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 the following documents:

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

Thank you for your assistance.

Sincerely,

[Signature]
DOUGLAS C. TINGEY
Associate General Counsel

DCT:bop

Enclosures
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

4. On July 14, 2017, PGE filed, with the OPUC, its Draft Energy Storage Potential Evaluation, which subsequently opened Docket No. UM 1856. Staff and stakeholders reviewed this draft and made recommendations to the Commission through a Staff Report. In Order No. 17-375, the Commission adopted the following schedule: (1) by January 1, 2018, PGE and PacifiCorp were to file draft project proposals and updated draft storage potential evaluations that incorporated the improvements outlined by Staff in its Report; (2) by April 2, 2018, the utilities were to file final project proposals and final storage potential evaluations; (3) no later than April 2, 2018, the Commission would begin review of the final filings.

5. PGE filed its final ESS Project Proposals and Energy Storage Potential Evaluation on November 1, 2017 (Application). A contested case procedural schedule was set for evaluation of PGE’s Application. On January 5, 2018, PGE submitted supplemental opening testimony in support of its Application. In the following two months, Staff and AWEC sent 84 data requests regarding PGE’s filing, to which PGE responded. On February 16, Staff, 2018, CUB, AWEC, NIPPC, and RNW filed written reply testimony.

6. On January 12, 2018 a stakeholder workshop was held. Likewise, on February 27, 2018, a Commissioner workshop was held.

7. All parties were invited to participate in a settlement conference on March 1, 2018. All parties to this docket attended with the exception of the Community Renewable 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.

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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.
11. For cost recovery purposes, overnight capital costs for controls are capped at $2.8M for all projects.

12. Administration and Evaluation costs are $0 in this Stipulation, but may be forecasted in a general rate case.

13. All costs for the five energy storage pilot projects agreed to in this Stipulation are subject to the standard prudence review. This means that PGE will still be required to show that spending up to the overnight capital cost caps is prudent. 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. Staff notes that current studies, such as Pacific Northwest National Laboratory’s (PNNL) “Assessment of Battery Performance and Economic Potential” are known and currently available sources of market based reference points for O&M and other costs.\(^4\) PGE has confirmed that O&M will not be capitalized.

14. The method of/mechanism for cost recovery for PGE’s five energy storage pilot projects is not decided in this Stipulation and will not be determined in the current proceeding in this docket. As the pilot projects get closer to being in service, PGE will file for its preferred method of cost recovery. At that time, all Parties to this Stipulation, and any new parties granted intervenor status, will have an opportunity to litigate their position on the appropriate method of/mechanism for cost recovery. This Stipulation does not limit any Party in their argument on cost recovery, including whether cost recovery should occur through a general rate case only, PGE’s Renewable Resource Automatic Adjustment Clause (RRAAC), a new automatic adjustment clause, or other method.\(^5\)


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

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

The Five Energy Storage Projects

Residential Pilot

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

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

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As such, the Parties may address PGE’s proposed revision in UE 335, but the method of cost recovery for the UM 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.

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

*Operation starts as of the date the first ESS is on line. Each evaluation will include all of the five energy storage projects.*
manages risks and optimizes learnings. 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.

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

**Microgrid Pilot**

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

21. Participant willingness to pay will be part of the site selection criteria.\(^9\) PGE is not limited to a specified number of microgrids, however, 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.

**Coffee Creek Pilot**

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

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\(^8\) See Application at 107.

\(^9\) See Application at 49.
23. The project must have a 17MW\textsuperscript{10} minimum battery size, however, PGE is aware that the project will undergo a prudence review that will consider whether the battery was correctly sized for the substation.

24. 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.

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

Baldock Pilot

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

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

28. To be able to proceed with this project, PGE must first present an analysis to Staff, supported by adequate evidence, that Baldock is the best site to locate the energy storage system given the universe of available feeders on 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.

Port Westward Pilot

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

30. The project must have a 4MW minimum battery size.\textsuperscript{12}

\textsuperscript{10}This size is based on the information provided by PGE in its Application.

\textsuperscript{11}This size is based on the information provided by PGE in its Application.

\textsuperscript{12}This size is based on the information provided by PGE in its Application.
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 benefits\textsuperscript{13} 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

\textsuperscript{13}All 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
settlement conferences in this docket, and conduct or statements made at settlement
conferences, are confidential and not admissible in the instant or any subsequent
proceeding, unless independently discoverable or offered for other purposes allowed
under ORS 40.190.

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

41. This Stipulation may be executed in counterparts and each signed counterpart shall
constitute an original document.
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For NIPPC:

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Name: Sidney Villanueva
Title: Attorney
Date: May 18, 2018

For RNW:

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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:

- 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:
  - 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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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
   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.
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

Q. Please state your names and positions.

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


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

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

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

Q. What is the purpose of your testimony?

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

1 The change became effective in this docket on April 2, 2018.
in italics. Also, should a term in the Stipulation and the Joint Testimony differ, the
Stipulation shall govern.

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

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

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

> The commission shall consider each proposal submitted under subsection

(2) of this section and evaluate each proposal to determine whether the

proposal:
(A) Is consistent with the guidelines adopted under subsection (1) of this section;

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

(C) Is in the public interest.

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

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2 The “guidelines adopted under subsection (1)” are the Commission’s project and proposal guidelines adopted in Order No. 16-504.
Q. Please summarize the agreements that apply to all five of PGE’s proposed ESSs.

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

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

1. All ESSs procured shall have a ten-year asset life.

2. For the purpose of prudent costs that can later be recovered from customers, overnight capital costs have been capped by the Stipulation. Operations and maintenance (O&M) costs related to the proposed ESSs have not been capped in the Stipulation; rather, they will be determined in a later prudence review that shall apply to all costs (including overnight capital) associated with the ESSs approved by the Commission. Please see paragraph 13 of the Stipulation.

3. Cost recovery method and mechanism will be determined outside of this docket. Please see paragraph 14 of the Stipulation. The Parties to the Stipulation disagreed on the appropriate cost recovery mechanism for HB 2193 pilots and therefore have decided to revisit the issue in a future proceeding if the stipulated pilots are approved and when the ESSs get closer to being in service for customers.
II. Resolved Issues Related to All Five ESSs

Q. Please describe the Stipulation regarding ESS asset life.

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

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

Q. How do the Parties resolve this issue?

A. The Parties agree that all ESSs procured shall have a ten-year asset life. 3

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

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

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

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3 This does not limit operation of the 10-year asset beyond its useful life if it is cost effective to do so.
Q. How do the Parties resolve this issue?

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

<table>
<thead>
<tr>
<th>Table 1</th>
<th>PGE’s ESS Cost Caps (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overnight Capital Cost</td>
</tr>
<tr>
<td>Residential</td>
<td>$1.5</td>
</tr>
<tr>
<td>Microgrid</td>
<td>2.0</td>
</tr>
<tr>
<td>Coffee Creek</td>
<td>30.1</td>
</tr>
<tr>
<td>Baldock</td>
<td>2.5</td>
</tr>
<tr>
<td>Generation</td>
<td>5.3</td>
</tr>
<tr>
<td>Controls</td>
<td>2.8</td>
</tr>
<tr>
<td>Total</td>
<td>$44.2</td>
</tr>
</tbody>
</table>

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

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

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

4 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.
A. No. Regardless of whether the Commission determines that third-party ownership for the
Coffee Creek ESS should be an option, this project will be capped at $30.1 million in
overnight capital.

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

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

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

Q. How do the Parties resolve this issue?

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

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

A. Because the five projects agreed to in this Stipulation are pilots that PGE has not proven to
be cost-effective at this time, Staff and other Parties emphasized the importance that these
pilots result in thorough data collection, gathering of new information, and learnings that can
be built upon or expanded upon as the scale of energy storage increases and the cost of
energy storage decreases in the future. PGE has included Appendix A to this Stipulation to
identify areas to be studied and learnings to be gained from the five pilot projects. The
Parties noted in the Stipulation that additional learnings may be identified and added to the list as the Parties litigate the remaining issue in this docket.

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

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

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

III. Resolved ESS-Specific Issues

A. Baldock Mid-feeder Energy Storage System

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

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

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

\(^5\) For example, see Application at 67, 83, 98, 117, and 131.

\(^6\) Operation starts as of the date the first ESS is on line. Each evaluation will include all of the five energy storage projects.
2. The minimum battery size\(^7\) is two megawatts (MW).

3. To be able to proceed with this pilot, PGE will present an analysis and evidence to Staff supporting the site selection of the Baldock Mid-feeder. If Staff does not agree that sufficient evidence supports PGE’s site selection, the decision on whether PGE is allowed move forward with the project will be made by the Commissioners.

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

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

<table>
<thead>
<tr>
<th>Project</th>
<th>Low-Cost Estimate</th>
<th>High-Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overnight Capital</td>
<td>Year 1 Revenue Requirement</td>
</tr>
<tr>
<td>Baldock Mid-feeder</td>
<td>$2.8</td>
<td>$0.6</td>
</tr>
</tbody>
</table>

Q. How do the Parties resolve this issue?

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

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\(^7\) Minimum size requirements explained further in this Joint Testimony denote ESS power (in MW). Energy sizing (in MWh) is not restricted.
Q. Please describe the Stipulation regarding battery size of the Baldock Mid-feeder project.

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

Q. How do the Parties resolve this issue?

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

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

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

Q. How do the Parties resolve this issue?

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

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

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

1. The overnight capital cost cap for this project is $30.1 million.

2. The minimum battery size will be 17 MW. PGE will present an analysis and supporting evidence to Staff supporting the site selection of the Coffee Creek substation. If Staff does not agree that sufficient evidence supports the site selection, the decision on whether PGE may move forward with the pilot project will be decided by the Commissioners.

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

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

<table>
<thead>
<tr>
<th>Project</th>
<th>Low-Cost Estimate</th>
<th>High-Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overnight Capital</td>
<td>Year 1 Revenue Requirement</td>
</tr>
<tr>
<td>Coffee Creek Substation</td>
<td>$30.4</td>
<td>$6.7</td>
</tr>
</tbody>
</table>

Q. How do the Parties resolve this issue?

A. The Parties agree that for cost recovery purposes, the overnight capital cost for this project is capped at $30.1 million.
Q. Please describe the Stipulation regarding battery size of the Coffee Creek Substation project.

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

Q. How do the Parties resolve this issue?

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

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

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

Q. How do the Parties resolve this issue?

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

C. Generation Kick-Start/Port Westward

Q. Please summarize the agreements in the Stipulation regarding the Generation Kick-Start pilot project.
A. The following agreements apply to PGE’s proposed Generation Kick-Start pilot project:

1. The overnight capital cost cap for this project is $5.3 million.
2. The minimum battery size is 4 MW.

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

A. PGE’s initial filing proposed a range of costs based on a 10- or 20-year asset life; see Table 4 below. As stated earlier, Parties expressed concerns with the wide range of proposal costs.

<table>
<thead>
<tr>
<th>Project</th>
<th>Low-Cost Estimate</th>
<th>High-Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overnight Capital</td>
<td>Year 1 Revenue</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requirement</td>
</tr>
<tr>
<td>Generation Kick-Start</td>
<td>$5.9</td>
<td>$1.4</td>
</tr>
</tbody>
</table>

Q. How do the Parties resolve this issue?

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

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

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

Q. How do the Parties resolve this issue?

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

D. Microgrid Pilot

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

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

1. The overnight capital cost cap for this pilot is $2.0 million.
2. Participant willingness-to-pay will be part of the site selection criteria.
3. Participation in this pilot will be open to PGE’s direct access customers.
Q. Please describe the Stipulation regarding cost of the Microgrid pilot.

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

Table 5
Microgrid ESS Costs (in millions)

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Low-Cost Estimate</th>
<th>High-Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microgrid</td>
<td>Overnight Capital</td>
<td>Year 1 Revenue</td>
</tr>
<tr>
<td></td>
<td>$11.6</td>
<td>$1.5</td>
</tr>
<tr>
<td>Microgrid</td>
<td>Overnight Capital</td>
<td>Year 1 Revenue</td>
</tr>
<tr>
<td></td>
<td>$41.2</td>
<td>$2.8</td>
</tr>
</tbody>
</table>

Q. How do the Parties resolve this issue?

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

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

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

Q. How do the Parties resolve this issue?

A. The Parties agree that participant willingness-to-pay will be part of the site selection criteria for all microgrids and the prudence review for this pilot project will also include an analysis of PGE's ability to appropriately test use cases.
Q. Please describe the Stipulation regarding participation of PGE’s direct access customers in the Microgrid pilot.

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

Q. How do the Parties resolve this issue?

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

E. Residential Pilot

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

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

1. The overnight capital cost cap for this pilot is $1.5 million.

2. PGE will revise and resubmit this pilot proposal to include a risk mitigation strategy, a data collection plan, and an evaluation plan.

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

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

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Low-Cost Estimate</th>
<th>High-Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overnight Capital</td>
<td>Year 1 Revenue</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requirement</td>
</tr>
<tr>
<td>Residential</td>
<td>$2.1</td>
<td>$0.8</td>
</tr>
</tbody>
</table>

Q. How do the Parties resolve this issue?

A. The Parties agree that for cost recovery purposes, the overnight capital cost for this pilot project is capped at $2.0 million.
Q. Please describe the Stipulation regarding revising the proposed Residential pilot.

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

Q. How do the Parties resolve this issue?

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

F. Energy Storage Potential Evaluation

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

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

Q. How do the Parties resolve this issue?

A. The Parties agree that prior to implementing any of the proposed ESSs, PGE will file in this docket a detailed plan to advance its ESS modeling capability to credibly estimate all benefits, co-optimized use cases, as directed in Commission Order Nos. 17-118 and 17-375. This plan will clearly break down the steps PGE is going to take to get to the effective modeling contemplated in HB 2193 and in the Commission’s orders and beyond. This much
improved methodology must be used for future ESS proposals, which will be made outside the IRP process for now. Staff must approve the effectiveness of PGE’s model in meeting the requirements described in the Stipulation. Please see paragraph 31-33 of the Stipulation for additional detail.

Additionally, an explanation of how the locational value of energy storage resources are considered in PGE’s Integrated Resource Planning (IRP) process will be provided in PGE’s IRP process going forward. Further, the requirements discussed about revised storage modeling (described in paragraph 31 and 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.
IV. Conclusion

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

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

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

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

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

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

First, PGE’s Application, as modified by the Stipulation, is consistent with the guidelines in HB 2193. Although the projects are modified by the Stipulation, all of the projects proposed by PGE are part of the Stipulation. PGE’s Application and supporting
testimony included in PGE Exhibits 100 and 200 provide in depth explanations of how the projects meet the guidelines. The Stipulation doesn’t compromise any of those explanations.

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

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

Q. Why does PGE support the Stipulation?

A. PGE supports the Stipulation as it provides an opportunity for us to learn how to deploy ESS resources that provide immediate value to the system and teach us about procuring, enabling, controlling, integrating, and evaluating individual ESS resources and aggregated
distributed ESS fleets. This will give us more information to support the efficient
development and utilization of ESS in the future, as the need for system flexibility and
distribution services continues to increase. ESS resources can be rapidly dispatched,
deployed at large or very small scales due to their modularity, can be relatively easily sited
and quickly developed, and have zero direct emissions. For these reasons, they have the
potential to provide the types of balancing and distribution services that are increasingly
needed on our system, while supporting the environmental and resiliency goals of the local
communities we serve.

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

_The project proposals reached in the Stipulation are consistent with
the Commission’s project and proposal guidelines._

In its reply testimony, Staff expressed concerns that both the storage potential evaluation
and PGE’s individual projects did not uphold the Commission’s established guidelines.
These concerns have been alleviated by the changes to the programs that PGE and the other Parties agreed to, as well as the additional analyses described below, which PGE will provide to Staff going forward. Together, these modifications to PGE’s original storage potential evaluation and individual project proposals make Staff comfortable that the overall proposal upholds the guidelines from Order No. 16-504.

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

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

Staff also presented a number of concerns in its reply testimony in relation to the Microgrid and Residential pilot projects. Staff is now comfortable with the Microgrid pilot
agreed to in the Stipulation because it is accompanied with a requirement that willingness-to-pay be a part of the selection criteria, as it should help make participant contributions as large as possible. Staff is also satisfied that the Residential pilot will not move forward until new plans for risk mitigation, additional data collection, and evaluation are presented to the Commission.

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

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

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

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

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

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

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

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

Q. Why does AWEC support the Stipulation?

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

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

Q. Why does NIPPC support the Stipulation?

A. NIPPC supports the Stipulation in recognition of the important role storage has to play in the energy market going forward. HB 2193 correctly identifies the significant value ESS projects offer with respect to improved integration of variable resources, meeting peak
capacity needs, frequency regulation, reliability and resiliency. As an advocate for competitive markets, NIPPC expressed concern that PGE was not considering third-party ownership options for its ESS projects, and particularly in the Coffee Creek project—due to the size of that project and the size of the costs projected by PGE. Because competition lowers prices, increased competition will make PGE’s projects cost effective. The Commission’s proposal guidelines require PGE to explain its reasoning for the ownership structure of each project proposed and PGE has since provided a rationale. HB 2193 authorizes the Commission to require PGE to develop any authorized projects in accordance with any competitive bidding guidelines prescribed by the Commission. Because the issue of competitive bidding will be addressed separately, NIPPC supports this Stipulation to encourage PGE to make the types investments in storage anticipated by HB 2193. NIPPC believes ESS investments will enhance regionalization and lead to a robust capacity market, both of which are in the public interest. Thus, NIPPC sees PGE’s ESS pilots as an important first step.

Q. Why does RNW support the Stipulation?

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

ESSs are the next pillar of a cleaner, more efficient, and more reliable electric grid. They can provide a wide range of benefits to utilities, customers, society, and the environment. For example, they can add value to utility portfolios through the provision of capacity, ramping, transmission deferral, ancillary services, and improved reliability and resiliency. As such, ESSs add important flexibility and responsiveness to a utility’s system,
facilitating more cost-effective renewable energy integration and carbon dioxide emissions reductions.

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

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

Q. Does this complete your joint-testimony?

A. Yes.