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V. Denise Saunders
Associate General Counsel

November 9, 2017

Via Electronic Filing

Oregon Public Utility Commission
Attention: Filing Center
PO Box 1088
Salem OR 97308-1088

Re: LC 66 – Portland General Electric Company 2016 Integrated Resource Plan (IRP)

Dear Filing Center:

In Order 17-386, the Commission acknowledged all action items in Portland General Electric Company's (PGE's) 2016 Integrated Resource Plan (IRP) except for one action item related to PGE's renewable resource procurement. The Commission agreed that it would allow PGE the opportunity to file a revised action plan regarding renewable resource procurement and present that to the Commission. Consistent with the Commission's order, PGE submits for filing an addendum to the 2016 IRP with a revised renewable action plan.

PGE asks that the Commission acknowledge the revised renewable action plan at the December 18, 2017 Public Meeting. This will allow PGE the opportunity to take advantage of the expiring Production Tax Credit (PTC) by issuing a request for proposals (RFP) in early 2018.

Thank you.

Sincerely,

A handwritten signature in blue ink that reads "V. Denise Saunders". The signature is written in a cursive, flowing style.

V. Denise Saunders
Associate General Counsel

VDS:bop

Enclosure

Addendum to PGE's 2016 Integrated Resource Plan

Revised Renewable Action Plan

NOVEMBER 2017



Contents

Executive Summary	4
1. Introduction	6
2. Background	7
2.1. 2016 IRP renewable action	7
2.2. Feedback from OPUC and stakeholders	8
3. Stakeholder engagement process	9
4. Revised Renewable Action Plan	11
4.1. Key components	11
4.2. Implementation of a cost containment screen	11
4.3. Mechanisms for returning REC value to customers.....	14
5. Implications of proposed action.....	15
5.1. Contribution to meeting near-term needs	15
5.2. The role PURPA qualifying facility additions will play in need assessment and RPS compliance.....	17
5.3. Proper sizing of resource investments and the long-term RPS strategy.....	18
5.4. Cost impact estimates	22
6. Proposed process.....	24
7. Renewable benchmark	24
8. Conclusion.....	24

Executive Summary

PGE is committed to providing its customers with safe, reliable, and affordable electricity while making meaningful progress towards Oregon's climate goals. This Revised Renewable Action Plan helps PGE to deliver on that promise by creating opportunities for the development of low cost renewable resources that provide clean energy to PGE customers while supporting near-term reliability. In No. Order 17-386 the Public Utility Commission of Oregon acknowledged PGE's 2016 Integrated Resource Plan and proposed Resource Action Plan, excepting PGE's proposal to acquire 175 MWa of new renewables, which the Commission did not acknowledge. However, the Commission encouraged PGE to work with Staff and other parties to submit a revised action plan for renewable resource acquisition that addressed the concerns noted in the Commission's order. This plan addresses the Commission's concerns and was developed based on both the long term planning exercise undertaken in the 2016 IRP and an extended stakeholder engagement process over the last three months. It addresses concerns raised by the Commission and parties, including long term uncertainties, incrementalism, near-term cost impacts, and overall cost effectiveness.

PGE proposes to conduct an RFP for approximately 100 MWa of RPS-eligible resources that help fulfill PGE's energy and capacity needs in 2021 and beyond. This revised renewable procurement aligns with near-term capacity and energy needs, supports PGE's long-range procurement strategy for meeting the Renewable Portfolio Standard (RPS), and allows customers an opportunity to realize the full value of expiring federal tax benefits.

The Revised Renewable Action Plan also supports PGE's long-term RPS strategy. PGE estimates that this action would fulfill approximately 11% of the incremental renewable development required to meet its 2040 RPS obligations, creating an important stepping-stone towards future RPS compliance while leaving substantial flexibility for future renewable procurement activities. This layered approach balances near-term and long-term risks and benefits for customers, while putting PGE on track to meet Oregon's 50% RPS target.

In order to realize the best value for customers, subject to acknowledgment by the Commission, PGE would initiate a Renewables RFP in early 2018 to ensure that projects that have already qualified for the federal production tax credit (PTC) are able to participate. In addition, PGE proposes two conditions for procurement within this RFP in order to protect customers from high cost outcomes and to reduce near-term costs:

- The RFP will incorporate a cost-containment screen, requiring that procured resources have forecasted value to customers that exceeds forecasted costs. This screen will help PGE to ensure that procured resources are cost-effective for customers. It will also help PGE appropriately recognize high value resources and those that provide diversity to PGE's energy portfolio.
- PGE also commits to return to customers the value associated with RECs procured prior to 2025 through this Revised Renewable Action Plan. This will allow the Company to reduce costs to customers in the near-term, before additional RECs are needed for compliance the RPS.

This proposal will allow PGE to meet a portion of its near term energy and capacity needs with incremental renewables, to capture the benefits of the current low price environment on behalf of customers, and to return additional cost savings to customers in the near term, while positioning PGE to flexibly meet its renewable obligations over time and to make meaningful progress towards Oregon's carbon reduction goals.

1. Introduction

In the following Revised Renewable Action Plan, PGE requests acknowledgment to conduct an RFP for approximately 100 MWa of RPS-eligible resources that contribute to meeting the Company's energy and capacity needs by 2021.

On August 8, 2017, the Oregon Public Utility Commission (OPUC) issued an order acknowledging PGE's 2016 Integrated Resource Plan (IRP) and proposed Resource Action Plan, excepting PGE's proposal to acquire 175 MWa of new renewables, which the Commission did not acknowledge. However, the Commission agreed to allow PGE the opportunity to file a revised action plan regarding renewable resource procurement. The Commission directed PGE to engage with OPUC Staff and IRP stakeholders to determine whether a revised proposal for renewables that would address concerns raised by the Commission, Staff, and stakeholders could be developed. The Commission further directed PGE to provide an update regarding these discussions within sixty days. PGE, Staff and stakeholders subsequently worked collaboratively to evaluate potential alternatives and PGE presented an update and the high level components of a Revised Renewable Action Plan at the October 10, 2017 Public Meeting.

In this Addendum, PGE describes and justifies a revision to the Renewable Action item included in the 2016 IRP Action Plan. The Revised Renewable Action Plan was developed based on feedback from stakeholders, Staff, and the Commission. It adds renewable resources to help meet PGE's near-term and long-term capacity and energy needs, and captures the benefits of near-term procurement for customers. This Addendum is organized as follows.

First, the Company provides background regarding the Renewable Action item originally presented in the 2016 IRP and feedback PGE received on this proposal within LC 66.

Next, the Addendum describes the stakeholder engagement process undertaken by PGE to identify potential components of an alternative proposal that address concerns raised by the Commission and stakeholders.

PGE then describes its Revised Renewable Action Plan and discusses in more detail the elements of the proposal designed to ensure cost effectiveness and reduction of near-term costs.

The Company then contextualizes the proposed action relative to its near-term resource needs, and within a long-term glide path for meeting the 50% RPS obligation in 2040. This Addendum also provides information regarding the estimated net cost impacts of the revised Renewable Action Plan proposal.

Finally, the Addendum concludes with a description of the proposed RFP process should the Revised Renewable Action Plan be acknowledged by the Commission.

2. Background

2.1. 2016 IRP renewable action

In the 2016 IRP, PGE proposed to conduct an RFP to procure 175 MWa of RPS-eligible resources with a commercial online date (COD) by the end of 2020. This proposal was supported by the Company's least-cost, least-risk IRP portfolio analysis, which identified that near-term renewable resource procurement provided economic benefits to customers via three primary means:

Energy value – the physical renewable resources modeled in the IRP help fill an energy deficit caused by the cessation of coal-fired operations at the Boardman plant at the end of 2020, as well as the expiry of power supply contracts. Under Reference Case conditions, PGE calculated that a wind resource with 2020 COD has a levelized energy value of \$49/MWh. In addition, physical renewables were found to reduce risk (for example, lowering the IRP variability risk metric) by decreasing exposure to uncertain market conditions.

Capacity value – the physical renewable resources modeled in the IRP also help fill a capacity deficit resulting from the Boardman coal plant retirement and contract expirations. For example, the 515 MW wind resource modeled in the 2016 IRP has an effective load carrying capability (ELCC) of approximately 11%.¹ This provides \$4/MWh of levelized value in the form of avoided capacity.

Production tax credits – the full federal production tax credit (PTC) reduces the levelized cost of a wind project by approximately \$20/MWh. This benefit represents a near-term opportunity, as the PTC is phased out by 2020.² PGE's understanding is that there are potential projects in the region that have qualified for the full PTC through safe harbor provisions, but that these opportunities have limited availability. PGE also believes that the expiration of the PTC has contributed to a near-term competitive price environment across other RPS-eligible technologies such as solar.

PGE updated the net present value revenue requirement (NPVRR) analysis in its March 31, 2017 Reply Comments based on an updated load forecast and execution of Qualifying Facility contracts. This analysis identified the value of a 175 MWa near-term renewable action relative to a just-in-time RPS compliance strategy as \$173 million, and also found that the NPVRR benefits of a larger renewable action (300 MWa) increased to \$193 million.

¹ The ELCC and capacity value of a renewable resource depends on system conditions and resource size. This addendum includes examples of ELCCs and capacity values for various generic resources of different sizes that correspondingly vary relative to the specific resource sizes modeled in the 2016 IRP.

² Resources must begin construction by December 31, 2016 to qualify for the full PTC; December 31, 2017 for 80% of the PTC; December 31, 2018 for 60% of the PTC; and December 31, 2019 for 40% of the PTC. The IRS safe harbor provisions require that projects that have already qualified for 100% PTC come online by December 31, 2020. PGE is following the ongoing discussions around federal tax legislation. PGE will act prudently if the RFP does not produce cost competitive options for customers due to tax reform or other factors.

In addition to these economic benefits, PGE's proposed renewable action Plan would allow PGE to continue to make meaningful progress toward meeting its long-term renewable resource obligations and help meet its share of the State of Oregon's carbon reduction goal.

2.2. Feedback from OPUC and stakeholders

PGE's 2016 IRP renewable action item received significant attention from stakeholders, Staff, and the Commission. While several stakeholders were supportive of PGE's proposal, and most Parties acknowledged the unique near-term opportunity afforded by capturing the benefit of expiring federal tax benefits, Staff, CUB, ICNU, and the Commission expressed concerns with the proposal. PGE broadly categorizes the concerns within four categories:

Near-term needs – Some Parties expressed a concern that a near-term RPS action may not contribute to meeting PGE's near-term resource needs.

Long-term risks and incrementalism – Some Parties expressed a concern that the long-term uncertainties affecting RPS planning may be wider than contemplated in the IRP. While it was acknowledged that some of these uncertainties may not be quantifiable, at its August 8, 2017 Public Meeting, the Commission expressed a desire for a near-term renewable action proposal to reflect a greater sense of incrementalism in recognition of these longer-term uncertainties.

Cost impacts to customers and utilization of banked RECs – Some Parties expressed a concern that near-term procurement of RPS-eligible resources may result in increased costs for renewable energy credits (RECs) being incurred by customers in the near-term, when those RECs would not be used for RPS compliance until later years.

Integration into a broader RPS strategy – At the August 8, 2017 Public Meeting, the Commission expressed a concern that the proposed near-term renewable action was not described within the context of a longer-term renewables procurement strategy. The Commission expressed a desire to better understand how near-term renewables procurement would help meet current portfolio needs, as well as how the action would support a longer-term RPS strategy.

In Order No. 17-386, the Commission addresses several items that it considers critical to justifying a near-term renewable action, including:

“how renewable resources could contribute most cost-competitively to near-term capacity and energy needs, the role PURPA Qualifying Facility additions will play in RPS compliance, and the proper sizing of resource investments to balance near-term opportunities to minimize future compliance costs with preservation of optionality through retaining RPS headroom to fill with future technological advances and opportunities.”
Order No. 17-386, page 15.

In addition, the Commission stated that “[a] greater showing of how the proposed resource action aligns with current capacity needs, how PGE can mitigate short-term rate impacts, and how long-term optionality can be maintained, was lacking in PGE's analysis.” Order No. 17-386, page 15-16.

The Commission also discussed the near-term opportunity presented by the expiring federal PTC, stating: “we recognize that expiring tax incentives, particularly the PTC, represent a time-limited opportunity that could benefit PGE's customers.” Order No. 17-386, page 16.

In recognition of both the potential value associated with near-term renewable action and the concerns with PGE’s original Renewable Action, the Commission “encourage[d] PGE to work with Staff and other parties to prepare and submit for our consideration a revised Action Plan for renewable resource acquisition that addresses the concerns noted in this order.” Order No. 17-386, page 16.

3. Stakeholder engagement process

PGE engaged stakeholders through multiple avenues to better understand concerns regarding PGE’s original Renewable Action item and to solicit feedback on potential options to address these concerns. PGE held individual meetings with Staff, CUB, ICNU, RNW, NWECC, Sierra Club, and NIPPC, as well as two workshops with Staff and stakeholders. PGE is grateful that Staff and stakeholders were very actively engaged in this process and provided candid and constructive feedback.

In response to the feedback from the individual meetings, PGE organized the first workshop, held on September 25, 2017 around four key questions:

1. How would an RPS action address a near-term or medium-term need?

PGE discussed near-term capacity and energy needs that could be met, in part, through renewable resources to ensure that customers benefit from potential RPS-eligible resources in the near-term. PGE noted that the bilateral negotiation process was unlikely to fill all of PGE’s capacity needs in the 2021 time frame and that renewable resources could contribute to meeting PGE’s remaining needs. PGE also described the capacity value component of the price score incorporated into the evaluation of offers in the bilateral negotiation process and the E3 RECAP modeling methodology, which would allow PGE to fully account for the capacity contribution and associated capacity value of each bid in an RFP. Stakeholders expressed that a revised renewable action proposal should be tied to the near-term capacity and energy need.

2. How can incremental near-term actions be grounded in a longer-term RPS compliance strategy?

PGE presented six different potential glide paths to 2040 and discussed near-term procurement targets in the context of these glide paths. Importantly, the glide paths were not designed as prescriptive plans that PGE would expect to precisely implement between now and 2040, but rather are potential long-term strategies to help inform incremental near-term actions. Stakeholders expressed interest in seeing how the glide paths might differ under lower (or zero) load growth assumptions. The workshop also included a robust discussion of the option for PGE to seek RPS-eligible resources that

provide energy and capacity to PGE in a time frame consistent with customers' energy and capacity needs, and that allows flexibility to acquire RECs on behalf of customers at a later date, for example beginning in 2025, when PGE has a physical RPS shortage. Stakeholders expressed interest in this option as a creative way to reconcile the difference in timing between PGE's capacity and REC needs, and to address concerns regarding intergenerational equity. However, stakeholders also expressed potential concerns around the ability of all potential bidders to take advantage of this flexibility.

3. How can an RPS action enhance the diversity of PGE's portfolio?

PGE discussed how the value of resource diversity could be accounted for in RFP scoring, based on the methodologies developed in the 2016 IRP and implemented in the evaluation of options in the bilateral negotiation process. PGE and some stakeholders indicated a preference to not impose an additional diversity constraint in an RFP in order to avoid reducing competition by limiting the bidder pool.

4. How can customers be protected against high cost outcomes?

PGE discussed a potential cost containment mechanism to ensure that any procured resources represent cost competitive options for customers. The proposed cost containment mechanism involves a bid-specific price screen within the RFP. For inclusion in the short list, this screen would require that the real-levelized cost of a bid must not exceed the forecasted real-levelized energy and capacity value of the bid under Reference Case conditions. PGE shared that this price screen would equate to approximately \$54/MWh for the PNW Wind resource modeled in the IRP and stakeholders corroborated PGE's understanding that multiple resources in the region could likely meet this threshold.

While consensus regarding each of these questions was not reached at the first workshop, PGE received generally positive feedback from Staff and stakeholders regarding the engagement process and the ideas discussed at the workshop.

PGE updated the Commission on this process at the October 10, 2017 Public Meeting and presented the high level components of a potential Revised Renewable Action Plan, including:

- Revising the renewable procurement target to 100 MWa to align with near-term capacity and energy needs, support long-range RPS strategy, and capture full value of federal tax benefits.
- Establishing an RFP price threshold that would prevent PGE from procuring a resource that has a real-levelized cost that exceeds its real-levelized forecasted market value.
- Committing to returning the REC value to customers prior to 2025 (by not increasing the REC bank balance and reducing near-term power costs).
- Filing an addendum to the 2016 IRP by year end and starting public process to develop the RFP with final bid selection by middle of 2018.

The Commission encouraged PGE to continue to engage stakeholders on refining a proposal and to file an addendum to the 2016 IRP for formal comment in a timely manner. PGE followed up with stakeholders at a second workshop on October 27, 2017. At this workshop, PGE presented more details regarding the proposed plan, including: analysis of the REC bank implications of a glide path to 2040 RPS compliance, a sensitivity that investigated a zero load growth future, and estimated NPVRR and near-term cost and rate impacts of the proposed action. The workshop also included a robust discussion of the proposed price screen and mechanisms for returning REC value to customers. Stakeholders requested additional discussion of the price screen methodology within the public process associated with a subsequent RFP.

4. Revised Renewable Action Plan

4.1. Key components

PGE’s Revised Renewable Action Plan consists of four key components. These components are briefly summarized below.

Table 1. PGE’s Revised Renewable Action Plan

Key Components of PGE’s Revised Renewable Action Plan
Timing and Need: PGE proposes to conduct an RFP for RPS-eligible resources that contribute to meeting PGE’s energy and capacity needs by 2021.
Procurement Size: PGE proposes to modify the procurement target to 100 MWa, consistent with multiple long-term glide paths to RPS compliance in 2040.
Cost Containment: PGE proposes that the Renewables RFP apply a cost containment screen, requiring that each bid on the short list have a real levelized cost below its forecasted real levelized value (including energy and capacity value).
Near-term REC Treatment: PGE commits to returning to customers the value associated with the volume of RECs procured prior to 2025 through this Revised Renewable Action Plan.

In the following sections, PGE provides additional discussion of the two more complex aspects of this plan: implementing the cost containment screen in an RFP, and returning the value of near-term RECs to customers. In addition, PGE provides additional discussion of the size and timing of the Revised Renewable Action Plan in the context of the Company’s near-term energy and capacity needs and long-term RPS compliance approach, and describes estimated cost impacts in Section 5.

4.2. Implementation of a cost containment screen

PGE recommends pursuing near-term renewable procurement to help meet energy and capacity needs and to capture the benefit from expiring federal tax credits. Through the 2016 IRP analysis, near-term renewable additions have been shown to lower the present value of PGE’s

revenue requirement by allowing for lower cost RPS compliance outcomes. Separately, PGE's 2016 IRP analysis also identified several futures in which near-term renewable resources are cost-effective when recognizing the value of the energy delivered and the value of avoiding the need to acquire additional capacity resources. The 2016 IRP and PGE's Reply Comments demonstrate that near-term renewable additions are strongly supported because they are cost-effective across many economic futures and result in lower long-term RPS compliance costs.

In response, Staff and stakeholders have identified concerns with the cost impact of near-term renewable additions. In particular, Parties question whether customers should pay today to bank additional RECs that will be used for RPS compliance in the future. The 2016 IRP analysis confirms that, under Reference Case conditions, new renewable resources were not cost-effective without considering the long-term RPS compliance savings delivered to customers. However, short-term market factors, potentially including the expiration of the PTC, have resulted in a near-term low price environment for both wind and solar resources. PGE expects that in this pricing environment, renewable resources may be cost-effective resources without considering future RPS compliance savings. PGE formulated the cost containment screen described below to enable the RFP for renewable resources to take advantage of this low price environment for customers.

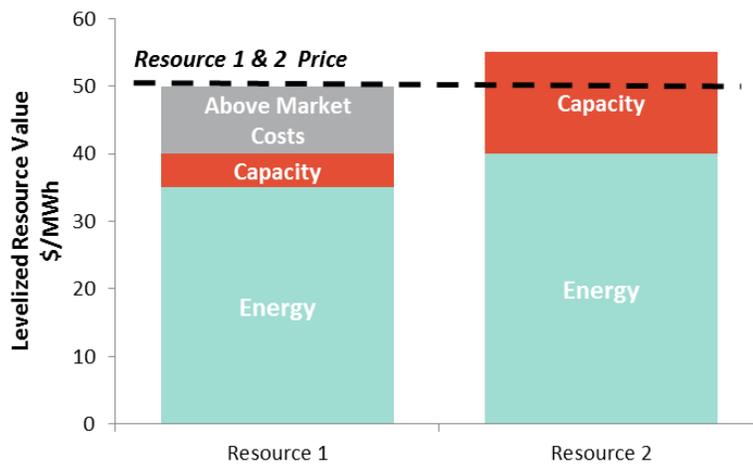
PGE proposes that the procurement of renewable resources employ a cost-containment screen that requires any added resource to be cost-effective under Reference Case conditions considering only the resource's forecasted energy and capacity values. If new renewable resources pass this economic screen, then resource pricing will be considered to include no 'above-market' real-levelized forecasted costs for acquiring the renewable attributes (RECs). Such resources are therefore expected to have negative incremental costs for the purposes of future RPS Compliance Plan filings.

PGE's proposed cost-containment screen would compare the levelized cost of a renewable resource to the levelized energy and capacity value of the renewable resource. To measure levelized costs, PGE will annuitize the present value revenue requirement of the proposed resource. To measure levelized value, PGE will first calculate the energy value of the proposed resource using resource specific generation profiles. Because each resource occupies a unique location with a different generating technology, each resource will be assigned a specific energy value in each year of operation using the hourly forecasted energy price under Reference Case conditions. The resource's levelized energy value reflects the annuitized present value of the resource's generated energy. Each resource will also have a calculated capacity value that reflects the product of the resource's capacity contribution, as calculated using the RECAP methodology, and the avoided costs associated with a generic capacity resource. The levelized capacity value reflects the annuitized present value of the resource's avoided generic capacity costs. PGE's proposed RFP price screen ensures that the levelized energy and capacity value of near-term renewable additions exceed the levelized cost of the associated resource.

The cost-containment screen will be unique for each resource evaluated by PGE. The screen will be elevated for resources that provide more value to PGE customers due to the resource's

geographic diversity. For this reason it is possible that a lower priced resource does not pass the economic screen, while a higher priced resource passes the economic screen due to increased resource value (e.g., higher capacity contribution or more valuable energy production profile). For example, Figure 1 illustrates a possible application of the proposed cost-containment screen. Resource 1 and Resource 2 have the same resource pricing. However, Resource 1’s levelized cost exceeds the resource’s energy and capacity value. The resource is found to have above-market costs on a real-levelized forecasted basis and does not pass the economic screen. Resource 2 passes the economic screen as its resource value exceeds the resource cost.

Figure 1: Example of cost containment screen



It is PGE’s expectation that the most economically competitive resources are capable of passing the proposed cost-containment screen. Table 2 provides an example of the applicable economic screen for generic 100 MW renewable resources.

Table 2: Example energy and capacity values for generic 100 MW resources

	Wind (\$/MWh)	Solar (\$/MWh)	MT Wind (\$/MWh)
Energy Value	\$ 46.61	\$ 41.12	\$ 48.87
Capacity Value	\$ 7.65	\$ 8.49	\$ 12.71
Total	\$ 54.26	\$ 49.61	\$ 61.58

Were these generic IRP resources to be evaluated within the proposed RFP, the resources would only pass the cost-containment screen if priced below the total resource value. Importantly, each actual resource offered into an RFP will be screened against its unique resource value (not a generic threshold).

4.3. Mechanisms for returning REC value to customers

PGE proposes to further reduce the costs associated with near-term renewables by delivering value from the incremental RECs. By returning the value of RECs procured prior to 2025 to customers, the Company will lower the near-term cost impacts of a Renewable Action, while also capturing the benefit of the PTC and the near-term low price environment for customers.

Multiple potential mechanisms may capture this value, including:

REC sales in the wholesale market – PGE could monetize RECs through the wholesale market via bilateral negotiations or through an RFP.

Retail REC sales – PGE could sell RECs to voluntary individual subscribers of a green tariff.

Alternative policy compliance value – If PGE is subject to additional carbon-related policy obligations before 2025 (e.g., an increased RPS obligation or a new policy in which RECs can be used as compliance tools), the Company may evaluate whether utilizing the procured RECs for incremental policy compliance provides the most value to customers.

In particular, PGE believes that there may prove significant interest by voluntary retail customers to purchase RECs made available by the proposed procurement. If realized, retail sales of RECs prior to 2025 may provide a valuable credit for PGE's broader cost-of-service customer base. PGE continues to engage with the retail community to consider voluntary REC purchase programs through alternate tariff designs. PGE looks forward to discussing with Staff and stakeholders how green tariff policy can accommodate additional retail REC sales to enhance the value of RECs sold for the benefit of customers.

Each of these mechanisms may require PGE to demonstrate to the Commission that it has adequately captured value for customers. Given uncertainties in REC markets and future policies, the Company recommends that the specific mechanism for returning value to customers be considered at a future time within a separate docket.

One area of concern for stakeholders regarding this proposal has been PGE's ability to take advantage of infinite-life RECs that may be generated prior to 2025. In 2016, Senate Bill 1547 established new rules for banking RECs, including a provision allowing projects that come online prior to December 31, 2022 to generate infinite-life RECs for the first five years of operation. These infinite-life RECs allow PGE more RPS compliance flexibility in future years, potentially reducing the cost of compliance in a given year. While PGE is not requesting acknowledgment of the exact mechanism for capturing the value of RECs generated prior to 2025, the Company does request that this component of its proposal be considered with enough flexibility to allow

the Company to take advantage of infinite-life RECs, should they be procured as part of the Revised Renewable Action Plan. By specifying that the value of an equivalent volume of RECs would be returned to customers (rather than the value of the specific generated RECs), PGE’s proposal provides this flexibility.

5. Implications of proposed action

In Order No. 17-386, the Commission stated: “PGE's strategy should have considered, among other things, how renewable resources could contribute most cost-competitively to near-term capacity and energy needs, the role PURPA qualifying facility additions will play in RPS compliance, and the proper sizing of resource investments to balance near-term opportunities to minimize future compliance costs with preservation of optionality through retaining RPS headroom to fill with future technological advances and opportunities.” Order No. 17-386 at 15. PGE addresses each of these considerations below.

5.1. Contribution to meeting near-term needs

In the 2016 IRP, the Commission acknowledged PGE’s resource capacity need of 561 MW in 2021. The 2016 IRP also showed an energy need of 388 MWa. PGE continues to have capacity and energy needs that this Revised Renewable Action Plan can help meet. PGE continually evaluates its expected resource needs and provides the most recent need snapshot in the table below. This snapshot is provided for information purposes only and does not replace the analysis used in the acknowledged 2016 IRP. PGE will provide a comprehensive update of need and other key IRP analyses when it files its IRP update.

Table 3. PGE’s current near-term and mid-term need snapshot

	2021	2022	2023	2024	2025
RPS Compliance (MWa)					
Physical RPS Need	0	0	0	0	71
Resource Adequacy (MW)					
Capacity Need ³	461	464	479	494	761
Energy (MWa)					
Energy Need	75	98	122	146	263
Market Purchases ⁴	84	151	170	283	390

³ This capacity need is in excess of the 200 MW market availability assumption in non-summer peak hours employed in the 2016 IRP resource adequacy evaluation.

⁴ Market purchases reflect the expected annual net purchases based on PGE’s load and plant dispatch if no incremental actions are taken. This is differentiated from the traditional energy need incorporated into the IRP, which is based on fixed plant availability rather than simulated plant dispatch.

This snapshot identifies that the Company’s near-term resource needs identified in the 2016 IRP remain and that these resource needs continue to grow in the early 2020s. The difference in PGE’s acknowledged 2021 capacity need is due predominantly to the execution of new Qualifying Facility contracts.

Consistent with Order No. 16-326, PGE accounted for the capacity contribution of renewable resources (i.e., the ability of renewable resources to contribute to meeting capacity needs) by implementing a Loss-of-load Expectation-based Effective Load Carrying Capability (ELCC) methodology within the 2016 IRP. This approach (RECAP, E3) identified that incremental renewable resources in PGE’s portfolio could provide substantive capacity to the system in both the near-term and the long-term. For illustration, the capacity contributions identified with this approach for three example resources in the 2016 IRP are listed in the table below.

Table 4. Capacity contributions of example renewable resources in the 2016 IRP

Example Resources	Capacity Contribution
100 MW PNW Wind	~19 MW
100 MW Single-Axis Tracking Solar PV	~15 MW
100 MW Montana Wind	~39 MW

In addition to analyzing the generic resources, PGE’s 2016 IRP analysis used improved internal modeling capabilities so that the RECAP model can be used to determine the capacity contribution of any potential resource under consideration, including resources bid into an RFP. This capability will allow PGE to determine the specific contribution of each potential bid in an RFP to meet its near-term capacity needs.

PGE’s capacity contribution methodology also allows the Company to differentiate resources that provide diversity benefits to its portfolio. Resources that generate during periods in which PGE has high load and low resource availability from its existing portfolio have the highest capacity contributions, while those that generate during hours with lower load and high availability from PGE’s existing fleet tend to have lower capacity contributions. For example, the capacity contributions of three example renewable resources are listed in the table above. Of these three sources, Montana Wind is the most complementary with PGE’s existing resources and therefore provides the most capacity to the system.

PGE’s 2016 IRP analysis demonstrated that renewable resources could contribute cost-competitively to near-term capacity and energy needs and, by targeting resources that provide capacity and accounting for capacity value in RFP scoring, PGE can ensure that resource procurement is in alignment with the Company’s needs and that diversity benefits are appropriately reflected in its evaluation.

5.2. The role PURPA qualifying facility additions will play in need assessment and RPS compliance

Resource needs and capacity contributions are constantly evolving and, although they are affected by a number of factors, the execution of contracts for Qualifying Facilities (QFs) has led to especially rapid fluctuations in, and a high degree of uncertainty regarding PGE's needs throughout the course of the 2016 IRP. As a result, the Commission has raised questions about the role of PURPA QFs in RPS compliance. As part of this Addendum, the Company includes an illustrative analysis to in part address the Commission's question regarding the role of QFs in RPS compliance and also to better understand the impact of QFs on PGE's evaluation of its near-term energy and capacity needs. This analysis finds that PGE's near-term need snapshot is highly sensitive to the volume of QF contracts that have been executed. Consistent with the methodology in the 2016 IRP, as a base assumption, the Company assumes that all contracts executed prior to a recent cut-off date (October 19, 2017 for the current snapshot) result in successful projects that come online by the estimated commercial online date. PGE has traditionally employed this assumption for both QF and non-QF contracts in the IRP. In practice, there are a number of development and financial uncertainties that could affect the success rate of the QF projects coming online. To understand the sensitivity of PGE's near-term needs to these uncertainties, the Company conducted a simple sensitivity analysis in which a fixed fraction of projects that are executed but not yet online are assumed to be successful. This analysis is shown below, assuming 100%, 75%, and 50% success rates.

Table 5. PGE's need snapshot sensitivity to QF success rates

	QF Success Rate		
	100%	75%	50%
RPS Compliance (MWa)			
2025 Physical RPS Need	71	109	148
Resource Adequacy (MW)			
2021 Capacity Need	461	503	551
Energy (MWa)			
2021 Energy Need	75	113	152
2021 Market Purchases	84	122	161

This illustrative analysis indicates that PGE's base assumption of a 100% success rate for QF contracts has a significant impact on its periodic need snapshot. While PGE does not currently have sufficient data to change its base assumption of a 100% of executed QFs reaching COD, the sensitivities above provide useful insights to potential changes in load resource balance if some percentage of QF projects do not reach COD. For example, with the addition of 100 MWa of incremental renewables, QF contracts would need to have a success rate of between 75% and 100% in order to fill the Company's remaining near-term energy needs and 2025 physical RPS compliance need. PGE intends to conduct further evaluation regarding the likelihood of QF

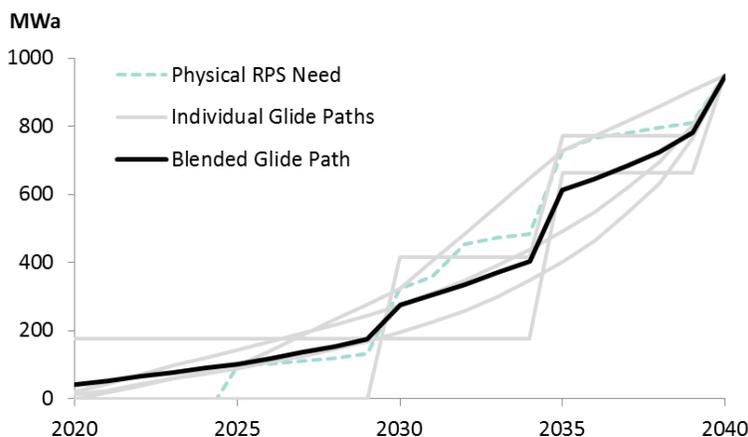
projects failing to reach COD and the resulting impact on the Company’s resource needs. In lieu of that evaluation, PGE provides this illustrative information to contextualize the current need snapshot.

5.3. Proper sizing of resource investments and the long-term RPS strategy

The Commission requested more information regarding the sizing and timing of resource investments in the context of a longer-term RPS strategy. In addition to the long-term procurement strategy reflected in the 2016 IRP and updated in PGE’s Reply Comments, the Company explored additional potential glide paths toward physical compliance with the RPS in 2040 to inform development of the proposed procurement target. Importantly, these glide paths were not intended to reflect new IRP Portfolios or strategies that must be adhered to on a forward-going basis, but rather to provide guidance about how a near-term renewables procurement would fit within a longer-range RPS approach. As conditions evolve, PGE expects that its RPS strategy will also evolve and these glide paths will adjust to reflect that evolution. The utility of the glide path method is to provide context for proposed near-term actions in terms of scale and long-term uncertainties.

PGE explored several glide paths, including: a straight line physical compliance strategy in which PGE would be physically compliant with its obligations at each five-year milestone between 2020 and 2040; a strategy that equalizes year-one net cost impacts of renewable additions over time (this pushes some procurement into later years when net cost impacts of new renewables are anticipated to be lower); a strategy that prioritizes reducing year-one net cost impacts in the near-term (this pushes even more procurement into the later years); and the two primary strategies investigated in the 2016 IRP, including the RPS Early Action portfolio (which includes 175 MWa with COD 2020) and the Delay Portfolio, which relies on the REC bank to defer RPS procurement to the 2029/2030 time frame. These five glide paths are shown in Figure 2, juxtaposed against a Blended Glide Path that combines the considerations reflected in each of the individual glide paths.

Figure 2. Potential glide paths to 2040 RPS compliance

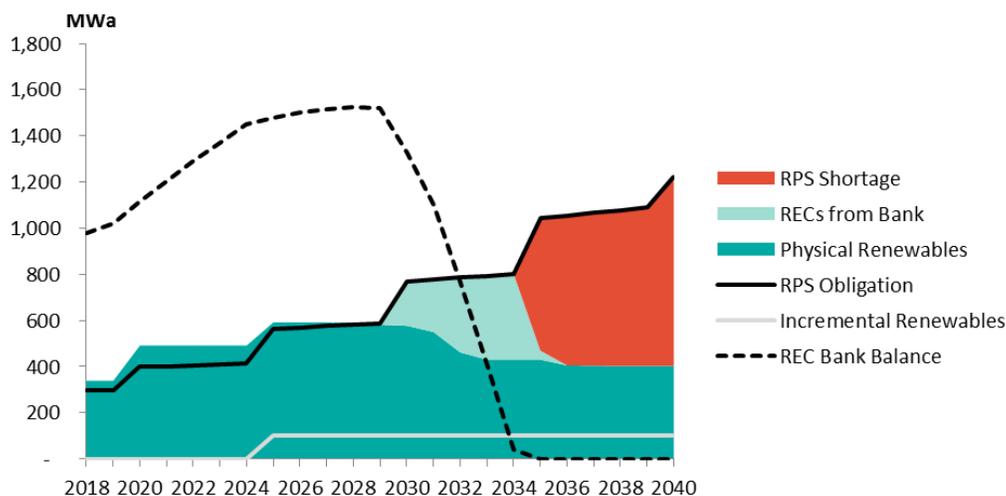


PGE considers the Blended Glide Path to be a useful tool for placing a near-term RPS action in the context of PGE’s long-term RPS obligations and the scale of deployment required over the next two decades. One takeaway from the glide path analysis is that a near-term procurement target of approximately 100 MWa is consistent with meeting PGE’s 2025 RPS obligation on a physical basis, is similar in scale to glide paths that balance year-one net cost impacts over time, and also corresponds to the Blended Glide Path in the 2025 time frame.

PGE further investigated the implications of pursuing 100 MWa of renewables in the near-term in the context of its REC bank. Consistent with the proposal outlined in Section 4.1, this analysis assumed that the value of incremental RECs procured prior to 2025 is returned to customers, so PGE’s REC bank position is not affected by the proposed Renewable Action until 2025. In response to feedback from stakeholders and concerns expressed by the Commission regarding long-term uncertainties, PGE conducted this investigation under both the Reference Load Forecast and a Zero Load Growth sensitivity. As described below, the REC bank analysis found the 100 MWa renewable procurement maintains significant flexibility for additional renewable actions between now and 2040 under both the Reference Case Forecast and the Zero Load Growth sensitivity.

Under the Reference Case load forecast (see figure below), procurement of 100 MWa in the near-term would require PGE to rely heavily on its REC bank for compliance by 2030 and would result in non-compliance beginning in 2035 if no incremental actions were taken. Under this strategy, PGE would have an RPS shortage (or flexibility for future procurement) of 821 MWa through 2040. In other words, the attainment of 100 MWa near-term renewables would represent approximately 11% of the total incremental procurement needed by 2040 for physical compliance.

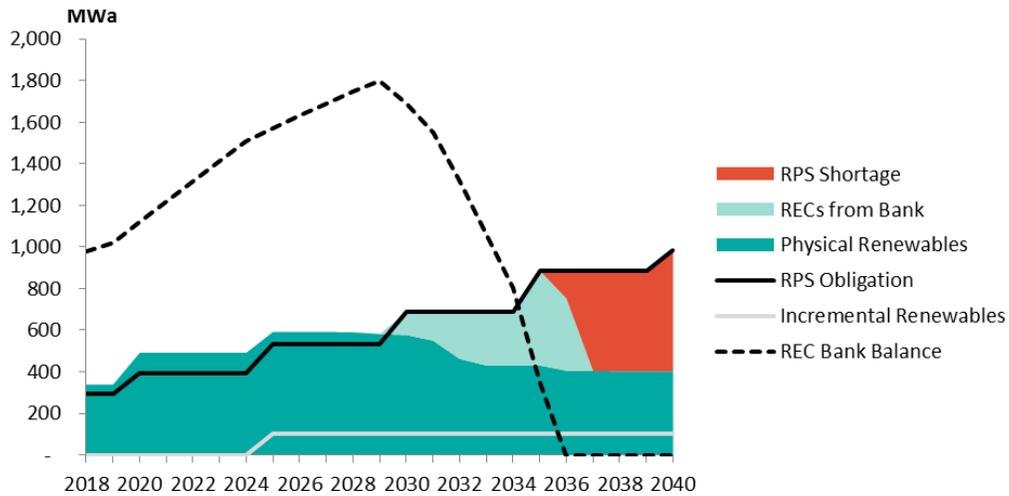
Figure 3. Long-term RPS position under Reference Case Load forecast with 100 MWa in 2025



Under a Zero Load Growth sensitivity (see Figure below), procurement of 100 MWa would contribute a higher percentage PGE’s long-term RPS obligations, but a significant need for procurement over time to meet RPS obligations would remain. For example, under this sensitivity, PGE would still begin relying heavily on its REC bank by 2030 and would have a deficit beginning

in 2036. Under this Zero Load Growth sensitivity, PGE would have an RPS shortage (or flexibility for future procurement) of 582 MWa through 2040. The 100 MWa near-term action would therefore represent approximately 15% (versus 11% under the Reference Case load forecast) of the total incremental procurement needed by 2040 for physical compliance.

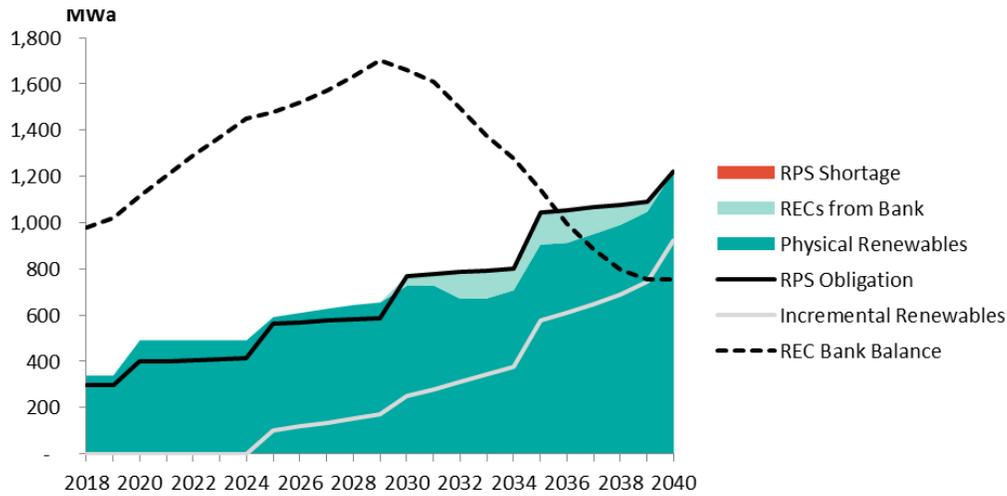
Figure 4. Long-term RPS position under Zero Load Growth with 100 MWa in 2025



PGE also investigated its RPS position in the context of the glide path to 2040 under Reference Case conditions (see figure below).⁵ This analysis identified that PGE would be physically compliant through 2029, would rely in part on banked RECs between 2030 and 2039 for compliance, and would have a REC bank balance of 757 MWa in 2040, falling just above the minimum REC bank constraint employed in the 2016 IRP.

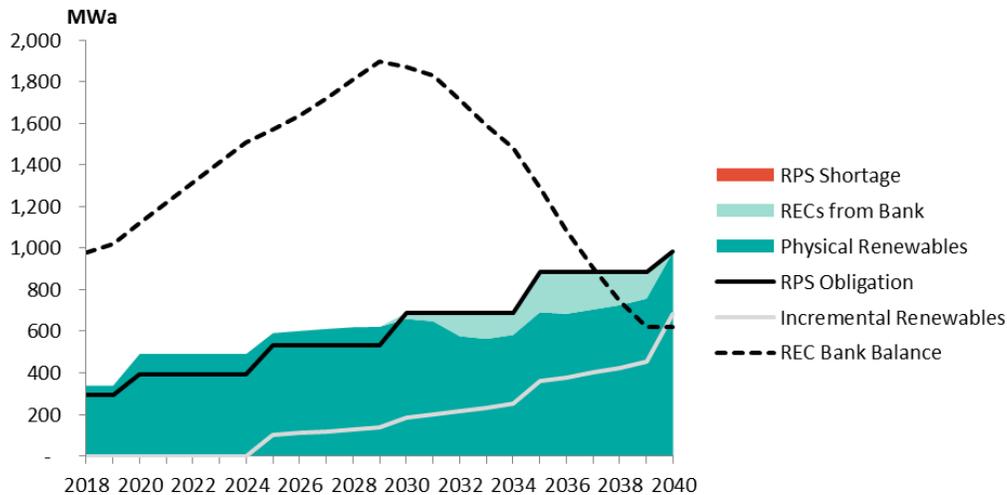
⁵ The Glide Path presented here was revised based on the Company's September 2017 load forecast and contracts signed through October 19, 2017 (including QF contracts). This update slightly reduced RPS obligations through 2040 relative to the Glide Path presented to the Commission at the October 10, 2017 Public Meeting.

Figure 5. Long-term RPS position under Reference Case Load with 100 MWa in 2025 and glide path to RPS compliance in 2040



To demonstrate the concept of an adaptable glide path, PGE determined an alternative glide path associated with the Zero Load Growth sensitivity. This glide path incorporates the 100 MWa near-term action and scales down incremental actions through 2040 to achieve a similar REC bank level in 2040 as a fraction of the RPS obligation. The RPS position implied by this approach is shown in the figure below.

Figure 6. Long-term RPS position under Zero Load Growth sensitivity with 100 MWa in 2025 and revised glide path to RPS compliance in 2040



PGE believes the glide path analysis demonstrates that procurement of 100 MWa in the near-term represents a prudent incremental action in the context of PGE’s long-term RPS needs and long-term uncertainties and allows for future procurement flexibility as conditions evolve. The proposed near-term action is also consistent with a long-term strategy that accelerates RPS procurement over time, a strategy that balances the need to make steady progress toward

meeting the 2040 RPS obligation with the potential to realize benefits of continued technology cost reductions over time. These findings held under both the Reference Case load forecast and under a Zero Load Growth sensitivity.

PGE acknowledges that in the context of rapid technological and policy change, consideration of long-term uncertainties should and will play a larger role in future IRPs. While the exploration described above is not exhaustive, it is consistent with an approach that seeks to identify prudent near-term actions in the context of longer-term uncertainties, particularly uncertainties in the Company's resource needs.

5.4. Cost impact estimates

While the original Renewable Action item prioritized NPVRR savings, the Revised Renewable Action Plan balances both NPVRR considerations and near-term cost impacts. In response to concerns raised by the Commission, this section describes an updated NPVRR analysis as well as potential near-term cost impacts to customers associated with the Revised Renewable Action Plan.

In the 2016 IRP, PGE focused on the economic benefits of pursuing renewable resources in the near-term relative to a just-in-time strategy that relied on the Company's REC bank for compliance through the late 2020s.⁶ Because the revised proposal is grounded in a smoother glide path to RPS compliance in 2040 and because PGE received feedback that the just-in-time counterfactual may be unrealistic, the economic analysis in this Addendum focuses on a slightly different question. Rather than comparing a near-term procurement to a just-in-time strategy, the Company compared two strategies that are both consistent with the Blended Glide Path: one in which 100 MWa are procured by 2021 and one in which 100 MWa are not procured until 2025. These strategies have the same REC bank balances (because PGE is assumed to monetize the value of incremental RECs through 2024), but have different resource costs and benefits over time due to the energy value, capacity value, and PTC value associated with near-term procurement as well as declining capital costs over time. This analysis identified that the revised Renewable Action has an estimated NPVRR benefit of \$121 million under Reference Case assumptions. This NPVRR benefit excludes the additional value that will be returned to customers for RECs procured prior to 2025.

PGE also addressed the Commission's concern that NPVRR benefits do not directly address near-term cost impacts. While it is challenging to estimate year-on-year cost impacts of potential procurement without specificity around the cost structures of potential options that would bid into an RFP, PGE has conducted updated analysis for an example utility-owned wind resource (UOG) and an example wind power purchase agreement (PPA) to provide context for potential rate impacts. This analysis assumes that both projects come online at the end of 2020, qualify for 100% PTC, and have cost and performance specifications consistent with a wind resource that

⁶ The 2016 IRP also considered a portfolio with a renewable action in 2025 that would not qualify for the PTC. This portfolio was found to be higher cost than both the near-term renewable action and just-in-time portfolios.

exactly meets the cost containment screen described in Section 4.2. The example PPA is assumed to have a fixed real price (i.e., a \$/MWh price that escalates with inflation). The resulting near-term cost impacts (annual costs net of annual energy and capacity value) are summarized in the table below. While the utility-owned example resource has higher initial costs than the example PPA, both example projects yield an average net cost increase of approximately 1% of the revenue requirement between 2021 and 2024 before accounting for cost reductions associated with the value of the RECs generated in those years.

Table 6. Long-term and near-term net cost impact estimates associated with 100 MWa resource with COD at the end of 2020, excluding near-term REC value

Cost Metric	Utility-owned Wind	PPA Wind
NPVRR Impact (million \$)	-\$121	-\$121
Year 1 net cost impact (% of revenue requirement)	+2.2%	+1.3%
2021-2024 average net cost impact (% of revenue requirement)	+1.0%	+0.8%

Because the example resources in this exercise exactly meet the cost containment screen, the cost estimates listed above can be thought of as approximate upper bounds. In general, if a bid has pricing well below its real levelized value, one would expect the net cost impacts to be lower than those identified here. For example, if resource costs for an equivalent resource are approximately \$10/MWh below the real levelized resource value (such a resource would be priced at approximately \$45/MWh), the estimated revenue requirement impact between 2021 and 2024 drops to less than 0.5%.

Both of the analyses described above neglect the value of REC compensation in years 2021 through 2024. While PGE cannot quantify the value of RECs in the 2021 through 2024 time frame at this time, the following table summarizes the estimated additional net cost reductions that could be achieved at various REC price points or values.

Table 7. Estimated near-term REC value under various REC price scenarios

REC Price or Value	Annual estimated net cost impact (% of revenue requirement)
\$1/MWh	-0.04%
\$3/MWh	-0.12%
\$5/MWh	-0.20%

6. Proposed process

PGE requests that the Commission acknowledge PGE's Revised Renewable Action Plan at the December 18, 2017 OPUC Public Meeting. This will allow PGE to conduct an RFP in early 2018. Even with a December 18, 2017 acknowledgment, it will be necessary to begin preparing for an RFP in advance of the Commission's decision. Based on the encouragement PGE has received from Staff and stakeholders, PGE will reengage with the Independent Evaluator selected by the Commission. Outreach to the bidding and stakeholder community will enable PGE to refine its draft RFP. PGE intends to file a final draft RFP with the Commission in January 2018, subject to acknowledgment of the revised Renewable Action in this addendum.

7. Renewable benchmark

PGE continues to explore a renewable benchmark resource option as described the 2016 IRP. If PGE executes a definitive agreement to develop a renewable benchmark, the Company will provide notice prior to issuing an RFP.

8. Conclusion

In summary, PGE proposes the following Revised Renewable Action Plan.

PGE proposes to conduct an RFP for approximately 100 MWa of RPS-eligible resources that contribute to meeting the Company's energy and capacity needs by 2021. PGE proposes two conditions for procurement within this RFP, including:

- The RFP will incorporate a cost-containment screen, requiring that each bid on the short list have forecasted real levelized value (including energy and capacity value) that exceeds its real levelized cost.
- PGE commits to return to customers the value associated with the volume of RECs procured prior to 2025 through this Revised Renewable Action Plan.

The analyses included in the 2016 IRP and this Addendum demonstrate that PGE's Revised Renewable Action Plan is consistent with the principles of least-cost, least-risk planning. In this addendum, PGE addresses issues raised by the Commission and Parties regarding long term uncertainties, incrementalism, and intergenerational equity. The Revised Renewable Action Plan will allow PGE to meet a portion of its near term energy and capacity needs with incremental renewables, to capture the benefits of the current low price environment for customers, and to return additional cost savings to customers in the near term, while positioning the Company to flexibly meet its renewable obligations over time and to make meaningful progress towards Oregon's carbon reduction goals.