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BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of PacifiCorp's 2017 Integrated Resource Plan	DOCKET NO. 17-035-16 Initial Comments of Utah Clean Energy

I. INTRODUCTION

Utah Clean Energy is grateful for opportunity to participate in the Integrated Resource Plan (IRP) public process and to submit comments in response to PacifiCorp's 2017 IRP. Utah Clean Energy has attended public input meetings, submitted stakeholder feedback to PacifiCorp, and filed data requests regarding IRP inputs and assumptions.

Utah Clean Energy's comments on the 2017 IRP are submitted in two parts:

1) Utah Clean Energy's comments related to acknowledgement of the IRP, solar cost assumptions, modeling of distributed generation, and modeling battery storage, provided herein.
2) Utah Clean Energy submits separate comments on the demand side management (DSM) potential study and DSM in the 2017 IRP jointly with the Southwest Energy Efficiency Project (SWEEP).

We provide a brief recommendation regarding acknowledgement and several recommendations related to the treatment of distributed energy resources in future IRP processes. Regardless of the

Commission's acknowledgement decision, the recommendations that follow are intended to ensure that the current and future IRP processes consider distributed generation resources appropriately. Utah Clean Energy's recommendations for the current and future IRPs are as follows:

- Amend the 2017 Action Plan to acquire solar resources called for later in the IRP in the near term while ratepayers can benefit from historic low prices and the Federal Investment Tax Credit.
- Model distributed generation as a supply-side resource in the 2019 IRP.
- Track and update battery cost trends to align modeling assumptions with the most accurate and current market information in the 2019 IRP.
- Model customer-sited battery storage programs and incentives.
- Convene technical workgroups to discuss challenges and needs related to modeling battery storage and to refine modeling in the 2019 IRP.

II. COMMENTS ON THE 2017 IRP

A. Acknowledgement – do not acknowledge.

Utah Clean Energy recommends that the Commission not acknowledge the 2017 IRP, or the Preferred Portfolio, because the planning analysis did not include "an evaluation of all present and future resources…on a consistent and comparable basis." Specifically, the analysis failed to compare existing coal resources consistently with and comparably to any other present or future supply or demand-side resources. Additionally, the repowered wind project was not raised as a resource option until the very end of the modeling process.

The requirements of integrated resource planning are straightforward: compare resources – existing and new – on a consistent and comparable basis to find the least cost, least risk mix. Planning should evaluate whether ratepayers are better off maintaining and operating existing resources or retiring them and replacing them with more cost-effective options. The 2017 IRP did not do this with its coal units. Prior to modeling eligible core cases, PacifiCorp ran "Regional Haze" screening scenarios, which created seven different coal plant retirement schedules.[1] In all subsequent capacity expansion modeling, coal resource retirement assumptions were locked in, as dictated by specific Regional Haze scenarios. In other words, coal plants were not "allowed" to compete with other resources in subsequent capacity expansion modeling. The timing and magnitude of run-rate capital and operations and maintenance costs for each coal unit were set within System Optimizer, and new resources were unable to compete with and replace them on a consistent and comparable basis.

Ratepayers should have the benefit of robust analysis comparing the economics of existing coal units compared with new resources (especially low cost renewable resources). The IRP guidelines require transparent analysis of the Company's existing coal units compared to alternative options. The 2017 IRP lacks this analysis, so the Commission cannot acknowledge the IRP in this respect. It is further problematic that the repowered wind and new wind with transmission were not allowed to compete on a consistent and comparable basis with coal and other resources, but were rather added to the Company's preferred portfolio at the end of portfolio analysis.

[1] *PacifiCorp 2017 Integrated Resource Plan, Volume 1*. April 4, 2017. P180.

B. Amend the 2017 Action Plan to acquire solar resources called for later in the IRP in the near term while ratepayers can benefit from historic low prices and the Federal Investment Tax Credit.

The solar cost assumptions used in the 2017 IRP are well above the price of recently signed PPAs, delaying the selection of solar in the System Optimizer model until 2028. We recommend that the 2017 IRP Action Plan be revised to include a solar Request for Proposals (RFP) and, depending on the results, that PacifiCorp procure solar resources now while ratepayers can capitalize on low prices and the Federal Investment Tax Credit (ITC).

As one of the sunniest states in the country, Utah ratepayers are poised to benefit from extremely low-cost solar energy resources. Historically low prices for solar energy, the 30% Federal Investment Tax Credit (ITC), PacifiCorp's planned acquisition of economic generating resources have created a time-limited window during which PacifiCorp can acquire extremely economic solar resources with significant long-term benefits for ratepayers.

Unfortunately, if unsurprisingly, given the high solar cost assumptions, the 2017 IRP Preferred Portfolio does not include any solar resources in Utah until 2028, well after the ITC step-down begins in 2020, and after the Action Plan window. A closer investigation of PacifiCorp's modeling inputs reveals that the 2017 IRP is predicated on solar cost assumptions that are twice as high as current market prices and significantly more expensive than the actual price for a Utah solar project completed more than a year ago.[2] As a result of outdated and inaccurate price estimates for solar resources, the 2017 IRP did not identify an obvious opportunity to leverage Utah's significant solar resources for the long-term benefit of ratepayers.

Utah Clean Energy has participated throughout the 2017 IRP process and emphasized this issue to PacifiCorp. We requested that System Optimizer be revised with accurate solar resource costs, including costs reflective of current PPA pricing, at public input meetings and in two public input forms.[3] Since the cost assumptions for supply-side solar resources in the 2017 IRP remain outdated, we suggest that the Commission require PacifiCorp to revise the 2017 IRP Action Plan to include a solar Request for Proposals.

PacifiCorp's 2017 IRP capital cost assumptions were $1,724 per kilowatt for Utah fixed-tilt solar and $1,822 per kilowatt for Utah single-axis tracking solar.[4] In comparison, a National Renewable Energy Lab (NREL) report benchmarked costs for utility-scale solar projects at $1,030 per kilowatt and $1,110 per kilowatt for fixed-tilt and single-axis tracking solar projects, respectively, in Q1 of 2017.[5] PacifiCorp's cost assumptions thus reflect a 64-67% markup compared to industry benchmarked costs.

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[2] *See infra* notes 5-10.

[3] PacifiCorp Stakeholder Feedback Forms – "*Utah Clean Energy – Supply-Side Resources and Capacity Contribution Study (11-4-16)*" and "*Utah Clean Energy – Portfolio Development Details, Supply Side Resource Tables and Battery Energy Storage Resource Table (9-15-16)*" available at http://www.pacificorp.com/es/irp/irpcomments.html.

[4] *PacifiCorp 2017 Integrated Resource Plan, Volume 1*, Table 6.1 – 2017 Supply Side Resource Table (2016$). P103.

[5] National Renewable Energy Laboratory (NREL). September 2017. *U.S. Solar Photovoltaic System Cost Benchmark: Q1 2017*. https://www.nrel.gov/docs/fy17osti/68925.pdf. Figure ES-1. NREL PV system cost benchmark summary (inflation adjusted), 2010 – 2017.

From another perspective, the total resource costs assumed for solar in the 2017 IRP range from $65.23 per megawatt-hour for fixed-tilt solar to $59.44 per megawatt-hour for single-axis tracking solar.[6] These assumptions are higher than actual costs for solar projects completed in Utah in 2016, when PacifiCorp signed a Power Purchase Agreement (PPA) for a 20 megawatt solar project that delivers power to Subscriber Solar customers at a cost of $52 per megawatt-hour.[7] This project is smaller than a typical utility-scale project, so the price is correspondingly higher compared to a larger project that leverages additional economies of scale. NREL benchmarked the 2017 Q1 levelized cost of energy in neighboring states at $47.3 - $49.5 per megawatt-hour for fixed-tilt projects and $41.6/MWh - $43.3 per megawatt-hour for single-axis tracking projects *assuming a 0% ITC* in Q1 2017.[8] Accounting for the 30% Federal ITC, these project costs would be approximately $30/MWh. Similarly, in Docket No. 17-035-23, a solar developer stated that "sPower's current levelized cost of solar in southern Utah is approximately $30/MWh."[9]

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[6] *PacifiCorp 2017 Integrated Resource Plan, Volume 1,* Table 6.2 – Total Resource Cost for Supply-Side Resource Options. P106.

[7] Docket No. 15-035-61, In the Matter of the Application of Rocky Mountain Power for Approval of its Subscriber Solar Program (Schedule 73). *Subscriber Solar Program Status Report*, June 22 2017. https://pscdocs.utah.gov/electric/15docs/1503561/294850RMPSubscribSolStatRep6-22-17.pdf See Appendix A - 2017 Subscriber Solar Dashboard. Total cost of generation ($906,991) divided by total kilowatt-hours generated (17,196,333) equals $0.05274/kWh, or $52.74/MWh.

[8] NREL. September 2017. *U.S. Solar Photovoltaic System Cost Benchmark: Q1 2017.* https://www.nrel.gov/docs/fy17osti/68925.pdf. Figure 34. Modeled real LCOE (¢/kWh) for a 100-MWdc utility-scale PV system with fixed-tilt and one-axis tracking in 2016. P 47.

[9] Docket No. 17-035-23, In the Matter of the Application of Rocky Mountain Power for Approval of Solicitation Process for Wind Resources. sPower Rebuttal Testimony, September 13, 2017. Line 158. https://pscdocs.utah.gov/electric/17docs/1703523/296644TestIsern9-13-2017.pdf

These low prices for solar may not be available in the future, creating a time limited opportunity for ratepayers to realize maximum benefits. The 30% Federal ITC begins to step down in 2020, a pending U.S. International Trade Commission decision could result in increased prices for solar modules, and the potential for continued price reductions is plateauing after years of technological improvement and cost declines. PacifiCorp should be capitalizing on the time-limited opportunity to acquire extremely low cost solar resources for its customers in the near term using the 30% ITC. However, ironically, PacifiCorp's 2017 IRP Preferred Portfolio does call for a gigawatt of solar starting in 2028 when PacifiCorp projects costs will be over $65 per megawatt-hour.[10] For $30 per megawatt-hour, PacifiCorp could acquire that same resource now at less than half the cost.

If the Commission chooses to acknowledge PacifiCorp's 2017 IRP, we suggest that the Commission require PacifiCorp to revise the 2017 IRP Action Plan to include a solar Request for Proposals, to be issued as soon as possible. If the RFP results in project proposals that are competitive, PacifiCorp should acquire the solar resources called for later in the IRP Preferred Portfolio in the near term while ratepayers can benefit from historic low prices and the 30% Federal ITC.

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[10] Docket No. 17-035-37, In the Matter of Rocky Mountain Power's 2017 Avoided Cost Input Changes Quarterly Compliance Filing. Dan MacNeil Direct Testimony, August 17, 2017. Lines 306 – 307.

C. Model distributed generation as a supply-side resource in the 2019 IRP.

PacifiCorp's IRP modeling practices do not accurately account for generation from distributed generation. We recommend that the 2019 IRP model distributed generation as a supply-side resource.

Customer-sited generating resources will play an increasing role in the grid of the future, and PacifiCorp's IRP process does not evaluate the significant (and growing) portfolio of distributed generation (DG) resources as the utility would evaluate any other generation resource – that is to say, *as a supply-side* resource. In the 2015 and 2017 IRPs, PacifiCorp retained Navigant consulting to report on distributed generation technical potential and market potential. PacifiCorp modeled distributed generation as a decrement to load based on Navigant's forecast of distributed generation growth, but did not model distributed generation as a supply-side resource. Utah Clean Energy agrees with comments made by the Division of Public Utilities during the 2015 IRP process noting that it is insufficient to treat distributed generation solely as a reduction to load and recommending that "renewable resources and DG be considered in greater detail in the Company's future IRPs as its own supply side resource."[11]

Evaluation of distributed generation as a supply-side resource will only become more important as distributed technologies like rooftop solar continue to gain in popularity among PacifiCorp customers. As of March 2017 more than 20,500 PacifiCorp customers had installed 161 MW of rooftop solar. To quantify the true impact of the growth of distributed generation

[11] Docket No. 15-035-04, PacifiCorp's 2015 Integrated Resource Plan. Division Comments, August 25, 2015. P 26.

technologies in the 2019 IRP processes, PacifiCorp should, at a minimum, include sensitivity runs that consider distributed generation as a supply-side resource. Utah Clean Energy requests that the Commission direct PacifiCorp to model distributed generation as a supply-side resource, in consultation with stakeholders, in future IRPs.

D. Recommendations related to modeling battery storage in future IRPs.

The cost of battery technology is falling quickly, which creates new modeling challenges for the utility. Given the incredible potential of battery storage, Utah Clean Energy recommends the following to support strong analysis of battery storage in the 2019 IRP:

1) Track and update battery cost trends to align modeling assumptions with the most accurate and current market information..
2) PacifiCorp should model customer-sited battery storage programs and incentives.
3) The Commission or PacifiCorp should convene technical workgroups to discuss challenges and needs related to modeling battery storage and refine its modeling of battery storage in the 2019 IRP.

Each of these recommendations is discussed further below.

The availability of cheap energy storage will have impacts on every level of the utility landscape, from transmission to distribution to behind-the-meter applications. Batteries can be deployed at many locations on the grid and can provide a variety of energy services beyond just storage (see Figure 1). Utilities across the country are investing in battery storage as an alternative to traditional infrastructure investments and as a cost-effective tool to improve reliability and power quality. A recent study filed with the California Energy Commission[12]

[12] Clean Coalition. *Testimony to the California Energy Commission (CEC) offering a solar+storage solution as an alternative to the Puente Power Project*. August 29, 2017. http://www.clean-

demonstrates that solar and storage may to be more economic than planned investments in two natural gas peaker plants. The California Energy Commission recently rejected a proposal to refurbish the Ellwood gas peaker plant and signaled an intention to reject NRG's proposal to

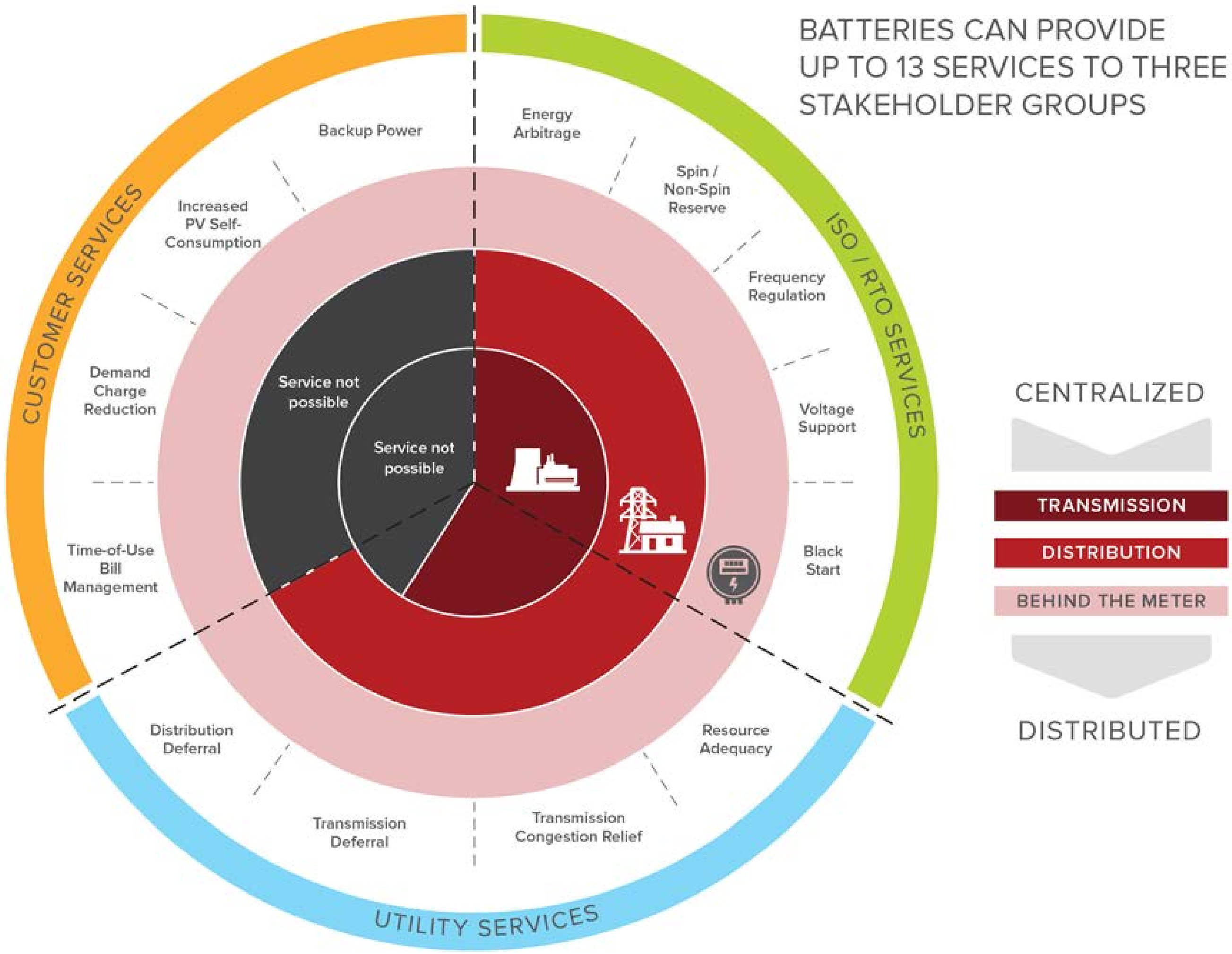

Figure 1: battery storage can offer a variety of services deployed in many locations on the grid.

Source: Rocky Mountain Institute, the Economics of Battery Storage. https://rmi.org/insights/reports/economics-battery-energy-storage/.

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coalition.org/regulatory-filings/cec-proposing-a-cost-effective-solarstorage-alternative-to-puente-gas-plant/.

build the Puente gas peaker plant. PacifiCorp, too, has already identified solar and storage to be a least-cost alternative to new transmission infrastructure.[13] Cases like this demonstrate the tremendous potential of battery storage, especially as costs continue to fall. It is critical to begin modeling battery storage correctly now to avoid missed opportunities for least-cost, least-risk resource investments.

Battery storage is poised to become a least-cost resource for a variety of utility services, which include not just energy storage, but capacity, spinning and supplemental reserves, voltage support, load following and ramping, support for integrating renewables, frequency response, and transmission and distribution congestion relief.[14] In order to capture the diverse and wide-ranging applications for battery storage in utility planning and modeling, it is essential to use up-to-date cost assumptions for battery technology and begin modernizing utility planning processes. The following recommendations are intended to facilitate this objective.

1: Track and update battery cost trends to align modeling assumptions with the most accurate and current market information.

The cost of battery storage fell 80% between 2010 and 2016 and will continue to decline steeply.[15] It is important to update inputs related to battery costs as frequently as possible in

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[13] Docket No. 16-036-36, In the Matter of Rocky Mountain Power's Sustainable Transportation and Energy Plan ("STEP") Act Initiatives. RMP Application to Implement Programs Authorized by the Sustainable Transportation and Energy Plan Act, Exhibit D – Solar and Storage Program. September 12, 2016.

[14] KEMA, Inc. *Battery Energy Storage for the 2017 IRP*. Table 11 Application Rankings in Current Market Scenario. http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Integrated_Resource_Plan/2017_IRP/10018304_R-01-D_PacifiCorp_Battery_Energy_Storage_Study.pdf

[15] McKinsey & Company. *Electrifying Insights: How automakers can drive electrified vehicle sales and profitability*. Page 10. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/electrifying-insights-how-automakers-can-drive-electrified-vehicle-sales-and-profitability.

order to keep up with actual market prices. In the 2017 IRP, PacifiCorp's estimated cost of energy storage equipment (not including power conversion and control equipment, balance of system costs, installation, and fixed O&M) for lithium ion batteries in the 2017 IRP ranges from $325/kWh to $850/kWh.[16] However, recent market evaluations benchmark the cost of lithium ion batteries in 2016 to be in the ballpark of $225 - $275/kWh, well below RMP's lowest current estimate for this technology. Market evaluations further project that the cost of lithium ion batteries will fall below $190/kWh by 2020.[17] PacifiCorp must stay aware of market trends in order to be able to accurately model battery costs prospectively.

PacifiCorp's 2017 IRP battery storage cost assumptions for a total installed project (including power conversion and control equipment, balance of system costs, installation, and fixed O&M) are also high. According to Table 10 of the Battery Energy Storage Study, the total installed cost for a 10 MW, 20 MWh lithium ion battery project is approximately $16.9 million.[18] In the 2017 IRP, Table 6.9 provides an assumed capital cost for a 1 MW, 2 MWh

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[16] KEMA, Inc. *Battery Energy Storage for the 2017 IRP*. P 19. http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Integrated_Resource_Plan/2017_IRP/10018304_R-01-D_PacifiCorp_Battery_Energy_Storage_Study.pdf

[17] McKinsey & Company benchmarks lithium ion battery prices at $227/kWh in 2016 and projects costs below $190/kWh by 2020. Bloomberg New Energy Finance benchmarks battery prices at $273/kWh in 2016.

McKinsey & Company. *Electrifying Insights: How automakers can drive electrified vehicle sales and profitability*. (2017, January). P10. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/electrifying-insights-how-automakers-can-drive-electrified-vehicle-sales-and-profitability.

Bloomberg New Energy Finance. *Lithium-ion Battery Costs and Markets.* (2017, July). P2. https://data.bloomberglp.com/bnef/sites/14/2017/07/BNEF-Lithium-ion-battery-costs-and-market.pdf

[18] KEMA, Inc. *Battery Energy Storage for the 2017 IRP*. Table 10 Example Installed Cost Calculation for 10 MW, 20 MWh NCM Li-Ion Energy Storage System.

lithium ion battery of $2.5 million.[19] These costs are higher than the costs reported by RMP for a battery storage project approved through the STEP Program, which reported the cost of a 2 MWh battery storage project in 2018 at $1.6 million and the cost of a 3 MWh battery storage project in 2020 at $2.2 million.[20]

Utah Clean Energy recommends that PacifiCorp update the cost inputs for battery storage based on reputable third-party market reports as often as possible. Even so, the cost of battery storage is falling so quickly that the two year IRP planning process may not be able to capture actual cost declines. The Oregon Public Utilities Commission recently issued draft guidance for modeling battery storage in IRPs and, among many other recommendations, urged utilities to apply a reasonable learning curve to future storage costs to account for forecasted declines between IRPs.[21] In order to accurately capture projected battery storage costs prospectively within the Action Plan timeframe and through the latter years of the IRP, PacifiCorp should do the same in Utah.

2: Model customer-sited battery storage programs and incentives

The 2017 IRP modeled just one application of battery storage: utility-scale storage as a supply-side resource. However consumer-sited distributed storage can offer multiple benefits and

[19] *PacifiCorp 2017 Integrated Resource Plan, Volume 1,* Table 6.9 Battery Storage Study Summary Cost and Capacity Results (2016$)

[20] Docket No. 16-035-36, In the Matter of Rocky Mountain Power STEP Act Initiatives – Exhibit D – Solar and Energy Storage Program, September 12 2016. Page 6.

[21] Docket UE-151069. *Draft Report and Policy Statement on Treatment of Energy Storage Technologies in Integrated Resource Planning and Resource Acquisition*. March 7, 2017. https://www.utc.wa.gov/_layouts/15/CasesPublicWebsite/CaseItem.aspx?item=document&id=65&year=2015&docketNumber=151069&resultSource=&page=&query=&refiners=&isModal=&omItem=false&doItem=false.

can be acquired cost-effectively because ratepayers do not need to cover the full cost of the battery storage resource. We recommend that the 2019 IRP model distributed energy storage on the customer side of the meter, including incentive programs for battery storage. Several utilities across the country provide incentives for customer-sited battery storage. For example Vermont, New York, and California have established programs that offer customers incentives or opportunities to host battery storage:

- Green Mountain Power, in Vermont, piloted a program for customer-sited battery storage in 2015 and expanded the program in 2017. Due to decreased battery costs and additional grid benefits available through new battery software, the utility cut the cost to participate in the expanded program by more than half compared to the pilot. For $15 a month, or a one-time fee of $1,500, utility customers receive a Tesla Powerwall battery that provides a variety of grid services on a day-to-day basis and provides backup power to the customer in the event of an outage.[22]
- In New York, Con-Edison provides an incentive of up to 50% of project costs or $1,500/kW for building owners to install battery storage in order help reduce peak load.[23]
- The California Public Utility Commission has established a Self-Generation Incentive Program (SGIP) to provide incentives for new and existing distributed energy resources, a portion of which is reserved for residential energy storage. The incentive for small residential storage is currently $0.35 - $0.40/watt. The SGIP program is available to retail electric and gas customers of California's four investor-owned utilities.[24]

In order to evaluate the potential for customer-sited battery storage to serve as a cost-effective utility resource, Utah Clean Energy recommends that in the 2019 IRP PacifiCorp model customer-sited distributed energy storage, including a battery storage incentive program.

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[22] Additional information available at https://www.greenmountainpower.com/press/gmp-launches-new-comprehensive-energy-home-solution-tesla-lower-costs-customers/.

[23] Additional information available at: https://www.coned.com/en/save-money/rebates-incentives-tax-credits/rebates-incentives-tax-credits-for-commercial-industrial-buildings-customers/demand-management-incentives.

[24] Additional information available at: https://www.selfgenca.com/home/program_metrics/.

<u>3: Convene technical workgroups to discuss challenges and needs related to modeling battery storage and to refine modeling in the 2019 IRP.</u>

Battery storage is unlike any other generating resource currently in use by the utility because it has many diverse applications at every level of the grid and is highly scalable, from utility-scale projects like PacifiCorp's 5 MWh STEP project to customer-sited products like the 13.5 kWh Tesla Powerwall. In order to provide opportunities for shared learning, we recommend the Commission convene battery technology workgroups with the utility, technical experts, and interested stakeholders. The technology workgroup could provide additional recommendations regarding battery storage modeling, including (but not limited to) the following topics:

- Considerations related to different battery technologies, capabilities, applications, and costs.
- Evaluating the benefits of smaller battery storage projects located on the distribution system. In the 2017 IRP PacifiCorp considered battery storage projects 1 megawatt and larger.
- Future modeling needs related to energy storage. For example, the need for sub-hourly modeling to capture the intra-hour benefits of energy storage.

III. CONCLUSION AND RECOMMENDATIONS

Utah Clean Energy appreciates the opportunity to provide comments related to the 2017 Integrated Resource Plan (IRP) and recommendations for future IRPs. In addition to these comments, Utah Clean Energy submitted separate comments on the demand side management (DSM) potential study and DSM in the 2017 IRP jointly with the Southwest Energy Efficiency Project (SWEEP).

Utah Clean Energy recommends that the Commission not acknowledge the 2017 IRP due to concerns that the 2017 IRP failed to compare existing coal resources consistently with and comparably to any other present or future supply or demand-side resources and that the repowered wind project was not raised as a resource option until the very end of the modeling process.

Regardless of the Commission's acknowledgement decision, Utah Clean Energy provides the following recommendations to ensure that the current and future IRP processes consider distributed generation resources appropriately:

- Amend the 2017 Action Plan to acquire solar resources called for later in the IRP in the near term while ratepayers can benefit from historic low prices and the Federal Investment Tax Credit.
- Model distributed generation as a supply-side resource in the 2019 IRP.
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- Convene technical workgroups to discuss challenges and needs related to modeling battery storage and to refine modeling in the 2019 IRP.

RESPECTFULLY SUBMITTED,
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