

**BEFORE THE PUBLIC UTILITY COMMISSION
OF OREGON**

UM 1856

In the Matter of

PORTLAND GENERAL ELECTRIC
COMPANY,Draft Storage Potential Evaluation.

ORDER

DISPOSITION: STIPULATION ADOPTED

I. SUMMARY

In this order, we adopt a stipulation outlining an agreed approach to the development of five energy storage projects by Portland General Electric Company. We also resolve the primary remaining issue not addressed in the stipulation, and conclude at this time that the proposed structure for PGE's Coffee Creek Request for Proposal (RFP) is reasonable. We also do not adopt any specific competitive bidding requirements for storage acquisitions made pursuant to HB 2193, though we do require that PGE review ownership issues as part of future filings on the Coffee Creek project and explain how we will examine related issues in any future rate proceeding.

II. BACKGROUND

House Bill 2193 requires PGE to submit to the Commission a proposal to develop energy storage systems and procure any authorized projects by January 1, 2020. The storage systems must have the capacity to store at least 5 MW of energy, and the total capacity acquired may not exceed one percent of an electric company's peak load in 2014, unless a project has statewide significance. HB 2193 also requires that each energy storage proposal be accompanied by the electric company's evaluation of storage potential in its system.

In our Order Nos. 16-504, 17-118 and 17-291, we provided direction on the development of electric company evaluation tools and proposals. Under the legislation, we are

permitted but not required to apply existing or new competitive bidding guidelines to storage projects developed according to HB 2193.¹

Finally, in our review of HB 2193 storage projects, we must:

[E]valuate each proposal to determine whether the proposal: (A) Is consistent with the guidelines adopted by the commission under subsection (1) of this section: (B) Reasonably balances the benefits of qualifying energy storage systems to ratepayers and the development of energy storage systems and the technology necessary to construct, operate and maintain energy storage systems; and (C) Is in the public interest.²

III. PROCEDURAL HISTORY

On July 14, 2017, PGE filed its initial application for a Draft Storage Potential Evaluation, which outlined how PGE proposed to use the evaluation to create energy storage project proposals. Along with Commission Staff, the following intervenors participated in this docket: the Oregon Citizens' Utilities Board (CUB), the Alliance of Western Energy Consumers (AWEC, formerly ICNU), Renewable Northwest (Renewable NW), the Northwest and Intermountain Power Producers Coalition (NIPPC), the Community Renewable Energy Association (CREA), and the Oregon Department of Energy (ODOE).

On November 1, 2017, PGE filed its final Energy Storage System Project Proposals and Energy Storage Potential Evaluation. On January 5, 2018, PGE filed direct testimony and exhibits discussing and describing PGE's energy storage proposals. Intervenors filed opening testimony on February 16, 2018. PGE filed rebuttal testimony on March 23, 2018. On April 24, 2018, Staff filed surrebuttal testimony that indicated that settlement had been reached in the proceeding, with one issue remaining to be litigated: "whether [PGE] should be required to allow third-party ownership options for the Coffee Creek project in its RFP."

On May 22, 2018, the stipulation and joint supporting testimony was filed by PGE, Staff, CUB, AWEC, Renewable NW, and NIPPC. The stipulation is attached as Appendix A.

¹ HB 2193 provides that: "If authorized to develop a project under subsection (3) of this section, an electric company shall develop the project in accordance with any competitive bidding guidelines prescribed by the Commission."

² Oregon Laws 2015, chapter 312, section 3(a), directs the Commission to examine the potential value of applying energy storage system technology.

PGE, AWEC, NIPPC and Staff all filed testimony discussing the third-party ownership option issue. PGE, NIPPC, and Staff filed briefs discussing the third-party ownership option issue.

We first address the parties' stipulation, providing a summary of its terms and our discussion. We then separately address the remaining contested issue relating to allowing a third-party ownership option in the RFP for PGE's proposed Coffee Creek project.

IV. STIPULATION

The stipulation seeks approval of five energy storage project proposals and includes support for a storage potential evaluation methodology. The stipulation modifies in part the storage proposals and storage potential evaluation as filed by PGE.

A. Terms Applicable to All Five Projects

The stipulation assumes a 10-year asset life for all energy storage systems subject to the stipulation. The stipulation provides for overnight capital cost caps, described and detailed on page 3 of the stipulation. Those capped costs are outlined as follows:

	Overnight Capital Cost	NPV Rev. Requirement	Year 1 Rev. Req.
Residential	\$1.5	\$5.7	\$0.7
Microgrid	\$2.0	\$3.5	\$0.8
Coffee Creek	\$30.1	\$44.0	\$7.5
Baldock	\$2.5	\$3.7	\$0.6
Generation	\$5.3	\$8.5	\$1.4
Controls	\$2.8	\$5.6	\$0.4
Total	\$44.2	\$71.0	\$11.4

The stipulation caps overnight capital costs for controls at \$2.8 million for all projects for cost recovery purposes. Administration and evaluation are not addressed, and the parties propose that PGE forecast these values in a general rate case. The parties acknowledge in the stipulation that all five projects are subject to the standard prudence review, and notes that "all costs other than overnight capital have not been capped in this stipulation, but will be carefully scrutinized and vetted, along with capital costs, in the future prudence review."³

³ Stipulation at para. 13; *see also* Joint Testimony in Support of Partial Stipulation at 4 (May 22, 2018).

PGE confirmed in the stipulation that operations and maintenance (O&M) will not be capitalized. The stipulation does not address cost recovery and leaves those issues for future determination. PGE commits to the filing of annual updates on the progress of the five pilot projects, and to filing a comprehensive evaluation of the pilots after the storage systems have been in operation for three years, at the end of the sixth year of operation, and at the end of the tenth.

B. Residential Pilot Project

In its residential pilot project, PGE will integrate residential storage units as a dispatchable resource providing grid services. During grid outages, the energy storage system (ESS) could provide power to the residence. PGE will offer a PGE-owned storage unit option where participants pay monthly fees for increased reliability, and a customer-owned option where participants are paid for grid services.

PGE and the signatories agree that the residential pilot project will be dispatched as a unit, using the aggregated dispatch as described in the application. The project will be designed to manage risks and optimize learning. The stipulation requires that PGE present a revised project design to Staff with evidence demonstrating that PGE will manage risk and optimize learnings. In the event that Staff does not agree that adequate evidence has been provided, signatories agree that the Commission would determine whether PGE can move forward with the project. PGE commits to file a revised project proposal, which will include a plan that will include specificity on how the individual energy storage systems will be aggregated and dispatched as outlined in the original application.

C. Microgrid Pilot

PGE will develop two to five microgrids in its service territory. These projects will serve either single customers or a subset of customers. Signatories agree that participant willingness to pay to be part of the microgrid pilot project will be a part of the site selection criteria. The stipulation does not limit PGE to a specified number of microgrids; and the prudence review for this project will include an analysis of the ability to appropriately test use cases. Participation in this pilot will be open to PGE's direct access customers.

D. Coffee Creek Pilot

The Coffee Creek project will be a large (17-20 MW) energy storage system located at a substation. PGE has over 150 substations, and has selected Coffee Creek as the most optimal location for the project.

This stipulation requires that the project must have a 17 MW (68 MWh) minimum battery size. The parties agree that PGE's decision on the final selected size of the project will be subject to a prudence review. The stipulation also requires that PGE make a demonstration that the location of the project is appropriate before proceeding with its implementation.⁴

E. Baldock Pilot

PGE will build an ESS mid-feeder at an existing solar facility to demonstrate ESS integration with solar, and serve to educate the public. The stipulation determines that this project will have a 2 MW (4 MWh) minimum battery size, which will ultimately be subject to prudence review. To proceed with the project, PGE will present an analysis to Staff demonstrating that Baldock is the "best site to locate the energy storage system given the universe of available feeders of PGE's system." Similar to the Coffee Creek project, the stipulation puts the Commission in the position of resolving a disagreement on location between Staff and PGE.

F. Port Westward Pilot

In this pilot, PGE will build an ESS at its Port Westward generation facility. The project will increase spinning reserves while providing additional capacity and ancillary services. This stipulation requires that the project must have a 4 MW minimum battery size.

G. Energy Storage Potential Evaluation

The stipulation commits PGE to file a detailed written explanation of a plan to improve its energy storage modeling capability to estimate all of the energy storage benefits as directed in our Order Nos. 17-118 and 17-375. The stipulation requires that "Staff must

⁴ "To be able to proceed with this project, PGE must first present an analysis to Staff, supported by adequate evidence, that Coffee Creek is the best site for the ESS based on the universe of available substation sites within PGE's system. In the event that Staff does not agree that adequate evidence has been provided, the Parties agree that the Commission should determine whether PGE can move forward with the project." *Id* at 6.

approve of the effectiveness of PGE's model in meeting the requirements described in this section***" (i.e. with regard to evaluation). According to the stipulation all future energy storage projects proposed by PGE must credibly estimate the value of all listed benefits, regardless of project characteristics and use cases. Additionally, "PGE will explain how the locational value of energy storage resources are considered in the IRP planning process."⁵

H. Commission Resolution

Staff and parties entered into a stipulation that resolves several issues in this proceeding, and no party has filed an objection to the stipulation. We encourage Staff and parties to voluntarily resolve issues to the extent that settlement is in the public interest.

We have examined the stipulation, the joint testimony, and the record in this case. We conclude that the stipulation is an appropriate resolution of primary issues in this docket, and we adopt the stipulation in its entirety without modification.

However, the stipulation includes three specific instances where the parties could seek Commission involvement. Specifically, for the Coffee Creek, Baldock and residential projects the stipulation provides that:

In the event that Staff does not agree that adequate evidence has been provided, the Parties agree that the Commission should determine whether PGE can move forward with the project.

We adopt the these provisions that require PGE to provide adequate evidence, but clarify that Commission involvement in a dispute on whether the evidence is adequate would not occur until a prudence determination is made as part of a cost recovery proceeding.

We find that each ESS proposal is consistent with adopted guidelines, reasonably balances the value for customers of storage and the costs and benefits of the installations, and is in the overall public interest.

⁵ *Id.* at 8.

V. CONTESTED ISSUE

A. Parties' Position

The sole primary issue not addressed by the stipulation is the question of third-party ownership of the Coffee Creek ESS project. As currently proposed by PGE, the RFP for this project would be limited to utility-owned and operated responses.

1. *Applicable Competitive Bidding Standard*

PGE argues that neither our current competitive bidding guidelines, nor proposed competitive bidding rules in docket AR 600, apply to pilot storage projects and that we adopted limited competitive bidding requirements for these projects in Order No. 16-504.

NIPPC objects to PGE's plans to limit this project to utility owned and operated resources, and recommends that we order PGE to include third-party owned responses as part of the RFP. NIPPC argues that proposed competitive bidding rules in AR 600 necessitate a high level of scrutiny on this proposal, as the Coffee Creek project could be subject to these rules if they were operative. NIPPC finds that PGE's justification for limiting the RFP to utility owned options is insufficient.

Staff also suggests that the competitive bidding rules under consideration by the Commission argue for a high level of scrutiny of the proposed project, in that they treat storage projects as distinct from other resources. Staff recognizes that at this point in time, the minimum competitive bidding requirements that have been imposed on PGE to date for this project are those outlined in Order No. 16-504.

2. *Risks of Third-Party Ownership*

PGE asserts that if third-party ownership and operation of the proposed Coffee Creek project were to be contemplated, then customers would be confronted with substantial risks because the project would be "located on utility-owned property that directly connects with the Coffee Creek substation."⁶ In briefing, PGE identifies the following risks:

- Equipment malfunction from a third-party owned asset adjunct to a PGE asset could put PGE personnel at risk.
- PGE could be held jointly liable for environmental issues on its property.

⁶ PGE Opening Brief at 7.

- Third-party access to the Coffee Creek substation Supervisory Control and Data Acquisition would allow the ESS owner to manipulate PGE's substation asset, posing cybersecurity treats and result in service interruptions.
- Third-party asset ownership on PGE property could lead to serious financial burdens.

PGE claims that if these issues were to be addressed via contract, there would be undue complexity and project development delays.

PGE also contends that third-party ownership would impair or limit its opportunities for company learnings. These learnings, which apply to all five pilot projects, include gaining experience from the following activities: contracting with an ESS developer for the construction (but not operation) of an ESS; gaining understanding regarding the ability of an ESS to support entire substation load during different transmission outage scenarios; developing, managing, operating, and maintaining a substation-location ESS; integrating the ESS into substation controls, and effectiveness in replacing and supplementing control devices; understanding how a centralized ESS can simultaneously benefit the transmission and distribution systems; and understanding which benefits and challenges are scalable.

Targeted learnings for the Coffee Creek project also include the following:

1. How can centralized ESS simultaneously benefit both PGE's transmission and distribution system?
2. What is required for the successful integration of operations and control of centralized ESS to both PGE's Power Operations and Balancing Area Authority?
3. What benefits or issues "scale-up" with centralized ESS and what benefits or issues do not?
4. What operations and maintenance issues arise from utility-scale ESS operation?
5. Working with the various codes, standards and regulations necessary for construction and operation of an ESS (e.g., IEEE, UL, NFPA, FM, UBS, State, local).⁷

NIPPC disputes PGE's arguments related to risk and claims that the company's cybersecurity arguments are circular and self-serving. NIPPC contends that PGE should not be allowed claim on the one hand that it does not have the capacity to mitigate cybersecurity and other risks, and on the other that claim that it must own the project to

⁷ Appendix to Stipulation at 5.

obtain this capacity. NIPPC argues that third-party developers already have this experience, and are fully capable of addressing these risks, even if PGE claims it cannot.

NIPPC also claims that PGE's concerns with on-site security are contradicted by current practice. Specifically, NIPPC points to the fact that 40 percent of PGE's labor budget for construction work on substations was for outside contractors; *i.e.*, non-PGE personnel. NIPPC also emphasizes that most utility storage projects are third-party owned, and contends that allowing third-party ownership would "help PGE develop a better understanding of procuring ESS projects owned by third parties, including how to improve cybersecurity and protect its systems from cyber-attacks more generally."⁸

If we determine that some aspect of the Coffee Creek pilot project is incompatible with third-party ownership, NIPPC alternatively requests that PGE be ordered to work to identify a different location that would be better suited for potential third-party ownership.

Staff highlights the fact that the stipulation requires PGE to demonstrate that the Coffee Creek location is the optimal location for the Coffee Creek project. Staff notes that the partial stipulation requires additional supporting analysis to be provided by PGE before it may proceed with the finalization of site selection for the project. For this reason, Staff observes that "the Coffee Creek substation location is not a certainty."⁹

B. Commission Resolution

For the reasons that follow, we decline NIPPC's recommendation to require that PGE expand its substation ESS RFP to third-party owned and operated projects. Instead, we require that, in PGE's analysis justifying to Staff the superiority of the Coffee Creek location as opposed to other alternative locations, the company address the feasibility of third-party ownership and operation at the alternative locations discussed.

In a future rate proceeding, we expect PGE to justify any future decision to limit its RFP with a concrete review of reasons for the decision to exclude third-party bids that explains why the cited reasons cannot be addressed by contract in a third-party owned arrangement.

⁸ AWEC-NIPPC/400 Crotzer/2.

⁹ Staff Reply Brief at 4 (Jul 11, 2018).

1. Applicable Competitive Bidding Standard

At the outset, we affirm that Order No. 16-504 provides the applicable competitive bidding requirements for energy storage projects proposed under HB 2193. Those guidelines provide:

1. An electric company may award a contract for a project without competition if it determines and presents justification that only a single vendor or contractor is capable of meeting the requirements of the project.
2. Where the requirements for sole source procurement are unmet, electric companies must use a competitive process to award contracts.
 - a. The electric companies will bear the burden of demonstrating that they followed a fair, competitive solicitation to identify all vendors with the requisite expertise, experience, and capability to install viable projects.
 - b. The electric companies must give the Commission and stakeholders the opportunity to review the electric companies' Request for Proposal design and offer nonbinding input.
 - c. The electric companies must summarize and report to the Commission their solicitation process and scoring approach. The report should be included with the formal project proposal submitted to the Commission, or, if bidding occurs after Commission authorization, at a special public meeting to follow.

Staff and NIPCC are correct that we are currently examining changes to our general competitive bidding requirements in docket AR 600. However rules proposed in AR 600 have not been adopted as of the time of this order. Accordingly, the competitive bidding requirements described in Order No. 16-504 apply at this time.

2. Decision to Offer Utility Property or to Contract with Third Party-owned Resources

The use of utility-owned assets by a third party is relevant in this proceeding, because PGE asserts that a lease or sale of property to a third party would be the only way in which a third party could own and operate the Coffee Creek project.

A decision not to offer property or other relevant resources to third parties as part of an RFP is a management determination, which the utility alone can make. That determination, however, may impact a prudence determination. The record developed in

this proceeding and in the future RFP docket on the questions of ownership will provide information to the Commission and parties in future proceedings in which the determination of the prudence of the storage investment is considered. Should PGE's RFP impose any ownership limitations or if there is an absence of third-party options to utilize utility property in the RFP, we will closely examine the appropriateness of these elements and the analysis justifying these decisions.

We have consistently encouraged utilities to expand options and offer utility-owned assets or resources to third parties in RFPs.¹⁰ Generally, we consider more bids and more ownership structures and options in the context of an RFP to be better than less, because the likelihood of identifying the lowest-cost, lowest-risk resource is greater in an RFP with a variety of ownership options than a more restricted RFP. Opening this RFP to third-party owned and operated proposals could have concrete benefits, even if such a proposal is not ultimately selected. For example, one of the valuable outcomes of an RFP open to third-party owned and operated storage resources will be the ability to examine a variety of O&M cost estimates. O&M costs for storage projects could be extensive, potentially rivaling capital costs over the life of the project. The Commission will gain less information about these costs in an RFP limited to utility-owned resources.

In an RFP docket and a subsequent prudence review, a utility may demonstrate that it is not appropriate to allow third party owned and operated projects as part of a specific RFP. A utility may demonstrate that considerations such as security or other unique risks dictate that an RFP be limited in permissible ownership structure. We find that these considerations are appropriate for the prudence review and RFP development phase of an acquisition.

In encouraging the company to open bidding up to non-utility owned options, we note that the decision to select a location or final bid remains with PGE. Should the company open the RFP to third-party owned options, its RFP should appropriately describe requirements that would ensure that PGE's systems, customers, and pilot project objectives are fully protected and its project goals achieved.

3. Risks of Third Party Ownership

Although there has been much discussion of risks in this proceeding related to third-party ownership of a project at the Coffee Creek substation, we share Staff's view that the site selection for the Coffee Creek project is not yet settled. The stipulation requires a more detailed analysis of the Coffee Creek site selection, and supports Staff's position that the

¹⁰ "...we adopt Staff's suggestion that the utility be encouraged to offer its site for third party development..." Order No. 06-446 at 6.

third-party ownership issue might be addressed as part of this future analysis. The filed partial stipulation requires that PGE must provide evidence that demonstrates Coffee Creek as the best location to site the project. The relevant language is as follows:

To be able to proceed with this project, PGE must first present an analysis to Staff, supported by adequate evidence, that Coffee Creek is the best site for the ESS based on the universe of available substation sites within PGE's system.

For this reason, Staff observes that "other sites on PGE's system exist that could make the access to utility-owned property concern irrelevant." Ultimately, we may be placed in the position of determining the reasonableness and impact of PGE's site selection as part of a cost recovery proceeding. We consider it essential to consider the complications individual sites pose for third-party ownership, and to continue to develop the record on questions of risk as part of that review.

4. *Learnings*

Finally, we make some observations about the impact of learnings PGE believes will be advanced by the Coffee Creek project. Arguably, only one of the learnings described above is tied to the ESS location or ownership questions. Specifically, if PGE desires to gain experience "developing, managing, operating, and maintaining a substation-located ESS" it must own and operate the facility, and that facility must be substation co-located. All of the remaining learning objectives, however, could arguably be achieved through a contract with a third party. PGE is responsible for developing the RFP and setting the terms of any third-party operational contract, and it can require as part of that contract that the third-party provide wide-ranging insight and access to operations, controls, operations, maintenance, construction, and compliance with codes and standards.

The concept of "learnings" would not be highly relevant in most resource acquisition decisions. Resources are acquired after a process, typically the IRP, identifies them as least-cost, least-risk. We expect electric companies to acquire those resources in an ownership-agnostic way, primarily focusing on costs and risks. We do not consider the "learnings" solely associated with an electric company owned generation resource in the balance, as compared to a third-party owned resource.

But, we acknowledge that this is not a typical resource acquisition. Large-scale storage is an emerging space, and the legislature has seen fit to accelerate utility development and use of storage as a resource and empowered us to authorize recovery for that purpose. As a result, we will consider learnings associated with ownership to a limited extent, with the


understanding that ultimately and likely very soon most storage applications will be ubiquitous enough to no longer justify such considerations in the resource acquisition process. In a future review of PGE's RFP on this project or at the point of cost recovery, we will consider analysis from PGE that provides concrete examples of learnings that cannot be contracted for with a third-party owner, and are only available to PGE in the context of PGE ownership and operation of the project.

VI. ORDER


IT IS ORDERED that:

1. The stipulation attached as Appendix A is adopted.
2. Consistent with the stipulation, Portland General Electric Company will develop analysis justifying the Coffee Creek site selection. As part of that analysis and in the review of other potential locations, Portland General Electric Company must consider the feasibility of third-party ownership and operation.

Made, entered, and effective AUG 13 2018.


Megan W. Decker
 Chair




Stephen M. Bloom
 Commissioner


Letha Tawney
 Commissioner

A party may request rehearing or reconsideration of this order under ORS 756.561. A request for rehearing or reconsideration must be filed with the Commission within 60 days of the date of service of this order. The request must comply with the requirements in OAR 860-001-0720. A copy of the request must also be served on each party to the proceedings as provided in OAR 860-001-0180(2). A party may appeal this order by filing a petition for review with the Court of Appeals in compliance with ORS 183.480 through 183.484.

BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UM 1856

In the Matter of

PORTLAND GENERAL ELECTRIC
COMPANY,

Energy Storage Proposals and
Revised Energy Storage Potential Evaluation

PARTIAL STIPULATION

1. This stipulation is entered into by and among the parties set forth below for the purpose of resolving all issues in this proceeding, except for the issue of third-party ownership of the Coffee Creek pilot project, and modifies Portland General Electric Company's Energy Storage Proposals and Revised Energy Storage Potential Evaluation filed on November 1, 2017 (Application) as described by the terms herein.

PARTIES

2. The parties to this stipulation (Stipulation) are Portland General Electric Company (PGE), Staff of the Public Utility Commission of Oregon (Staff), the Oregon Citizens' Utilities Board (CUB), the Alliance of Western Energy Consumers (AWEC, formerly ICNU), Renewable Northwest (RNW); and Northwest and Intermountain Power Producers Coalition (NIPPC), (together "the Parties" and individually "Party").

BACKGROUND

3. The Public Utility Commission of Oregon (OPUC or Commission) opened Docket No. UM 1751 in September of 2015 to implement House Bill (HB) 2193, which requires large Oregon electric companies to submit proposals to develop qualifying energy storage systems (ESS) with the capacity to store at least 5 MWh of energy to

- 1 the Commission by January 1, 2018. On December 28, 2016, the Commission
2 adopted specific guidelines and requirements, in Order No. 16-504, for Pacific Power
3 and PGE's ESS project proposals. Later, on March 21, 2017, in Order No. 17-118,
4 the Commission adopted a framework for Pacific Power and PGE's Energy Storage
5 Potential Evaluations (Potential Evaluations) that includes seven elements.
- 6 4. On July 14, 2017, PGE filed, with the OPUC, its *Draft* Energy Storage Potential
7 Evaluation, which subsequently opened Docket No. UM 1856. Staff and stakeholders
8 reviewed this draft and made recommendations to the Commission through a Staff
9 Report. In Order No. 17-375, the Commission adopted the following schedule: (1) by
10 January 1, 2018, PGE and PacifiCorp were to file draft project proposals and updated
11 draft storage potential evaluations that incorporated the improvements outlined by
12 Staff in its Report; (2) by April 2, 2018, the utilities were to file final project
13 proposals and final storage potential evaluations; (3) no later than April 2, 2018, the
14 Commission would begin review of the final filings.
- 15 5. PGE filed its final ESS Project Proposals and Energy Storage Potential Evaluation on
16 November 1, 2017 (Application). A contested case procedural schedule was set for
17 evaluation of PGE's Application. On January 5, 2018, PGE submitted supplemental
18 opening testimony in support of its Application. In the following two months, Staff
19 and AWEC sent 84 data requests regarding PGE's filing, to which PGE responded.
20 On February 16, Staff, 2018, CUB, AWEC, NIPPC, and RNW filed written reply
21 testimony.
- 22 6. On January 12, 2018 a stakeholder workshop was held. Likewise, on February 27,
23 2018, a Commissioner workshop was held.
- 24 7. All parties were invited to participate in a settlement conference on March 1, 2018.
25 All parties to this docket attended with the exception of the Community Renewable
26 Energy Association (CREA) and the Oregon Department of Energy (ODOE). As a

result of that settlement conference, and several follow up discussions, the Parties have reached settlement on all issues in this docket, except for one, as set forth in the Agreement section below.

8. The Parties circulated the Stipulation to CREA and ODOE for review. CREA and ODOE have declined to join the Stipulation, but have both indicated that they do not object to the Stipulation.

AGREEMENT

Terms Applicable to All Five Energy Storage Projects

9. All energy storage systems (ESS) procured subject to this Stipulation shall have a 10-year asset life.¹
10. Overnight Capital Cost² caps for each of PGE's five energy storage projects are specified in this Stipulation. In addition, revenue requirement estimates are provided below.³ For avoidance of doubt, the capital cost cap for Coffee Creek shall apply regardless of the outcome of the remaining litigated issue.

Pilot Costs (in millions)

	Overnight Capital Cost	NPV Rev. Requirement	Year 1 Rev. Requirement
Residential	\$1.5	\$5.7	\$0.7
Microgrid	\$2.0	\$3.5	\$0.8
Coffee Creek	\$30.1	\$44.0	\$7.5
Baldock	\$2.5	\$3.7	\$0.6
Generation	\$5.3	\$8.5	\$1.4
Controls	\$2.8	\$5.6	\$0.4
Portfolio	\$44.2	\$71.0	\$11.4

¹ This does not limit operation of the 10-year asset beyond its useful life if it is cost effective to do so.

² Overnight capital describes the total capital investment as if the asset were delivered on a single day; it excludes interest costs associated with the construction time period such as Allowance for Funds During Construction. NPV of Revenue Requirement, in contrast, reflects an annual revenue stream over the life of the asset. This stream includes annual depreciation expense, return on rate base, taxes, and Operations and Maintenance (O&M). Depending upon the project, O&M can include battery maintenance and power augmentation, program management, and customer compensation for PGE's use of residential batteries. This revenue stream is translated into a single number using a discount rate of 6.27% (PGE's after tax cost of capital as of June 2017).

³ All costs are displayed in 2017 dollars.

- 1 11. For cost recovery purposes, overnight capital costs for controls are capped at \$2.8M
2 for all projects.
- 3 12. Administration and Evaluation costs are \$0 in this Stipulation, but may be forecasted
4 in a general rate case.
- 5 13. All costs for the five energy storage pilot projects agreed to in this Stipulation are
6 subject to the standard prudence review. This means that PGE will still be required to
7 show that spending up to the overnight capital cost caps is prudent. All costs other
8 than overnight capital have not been capped in this Stipulation, but will be carefully
9 scrutinized and vetted, along with capital costs, in the future prudence review. Staff
10 notes that current studies, such as Pacific Northwest National Laboratory's (PNNL)
11 "Assessment of Battery Performance and Economic Potential" are known and
12 currently available sources of market based reference points for O&M and other
13 costs.⁴ PGE has confirmed that O&M will not be capitalized.
- 14 14. The method of/mechanism for cost recovery for PGE's five energy storage pilot
15 projects is not decided in this Stipulation and will not be determined in the current
16 proceeding in this docket. As the pilot projects get closer to being in service, PGE
17 will file for its preferred method of cost recovery. At that time, all Parties to this
18 Stipulation, and any new parties granted intervenor status, will have an opportunity to
19 litigate their position on the appropriate method of/mechanism for cost recovery.
20 This Stipulation does not limit any Party in their argument on cost recovery, including
21 whether cost recovery should occur through a general rate case only, PGE's
22 Renewable Resource Automatic Adjustment Clause (RRAAC), a new automatic
23 adjustment clause, or other method.⁵

24 ⁴ See Pacific Northwest National Laboratory, "The Salem Smart Power Center, An Assessment of Battery
25 Performance and Economic Potential," p. 121 of PDF, p. 4.15 of report, Table 4.4 Lahiri 2017 Estimated Costs,
26 published Sept. 2017, available at [https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-
26858.pdf](https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-26858.pdf)

⁵ The Parties note that PGE, in its active rate case (see UE 335), has proposed a revision to its current Renewable
Resources Automatic Adjustment Clause (RRAAC) to include "associated energy storage" among other changes.

1 15. Because the five projects agreed to in this Stipulation are pilots, the Parties agree that
 2 data collection, information gathering, and learnings are an important component of
 3 these projects. The Parties have asked PGE to include Appendix A to this Stipulation
 4 to identify areas to be studied and learnings to be gained from the five pilot
 5 projects. Additional learnings may be identified as the Parties litigate the remaining
 6 issue in this docket.

7 16. The five projects agreed to in this Stipulation are pilots and require reporting to the
 8 Commission on the evaluation topics outlined in PGE's Application.⁶ PGE will file
 9 an annual update on the progress of the five pilot projects, and will also file a
 10 comprehensive evaluation of the pilots after the energy storage systems have been in
 11 operation⁷ for three years, as well as after the end of the 6th year in operation, and
 12 after the end of the 10th year in operation. The Commission may direct PGE to
 13 include additional topics and/or data in the annual update and/or evaluations to ensure
 14 that adequate learning and data collection is achieved from the five pilot projects.

15 **The Five Energy Storage Projects**

16 Residential Pilot

17 17. For cost recovery purposes, the overnight capital cost cap for this project is \$1.5M.

18 18. PGE agrees that this project will be dispatched as a unit using the aggregated dispatch
 19 as described in its Application and that it will be designed to manage risks and
 20 optimize learning (shared control between the participant and PGE, and shared
 21 benefits of the system with the participant). To be able to proceed with this project,
 22 PGE must first present a revised project design to Staff with adequate evidence that it

23
 24 As such, the Parties may address PGE's proposed revision in UE 335, but the method of cost recovery for the UM
 25 1856 storage pilots will not be determined in UE 335—the Parties have agreed, as explained in this Stipulation, to
 reserve that issue for later determination.

26 ⁶ For example, see Application at 67, 83, 98, 117, and 131.

⁷ Operation starts as of the date the first ESS is on line. Each evaluation will include all of the five energy storage
 projects.

1 manages risks and optimizes learnings. In the event that Staff does not agree that
2 adequate evidence has been provided, the Parties agree that the Commission should
3 determine whether PGE can move forward with the project.

4 19. The revised project proposal will be a plan that must include specificity on how the
5 individual energy storage systems will be aggregated and dispatched as stated in the
6 original Application. This plan will clearly explain how the pilot is designed to
7 manage each of the identified categories of risks listed in PGE's Application⁸ and to
8 optimize learning. PGE's Application provided only a high-level description that
9 identified risks and learnings but did not provide detail regarding mitigation
10 strategies, a data collection plan, or an evaluation plan, all three of which must be
11 included in the revised project proposal. Staff suggests that PGE follow a phased-in
12 deployment plan and implementation strategy as opposed to setting a target number
13 of households for the entire pilot and launching with the intent of reaching full
14 capacity immediately.

15 Microgrid Pilot

16 20. For cost recovery purposes, the overnight capital cost cap for this project is \$2M.

17 21. Participant willingness to pay will be part of the site selection criteria.⁹ PGE is not
18 limited to a specified number of microgrids, however, the prudence review for this
19 project will include an analysis of the ability to appropriately test use cases.

20 Participation in this pilot will be open to PGE's direct access customers.

21 Coffee Creek Pilot

22 22. For cost recovery purposes, the overnight capital cost cap for this project is \$30.14M.

23
24
25
26 ⁸ See Application at 107.

⁹ See Application at 49.

1 23. The project must have a 17MW¹⁰ minimum battery size, however, PGE is aware that
2 the project will undergo a prudence review that will consider whether the battery was
3 correctly sized for the substation.

4 24. To be able to proceed with this project, PGE must first present an analysis to Staff,
5 supported by adequate evidence, that Coffee Creek is the best site for the ESS based
6 on the universe of available substation sites within PGE's system. In the event that
7 Staff does not agree that adequate evidence has been provided, the Parties agree that
8 the Commission should determine whether PGE can move forward with the project.

9 25. Whether PGE's RFP for this project must allow third-party ownership has been
10 carved out as the single remaining issue in this docket.

11 Baldock Pilot

12 26. For cost recovery purposes, the overnight capital cost cap for this project is \$2.5M.

13 27. The project must have a 2MW minimum battery size,¹¹ however, PGE is aware that
14 the project will undergo a prudence review that will consider whether the battery was
15 correctly sized.

16 28. To be able to proceed with this project, PGE must first present an analysis to Staff,
17 supported by adequate evidence, that Baldock is the best site to locate the energy
18 storage system given the universe of available feeders on PGE's system. In the event
19 that Staff does not agree that adequate evidence has been provided, the Parties agree
20 that the Commission should determine whether PGE can move forward with the
21 project.

22 Port Westward Pilot

23 29. For cost recovery purposes, the overnight capital cost cap for this project is \$5.3M.

24 30. The project must have a 4MW minimum battery size.¹²

25 ¹⁰ This size is based on the information provided by PGE in its Application.

26 ¹¹ This size is based on the information provided by PGE in its Application.

¹² This size is based on the information provided by PGE in its Application.

Energy Storage Potential Evaluation

31. Prior to implementing any of the five projects agreed to in this Stipulation, PGE will file in this docket a detailed written explanation of its plan, including incremental next steps, to advance its energy storage modeling capability to credibly estimate all benefits¹³ associated with the proposed energy storage systems as directed in Commission Order Nos. 17-118 and 17-375. PGE's plan must set clear milestones with explanations regarding the analysis or tool development necessary to advance its methodologies to the forefront of ESS benefit modeling; then PGE must implement those methodologies for future ESS proposals made outside of the IRP process. Finally, PGE will work with the Commission to develop best practices for the integration of energy storage modeling into its IRP process.
32. PGE has the freedom to determine how to design and arrive at a model that credibly estimates all ESS benefits, whether or not that includes using Pacific NW National Labs (PNNL) resources, however, Staff must approve the effectiveness of PGE's model in meeting the requirements described in this Stipulation.
33. All future energy storage projects proposed by PGE, excluding the five pilots agreed to in this Stipulation, must credibly estimate (based on PGE's reasonable best efforts; reasonable best efforts will be determined by the Commission should Staff disagree) the value of all tangible benefits, regardless of size, to retail electricity customers, including the use cases found in Commission Order No. 17-375, as well as other applicable use cases. Further, PGE will explain how the locational value of energy storage resources are considered in the IRP planning process. The Parties agree that storage modeling and deployment is currently in an iterative stage and therefore the information gained from the revised storage modeling described in paragraphs 31 and

¹³All benefits associated with each use-case, co-optimized.

32 will be incorporated into PGE's IRP process based on PGE's best efforts, and in a manner consistent with the Commission's IRP orders and rules.

Remaining Issue

34. The single remaining issue to be resolved, which the Parties agree to litigate in this docket, is the issue of competitive bidding, and specifically whether PGE should be required to allow third-party ownership options for the Coffee Creek project in its RFP.

Additional

35. The Parties recommend and request that the Commission approve this Stipulation as an appropriate and reasonable resolution of the issues in this docket. Adoption of this Stipulation will effectively approve PGE's November 1, 2017 Application except as it has been modified by this Stipulation.

36. This Stipulation will be offered into the record in this proceeding as evidence pursuant to OAR 860-001-0350(7). The Parties agree to support this Stipulation throughout this proceeding and in any appeal, provide witnesses to support this Stipulation (if specifically required by the Commission), and recommend that the Commission issue an order adopting the settlements contained herein.

37. By entering into this Stipulation, no Party shall be deemed to have approved, admitted or consented to the facts, principles, methods or theories employed by any other Party in arriving at the terms of this Stipulation.

38. Except as provided in this Stipulation, no Party shall be deemed to have agreed that any provision of this Stipulation is appropriate for resolving issues in any other proceeding.

39. The Parties agree that this Stipulation represents a compromise in the positions of the Parties. Without the written consent of all Parties, evidence of conduct or statements, including but not limited to term sheets or other documents created solely for use in

1 settlement conferences in this docket, and conduct or statements made at settlement
2 conferences, are confidential and not admissible in the instant or any subsequent
3 proceeding, unless independently discoverable or offered for other purposes allowed
4 under ORS 40.190.

5 40. The Parties have negotiated this Stipulation as an integrated document. If the
6 Commission rejects all or any material part of this Stipulation, or adds any material
7 condition to any final order that is not consistent with this Stipulation, each Party
8 reserves its right: (i) to withdraw from the Stipulation, upon written notice to the
9 Commission and the other Parties within five (5) business days of service of the final
10 order that rejects this Stipulation, in whole or material part, or adds such material
11 condition; (ii) pursuant to OAR 860-001-0350(9), to present evidence and argument
12 on the record in support of the Stipulation, including the right to cross-examine
13 witnesses, introduce evidence as deemed appropriate to respond fully to issues
14 presented, and raise issues that are incorporated in the settlements embodied in this
15 Stipulation; and (iii) pursuant to ORS 756.561 and OAR 860-001-0720, to seek
16 rehearing or reconsideration, or pursuant to ORS 756.610 to appeal the Commission
17 order. Nothing in this paragraph provides any Party the right to withdraw from this
18 Stipulation as a result of the Commission's resolution of issues that this Stipulation
19 does not resolve.

20 41. This Stipulation may be executed in counterparts and each signed counterpart shall
21 constitute an original document.

22 //
23 //
24 //
25 //
26 //

1 **For PGE:**

2 Signature: _____

3 Name: _____

4 Title: _____

5 Date: _____

7

8

9 **For CUB:**

10 Signature: _____

11 Name: _____

12 Title: _____

13 Date: _____

14

15

16 **For NIPPC:**

17 Signature: _____

18 Name: _____

19 Title: _____

20 Date: _____

22

23

24

25

26

For Staff:

Signature: Kaylee Klein

Name: Kaylee Klein

Title: AAG for Staff

Date: 5/11/18

For AWEC (formerly ICNU):

Signature: _____

Name: _____

Title: _____

Date: _____

For RNW:

Signature: _____

Name: _____

Title: _____

Date: _____

1 **For PGE:**

2 Signature: DPC Tys

3 Name: Doug Tugay

4 Title: Attorney

5 Date: 5/17/18

7

8

9 **For CUB:**

10 Signature: _____

11 Name: _____

12 Title: _____

13 Date: _____

14

15

16 **For NIPPC:**

17 Signature: _____

18 Name: _____

19 Title: _____

20 Date: _____

21

22

23

24

25

26

For Staff:

Signature: _____

Name: _____

Title: _____

Date: _____

For AWEC (formerly ICNU):

Signature: _____

Name: _____

Title: _____

Date: _____

For RNW:

Signature: _____

Name: _____

Title: _____

Date: _____

1	For PGE:	For Staff:
2	Signature: _____	Signature: _____
3	Name: _____	Name: _____
4	Title: _____	Title: _____
5	Date: _____	Date: _____
6		
7		
8		
9	For CUB:	For AWEC (formerly ICNU):
10	Signature: <u>Michael P. Goetz</u>	Signature: _____
11	Name: <u>Michael Goetz</u>	Name: _____
12	Title: <u>Staff Attorney</u>	Title: _____
13	Date: <u>5/22/18</u>	Date: _____
14		
15		
16	For NIPPC:	For RNW:
17	Signature: _____	Signature: _____
18	Name: _____	Name: _____
19	Title: _____	Title: _____
20	Date: _____	Date: _____
21		
22		
23		
24		
25		
26		

1 For PGE:

For Staff:

2 Signature:_____

Signature:_____

3 Name:_____

Name:_____

4 Title:_____

Title:_____

5 Date:_____

Date:_____

6

7

8

9 For CUB:

For AWEC (formerly ICNU):

10 Signature:_____

Signature: 

11 Name:_____

Name: Tyler Pepple

12 Title:_____

Title: Attorney

13 Date:_____

Date: 5/22/18

14

15

16 For NIPPC:

For RNW:

17 Signature:_____

Signature:_____

18 Name:_____

Name:_____

19 Title:_____

Title:_____

20 Date:_____

Date:_____

21

22

23

24

25

26

1 For PGE:

For Staff:

2 Signature: _____

Signature: _____

3 Name: _____

Name: _____

4 Title: _____

Title: _____

5 Date: _____

Date: _____

6

7

8

9 For CUB:

For AWEC (formerly ICNU):

10 Signature: _____

Signature: _____

11 Name: _____

Name: _____

12 Title: _____

Title: _____

13 Date: _____

Date: _____

14

15

16 For NIPPC:

For RNW:

17 Signature: Sidney Villanueva

Signature: _____

18 Name: Sidney Villanueva

Name: _____

19 Title: Attorney

Title: _____

20 Date: May 18, 2018

Date: _____

21

22

23

24

25

26

1 **For PGE:**

2 Signature: _____

3 Name: _____

4 Title: _____

5 Date: _____

6

7

8

9 **For CUB:**

10 Signature: _____

11 Name: _____

12 Title: _____

13 Date: _____

14

15

16 **For NIPPC:**

17 Signature: _____

18 Name: _____

19 Title: _____

20 Date: _____

21

22

23

24

25

26

For Staff:

Signature: _____

Name: _____

Title: _____

Date: _____

For AWEC (formerly ICNU):

Signature: _____

Name: _____

Title: _____

Date: _____

For RNW:

Signature: Silvia Tanner

Name: Silvia Tanner

Title: Senior Counsel & Analyst

Date: 5/18/18

APPENDIX A:

UM 1856 Energy Storage System Learnings by Pilot/Project

1. Background

On December 28, 2016, the Public Utility Commission of Oregon (Commission) adopted guidelines and requirements to implement House Bill 2193 in Commission Order 16-504. Based on these guidelines, Portland General Electric Company (PGE) proposed five energy storage system (ESS) projects that include a diversity of project sizes, locations on PGE's system, use cases, and ownership structures to create varied learnings for PGE and stakeholders.

The overall learning objective is to optimize learnings by conducting different types of ESS pilots and evaluating many topics. The evaluation will include topics with both quantitative and qualitative assessment.

The quantitative analyses will focus on the evaluation of net benefits derived from various different applications, including the following¹:

- Capacity – The ESS will be dispatched during peak demand periods to supply energy and shave peak demand, reducing the need to rely on new peaking power plants.
- Energy and Ancillary Services – The ESS will be used for a variety of system ancillary services (e.g., frequency regulation, load following, operating reserves, voltage support).
- Locational Value Benefits²:
 - Outage Mitigation – The ESS can be used to reduce the duration of customer outages and potentially defer the investment of capital by extending the life of existing distribution assets; and/or
 - Power Reliability – The ESS will also be used to reduce or eliminate outage impact costs to specific participating customers.

PGE anticipates using the ESSs for the listed functions above because they have the highest value and ability to be co-optimized. For example, during normal operating conditions, the ESSs will provide grid services (i.e., capacity, energy, and ancillary services). During an outage event, depending on location, the ESSs may provide outage mitigation and/or power reliability.

¹ Other quantitative topics include transmission deferral, individual customer benefits, and resiliency.

² Whether power reliability benefits, outage mitigation benefits, or both are accrued for a specific project depends largely on the project's location in the grid and project specific design criteria.

The qualitative analyses focus on the evaluation of PGE’s abilities and preparedness to deploy similar ESS projects at scale:

- Procurement – The ability to procure systems in an efficient manner, utilize appropriate tools and processes, are cost-effective (or near to), to ensure procurement of ESSs that perform as desired.
- Infrastructural Readiness – The presence of sufficient enabling infrastructure to manage a large portfolio of ESSs in an optimized fashion, including the necessary infrastructure for communicating with, monitoring, dispatching, measuring, and maintaining ESSs.
- Operational Readiness – The presence of necessary people and processes to ensure that ESSs will be effectively implemented, operated, and maintained over their operational life on an ongoing basis and that management of ESSs is integrated into regular planning and operations activities.
- Customer Engagement – The effectiveness of strategies for engaging with customers who are served by the ESSs, including strategies for customer acquisition, ESS implementation, operation, maintenance, and billing.

These learnings will inform future strategic investments at a larger scale in ESS in Oregon and further the state’s policy objectives of House Bill 2193. To do this, the pilots/projects will emphasize collection and analysis of data and information, including:

- As discussed in PGE Exhibit 100 and 101, PGE will implement a control system (i.e., GenOnSys) that provides the necessary features to capture benefits associated with the use cases identified in the Energy Storage System Potential Evaluation report (provided as Appendix 4 of PGE Exhibit 101).
- PGE will hire an experienced external ESS consultant to evaluate the projects; the consultant’s insights from similar projects will benefit PGE’s assessment of project data and information regarding this rapidly-evolving technology.
- To operationalize ESS pilot/project evaluation, PGE anticipates refining models and modeling inputs as they will have real operational data from these ESS pilots and projects, regarding the output, integrity, and value of ESS. PGE will incorporate these learnings into their models.
- PGE will report on progress, learnings, costs, benefits, and evaluation of these initiatives.

For more information on PGE’s evaluation of learnings and methodology, see PGE Exhibit 101 and 200. A summary of the evaluation approaches of the listed topics and methods are provided in Table 44 of PGE Exhibit 101.

2. Baldock Mid-feeder**a. Learning Objectives**

- i. Gain experience developing, contracting, constructing and maintaining a mid-feeder sited ESS.
- ii. Gain knowledge in the operations of the various use cases of a mid-feeder sited ESS (e.g., potential for automation schemes).
- iii. Optimize and integrate ESS at large-scale renewable projects.
- iv. Gain experience in power smoothing and mitigating system impacts resulting from distribution-connected large solar facilities. In addition, enable smart inverter functions to test the effectiveness of using ESS to support feeder Volt-Var optimization.

b. Evaluation Plan**i. Evaluation Topics****1. Quantitative:**

- a. Capacity;
- b. Transmission Deferral;
- c. Energy and Ancillary Services; and
- d. Outage Mitigation.

2. Qualitative:

- a. Procurement;
- b. Infrastructural Readiness; and
- c. Organizational Readiness.

ii. Learnings that the project will target include:

1. How can utility-scale co-located ESS benefit both PGE's distribution system and the adoption of renewable generation?
2. What is required for the successful integration of operations and control of local ESS to both PGE's Power Operations and Balancing Area Authority?
3. What benefits or issues "scale-up" with the installation of additional local ESS, what benefits or issues do not?
4. What operation and maintenance issues arise from utility-scale ESS operation?
5. Working with the various codes, standards and regulations necessary for construction and operation of an ESS (e.g., IEEE, UL, NFPA, FM, UBC, State, local).

3. Coffee Creek Substation

a. Learning Objective

- i. Understand the ability of an ESS to support the entire substation load during different transmission outage scenarios.
- ii. Gain experience developing, managing contracting and constructing, operating, and maintaining a substation-located ESS.
- iii. Gain experience integrating the ESS into substation controls, effectiveness in replacing/supplementing other substation control devices (e.g., capacitor banks), and test capability to inform future substation design.
- iv. Understand how a centralized ESS can simultaneously benefit the transmission and distribution systems.
- v. Identify which benefits and issues do and don't "scale up".

b. Evaluation Plan

i. Evaluation Topics

1. Quantitative:

- a. Capacity;
- b. Transmission Deferral;
- c. Energy and Ancillary Services; and
- d. Outage Mitigation.

2. Qualitative:

- a. Procurement;
- b. Infrastructural Readiness; and
- c. Organizational Readiness.

ii. Learnings that the project will target include:

1. How can centralized ESS simultaneously benefit both PGE's transmission and distribution systems?
2. What is required for the successful integration of operations and control of centralized ESS to both PGE's Power Operations and Balancing Area Authority?
3. What benefits or issues "scale-up" with centralized ESS and what benefits or issues do not?
4. What operations and maintenance issues arise from utility-scale ESS operation?
5. Working with the various codes, standards and regulations necessary for construction and operation of an ESS (e.g., IEEE, UL, NFPA, FM, UBC, State, local).

4. Generation Kick-Start

a. Learning Objectives

- i. Understand how to utilize an entire generating unit as spinning reserve even when not synchronized to the grid.
- ii. Integrate an ESS into an existing generation plant control system.
- iii. Implement an ESS to better utilize existing assets.
- iv. Understand operations and maintenance issues arising from generation plant sited ESS.

b. Evaluation Plan

i. Evaluation Topics

1. Quantitative:
 - a. Capacity; and
 - b. Energy and Ancillary Services.
2. Qualitative:
 - a. Resiliency;
 - b. Procurement;
 - c. Infrastructural Readiness; and
 - d. Organizational Readiness.

ii. Learnings that the project will target include:

1. How can centralized ESS benefit PGE's generation system – in particular, the need for spinning reserves?
2. How can ESS be integrated into an existing generation plant control system?
3. How can PGE implement ESS to better utilize existing assets?
4. How can ESSs help meet regulatory requirements?
5. What is required for the successful integration of operations and control of generation plant-sited ESS to both PGE's Power Operations and Balancing Area Authority?
6. What benefits or issues "scale-up" with generation plant-sited ESS and what benefits or issues do not?
7. What operations and maintenance issues arise from generation plant-sited ESS?
8. Working with the various codes, standards and regulations necessary for construction and operation of an ESS (e.g., IEEE, UL, NFPA, FM, UBC, State, local).

5. Microgrid Pilot

a. Learning Objective

- i. The stipulated microgrid pilot will include 1-2 sites to demonstrate benefits of microgrids to PGE, its customers, and the local community. The pilot will help PGE gain experience with microgrid planning, installation, and operations to inform a larger-scale microgrid program deployment that meet customer demand for clean and resilient energy solutions.
- ii. The pilot will inform future program design elements, including but not limited to:
 1. Recruitment and enrollment strategies and best practices;
 2. The value of and right questions to ask during a feasibility assessment;
 3. Participation requirements and design specifications;
 4. Sizing considerations;
 5. Construction and commissioning processes and best practices; and
 6. Operational strategies and best practices:
 - a. Billing and Credits;
 - b. Maintenance; and
 - c. Automated dispatch.

b. Evaluation Plan

i. Evaluation Topics

1. Quantitative:
 - a. Capacity;
 - b. Transmission Deferral;
 - c. Energy and Ancillary Services;
 - d. Outage Mitigation; and
 - e. Power Reliability.
2. Qualitative:
 - a. Resiliency;
 - b. Procurement;
 - c. Infrastructural Readiness;
 - d. Organizational Readiness; and
 - e. Customer Engagement.

ii. The pilot will evaluate:

1. Program costs;

2. Realized system benefits;
 3. Realized customer value and willingness to pay;
 4. Program structure/design considerations (e.g., who owns which equipment, who pays for what/how much).
- iii. Learnings that the pilot will target include the following. Learnings are dependent on the characteristics and resources of the selected site(s):
1. What is the value of integrated ESS, solar, and dispatchable standby generation (DSG) on a microgrid?
 2. What is the cost-effectiveness of adding solar, ESS, and a diesel generator?
 3. What is the cost effectiveness of adding solar and ESS (only) to a customer with no backup?
 4. How can PGE most effectively manage solar, ESS, and a diesel generator during an outage?
 5. What are the best practices for balancing frequency and providing other ancillary services with ESS, solar, and generators?
 6. What are customers' willingness to pay for resiliency/islanding, and how does this inform pricing and appropriate customer costs?
 7. What are the appropriate considerations for installing, operating, and maintaining customer-sited ESSs?
 8. What impact do such ESS and solar systems have on the size of back-up generators required by critical customers?
 9. How can PGE's Power Operations and reliability teams most effectively leverage distributed storage to benefit the entire system while the microgrid is operating in conjunction with the main grid?
 10. What are the technical limitations of solar and ESS for critical backup in the service area?
 11. What are the operational challenges and benefits associated with a microgrid?
 12. What are the maintenance requirements of a microgrid with a diversity of generating resources?
 13. Working with the various codes, standards and regulations necessary for construction and operation of an ESS (e.g., IEEE, UL, NFPA, FM, UBC, State, local).

6. Residential Pilot

a. Learning Objectives

- i. Aggregate and dispatch distributed storage assets.

- ii. Integrate operation and control of a fleet of distributed storage assets into both PGE's Power Operations and Balancing Area Authority.
- iii. Understand customer-preferences for utility vs customer-owned behind-the-meter assets, as well as price sensitivity.
- iv. Allocate battery capacity to maximize utility and residential customer benefits.

b. Evaluation Plan

- i. Evaluation Topics
 - 1. Quantitative:
 - a. Capacity;
 - b. Transmission Deferral;
 - c. Energy and Ancillary Services; and
 - d. Power Reliability.
 - 2. Qualitative:
 - a. Resiliency;
 - b. Procurement;
 - c. Infrastructural Readiness;
 - d. Organizational Readiness; and
 - e. Customer Engagement.
- ii. The pilot will evaluate:
 - 1. Program costs;
 - 2. Realized system benefits;
 - 3. Realized customer benefits and willingness to pay; and
 - 4. Equipment ownership structure.
- iii. Learnings that the pilot will target include:
 - 1. How can PGE most effectively leverage distributed ESS to benefit the entire electrical distribution system?
 - 2. Was PGE successful in dispatching the aggregated battery inverter system (BIS) fleet to provide capacity, energy and ancillary services, and transmission deferral services? If not, what improvements are required?
 - 3. Was PGE successful in dispatching the aggregated BIS fleet for other services that should be considered system benefits?
 - a. If so, how can these benefits be best included in future program designs?
 - 4. What are PGE customers willing to pay for enhanced and power reliability?

5. How should battery capability be shared between PGE and customers to maximize total benefits?
6. What operations and maintenance issues arise from BIS operation?
7. Working with the various codes, standards and regulations necessary for construction and operation of an ESS (e.g., IEEE, UL, NFPA, FM, UBC, State, local).

7. Integrated Controls

a. Learning Objectives

- i. Allow for real-time and scheduled operation of the various assets by the appropriate “owner” of each use case.³
- ii. Provide the necessary two-way communications to receive, display, and store all system data in a meaningful and useful format.
- iii. Capture data, regarding system performance, to support the goal of maximizing learnings and allow internal and external agencies to study use case viability.

b. Evaluation Plan

- i. Learnings that PGE will target include:
 1. What is the most efficient method to communicate with customer distributed energy?
 2. Can the controls be responsive enough to exploit all the anticipated use cases?
 3. How would highly distributed resources coexist with central ESS sites on a control platform?
 4. What is the best way to operate and maintain a DER/ESS control platform?
 5. How can process owners interact with the system while limiting conflict and cybersecurity issues?

³ PGE’s Power Operations plans assets to serve peak demand and the Balancing Authority own frequency response.