-731) or Agreement (Form 14-742).
3. **A Generating Facility Interconnection Agreement (Inadvertent Export) (Form 14-745)** that provides for parallel operation of the Generating Facility, and the occasional, inadvertent, non-compensated, export of power to SCE's Distribution System.
4. **A Generating Facility Interconnection Agreement (Multiple Tariff) (Form 14-773)** that provides for parallel operation of a Generating Facility that utilizes generators eligible for service under NEM or other applicable NEM tariffs (e.g., NEM, NEM-ST, BG-NEM, FC-NEM) that are electrically connected behind the same Point of Common Coupling (PCC) with generators that are not eligible to receive service under a NEM tariff.

Third Party Owned Generating Facility

5. **A Generating Facility Interconnection Agreement (Non-Export) (Form 14-742)** that provides for parallel operation of the Generating Facility, but does not provide for exporting power to SCE's Distribution System.
6. **A Generating Facility Interconnection Agreement (Inadvertent Export) (form 14-743)** that provides for parallel operation of the Generating Facility, and the occasional, inadvertent, non-compensated, export of power to SCE's Distribution System.
7. **A Customer Generation Agreement (Form 14-744)** that defines the relationship between SCE and the Customer whose name appears on SCE's Customer Account. This agreement must be executed in addition to agreements 5 and 6.

Credit: *Generating Facilities Interconnection Form 14-732. Southern California Edison, 2016*

Finally, section 3 of the application asks questions about the point of interconnection and how the generation facility (battery) will be used.

Part 4: Description of generators

Section 4 of the application asks for information on what type of generation facility will be installed. There are several options as this application is used for over a dozen generation types. For battery projects, the applicant will need to provide the max capacity (kWh) and rated discharge (kW) for the unit, as well as the operating voltage and power factor rating. Further, applications for energy storage require that the applicant provide information about the specific battery system including manufacturer, model, and number of batteries. Lastly, there is a portion of Section 4 that is intended solely for interconnection applications for energy storage, specifically about the energy charging storage function. Figure 3 below shows the technical requirements an applicant is required to provide when installing energy storage.⁹

⁹ *Generating Facility Interconnection Report – Form 14-732. Southern California Edison Retrieved at <https://www.sce.com/nrc/TM2/PDF/14-732.pdf>*

Figure 4: Additional information required for energy storage applications

Energy Storage System Operations (if applicable):

Describe the intended use of the storage device (note 1):

Note 1: Example of this can be peaking shaving, export to grid, load shifting, etc. The intended use may be taken into account in the study process.

Energy Storage Charging Function:

Rated Charge Demand (Load): _____ kW

Estimated annual Net Energy Usage* of the energy storage device(s): _____ kWh

*Net Energy Usage = (kWh input, including charging, storage device auxiliary loads, and losses) – (kWh output, including discharging)

Will the Distribution System be used to charge the storage device(s): Yes No

If no: Provide technical description of control systems including:

Source of energy for charging: _____

Mechanism to prevent charging from the Distribution System: _____

If yes: Will charging the storage device(s) increase the host facility's existing peak load demand:

Yes No

If yes: Provide the following loading information:

Amount of added peak demand: _____ kW

If no: Provide technical description of control systems including:

Charging periods: _____

Mechanism to prevent charging from the Distribution System during host facility peak: _____

Credit: *Generating Facilities Interconnection Form 14-732. Southern California Edison, 2016*

Alternative instructions for interconnecting batteries and solar

The above directions were specifically drafted for applications in which a commercial customer installs batteries for non-export. Based on a review of the SCE interconnection queue for battery applications, this was the use case in nearly all applications. Should the applicant wish to install solar and batteries, Form 14-732 can still be used in applying for interconnection, but only if the solar PV is participating in NEM, the battery is non-export, and the solar PV and battery storage components are behind the same point of common coupling. In the solar PV and battery storage use case, additional information regarding the generator is required, including but not limited to the type of generator (and inverter), nameplate information, and wiring configuration.¹⁰

¹⁰ *Generating Facility Interconnection Report – Form 14-732. Southern California Edison Retrieved at <https://www.sce.com/nrc/TM2/PDF/14-732.pdf>*

Chapter 2: Challenges and opportunities for non-export battery interconnection

Background

As California reshapes how it generates and consumes energy, the need for battery storage and peak shifting will become increasingly important to ensure electric service remains reliable. Further, businesses have incentive to reduce their demand charges and one way to do so is through the installation of battery storage. Utilities can also work to further incent battery installations in grid-constrained areas as opposed to investing in expensive, transmission and distribution infrastructure.

Challenges and Opportunities

Utilities should ensure there is an adequate number of trained staff dedicated to working with customers on interconnection requests. There are unique tariffs for different kinds of projects, but it is difficult to ascertain exactly which tariff is correct since projects can appear to be classified under multiple tariffs. As more interconnection request occur, the need for specialist will increase, so there may be value in creating a sample application that lets a user input a specific use case into an online system and with that, provide information about the specific tariff that should be used.

For projects that intend to install solar PV for NEM and a battery for non-export, allowing the customer to submit one application is a great start. But in instances in which the utility or CCA retains full or partial ownership over the assets, there are restrictions in tariffs, specifically the NEM-Aggregation tariff that would delay or worse, lead to a reduction in distributed energy resource installations. According to SCE's NEM FAQs, service accounts can only be added or removed once every twelve months.¹¹ While it is understandable that allowing to add accounts whenever is infeasible due to transaction costs and not enough time to study potential grid impacts, a full twelve months in between can lead to capital-intensive battery projects falling through because businesses make capital expenditures when it makes sense for them, not in alignment with a utility' timeline. Reducing the time in between adding service accounts on a NEM-An interconnection agreement can help reduce the burden on businesses and the owner of the generation assets.

¹¹ *Net Energy Metering Frequently Asked Questions*. Southern California Edison. 2018

Chapter 3: Conclusion

As the Green District Program launches, LCE should work directly with commercial customers to ensure their interconnection applications move forward seamlessly. Depending on the ownership structure, there may be opportunities to improve the NEM-Aggregation application process by allowing more flexibility to add and remove service accounts in shorter time spans than 12 months. Additionally, creating an online tool in which a user can input general information and understand the specific tariff to interconnect under will help the end user and ultimately lead to less redundancies for staff at the distribution provider that specialize in interconnection.