



**Portland General Electric Company**  
*Legal Department*  
121 SW Salmon Street • Portland, Oregon 97204  
503-464-8926 • Facsimile 503- 464-2200

**Douglas C. Tingey**  
*Associate General Counsel*

May 22, 2018

***Via Electronic Filing***

Oregon Public Utility Commission  
Attention: Filing Center  
201 High Street, Suite 100  
PO Box 1088  
Salem OR 97308-1088

**Re: UM 1856 – PORTLAND GENERAL ELECTRIC COMPANY, Draft Storage  
Potential Evaluation**

Dear Filing Center:

On behalf of 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), PGE is filing electronic the following documents:

- **Partial Stipulation and Appendix A**
- **Joint Testimony in Support of Partial Stipulation**

Thank you for your assistance.

Sincerely,

A handwritten signature in blue ink, appearing to read "DCT", is written over the printed name of Douglas C. Tingey.

**DOUGLAS C. TINGEY**  
Associate General Counsel

DCT:bop

Enclosures

1 **BEFORE THE PUBLIC UTILITY COMMISSION**  
2 **OF OREGON**

3 UM 1856

4 In the Matter of  
5 PORTLAND GENERAL ELECTRIC  
6 COMPANY,  
7 Energy Storage Proposals and  
8 Revised Energy Storage Potential Evaluation

**PARTIAL STIPULATION**

- 9
- 10 1. This stipulation is entered into by and among the parties set forth below for the  
11 purpose of resolving all issues in this proceeding, except for the issue of third-party  
12 ownership of the Coffee Creek pilot project, and modifies Portland General Electric  
13 Company’s Energy Storage Proposals and Revised Energy Storage Potential  
14 Evaluation filed on November 1, 2017 (Application) as described by the terms herein.

15 **PARTIES**

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

22 **BACKGROUND**

- 23 3. The Public Utility Commission of Oregon (OPUC or Commission) opened Docket  
24 No. UM 1751 in September of 2015 to implement House Bill (HB) 2193, which  
25 requires large Oregon electric companies to submit proposals to develop qualifying  
26 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

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

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

7 **AGREEMENT**

8 **Terms Applicable to All Five Energy Storage Projects**

- 9 9. All energy storage systems (ESS) procured subject to this Stipulation shall have a 10-  
10 year asset life.<sup>1</sup>  
11 10. Overnight Capital Cost<sup>2</sup> caps for each of PGE’s five energy storage projects are  
12 specified in this Stipulation. In addition, revenue requirement estimates are provided  
13 below.<sup>3</sup> For avoidance of doubt, the capital cost cap for Coffee Creek shall apply  
14 regardless of the outcome of the remaining litigated issue.

15 **Pilot Costs (in millions)**

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

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

23 <sup>2</sup> Overnight capital describes the total capital investment as if the asset were delivered on a single day; it excludes  
24 interest costs associated with the construction time period such as Allowance for Funds During Construction. NPV  
25 of Revenue Requirement, in contrast, reflects an annual revenue stream over the life of the asset. This stream  
26 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).

<sup>3</sup> 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.<sup>4</sup> 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.<sup>5</sup>

24 \_\_\_\_\_  
25 <sup>4</sup> See Pacific Northwest National Laboratory, "The Salem Smart Power Center, An Assessment of Battery  
26 Performance and Economic Potential," p. 121 of PDF, p. 4.15 of report, Table 4.4 Lahiri 2017 Estimated Costs,  
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)

<sup>5</sup> 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.<sup>6</sup> 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 operation<sup>7</sup> 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  
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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 <sup>6</sup> For example, see Application at 67, 83, 98, 117, and 131.

<sup>7</sup> 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 Application<sup>8</sup> 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.<sup>9</sup> 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.

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26 <sup>8</sup> See Application at 107.

<sup>9</sup> See Application at 49.

1 23. The project must have a 17MW<sup>10</sup> 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,<sup>11</sup> 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.<sup>12</sup>

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

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

<sup>12</sup> This size is based on the information provided by PGE in its Application.



1 **Energy Storage Potential Evaluation**

2 31. Prior to implementing any of the five projects agreed to in this Stipulation, PGE will  
3 file in this docket a detailed written explanation of its plan, including incremental  
4 next steps, to advance its energy storage modeling capability to credibly estimate all  
5 benefits<sup>13</sup> associated with the proposed energy storage systems as directed in  
6 Commission Order Nos. 17-118 and 17-375. PGE’s plan must set clear milestones  
7 with explanations regarding the analysis or tool development necessary to advance its  
8 methodologies to the forefront of ESS benefit modeling; then PGE must implement  
9 those methodologies for future ESS proposals made outside of the IRP process.  
10 Finally, PGE will work with the Commission to develop best practices for the  
11 integration of energy storage modeling into its IRP process.

12 32. PGE has the freedom to determine how to design and arrive at a model that credibly  
13 estimates all ESS benefits, whether or not that includes using Pacific NW National  
14 Labs (PNNL) resources, however, Staff must approve the effectiveness of PGE’s  
15 model in meeting the requirements described in this Stipulation.

16 33. All future energy storage projects proposed by PGE, excluding the five pilots agreed  
17 to in this Stipulation, must credibly estimate (based on PGE’s reasonable best efforts;  
18 reasonable best efforts will be determined by the Commission should Staff disagree)  
19 the value of all tangible benefits, regardless of size, to retail electricity customers,  
20 including the use cases found in Commission Order No. 17-375, as well as other  
21 applicable use cases. Further, PGE will explain how the locational value of energy  
22 storage resources are considered in the IRP planning process. The Parties agree that  
23 storage modeling and deployment is currently in an iterative stage and therefore the  
24 information gained from the revised storage modeling described in paragraphs 31 and  
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<sup>13</sup>All benefits associated with each use-case, co-optimized.



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.

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1 **For PGE:**

2 Signature: \_\_\_\_\_

3 Name: \_\_\_\_\_

4 Title: \_\_\_\_\_

5 Date: \_\_\_\_\_

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9 **For CUB:**

10 Signature: \_\_\_\_\_

11 Name: \_\_\_\_\_

12 Title: \_\_\_\_\_

13 Date: \_\_\_\_\_

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16 **For NIPPC:**

17 Signature: \_\_\_\_\_

18 Name: \_\_\_\_\_

19 Title: \_\_\_\_\_

20 Date: \_\_\_\_\_

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**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: DRC Tjy  
3 Name: Doug Tingey  
4 Title: Attorney  
5 Date: 5/17/18  
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**For Staff:**

Signature: \_\_\_\_\_  
Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Date: \_\_\_\_\_

9 **For CUB:**

10 Signature: \_\_\_\_\_  
11 Name: \_\_\_\_\_  
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**For AWEC (formerly ICNU):**

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Title: \_\_\_\_\_  
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16 **For NIPPC:**

17 Signature: \_\_\_\_\_  
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**For RNW:**

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**For Staff:**

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9 **For CUB:**

**For AWEC (formerly ICNU):**

10 Signature: 

Signature: \_\_\_\_\_

11 Name: Michael Goetz

Name: \_\_\_\_\_

12 Title: Staff Attorney

Title: \_\_\_\_\_

13 Date: 5/22/18

Date: \_\_\_\_\_

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16 **For NIPPC:**

**For RNW:**

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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

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16 **For NIPPC:**

**For RNW:**

17 Signature: \_\_\_\_\_

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12 Title: \_\_\_\_\_

13 Date: \_\_\_\_\_

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16 **For NIPPC:**

17 Signature: Sidney Villanueva

18 Name: Sidney Villanueva

19 Title: Attorney

20 Date: May 18, 2018

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**For Staff:**

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**For AWEC (formerly ICNU):**

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1 **For PGE:**  
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**For Staff:**  
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**For AWEC (formerly ICNU):**  
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16 **For NIPPC:**  
17 Signature: \_\_\_\_\_  
18 Name: \_\_\_\_\_  
19 Title: \_\_\_\_\_  
20 Date: \_\_\_\_\_  
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**For RNW:**  
Signature: Sandra Fuller  
Name: Sandra Fuller  
Title: Senior Counsel & Analyst  
Date: 5/18/18

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## 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 following<sup>1</sup>:

- 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 Benefits<sup>2</sup>:
  - 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.

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<sup>1</sup> Other quantitative topics include transmission deferral, individual customer benefits, and resiliency.

<sup>2</sup> 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.<sup>3</sup>
- 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?

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

**BEFORE THE PUBLIC UTILITY COMMISSION  
OF THE STATE OF OREGON**

**UM 1856**

**PORTLAND GENERAL ELECTRIC COMPANY**

**Joint Testimony in Support of Partial Stipulation**

*Darren Murtaugh  
Seth Wiggins  
Bob Jenks  
Benjamin Fitch-Fleishmann  
Cameron Yourkowski*

**May 22, 2018**

## I. Introduction

1 **Q. Please state your names and positions.**

2 A. My name is Darren Murtaugh. I am a Manager for Portland General Electric (PGE). My  
3 qualifications appear in Exhibit PGE/300.

4 My name is Seth Wiggins. I am a Senior Utility Analyst for the Public Utility  
5 Commission of Oregon (OPUC). My qualifications appear in Exhibit Staff/101.

6 My name is Bob Jenks. I am the Executive Director of the Oregon Citizens' Utility  
7 Board (CUB). My qualifications appear in Exhibit CUB/101.

8 My name is Benjamin Fitch-Fleishmann. I am a Senior Economist with Ecosystem  
9 Research Group, LLC. I am testifying on behalf of Alliance of Western Energy Consumers  
10 (AWEC, formerly known as Industrial Customers of Northwest Utilities<sup>1</sup>) and Northwest  
11 and Intermountain Power Producers Coalition (NIPPC). My qualifications appear in Exhibit  
12 ICNU-NIPPC/100.

13 My name is Cameron Yourkowski. I am a Senior Policy Manager for Renewable  
14 Northwest (RNW). I have previously submitted testimony in this docket in Exhibit  
15 RNW/100.

16 **Q. What is the purpose of your testimony?**

17 A. The purpose of this joint testimony is to describe the terms of the partial settlement  
18 (Stipulation) reached among PGE, OPUC Staff (Staff), CUB, AWEC, NIPPC, and RNW  
19 (Parties) regarding the energy storage system (ESS) pilot projects and costs filed in this  
20 docket (UM 1856), as well as the different Party rationales for supporting the Stipulation. If  
21 a particular Party's position differs from the other Parties in this Joint Testimony, it is noted

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<sup>1</sup> The change became effective in this docket on April 2, 2018.

1 in italics. Also, should a term in the Stipulation and the Joint Testimony differ, the  
2 Stipulation shall govern.

3 **Q. What is the basis for the Stipulation?**

4 A. PGE filed its ESS proposal and Energy Storage Potential Evaluation on November 1, 2017  
5 (Application) in compliance with the House Bill (HB) 2193's January 1, 2018 deadline. On  
6 January 5, 2018, PGE submitted supplemental opening testimony in support of its  
7 Application. Parties to this docket, namely, Staff and AWEC, issued 84 data requests  
8 regarding PGE's Application and opening testimony. A stakeholder workshop, on January  
9 12, and a Commissioner workshop, on February 27, was held. On February 16, Staff, CUB,  
10 AWEC and NIPPC jointly, and RNW filed reply testimony in this docket. All Parties to this  
11 docket participated in a Settlement Conference on March 1, during which they discussed  
12 their positions and support for, and concerns regarding, certain aspects of PGE's  
13 Application. During that discussion, and over the subsequent month during settlement  
14 phone conferences, PGE accepted a number of the Parties' proposals and offered  
15 modifications regarding other proposals, while the Parties also accepted a number of PGE's  
16 suggestions. The Parties believe that the Stipulation reached represents a reasonable  
17 compromise and resolution of the issues that arose in this case, in addition to meeting the  
18 legal standard for approval outlined in HB 2193.

19 Therefore, this partial stipulation is submitted to the Commission for review in  
20 accordance with House Bill 2193 considerations that state:

21 The commission shall consider each proposal submitted under subsection  
22 (2) of this section and evaluate each proposal to determine whether the  
23 proposal:

1 (A) Is consistent with the guidelines adopted under subsection (1) of this  
2 section<sup>2</sup>;

3 (B) Reasonably balances the value for ratepayers and utility operations  
4 that is potentially derived from the application of energy storage system  
5 technology and the costs of construction, operation and maintenance of  
6 energy storage systems; and

7 (C) Is in the public interest.

8 In sum, the Stipulation reached between the six Parties represents agreements and  
9 compromises that they deemed to be reasonable resolutions for all issues in this docket,  
10 except for one, which concerns third-party ownership of the proposed Coffee Creek ESS.

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<sup>2</sup> The “guidelines adopted under subsection (1)” are the Commission’s project and proposal guidelines adopted in Order No. 16-504.

1 **Q. Please summarize the agreements that apply to all five of PGE’s proposed ESSs.**

2 A. With regard to the Parties, this Stipulation settles all issues in this docket, except for the  
3 issue of third-party ownership of the Coffee Creek ESS.

4 The settled issues that apply to all five ESSs and controls are the following:

- 5 1. All ESSs procured shall have a ten-year asset life.
- 6 2. For the purpose of prudent costs that can later be recovered from customers,  
7 overnight capital costs have been capped by the Stipulation. Operations and  
8 maintenance (O&M) costs related to the proposed ESSs have not been capped in  
9 the Stipulation; rather, they will be determined in a later prudence review that  
10 shall apply to all costs (including overnight capital) associated with the ESSs  
11 approved by the Commission. Please see paragraph 13 of the Stipulation.
- 12 3. Cost recovery method and mechanism will be determined outside of this docket.  
13 Please see paragraph 14 of the Stipulation. The Parties to the Stipulation  
14 disagreed on the appropriate cost recovery mechanism for HB 2193 pilots and  
15 therefore have decided to revisit the issue in a future proceeding if the stipulated  
16 pilots are approved and when the ESSs get closer to being in service for  
17 customers.

## II. Resolved Issues Related to All Five ESSs

1 **Q. Please describe the Stipulation regarding ESS asset life.**

2 A. PGE's initial filing provided 10- and 20-year asset lives. PGE calculated costs and benefits  
3 on a net present value (NPV) basis over a 10- and 20-year time frame for non-residential  
4 projects, and over a 10-year timeframe for the Residential pilot. The costs were derived  
5 from the request for information (RFI) issued, where vendors provided indicative pricing for  
6 ESSs of both 10- and 20-year asset lives.

7 CUB expressed that the knowledge and experience gained in the first five years should be  
8 used to evaluate what happens after ten years; thus, a ten-year asset life would provide more  
9 flexibility. Other concerns were raised about the quickly-changing pace of energy storage  
10 technology and options, and therefore some Parties were reluctant to have customers bear  
11 the risk of paying for an ESS investment with an asset life as long as 20 years.

12 **Q. How do the Parties resolve this issue?**

13 A. The Parties agree that all ESSs procured shall have a ten-year asset life.<sup>3</sup>

14 **Q. Please describe the Stipulation regarding costs to be recovered.**

15 A. PGE's initial filing proposed a total range of overnight capital costs (\$56-98 million), NPV  
16 Revenue Requirement (\$106-190 million), and Year 1 Revenue Requirement (\$12-16  
17 million). The cost range represents ESS asset lives of both 10- and 20-years. This also  
18 included \$3.2 million in NPV of Revenue Requirement for Administration and Evaluation,  
19 which would be over the course of five years.

20 Parties, specifically Staff, CUB and AWEC, expressed concerns over the large range of  
21 portfolio costs.

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<sup>3</sup> This does not limit operation of the 10-year asset beyond its useful life if it is cost effective to do so.



1 **Q. How do the Parties resolve this issue?**

2 A. The Parties agree that for the purpose of cost recovery, overnight capital costs for the five  
3 ESSs are capped in terms of the total prudently-incurred amount that can be recovered from  
4 customers, shown in Table 1 below. The cap on overnight capital costs also applies to  
5 PGE’s proposed control system<sup>4</sup> at \$2.8 million. Costs other than overnight capital costs,  
6 such as O&M costs are not capped in this Stipulation, but *all costs* are subject to prudence  
7 review. Further, Staff has included a citation to currently existing studies that identify  
8 market-based costs for similar projects that can serve as a reference point for costs. The  
9 Parties agreed that Administration and Evaluation costs are \$0 in this Stipulation, but may  
10 be forecasted in a general rate case.

**Table 1**  
**PGE’s ESS Cost Caps (in millions)**

	Overnight Capital Cost	NPV Revenue Requirement	Year 1 Revenue Requirement
Residential	\$1.5	\$5.7	\$0.7
Microgrid	2.0	2.5	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

11 **Q. If all ESSs were included in rates at their capped amount, what would the approximate**  
12 **first-year price impact be for customers?**

13 A. The first year price impact would be approximately 0.6% using the total year one revenue  
14 requirement indicated above.

15 **Q. Would the cap for Coffee Creek be impacted by resolution of the remaining litigated**  
16 **issue in this case?**

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<sup>4</sup> PGE intends to implement a control system that provides the necessary features to capture benefits associated with the use cases identified in the Storage Potential report. In order to accomplish this in the short term, PGE intends to use the existing GenOnSys software utilized by the distributed generation group. This software platform already provides many of the functions needed to interface with systems in the field. Functionality will be added to help define the requirements for a vendor supported controls platform in the near future.

1 A. No. Regardless of whether the Commission determines that third-party ownership for the  
2 Coffee Creek ESS should be an option, this project will be capped at \$30.1 million in  
3 overnight capital.

4 **Q. Please describe the Stipulation regarding cost recovery method/mechanism.**

5 A. PGE’s initial Application proposed to modify its Schedule 122 Renewable Resources  
6 Automatic Adjustment Clause (RRAAC) tariff to add ESSs as eligible resources for cost  
7 recovery.

8 Staff, CUB, AWEC, and RNW all expressed concerns regarding the modification of  
9 Schedule 122.

10 **Q. How do the Parties resolve this issue?**

11 A. The Parties agree that the method of/mechanism for cost recovery for PGE’s five ESS pilot  
12 projects is not decided in this Stipulation and will not be determined in the current  
13 proceeding in this docket. As the pilot projects get closer to being in service, PGE will file  
14 for its preferred method of cost recovery. At that time, all Parties, and new parties granted  
15 intervenor status, will have opportunities to challenge PGE’s filed method of cost recovery.

16 **Q. How does the Stipulation ensure that the pilots will produce valuable new learnings,  
17 data generation, and benefits for customers?**

18 A. Because the five projects agreed to in this Stipulation are pilots that PGE has not proven to  
19 be cost-effective at this time, Staff and other Parties emphasized the importance that these  
20 pilots result in thorough data collection, gathering of new information, and learnings that can  
21 be built upon or expanded upon as the scale of energy storage increases and the cost of  
22 energy storage decreases in the future. PGE has included Appendix A to this Stipulation to  
23 identify areas to be studied and learnings to be gained from the five pilot projects. The

1 Parties noted in the Stipulation that additional learnings may be identified and added to the  
2 list as the Parties litigate the remaining issue in this docket.

3 **Q. Did the Parties reach agreement on how the new learnings, data, and other benefits**  
4 **from the pilots will be captured and presented to the Commission?**

5 A. Yes. Staff and other Parties emphasized the importance of reporting to the Commission on  
6 the data and learnings gained from the pilots to be sure such information is regularly  
7 collected and available for use in future projects and even to improve the stipulated pilots.  
8 The Stipulation requires evaluation of all topics outlined in PGE’s Application.<sup>5</sup>

9 To make sure the Commission has regular access to pilot-related information and  
10 progress, and the opportunity to redirect if necessary, the Parties stipulated that PGE will file  
11 an annual update on the progress of the five pilot projects, and will also file a comprehensive  
12 evaluation of the pilots after the energy storage systems have been in operation<sup>6</sup> for three  
13 years, after the end of the 6th year, and after the end of the 10th year. However, the Parties  
14 made it clear that the Commission may direct PGE to include additional topics areas and  
15 data to be collected and reported in the annual update or evaluations in order to ensure that  
16 sufficient learning and data collection is achieved from the five pilot projects.

### III. Resolved ESS-Specific Issues

#### A. Baldock Mid-feeder Energy Storage System

17 **Q. Please summarize the agreements in the Stipulation regarding the Baldock Mid-feeder**  
18 **ESS project.**

19 A. The following agreements apply to PGE’s proposed Baldock Mid-feeder project:

- 20 1. The overnight capital cost cap for this project is \$2.5 million.

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<sup>5</sup> For example, see Application at 67, 83, 98, 117, and 131.

<sup>6</sup> Operation starts as of the date the first ESS is on line. Each evaluation will include all of the five energy storage projects.

- 1           2. The minimum battery size<sup>7</sup> is two megawatts (MW).
- 2           3. To be able to proceed with this pilot, PGE will present an analysis and evidence to
- 3           Staff supporting the site selection of the Baldock Mid-feeder. If Staff does not
- 4           agree that sufficient evidence supports PGE’s site selection, the decision on
- 5           whether PGE is allowed move forward with the project will be made by the
- 6           Commissioners.

7 **Q. Please describe the Stipulation regarding cost of the Baldock Mid-feeder ESS project.**

- 8 A. PGE’s initial filing proposed a range of costs based on a 10- or 20-year asset life, see Table
- 9       2 below. As stated earlier, Parties expressed concerns with the wide range of proposal costs.

**Table 2**  
**Baldock ESS Costs (in millions)**

Project	Low-Cost Estimate		High-Cost Estimate	
	Overnight Capital	Year 1 Revenue Requirement	Overnight Capital	Year 1 Revenue Requirement
Baldock Mid-feeder	\$2.8	\$0.6	\$4.1	\$1.0

10 **Q. How do the Parties resolve this issue?**

- 11 A. The Parties agree that for cost recovery purposes, the overnight capital cost for this project
- 12 shall be capped at no more than \$2.5 million. This cap is \$300,000 less than the low-end
- 13 indicated in the results of PGE’s RFI.

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<sup>7</sup> Minimum size requirements explained further in this Joint Testimony denote ESS power (in MW). Energy sizing (in MWh) is not restricted.

1 **Q. Please describe the Stipulation regarding battery size of the Baldock Mid-feeder**  
2 **project.**

3 A. PGE’s initial Application proposed a battery with a capacity of 2 MW. Staff expressed  
4 concern over the proposed sizing of the battery given the facility’s size-constrained benefits  
5 and proposed cost.

6 **Q. How do the Parties resolve this issue?**

7 A. The Parties agree that the battery size will be a minimum of 2 MW with a Commission  
8 prudence review to consider whether the battery was appropriately sized for the facility,  
9 with disallowances imposed should PGE not present compelling evidence.

10 **Q. Please describe the Stipulation regarding the site selection of the Baldock Mid-feeder**  
11 **project.**

12 A. PGE used PGE’s Integrated Planning Tool (IPT) to evaluate mid-feeder and substation sites  
13 on the system, resulting in identifying the sites for both the Baldock and Coffee Creek ESSs.  
14 Staff expressed concerns regarding PGE’s methodology in the Energy Storage Potential  
15 Evaluation and took the position that PGE had not incorporated as the requirements included  
16 in Commission Order No. 17-375.

17 **Q. How do the Parties resolve this issue?**

18 A. The Parties agree that, for settlement purposes, prior to proceeding with this pilot project,  
19 PGE will present an analysis and supporting evidence to Staff describing the site selection  
20 process of the mid-feeder for the Baldock ESS. If Staff does not agree that sufficient  
21 evidence supports the site selection, the decision on whether PGE may move forward with  
22 the project will be decided by the Commissioners.

**B. Coffee Creek Substation Energy Storage System**

1 **Q. Please summarize the agreements in the Stipulation regarding the Coffee Creek**  
2 **Substation ESS project.**

3 A. The following agreements apply to PGE’s proposed Coffee Creek Substation project:

- 4 1. The overnight capital cost cap for this project is \$30.1 million.
- 5 2. The minimum battery size will be 17 MW. PGE will present an analysis and  
6 supporting evidence to Staff supporting the site selection of the Coffee Creek  
7 substation. If Staff does not agree that sufficient evidence supports the site  
8 selection, the decision on whether PGE may move forward with the pilot project  
9 will be decided by the Commissioners.

10 **Q. Please describe the Stipulation regarding cost of the Coffee Creek Substation ESS**  
11 **project.**

12 A. PGE’s initial filing proposed a range of costs based on a 10- or 20-year asset life, see Table  
13 3 below. As stated earlier, Parties expressed concerns with the wide range of proposal costs.

Table 3  
Coffee Creek ESS Costs (in millions)

Project	Low-Cost Estimate		High-Cost Estimate	
	Overnight Capital	Year 1 Revenue Requirement	Overnight Capital	Year 1 Revenue Requirement
Coffee Creek Substation	\$30.4	\$6.7	\$35.7	\$8.2

14 **Q. How do the Parties resolve this issue?**

15 A. The Parties agree that for cost recovery purposes, the overnight capital cost for this project is  
16 capped at \$30.1 million.

1 **Q. Please describe the Stipulation regarding battery size of the Coffee Creek Substation**  
2 **project.**

3 A. PGE’s initial filing proposed a 17-20 MW ESS. Parties had expressed concern over the  
4 sizing of the battery.

5 **Q. How do the Parties resolve this issue?**

6 A. The Parties agree that for settlement purposes, the battery size will be a minimum of 17 MW  
7 with a Commission prudence review to consider whether the battery was appropriately  
8 sized.

9 **Q. Please describe the Stipulation regarding the site selection of the Coffee Creek**  
10 **Substation project.**

11 A. PGE’s Energy Storage Potential Evaluation used PGE’s Integrated Planning Tool (IPT) to  
12 identify the sites for both the Baldock and Coffee Creek ESSs. Staff expressed concerns  
13 regarding PGE’s methodology in the Energy Storage Potential Evaluation and whether PGE  
14 incorporated the requirements presented in Commission Order No. 17-375.

15 **Q. How do the Parties resolve this issue?**

16 A. The Parties agree that that prior to proceeding with this project, PGE will present an analysis  
17 and supporting evidence to Staff describing the site selection process of the substation for  
18 the Coffee Creek ESS. If Staff does not agree sufficient evidence supports the site selection,  
19 the decision on whether PGE may move forward with the project will be decided by the  
20 Commissioners.

### C. Generation Kick-Start/Port Westward

21 **Q. Please summarize the agreements in the Stipulation regarding the Generation Kick-**  
22 **Start pilot project.**

23

1 A. The following agreements apply to PGE’s proposed Generation Kick-Start pilot project:

2 1. The overnight capital cost cap for this project is \$5.3 million.

3 2. The minimum battery size is 4 MW.

4 **Q. Please describe the Stipulation regarding cost of the Generation Kick-Start project.**

5 A. PGE’s initial filing proposed a range of costs based on a 10- or 20-year asset life; see Table

6 4 below. As stated earlier, Parties expressed concerns with the wide range of proposal costs.

Table 4  
Generation Kick-Start ESS Costs (in millions)

Project	Low-Cost Estimate		High-Cost Estimate	
	Overnight Capital	Year 1 Revenue Requirement	Overnight Capital	Year 1 Revenue Requirement
Generation Kick-Start	\$5.9	\$1.4	\$7.7	\$1.9

7 **Q. How do the Parties resolve this issue?**

8 A. The Parties agree that for cost recovery purposes, the overnight capital cost for this pilot  
9 project is capped at \$5.3 million.

10 **Q. Please describe the Stipulation regarding battery size of the Generation Kick-Start  
11 project.**

12 A. PGE’s initial filing proposed a battery with a cumulative capacity of 4-6 MW. Parties  
13 expressed concern over the battery size.

14 **Q. How do the Parties resolve this issue?**

15 A. The Parties agree that the battery size will be a minimum of 4 MW.

### D. Microgrid Pilot

16 **Q. Please summarize the agreements in the Stipulation regarding the Microgrid pilot.**

17 A. The following agreements apply to PGE’s proposed Microgrid pilot:

18 1. The overnight capital cost cap for this pilot is \$2.0 million.

19 2. Participant willingness-to-pay will be part of the site selection criteria.

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



1 **Q. Please describe the Stipulation regarding cost of the Microgrid pilot.**

2 A. PGE’s initial filing proposed a range of costs based on a 10- or 20-year asset life for three to  
3 five microgrids, see Table 5 below. As stated earlier, Parties expressed concern with the  
4 wide range of proposal costs and unclear benefits associated with various numbers of  
5 microgrids.

**Table 5**  
**Microgrid ESS Costs (in millions)**

Pilot	Low-Cost Estimate		High-Cost Estimate	
	Overnight Capital	Year 1 Revenue Requirement	Overnight Capital	Year 1 Revenue Requirement
Microgrid	\$11.6	\$1.5	\$41.2	\$2.8

6 **Q. How do the Parties resolve this issue?**

7 A. The Parties agree that for cost recovery purposes, the overnight capital cost for this project is  
8 capped at \$2.0 million.

9 **Q. Please describe the Stipulation regarding participant willingness-to-pay for the**  
10 **Microgrid pilot.**

11 A. PGE’s initial Application proposed that part of the site selection criteria include the potential  
12 matching of funds (customer willingness-to-pay); however, not all criteria would be met for  
13 all of the three to five microgrids. Staff expressed the position that the distribution of  
14 benefits created by the program accrued primarily to program participants, rather than  
15 ratepayers.

16 **Q. How do the Parties resolve this issue?**

17 A. The Parties agree that participant willingness-to-pay will be part of the site selection criteria  
18 for *all* microgrids and the prudence review for this pilot project will also include an analysis  
19 of PGE’s ability to appropriately test use cases.

1 **Q. Please describe the Stipulation regarding participation of PGE’s direct access**  
2 **customers in the Microgrid pilot.**

3 A. PGE’s initial filing did not address participation of its direct access customers. AWEC and  
4 NIPPC expressed that PGE may limit this pilot to fully bundled customers, not including  
5 direct access customers.

6 **Q. How do the Parties resolve this issue?**

7 A. The Parties agree that PGE’s direct access customers are eligible to participate in this pilot.

**E. Residential Pilot**

8 **Q. Please summarize the agreements in the Stipulation regarding the Residential pilot.**

9 A. The following agreements apply to PGE’s proposed Residential pilot:

- 10 1. The overnight capital cost cap for this pilot is \$1.5 million.  
11 2. PGE will revise and resubmit this pilot proposal to include a risk mitigation  
12 strategy, a data collection plan, and an evaluation plan.

13 **Q. Please describe the Stipulation regarding cost of the Residential pilot.**

14 A. PGE’s initial filing proposed a range of costs based on a 10-year asset life, see Table 6  
15 below.

Table 6  
Residential ESS Costs (in millions)

Pilot	Low-Cost Estimate		High-Cost Estimate	
	Overnight Capital	Year 1 Revenue Requirement	Overnight Capital	Year 1 Revenue Requirement
Residential	\$2.1	\$0.8	\$6.0	\$1.6

16 **Q. How do the Parties resolve this issue?**

17 A. The Parties agree that for cost recovery purposes, the overnight capital cost for this pilot  
18 project is capped at \$2.0 million.

1 **Q. Please describe the Stipulation regarding revising the proposed Residential pilot.**

2 A. Staff expressed concerns that the details provided for PGE’s proposed Residential pilot were  
3 too vague and the learnings to be gained from this project were unclear. Staff also wanted to  
4 evaluate the sizing and confirm that the project would be dispatched as a unit.

5 **Q. How do the Parties resolve this issue?**

6 A. The Parties agree that in order for PGE to proceed with this pilot, PGE must submit a  
7 revised pilot project proposal that includes a risk mitigation strategy to manage each of the  
8 identified categories of risks listed in PGE’s Application, a data collection plan, and  
9 evaluation plan. In the event that Staff does not agree that sufficient evidence has been  
10 provided to show that PGE has determined how to re-design this pilot to manage risks and  
11 optimize pilot learnings, the decision on whether PGE may move forward with the project  
12 will be decided by the Commissioners.

### F. Energy Storage Potential Evaluation

13 **Q. Please summarize the Stipulation regarding the Energy Storage Potential Evaluation.**

14 A. PGE’s initial Application provided its Energy Storage Potential Evaluation, which was used  
15 to evaluate the opportunity for ESS development on its grid. Staff expressed concerns  
16 regarding the methodology used by PGE based on the clear Commission requirements in  
17 Commission Order No. 17-375.

18 **Q. How do the Parties resolve this issue?**

19 A. The Parties agree that prior to implementing any of the proposed ESSs, PGE will file in this  
20 docket a detailed plan to advance its ESS modeling capability to credibly estimate all  
21 benefits, co-optimized use cases, as directed in Commission Order Nos. 17-118 and 17-375.  
22 This plan will clearly break down the steps PGE is going to take to get to the effective  
23 modeling contemplated in HB 2193 and in the Commission’s orders and beyond. This much

1 improved methodology must be used for future ESS proposals, which will be made outside  
2 the IRP process for now. Staff must approve the effectiveness of PGE’s model in meeting  
3 the requirements described in the Stipulation. Please see paragraph 31-33 of the Stipulation  
4 for additional detail.

5           Additionally, an explanation of how the locational value of energy storage  
6 resources are considered in PGE’s Integrated Resource Planning (IRP) process will be  
7 provided in PGE’s IRP process going forward. Further, the requirements discussed about  
8 revised storage modeling (described in paragraph 31 and 32) will be incorporated into  
9 PGE’s IRP process based on PGE’s best efforts, and in a manner consistent with the  
10 Commission’s IRP orders and rules.

#### IV. Conclusion

1 **Q. Are there any issues in this docket that are unresolved by the Stipulation?**

2 A. Yes. The single remaining issue to be resolved, which the Parties agree to litigate using the  
3 currently-adopted procedural schedule in this docket, is whether PGE should be required to  
4 allow third-party ownership options for the Coffee Creek ESS in its request for proposal  
5 (RFP) process.

6 **Q. What do the Parties recommend to the Commission regarding their adjustments and  
7 modifications to PGE’s filed ESS pilots and projects, and Energy Storage Potential  
8 Evaluation?**

9 A. The Parties recommend and request that the Commission approve PGE’s proposed ESS  
10 pilots and projects, subject to the adjustments and revisions agreed to in the Stipulation.  
11 Based on careful review of PGE’s Application, consideration of PGE’s responses to 84 data  
12 requests, and vetting of the issues during settlement discussions, the adjustments made to the  
13 Application by the Parties represent appropriate and reasonable resolutions of the issues in  
14 this docket. Customer rates reflecting these adjustments will be fair, just, and reasonable.

15 **Q. How does the Stipulation meet the three requirements for Commission consideration  
16 outlined in HB 2193 according to PGE?**

17 A. HB 2193 asks the Commission to evaluate each utility ESS proposal to determine whether  
18 the proposal: (1) is consistent with the adopted guidelines, (2) reasonably balances the value  
19 for customers and the costs and benefits of the ESS, and (3) is in the public interest. PGE’s  
20 Application as modified by the Stipulation satisfies all of the legislative requirements.

21 First, PGE’s Application, as modified by the Stipulation, is consistent with the  
22 guidelines in HB 2193. Although the projects are modified by the Stipulation, all of the  
23 projects proposed by PGE are part of the Stipulation. PGE’s Application and supporting

1 testimony included in PGE Exhibits 100 and 200 provide in depth explanations of how the  
2 projects meet the guidelines. The Stipulation doesn't compromise any of those  
3 explanations.

4 Second, PGE's Application, as modified by the Stipulation, provides a reasonable  
5 balance between the value for customers and the costs and benefits of the ESS. PGE  
6 provided in depth analysis of the costs and benefits of its proposed projects. The Stipulation  
7 provides capital cost caps that are at or below the low range of estimates indicated in the  
8 results of PGE's RFI.

9 Finally, PGE's Application, as modified by the Stipulation, is one part of an integrated  
10 approach to supporting customer's clean energy goals. In addition to complying with HB  
11 2193, the Stipulation helps PGE develop projects to learn about storage and its varied uses,  
12 system impacts, customer benefits, operational impacts, and distribution system benefits.  
13 PGE is committed to building a cleaner energy future for Oregon, and ESSs can provide a  
14 range of grid services to support the transition to that clean energy future while meeting  
15 customers' growing demands for resilient power. The projects allow PGE and stakeholders  
16 to best understand the approaches to storage that might make the most sense in the future.  
17 These learnings will inform future integration of energy storage system, ensure that PGE can  
18 effectively operationalize energy storage system on its grid, and maximize the benefits from  
19 future storage systems. PGE's Application, as modified by the Stipulation, helps enable the  
20 pathway to achieve Oregon's clean energy goals and thus, is in the public interest.

21 **Q. Why does PGE support the Stipulation?**

22 A. PGE supports the Stipulation as it provides an opportunity for us to learn how to deploy ESS  
23 resources that provide immediate value to the system and teach us about procuring,  
24 enabling, controlling, integrating, and evaluating individual ESS resources and aggregated

1 distributed ESS fleets. This will give us more information to support the efficient  
2 development and utilization of ESS in the future, as the need for system flexibility and  
3 distribution services continues to increase. ESS resources can be rapidly dispatched,  
4 deployed at large or very small scales due to their modularity, can be relatively easily sited  
5 and quickly developed, and have zero direct emissions. For these reasons, they have the  
6 potential to provide the types of balancing and distribution services that are increasingly  
7 needed on our system, while supporting the environmental and resiliency goals of the local  
8 communities we serve.

9 **Q. Why does Staff Support the Stipulation?**

10 A. Staff supports the Stipulation because it provides an opportunity to grow PGE’s capability in  
11 development and deployment of ESS pilots at reasonable cost to ratepayers. The potential of  
12 battery storage to improve many challenges in reliability, affordability, and sustainability is  
13 immense, but significant operational and economic challenges remain at this point in time.  
14 The individual pilot projects agreed to by the Parties, and PGE’s storage potential  
15 evaluation, offer a method of exploration: the market stimulation and learnings associated  
16 with the ESS procurement in this Stipulation will increase PGE’s ability to locate additional  
17 storage opportunities on its system, especially when it implements the changes required by  
18 the Stipulation to further develop the Energy Storage Potential Evaluation model. Staff  
19 expects the increase in customer rates today to be eclipsed by the benefits that well-  
20 integrated ESSs can provide for ratepayers in the future. Accordingly, Staff is supportive of  
21 the agreements reached in the Stipulation.

22 *The project proposals reached in the Stipulation are consistent with*  
23 *the Commission’s project and proposal guidelines.*  
24

25 In its reply testimony, Staff expressed concerns that both the storage potential evaluation  
26 and PGE’s individual projects did not uphold the Commission’s established guidelines.

1 These concerns have been alleviated by the changes to the programs that PGE and the other  
2 Parties agreed to, as well as the additional analyses described below, which PGE will  
3 provide to Staff going forward. Together, these modifications to PGE’s original storage  
4 potential evaluation and individual project proposals make Staff comfortable that the overall  
5 proposal upholds the guidelines from Order No. 16-504.

6 With regard to the comprehensive energy storage potential evaluation required by HB  
7 2193 (2015), Staff was initially concerned that PGE’s revised storage potential evaluation  
8 did not credibly estimate the ex-ante benefits associated with ESS. This concern is now  
9 mitigated because the Stipulation requires that PGE provide a detailed implementation plan  
10 to advance its modeling capacity, to be approved by Staff. Further, PGE will work with the  
11 Commission to develop best practices for ESS integration, and explain how locational  
12 values are incorporated into its IRP process. Staff believes this is an acceptable compromise,  
13 and that it will lead to the highest level of cost-effective battery storage development.

14 In its reply testimony, Staff articulated a number of concerns relating to individual  
15 projects not complying with specific Commission guidelines. For both the Baldock and  
16 Coffee Creek project locations, Staff explained that PGE did not provide evidence of how  
17 and why these two projects presented the best opportunity for piloting an ESS, for example,  
18 why were these particular locations selected over all other possible locations with seemingly  
19 equal or better learning opportunities? To address this concern, the Parties have agreed that  
20 PGE must offer sufficient evidence as to why the two locations present the best  
21 opportunities to develop ESSs in PGE’s network before PGE is allowed to proceed with  
22 these two projects.

23 Staff also presented a number of concerns in its reply testimony in relation to the  
24 Microgrid and Residential pilot projects. Staff is now comfortable with the Microgrid pilot



1 agreed to in the Stipulation because it is accompanied with a requirement that willingness-  
2 to-pay be a part of the selection criteria, as it should help make participant contributions as  
3 large as possible. Staff is also satisfied that the Residential pilot will not move forward until  
4 new plans for risk mitigation, additional data collection, and evaluation are presented to the  
5 Commission.

6 *PGE's proposals reasonably balance the value and costs associated with the ESS.*

7 A number of agreements in this Stipulation have improved the balance between value of  
8 the ESS and costs that make the costs of the pilots more appropriate for customers to bear.  
9 By negotiating, compromising, and agreeing to the new cost-caps on overnight capital for  
10 each of the five pilots, the Parties have limited cost-overflow exposure, and reduced the total  
11 estimated capital cost of the proposals in aggregate from a range of \$55.8-97.8 million to  
12 maximum of \$44.2 million. Likewise, the Stipulation clearly expresses that a prudence  
13 review that will occur for all pilot costs when PGE goes to recover costs from customers.  
14 Further, for three of the projects, the Parties have required minimum battery capacity  
15 requirements, which should help keep the cost per MW relatively low. The remaining pilots  
16 (Microgrid and Residential), as mentioned above, will be supplemented by either customer  
17 financing or a comprehensive reevaluation.

18 Finally, determining the appropriate size is critical to balance the costs and benefits for  
19 individual ESS pilots; a project sized too small will fail to capture important learnings, and  
20 significant redundancies can increase cost for little benefit. Staff is satisfied that each of the  
21 five pilots have either been sized more appropriately through the Stipulation or will not  
22 progress until further sizing analysis is completed and verified. Together, these stipulated  
23 additions to PGE's proposal will provide higher value from the pilots while keeping  
24 ratepayer contributions to a minimum.

*PGE’s proposal is in the public interest.*

1  
2           Conditional on each of the stipulated terms being met, Staff believes the benefits of  
3 each pilot project will outweigh the associated costs. Each project will provide PGE with  
4 tangible experience with the procurement, installation, operation, and evaluation of ESSs  
5 within its electricity network. Further, increased demand for ESSs at the utility-, residential-,  
6 and commercial-level should assist with stimulating the battery storage market, leading to  
7 increased capacity and lower costs overall.

8           Further, each individual project is designed to provide additional benefits. First, the Port  
9 Westward pilot should provide a valuable means to evaluate a generation-located ESS  
10 project that, based on its sizing, is scalable within PGE’s generation fleet. Second, the  
11 Coffee Creek ESS size and location will provide significant learning in the capabilities of a  
12 sub-station located ESS. Third, the Baldock facility will provide similar learnings at the  
13 feeder-level, and provides the ability to pair storage with renewable generation. Fourth, the  
14 Residential pilot will increase the ability of PGE to develop and integrate behind-the-meter  
15 ESSs. Finally, the Microgrid pilot will evaluate customer-sited ESS operation, as well as  
16 gauge customer willingness to pay for this type of service offering.

17           Aggregated together, these benefits are expected to significantly increase PGE’s ability  
18 to operate and further deploy battery storage on its grid. This would be extremely beneficial  
19 to the public and causes no harm to utility customers. Importantly, utility-scale battery  
20 storage has the potential to solve the limitation caused by the intermittency of renewable  
21 resource-based generation, providing a method of widespread reliable, least-cost, and  
22 carbon-free generation.

1 **Q. Why does CUB support the Stipulation?**

2 A. CUB supports the Stipulation because it directly addresses each of the concerns CUB had  
3 concerning PGE’s original proposal. CUB believes that the Stipulation represents a reasonable  
4 compromise of issues raised in this proceeding, meets the legal standard delineated in HB 2193,  
5 and is in the public interest. Moreover, it is intended to maximize PGE’s understanding of the  
6 impacts of various ESS’s on its system while mitigating costs to customers. In Reply Testimony,  
7 CUB gave general support for energy storage pilot programs. While energy storage is not cost  
8 effective today, it will likely play an important role for utilities as coal plants are phased out and  
9 replaced by intermittent renewable resources. ESS’s have the potential to add great flexibility to  
10 PGE’s system.

11 However, CUB was concerned that PGE was proposing a large investment in energy  
12 storage that went beyond what was necessary to gain knowledge and experience. PGE proposed  
13 a 20-year life, when most of the knowledge and experience would be gathered in the first 5 years  
14 and PGE was proposing multiple microgrids and hundreds of residential storage units without  
15 showing that that how were needed in order to gain the knowledge and experience that was  
16 expected from the pilot. The Stipulation addresses these concerns by limiting the life of the  
17 pilots to 10 years, and scaling back the size of the projects to insure that they are properly sized  
18 for the goals of the pilot. The only concern of CUB that was not addressed is the cost recovery  
19 mechanism. CUB opposed using the Renewable Resources Automatic Adjustment Clause by  
20 expanding it to include the energy storage pilots at issue here, as was PGE’s proposal. The  
21 parties agreed that this issue can be taken up when PGE files for recovery of the costs associated  
22 with this pilot. While these storage investments are not expected to be cost effective, CUB  
23 believes that with the adjustments contained in the stipulation that they are prudent because there  
24 is a need to learn about what storage can contribute to a utility’s system.

1  
2 CUB evaluated PGE’s original proposal and testified to our concerns in our Reply Testimony.  
3

4 **Q. Why does AWEC support the Stipulation?**

5 A. AWEC supports the stipulation because it provides PGE with the opportunity to increase its  
6 understanding of a variety of energy storage projects while appropriately balancing the  
7 impact to customer rates. AWEC was significantly concerned with the potential rate  
8 impacts for customers in PGE’s initial filing. By capping overnight capital costs, this  
9 provides customers with assurances over the potential cost increases they could be exposed  
10 to from these projects, which on the high end AWEC considers to be reasonable. The  
11 Stipulation also leaves unresolved the issue of third-party ownership for the Coffee Creek  
12 ESS, the most expensive of PGE’s proposed projects. If third-party ownership is allowed,  
13 this could reduce the costs for customers further.

14 Additionally, AWEC had concerns over PGE’s proposal to modify its RAC to include  
15 these energy storage projects, which AWEC did not believe qualified for recovery through  
16 an automatic adjustment clause. The Stipulation removes resolution of cost recovery issues  
17 from this docket and defers them to the time closer to when PGE places these projects in  
18 service. Finally, while AWEC supported PGE’s proposed microgrid projects, it felt that  
19 such projects should be made available to direct access customers as this increases the pool  
20 of potential customers that could provide ideal learning opportunities for PGE. The  
21 Stipulation includes AWEC’s recommendation on this issue.

22 **Q. Why does NIPPC support the Stipulation?**

23 A. NIPPC supports the Stipulation in recognition of the important role storage has to play in the  
24 energy market going forward. HB 2193 correctly identifies the significant value ESS  
25 projects offer with respect to improved integration of variable resources, meeting peak

1 capacity needs, frequency regulation, reliability and resiliency. As an advocate for  
2 competitive markets, NIPPC expressed concern that PGE was not considering third-party  
3 ownership options for its ESS projects, and particularly in the Coffee Creek project—due to  
4 the size of that project and the size of the costs projected by PGE. Because competition  
5 lowers prices, increased competition will make PGE’s projects cost effective. The  
6 Commission’s proposal guidelines require PGE to explain its reasoning for the ownership  
7 structure of each project proposed and PGE has since provided a rationale. HB 2193  
8 authorizes the Commission to require PGE to develop any authorized projects in accordance  
9 with any competitive bidding guidelines prescribed by the Commission. Because the issue  
10 of competitive bidding will be addressed separately, NIPPC supports this Stipulation to  
11 encourage PGE to make the types investments in storage anticipated by HB 2193. NIPPC  
12 believes ESS investments will enhance regionalization and lead to a robust capacity market,  
13 both of which are in the public interest. Thus, NIPPC sees PGE’s ESS pilots as an important  
14 first step.

15 **Q. Why does RNW support the Stipulation?**

16 A. RNW supports the Stipulation because of the value of PGE’s proposed projects to PGE and  
17 its customers and because this process will help PGE, stakeholders, the Commission, and  
18 Commission Staff increase their experience with modeling and evaluating the benefits of  
19 ESSs.

20 ESSs are the next pillar of a cleaner, more efficient, and more reliable electric grid.  
21 They can provide a wide range of benefits to utilities, customers, society, and the  
22 environment. For example, they can add value to utility portfolios through the provision of  
23 capacity, ramping, transmission deferral, ancillary services, and improved reliability and  
24 resiliency. As such, ESSs add important flexibility and responsiveness to a utility’s system,

1 facilitating more cost-effective renewable energy integration and carbon dioxide emissions  
2 reductions.

3 ESSs present unique modeling challenges in resource planning and procurement  
4 processes because they can provide so many services across all aspects of the utility's  
5 business. The methods for fully capturing all of those potential benefits across the  
6 generation and transmission business lines within the resource planning and procurement  
7 framework are still developing in the Northwest. The agreement on storage potential  
8 evaluations that is reflected in this Stipulation helps advance the development of those  
9 methods for PGE.

10 Finally, RNW supports this Stipulation because the proposed projects comply with the  
11 Commission's guidelines for this program, reasonably balance the costs and benefits to  
12 customers, and are in the public interest.

13 **Q. Does this complete your joint-testimony?**

14 **A. Yes.**