



2021 CONSERVATION POTENTIAL ASSESSMENT DRAFT FINAL WORK PLAN

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This Work Plan was prepared for:
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INTRODUCTION AND SUMMARY

In August of 2019, PacifiCorp engaged Applied Energy Group, Inc. (AEG), to perform a Conservation Potential Assessment (CPA) to support PacifiCorp's 2021 Integrated Resource Plan and energy efficiency and demand response program and portfolio planning. The assessment will utilize the best-available, applicable data and regionally- and nationally-accepted methods to assess the Technical Potential and Technical Achievable Potential (TAP) in each of the six states served by PacifiCorp, excluding an assessment of energy efficiency demand-side resources in Oregon, which is assessed by the Energy Trust of Oregon (Energy Trust). This study will build on the three previous CPAs AEG completed for PacifiCorp in 2019, 2017, and 2015 and will benefit from a foundation of research, materials, and models that were fine-tuned and enhanced during the prior studies.

The first step in any CPA is the development of a clear and concise work plan, documenting key scoping decisions, responsibilities, and milestones and ensuring a common understanding of study tasks, methodologies, and outputs between AEG and PacifiCorp. Additionally, the work plan serves as a tool for describing the CPA to internal and external PacifiCorp stakeholders.

In this document, we describe an in-depth scope of work, including data collection, analysis, stakeholder support, and reporting as well as a timeline of project tasks and milestones.

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SCOPE OF WORK

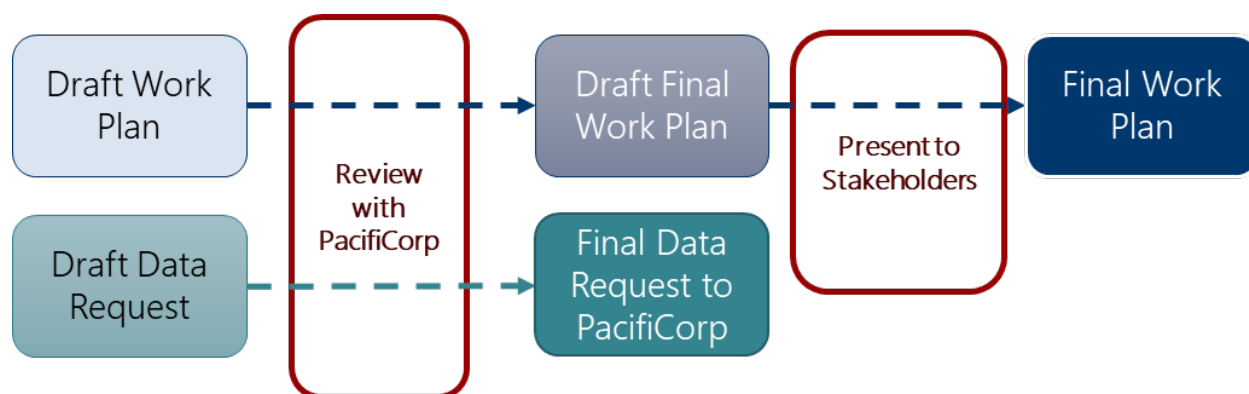
The CPA scope of work is separated into the following tasks, which are described in detail below:

- Task 1: Develop Final Work Plan
- Task 2: Conduct Research
- Task 3: Estimate Potential
- Task 4: Segmentation and Data Presentation
- Task 5: Summary Report and Stakeholder Support

Task 1: Project Initiation and Finalize Work Plan

This task summarizes the process for kicking off the CPA project with PacifiCorp and stakeholders and setting the stage for future analytical steps. The two deliverables of this step will be a finalized project work plan and a detailed data request to PacifiCorp in support of the CPA. We will work with the Company in-person to review and refine, then present the revised work plan to stakeholders. The flowchart below summarizes this process:

Figure 2-1 Project Initiation Flowchart



Draft Work Plan

The first step in this process will be for AEG to draft a work plan summarizing the core CPA tasks and approaches that AEG will take to successfully complete them. This work plan will reflect tasks from the 2019 CPA, updated to reflect PacifiCorp's evolving needs and data requirements. We will provide this to PacifiCorp for review and discuss during the kickoff meetings listed below.

Data Request

Utilizing up-to-date and PacifiCorp-specific data greatly enhances the accuracy and defensibility of study results. Prior to the second kickoff meeting, AEG will send PacifiCorp an initial list of requested data for use in the CPA and will review data elements with PacifiCorp subject matter experts at the kickoff meeting. The data request will largely be an update to what PacifiCorp provided AEG for the 2019 CPA but may include additional data elements to support the updated work plan. A preliminary list of data sources that we plan to discuss with PacifiCorp is included in Task 2.1 below, to be refined throughout development of the work plan.

Based on the discussion, we will revise the data request to describe exactly what information we would like to receive from PacifiCorp and other data sources we will use to update the data for the study.

Kickoff Meetings

The project will begin with two in-person kickoff meetings to be held at PacifiCorp's offices. For the first meeting, AEG will meet with PacifiCorp Planning Manager(s) and available Program Manager team to debrief on the 2019 CPA and review proposed updates to the methodology and make relevant updates to the work plan. During the second meeting, AEG and PacifiCorp Planning Managers will present the proposed updated methodology and other topics of interest to the larger team following the conclusion of the 2019 CPA and the filing of the 2019 IRP.

Finalize Work Plan

Within 10 days of the kickoff meeting, we will deliver a revised work plan to PacifiCorp, incorporating feedback received during the project kickoff meetings. We will work with PacifiCorp Planning Managers as needed to create a mutually agreeable "draft final" work plan. PacifiCorp plans to send this draft final work plan to external DSM and IRP stakeholders for review and comment. After stakeholder comments are received, AEG and PacifiCorp will work collaboratively to modify the draft final work plan, as necessary, and to create a final work plan. Note, while there are certain core study tasks that can occur while stakeholders review the work plan (e.g., data requests, data collection), AEG will not be able to begin detailed potential modeling work until after the scope of work is finalized.

If, after work plan finalization, there are additional needs to revise the work plan based on business needs, stakeholder feedback, or regulatory requirements, we will work collaboratively with the Company to revise accordingly.

Deliverables for Task 1: Develop Final Work Plan

- Kickoff meeting agenda, presentation, and meeting minutes
- Data request
- Detailed work plan draft
- Revised detailed work plan, draft final, incorporating feedback from PacifiCorp
- Final detailed work plan incorporating feedback from PacifiCorp stakeholders

Task 2: Conduct Research

The research process described in this section will begin by assembling data and identifying differences from the prior CPA, much of which will pertain to all three resource classes, although some information will be specific to a particular resource class. With the data in hand, we will then perform the analysis for each respective resource class.

Resource Classes Considered

For the 2021 CPA, we have relabeled the three resource classes to be reflective of the types of measures contained within, rather than a rating on "firmness" of potential. Class 4 will continue to be excluded as a behavioral-based resource such as education and information. Details and definitions surrounding the three classes to be analyzed can be found in Table 2-1 below.

Table 2-1 *Labels and Definitions for Resource Classes Considered in the CPA*

Resource Class	Descriptive Name	2019 IRP Description
Class 1	Demand Response (DR)	A firm, capacity focused resource such as a load control
Class 2	Energy Efficiency (EE)	A firm energy intensity resource such as energy efficiency
Class 3	Pricing and Rates (P&R)	A non-firm, capacity focused such as pricing response or load shifting

Task 2.1 Data Collection and Research

From the previous CPA, we already have fully populated models for estimating potential in PacifiCorp's service territory. In this step, we will leverage existing data sources but will also perform a thorough assessment to be sure the inputs are up-to-date and applicable to each state in the PacifiCorp's service territory. Before updating assumptions and characterizing measures, AEG will develop a source hierarchy for each jurisdiction, identifying the most relevant sources to be characterized and where additional research may be required. Some examples of relevant sources include past PacifiCorp studies, PacifiCorp program data as reviewed by AEG, relevant TRMs and workbooks from within PacifiCorp's six-state territory, program and TRM data from neighboring states and utilities, well-vetted national sources such as the U.S. Department of Energy's Annual Energy Outlook and ENERGY STAR documentation, and TRMs from across the country when data can be sufficiently localized to each jurisdiction.

The following list will provide a starting point for discussion during the kickoff meeting in Task 1 and the future data development efforts below:

- From PacifiCorp:
 - Program data, including historical actuals, and program tariffs
 - Historical billing data
 - Load research data and any new load shapes
 - Most recent load forecast, including forecasts of customers, retail energy sales, and peak demand (including both monthly system and jurisdictional peaks)
 - Results from any Customer Decisions surveys conducted since the previous potential assessment
 - Updates to modeling assumptions including forecasts of retail rates, and other economic parameters used by PacifiCorp in various comparable economic assessments (e.g., customer growth forecasts, income forecasts, line-losses, discount rates, program administrations costs, etc.); these items are inputs to the models that can be modified for scenario analyses as well
 - PacifiCorp DSM results through 2019 along with full versions of any non-public Annual Reports (we understand that 2019 data will not be available during project initiation, but AEG is very familiar with these documents through prior engagements and can rapidly incorporate them into the analysis when they become available).
- Updated technical reference manuals and work products within the Northwest and Mountain regions as well as nationally if data can be reliably adapted to suit PacifiCorp's territory (e.g. weather appropriateness of assumptions).
- Emerging technology reports and databases, such as anything new from ACEEE, E3T, the US national labs, NEEA emerging technology reports, and the California Emerging Technology Library.

- We will also review, and update LED efficacy and cost projections based on the most recent publication by the U.S. DOE if available. If updates are not available, we will instead compare projections from the DOE's 2016 report with current efficiency and cost levels and make adjustments ourselves if warranted after review with PacifiCorp.
- Perform a regulatory review by state for energy efficiency and demand response to ensure the CPA is evolving with state requirements.
- Other secondary data resources, including studies from other utilities in the Mountain and Northwest regions.

Task 2.2 Identify and Characterize Demand Response and Pricing and Rates Resources

In this task, we define and characterize demand response (DR) and pricing and rates (P&R) programs and resources. This includes both re-assessing the characteristics of existing programs and identifying new programs for inclusion in the study.

We begin by working collaboratively with PacifiCorp to specify the capacity-focused products for inclusion in the DR and P&R potential analysis. As in the previous CPAs, the list of relevant products will include those currently being offered by PacifiCorp along with new products that have been successfully implemented by other comparable utilities. A list of DR and P&R resource options assessed in the previous study, including those of which are already offered by PacifiCorp, is provided in Appendix A.

At this time, AEG and PacifiCorp have already identified three new areas of focus for demand response and pricing and rates to include in the scope of work:

1. **DR and P&R potential outside of system peak window.** In previous CPAs, DR and P&R have been assessed based on their impacts during PacifiCorp's system-wide summer and/or winter peaks. In accordance with recent Rocky Mountain Power program updates and a focus by PacifiCorp's Customer Solutions and Transmission and Distribution teams on utilizing DSM as a non-wire alternative on constrained substations and feeders, AEG will re-assess demand response and pricing and rates impacts for periods outside the summer and/or winter system peaks. We will review these programmatic changes with PacifiCorp and identify a broader event window based on evolving system needs. This may include DR events at jurisdictional or locational peaks, events over all summer or winter weekdays, or some other timeframe of sufficient value to the grid. Emphasis will be placed on programs and technologies that enable what the industry is beginning to call "flexible buildings" which are able to increase consumption in addition to the traditional curtailment response based the utility grid needs. We will work with PacifiCorp's Customer Solutions and IRP teams to develop an approach on how to best integrate this analysis into the 2021 IRP.
2. **Battery Energy Storage.** This technology facilitates load shifting (not just peak shifting) using electricity stored as electrochemical energy within a battery. AEG will assess battery energy storage as a DR resource, with the utility having partial or total control over when the battery is charged and discharged.
3. **Updated Water Heater Direct Load Control Analysis.** In HB 1444, the State of Washington recently enacted legislation requiring, among other things, that all new electric water heaters installed in the state be network-enabled for direct load control. This rule has substantial implications to PacifiCorp's Washington jurisdiction, where many customers heat water using electricity. AEG will conduct research into impact and participation assumptions for this program and consider as a DR measure for each PacifiCorp jurisdiction.

Task 2.3 Identify Energy Efficiency Measures

To update the energy efficiency (EE) measure data, we must first review and update the list of measures to analyze. We will begin with the measure list from the previous CPA and add and remove measures as appropriate based on the source hierarchy developed in Task 2.1 above. Behavior-based measures will also be included.

Incorporate Emerging Technology into the Measure List

As part of AEG's ongoing effort to update our Database of Energy Efficiency Measures (DEEM) and support utility efficiency programs, our team has extensive experience performing technology research on emerging demand-side technologies and measures, which we will give special treatment to as part of this study. If considered today, many would not be feasible. However, based on our ongoing research efforts (through our Engineering and Technical Services group), we are constantly monitoring the feasibility of technologies that are currently in the demonstration stages. (e.g., heat pump swimming pool heaters, ozonation of cooling tower water, chiller heat recovery in a campus setting, electric infrared spot heating for commercial and industrial applications, and additive manufacturing using 3D printers). We rank emerging technology measures based on categories such as technical maturity and market scalability (e.g. applicable to one or more applications, segments, or regions). We will use this ranking methodology to transparently add, and qualitatively exclude, emerging technology measures when developing the list of EE measures. Our measure development approach allows for technologies to enter program portfolios when they become viable and cost-effective. As requested by PacifiCorp, we will include those measures that we expect will see significant price drops or increased market penetration over a five to ten-year horizon.

Summarize in Combined DR, EE, and P&R Measure List

We will provide the proposed lists of measures to PacifiCorp for review and incorporate any feedback received. After incorporating PacifiCorp feedback and generating a "Draft Final" measure list, we will incorporate all DSM measures into one document and share with PacifiCorp stakeholders for feedback and review. We will identify whether each measure fits within an existing PacifiCorp program, is an emerging technology, or is likely to be impacted by known state codes and standards as well as federal standards. The approach for this engagement and timeline for receiving and incorporating feedback will be determined by PacifiCorp prior to submitting the document for feedback. Once feedback is incorporated, AEG will distribute the final measure list to PacifiCorp to provide to external stakeholders for future reference.

Task 2.4 Characterize Energy Efficiency Measures

Next, we will characterize measures in terms of their energy savings, demand savings, costs, measure life, and other attributes needed to estimate potential. The measure characterization will differentiate savings, costs, and other characteristics for each state.

For the identified products/measures, we will assemble the following information:

- A brief technical description of what the measure accomplishes and its market and technical applicability.
- Identification of energy savings attributable to the measure. We will also quantify O&M, secondary fuel, and other non-energy benefits, such as water savings from horizontal-axis washing machines, as

required to meet Washington and Idaho requirements. Our BEST modeling tool¹ and many secondary source documents account for measure interactions at the end-use level. All non-energy benefits must be well-documented and monetized to be considered for inclusion in the study.

- Incremental costs associated with each measure. This is the cost difference between the standard - efficiency product and the high-efficiency product in the case of lost-opportunity decisions or the full cost of the device (such as a programmable thermostat) for discretionary measures. For analysis of incentive costs, see Task 2.6 below.
- Lifetime of the measures.
- Current saturation. We will use all available PacifiCorp data, NEEA RBSA, CBSA, and IFSA data, and other regional studies to develop these saturations for each measure.
- End effects that address measure persistence and reinstallation costs.
- Assumptions and impacts for early retirement measures when appropriate. List of possible measure candidates will be discussed with PacifiCorp and stakeholders.

In 2019, AEG updated the analysis from a study commissioned by PacifiCorp on potential savings from Waste Heat to Power and Regenerative Technologies (WHP & RT). The study found over 197,000 MWh of savings opportunity in PacifiCorp service territory if existing facilities installed these technologies. AEG will re-assess and update the findings of the study for inclusion in PacifiCorp's EE potential. Since only two years have passed since the last update on this study (in comparison to roughly five years in the previous iteration), AEG anticipates that this task will require less research in the 2021 CPA.

Treatment of Washington House Bill 1257 (HB 1257)

HB 1257 empowers the Commerce Department to specify that commercial buildings larger than 50,000 square feet meet specific end-use intensity standards between the years of 2026 and 2028 based on size and includes an incentive mechanism for early adoption. Although this standard has the potential to materially impact energy consumption in the commercial market, AEG will not be explicitly accounting for this in the CPA.

Task 2.5 California-Specific Measure Research

As part of this task, if approved by the Company, AEG will catalog and document California's wide array of existing measure assumptions. We will prioritize assumptions for the northernmost California Climate Zones (as appropriate for Pacific Power's California territory) but will need to review workpapers from across the state in order to account for all relevant measures in these zones. As-is, California measure data is housed within the aging DEER database as well as conflicting statewide workpapers drafted by all three of the large IOUs (PG&E, SCE, and SDG&E). These workpapers include assumptions for all three territories and are required to be used for statewide planning. (e.g. SDG&E might develop efficient weatherization assumptions for all 16 California Climate Zones that PG&E would then be required to use). Recent AEG review of these workpapers has shown that additional work is required to adapt and utilize these for planning purposes as many of them include embedded calculation files with corrupted or untraceable references.

This is listed as optional since it will not be necessary if California releases its eTRM, streamlining and correcting all sources and reviewing them for consistency amongst themselves.

¹ We will develop savings estimates for weather-sensitive measures (HVAC, building shell) using the RTF SEEM tool, AEG's Building Energy Simulation Tool (BEST), a derivative of the DOE 2.2 building simulation model, and Energy Plus simulations for the Rocky Mountain Power territories.

Task 2.6 Estimate Utility Incentive and Administrative Costs for Each PacifiCorp Jurisdiction

As part of the 2019 CPA, AEG developed jurisdiction-level administrative cost estimates for PacifiCorp's California, Idaho, Utah, Washington, and Wyoming territories using PacifiCorp Annual Reports from 2014 through 2016. AEG benchmarked these against similar utilities and programs for use in the analysis. For the 2021 CPA, AEG will first update this analysis using more recent annual reports (incorporating 2017 and 2018, if available). This will ensure that the analysis uses the most up-to-date data and incorporates any recent changes to the way that PacifiCorp administers programs.

Additionally, as new scope for this study, where applicable, AEG will summarize jurisdiction-specific incentive data for use in study benchmarking with actual utility spending. To accomplish this, we will review PacifiCorp's existing program offerings on the Pacific Power and Rocky Mountain Power websites and results for the 2014 through 2018 Annual Reports to develop incentives on a \$/kWh, fixed incentive, or percent of incremental cost as prescribed for applicable measures and/or measure categories. AEG has recently updated LoadMAP to account for all of these different calculations, among others.

Deliverables for Task 2: Conduct Research

- Draft memo describing initial list of demand response and pricing and rates capacity products/measures; revised memo incorporating PacifiCorp feedback
- Energy efficiency measure list and documentation on emerging technologies included or qualitatively excluded from the analysis
- Summary of incentive and non-incentive utility costs by jurisdiction
- Updated Waste Heat Technology to Power and Regenerative Technologies memo, summarizing approach, recommendations by state, and guidance on incorporating into PacifiCorp's portfolio

Task 3: Estimate Potential

In this step, we estimate potential for demand response and pricing and rates and energy efficiency resources. We begin by describing the process in estimating demand response and pricing and rates potential together, followed by energy efficiency. We then discuss the ways in which our approach considers interactive effects between measures and classes.

Task 3.1 Market Characterization

Review and Refine Analysis Segmentation Approach

PacifiCorp has used the same market segmentation approach for several previous studies. AEG believes this segmentation still captures the most important customer segments and additionally maintains consistency with previous studies, facilitating comparisons. The 2019 CPA segmentation for baseline market characterization and EE potential estimations are shown in Table 3-1. The 2019 CPA segmentation used for DR and P&R potential estimation, an aggregation of the baseline market characterization, is shown in Table 3-2. We anticipate using the same segmentation for this CPA but will review this assumption with PacifiCorp.

Table 3-2 Analysis Segmentation, Energy Efficiency (EE) Resources, from 2019 PacifiCorp Study

Dimension	Segmentation Variable	Description
1	State	Pacific Power: California and Washington Rocky Mountain Power: Idaho, Utah, Wyoming
2	Sector	Residential, commercial, industrial, irrigation, and street lighting

3	Customer Category	Residential: single family, multifamily, manufactured home Commercial: by building type Industrial: by industry type Irrigation: by pump horsepower Street lighting: customer-owned, company-owned, and off-area lighting
4	Vintage	Existing and new construction
5	End uses	Cooling, space heating, lighting, water heating, motors, etc. (as appropriate by sector)
6	Appliances/end uses and technologies	Technologies such as lamp and fixture type, air conditioning equipment type, motors by application, etc.
7	Equipment efficiency for new purchases	Baseline and higher-efficiency options as appropriate for each technology

* Oregon is not included because Oregon will be analyzed separately based on Energy Trust Assessment

Table 3-2 Example of Market Characterization for DR Analysis, from 2019 PacifiCorp Study

Market Dimension	Segmentation Variable	Description
Dimension 1	State	UT, OR, WY, WA, ID, CA
Dimension 2	Sector	Residential, Commercial and Industrial (C&I), and Irrigation
Dimension 3	Customer Class	Residential: all customers
		C&I: by maximum peak demand
		Small C&I: ≤30 kW
		Medium C&I: >30 kW and ≤200 kW
		Large C&I: >200 kW and ≤1,000 kW
		Extra-large C&I: >1,000 kW
		Irrigation: all customers

Market Characterization

The purpose of this step is to characterize the market in terms of the number of customers, annual electricity use, and peak demand for the residential, commercial, industrial (excluding special contract customers), irrigation, and street lighting sectors for the study's reference year (likely 2018, but possibly 2019). We refer to these values as the *control totals* to which we will calibrate our modeling to. While this analysis is straightforward in concept, it is vitally important to develop a common understanding among all team members about the PacifiCorp customer base and to provide a solid foundation for subsequent steps.

Next, for each state, sector, and customer segment, we will update the end-use market profiles from the previous study that describe how customers currently use electricity, which provide the foundation for assessing DSM potential. The market-profile data elements include:

- Number of customers
- Saturations for each end use and technology

- Unit energy consumption (UEC, expressed as kWh/household per year) for the residential sector or energy-use indices (EUIs, expressed as kWh/sq.ft. per year or kWh/employee per year for the commercial and industrial sectors respectively) for each end use and technology
- Summer and winter peak impacts per customer in a similar format to the UEC described above. We will work with PacifiCorp to determine whether periods of interest to ensure that baseline market characterization aligns with how potential for capacity-focused resources will be estimated.

These inputs are calibrated so that segment-level electricity consumption in the base year matches the control total value for the segment's energy use. Market profiles are developed to represent both new construction and the existing market within each segment. An example of the market characterization can be found in Volume 4, Appendix A of the 2019 CPA report.

Develop Baseline Projection

The next step in the analysis is to develop a reference projection of energy and peak demand through 2040, absent the effects of future utility DSM programs or regional market transformation programs. We will use the same approach as in the previous study, making sure that we align with the PacifiCorp load forecast.

To develop the baseline projection, we will combine the following data elements:

- Existing customer counts, new construction forecasts, and billing/usage data
- Fuel share and equipment saturation data
- End-use consumption characteristics across building types, end uses, and efficiency levels
- End-use equipment and measure lives (from measure data described above)

Codes, Standards, and Market Baselines

We will incorporate state-level codes and standards and federal standards into the baseline projections, working with PacifiCorp load forecasting to ensure alignment with values that are ultimately provided to the IRP. We will also review the RTF's "market baselines" in states where applicable, understand whether they are reflected in PacifiCorp's forecast, and quantify the impacts on the load forecast if necessary.

Our team will provide baseline projection results in a transparent tabular format. We will also work with the load forecasting team to incorporate an updated load forecast, expected in the summer of 2020.

Task 3.2 Demand Response and Pricing and Rates Analysis

This task encompasses the analysis of demand response and pricing and rates potential resources, based on the market characterization from Task 3.1. This study will assess the potential for expansion of existing products and explore potential impacts of new products that have been implemented successfully by other comparable utilities in the U.S. and abroad. Since AEG completed the previous study, we have performed DR potential studies for NV Energy, Omaha Public Power District, Avista Energy, and the Midcontinent ISO.

Demand Response and Pricing and Rates - Develop Program Assumptions

The three key parameters that are needed for DR potential estimation are:

- Participation rates
- Per unit peak demand impacts and annual energy savings (if appropriate)

- Program cost assumptions

Additional parameters for potential estimation include DR event participation rates, percentage of customers with enabling technology, attrition rate of participants. Additional parameters also feed into the development of program costs, such as: program development costs, equipment costs, marketing and program administration costs, product lifetimes, discount rate, etc. We also need to consider the availability of smart meters (or advanced metering infrastructure – AMI) across PacifiCorp’s service territory.

We will begin with the assumptions that are already populated in our analysis models from the previous CPA and update as needed based on any newly available PacifiCorp evaluations or program data, our recent related studies with other clients, and well-established secondary sources that include FERC, load management program evaluation reports, and program filings with state public service commissions.

Demand Response and Pricing and Rates - Estimate Potential

Once the above steps are completed, we will estimate potential for DR and P&R resources in our combined LoadMAP model. The model combines participation rates and per-customer savings to compute potential capacity and energy savings using straightforward and transparent calculations. We routinely present these estimates by program type, customer segment, and geography. Additional views into the potential will be determined jointly with PacifiCorp input. In this study, we will also incorporate the additional savings from energy efficiency that may result from the event or an integrated DSM measure with additional efficiency savings. We will discount these savings for snapback-type effects before and/or after an event if relevant (e.g. an air-conditioning unit may operate more frequently after an event to bring the space back to the desired temperature, reducing energy savings from the event).

The estimation of potential is performed, first for technical potential (only applicable for DR resources) and then for market potential for both DR and P&R resources as follows:

- **Technical Potential.** Technical potential assumes 100 percent participation of eligible customers in applicable DSM options. It is estimated by multiplying the unit load impact assumptions, described in the earlier section, by the entire eligible customer load in the relevant customer class. It assumes perfect market conditions in which all eligible customers participate in the applicable DSM option, without taking into consideration any barriers to participation. It is therefore a theoretical maximum potential for a particular DSM option. Technical potential will be computed for DR options only (similar to the previous CPA). Technical potential is not considered to be applicable for P&R DSM.
- **Market Potential.** Market potential considers achievable participation rates in DSM options, taking into consideration real world market conditions. It accounts for customers’ ability and willingness to participate in capacity-focused programs, subject to their unique business or household priorities, operating requirements, and economic considerations.
 - For DR options, market potential is calculated by multiplying the technical potential by the assumed participation rates. These participation assumptions are based on an extensive database of similar program offerings, offered nationwide by other utilities and system operators.
 - For P&R options, the study estimates potential associated with “opt-in” and “opt-out” dynamic pricing rate offerings, which is akin to market potential for DR options. The participation assumptions are based on a review of full-scale rate deployments and market research studies conducted in the U.S. and internationally.

Throughout the analysis, we will also keep a careful account of what DR and P&R resources are already existing and embedded in PacifiCorp’s load requirements. The existing impacts for DR resources will be

obtained from the most recent program evaluations and the impacts of existing P&R resources will come from the analysis included in the 2015 CPA or more recent data to be provided by PacifiCorp. These existing impacts will be netted out from the overall potential such that there is a clear accounting of the incremental resources that will be available for selection by the IRP.

Demand Response and Pricing and Rates - Calculation of Levelized Cost by Program Option and State

A critical element to PacifiCorp's resource planning process is to obtain estimates of the levelized cost of DSM resources to make them comparable to supply-side resources they may be competing with in IRP analysis. As we did in the previous study, we will develop levelized costs by taking the annualized costs and dividing them by the annualized kW reductions for each DR resource in each state. The levelized cost (\$/kW-year) calculations include costs for items such as program development and administration, customer marketing and recruitment, incentive payments, enabling technology, and O&M costs. Similar to the 2019 CPA, AEG will discount incentive costs in relevant jurisdictions (non-UCT states) by a fixed percentage as a proxy for customer benefits in a methodology consistent with the California Public Utility Commission's (CPUC's) cost-benefit analysis protocols and any methodology updates made by the Council in anticipation of the 2021 Plan. In the 2019 CPA, incentive costs were discounted by 25%. AEG will begin with a similar assumption then review updates in the region and stakeholder feedback with PacifiCorp prior to finalizing this value. In developing estimates of levelized costs, program costs are allocated annually over the expected program life cycle and then discounted using PacifiCorp's weighted average cost of capital (WACC) to calculate net present value (NPV) costs. As part of this step, we will look at evolutions in existing demand-response offerings on the market, including programs identified by PacifiCorp (such as cheaper "Bring Your Own Thermostat" offerings).

Task 3.3 Energy Efficiency DSM Analysis

The purpose of this task is to estimate energy efficiency potential in PacifiCorp's service area from 2021 through 2040 based on the market characterization from Task 3.1. As with DR and P&R analysis, the 2019 CPA provides a solid foundation for the EE analysis. We will start with this framework and update and enhance it to bring it up to date and to address additional aspects as requested by PacifiCorp.

Energy Efficiency DSM - Estimate Potential

The purpose of this task is to estimate two levels of potential:

- **Technical potential** is defined as the upper bound of conservation potential and represents the case where all feasible measures are adopted by customers regardless of cost-effectiveness or acceptance factors. The calculation of technical potential is a straightforward algorithm, aggregating the full, energy-saving effects of all the individual EE measures included in the study at their maximum theoretical deployment levels, adjusting only for applicability and interactive effects.
 - While theoretically all retrofit opportunities in existing construction (often called "discretionary" resources) could be acquired in the study's first year, this is patently unattainable in real-world markets. Therefore, we assume the realization of these opportunities will occur based on pre-defined adoption rates. By applying this assumption, along with natural equipment turnover rates and other adjustments described above, the annual incremental and cumulative potential will be estimated by state, sector, segment, construction vintage, end use, and measure.
- **Technical Achievable Potential** is a subset of technical potential constrained by applying market adoption rates for each measure that estimate the percentage of customers that would be likely to select each measure, given consumer preferences (partially a function of incentive levels), retail energy

rates, imperfect information, and real market barriers and conditions. These barriers tend to vary, depending on the customer sector, local energy market conditions, and other, hard-to-quantify factors.

Developing Market Adoption Rates

In previous studies, AEG has based these market adoption rates on ramp rates published by the Northwest Power and Conservation Council (NWPCC), modified as appropriate per discussions with the PacifiCorp team. For this study, AEG will develop a customized approach for each jurisdiction. In Washington, where a CPA is required to follow Power Council methodologies, we will incorporate the most up-to-date Seventh Plan or 2021 Plan ramp rates if available before April 1, 2020. In other states, we will review these ramp rates for appropriateness but will ultimately develop participation rates using a variety of sources. For example, we will incorporate primary market research conducted by AEG in the Mountain region and throughout the country and benchmark against PacifiCorp's existing programs and utilities with similar jurisdictions. Since development of ramp rates always receives considerable attention from stakeholders, we will work closely with PacifiCorp in this step. Please note also that these ramp rates will be visible to PacifiCorp and stakeholders, and can be modified to perform scenario analysis, including additional sensitivity cases if required by PacifiCorp.

Task 3.4 Treatment of Resource Interactions

This assessment will include multiple resources, actions, and interventions that would interact with each other if implemented in parallel. We take specific actions to account for these interactions to avoid double-counting the available potential. The interactive effects that we analyze occur within the major analysis sections; meaning that the interactions of energy efficiency resources are considered across all EE DSM resources. We will review the measure installation order (currently installed by levelized cost) and ensure it is consistent with the "first measure in, last measure out" methodology of the RTF when applicable. Likewise, the analysis of capacity-focused DR and P&R resources explicitly considers interactions. It should be noted, however, that this study will not attempt to quantify potential interactions between energy-focused and capacity-focused resources. Though an important factor to recognize, this study will not attempt to quantify such interactions due to uncertainties regarding resources likely to be found economic and pursued. This is the same approach taken in previous PacifiCorp CPAs.

Demand Response and Pricing and Rates Interactive Effects

Since DR and P&R programs may rely on similar customer classes and end-use loads to realize impacts during peak periods, it is important to consider and account for interactions to avoid double counting. For example, C&I customers enrolled in a Firm Curtailment Agreements program are unlikely to have sufficient load available to further reduce loads through a Critical Peak Pricing (CPP) program, given the likelihood of both programs targeting the same peak load hours.

To provide PacifiCorp with an accurate assessment of the impacts and economics of each individual resource option and to maintain consistency with past methodology for facilitated comparative analyses, the previous report focuses primarily on the program options on a standalone basis. The standalone analysis does not consider interactions between DR and P&R resources. Therefore, the potential and cost of programs for DR, presented in the main body of the report, are not additive to those for P&R DSM. However, within the same resource class, the standalone analysis considers interactions among different program options that are, or may become, available.

- For example, for P&R, the analysis assumes that if customers are offered a portfolio of rates, they would transition from time-of-use to CPP once a CPP product becomes available.

- For DR, there is no overlap in eligible customers among the options considered in our analysis, therefore we do not need to be concerned about interactive effect. So, the standalone analysis for DR represents potential for each individual resource on an independent basis.

In the previous study, we also provided an “integrated” scenario where DR and P&R resources were both included and arranged in a mutually exclusive hierarchy such that double counting was eliminated. This analysis was ultimately included in the report only as an appendix (Volume 5) for the sake of simplicity. We will investigate both scenarios again and discuss with PacifiCorp whether to use the same reporting methodology when the time comes to publish the results or to take a different approach.

Energy Efficiency Interactive Effects

There are several ways in which we accounted for the interactive effects that occur when modeling simultaneous and overlapping EE actions in the previous study. The first is to consider how or whether measures affect the energy consumption of other end uses and devices in the individual home or facility where they are installed. When measures have interactive effects (overwhelmingly waste heat gains or losses that affect the heating and cooling loads of HVAC systems), those effects are built into the unit energy savings (UES) before they are input into the model. For complex interactions among building shell measures and HVAC equipment, for example, we rely on RTF analyses using “SEEM” building simulations or supplement with our own “BEST” simulation model. HVAC interactive effects from lighting measures are accounted for in LoadMAP, which utilizes waste heat factors from client evaluations or other regional sources to incorporate the impact.

The second accounting for interactive effects occurs at the population or system level, where multiple DSM actions must be stacked or layered on top of each other in succession, rather than simply summed arithmetically. These interactions are natively handled within the EE measure database file. We first compute the total savings of each measure on a standalone basis, then also assign a stacking priority, based on levelized cost, to the measures such that “integrated” or “stacked” savings will be calculated as a percent reduction to the running total of baseline energy remaining in each end use after the previous measures have been applied. This ensures that the available pie of baseline energy shrinks in proportion to the number of DSM measures applied, as it would in reality. The loading order is based on levelized cost of conserved energy, such that the more economical measures that are more likely to be selected from a resource planning perspective will be the first to be applied to the modeled population.

Deliverables for Task 3: Potential Analysis

Deliverables for the analysis task will include a series of memoranda regarding interim results. For each step, we will solicit feedback from PacifiCorp and make revisions accordingly. These memoranda will be delivered in the format of the final report. We anticipate this enhancing the level of documentation in the report and expedite delivery of the final, combined version.

After we develop preliminary potential, we will schedule an in-person meeting with PacifiCorp staff to review the results of the analysis to date. It is our standard practice to have a project meeting at this stage of the project so we can review the analysis data, assumptions, and results in detail. Based on the discussion in this meeting, we will refine the input data to develop finalized estimates. For the 2021 CPA, we will conduct this review over the course of two meetings, one with Pacific Power program managers in Portland and one with Rocky Mountain Power program managers in Salt Lake City. This will provide us with the opportunity to dive deeper into existing programs and better understand how the preliminary estimates would impact future program design. Potential estimates will go hand-in-hand with the development of Task 4 below. As such, preliminary deliverables for these two tasks are likely to coincide.

Specific deliverables for Task 3 will include:

- Memos and webcast presentation to PacifiCorp on initial results of the market characterization
- Memo on initial results of the baseline projection development for EE potential analysis
- Memos and onsite presentations at PacifiCorp's Portland and Salt Lake City offices on preliminary potential estimate results for DR and P&R capacity-focused resources and EE resources.
- Revised memos and presentation slides incorporating PacifiCorp feedback on above.

Task 4: Segmentation and Data Presentation

In this task, we will develop a measure summary database and potential supply curves for use in PacifiCorp's 2021 IRP.

Task 4.1: Measure Summary Database

AEG will create and provide an enhanced Measure Database Excel file which contains the EE measure database and calculations. The measure data contained in this file and satisfying this task are at least those in the final version of the Summary of Measure Assumptions tables delivered for the 2019 CPA ("PacifiCorp Conservation Potential Assessment for 2019-2038, Volume 4: Class 2 DSM Analysis Appendix I).

We will work with PacifiCorp to modify the included fields to most succinctly summarize measure assumptions in Excel form.

Deliverables for Task 4.1: Measure Summary Database

- Draft and final measure summary databases in Excel form

Task 4.2: Supply Curves

In addition to the estimates of potential, PacifiCorp requires conservation supply curves to support the 2021 IRP modeling effort. As part of this scope, AEG will provide four iterations of the supply curves. These include preliminary CPA bundles, two revisions, and the final IRP supply curve bundles.

Part of the core analysis for all classes is to calculate the levelized cost of conserved energy or peak demand. Our approach is consistent with the Council's approach for calculation of levelized cost. Therefore, development of supply curves is straightforward. Additional manipulation and formatting are required to assemble the data in a way that is useful for the IRP simulations, and we are very familiar with this and prepared to use the same processes as for the 2019 IRP or update as required by PacifiCorp. We will meet with the IRP modeling team early in the study to discuss input formatting and how the team's specific data needs may have changed during the past two years. Since the LoadMAP model has been designed with transparent IRP input development in mind, AEG anticipates a relatively simple process to re-organize or update IRP inputs to reflect the current IRP.

We will develop reference-case supply curves for the three DSM classes as follows:

- For the Capacity-Focused Resource supply curves, the project will develop supply curves for each relevant case as a straightforward analysis task that identifies the amount of Capacity Resource available at different \$/kW-yr. levels.
- For the Energy Efficiency resources, we will develop a levelized cost of conserved energy (CCE) for each measure and develop curves that identify the amount of savings available at varying levels of CCE. For Utah and Idaho, as required by state guidelines, resource supply curves will be developed on a levelized Utility Cost Test (UCT) basis. For the remaining states, the analysis will use the levelized Total Resource Cost (TRC) test, with non-energy benefits, incremental O&M impacts, and secondary fuel impacts included for Washington as required by state regulations.

- For Oregon we will create supply curves for Energy Efficiency resources using cost and savings estimates provided by the Energy Trust of Oregon. If requested by PacifiCorp, we will note any cases where the Energy Trust values differ significantly from the values developed for other states in PacifiCorp's service territory. The format for these supply curves will be consistent with those developed for the other states.

Deliverables for Task 4.2: Supply Curves for Demand Response, Energy Efficiency, and Pricing and Rates

- For DR and P&R resource supply curves, AEG will develop MS Excel files containing the levelized cost (\$/kW-year) and annual incremental potential by state and resource, as well as savings potential on both a stand-alone and interactive (accounting for program competition) basis.
- For EE resources, the project will develop supply curve data slightly differently. EE inputs to the IRP will be provided as Excel files containing the following:
 - Bundles defined by state, load bubble, and levelized cost range
 - Annual incremental potential (in non-coincident MW and MWh) for each bundle
 - 20-year hourly load shape of each bundle; each state is a separate file
- Weighted average levelized cost of measures in each bundle

Task 5: Summary Report and Stakeholder Support

Throughout the project, AEG will provide PacifiCorp with frequent updates and interim results, as described above. We will also provide status updates, meeting minutes, and other communication as needed, to ensure that everything is progressing as necessary and to avoid any surprises in the final report. These interim deliverables will be woven together to create the final report. Since we will be providing memos in the expected final report format, this should allow us to include additional documentation and explanation around assumptions and methodology.

Task 5.1: Draft and Final Report

We understand that PacifiCorp's external stakeholders are interested in seeing these reports as early as possible in the study. In order to streamline the reports for review, expedite future report updates, and address evolving use cases for CPA data, AEG will update the structure and content of the 2021 CPA report relative to what was provided for the 2019 CPA. We will consider updates discussed during completion of the 2019 CPA and work with PacifiCorp to incorporate requested updates while retaining data valuable for current use cases. Below, AEG details a process to update the report using existing CPA data. We will complete this update using the following three steps:

- First, we will work with the PacifiCorp team to develop a report outline to guide the update process
- Next, we will update the main report volumes and review with PacifiCorp
- Finally, we will draft a streamlined version of the CPA appendices to allow for more efficient reader review and updating

We describe these steps in more detail below:

Step 1: Develop Proposed CPA Report Outline

We will begin by synthesizing notes from previous brainstorming sessions on this topic between AEG and PacifiCorp with the goal of producing a report outline for review with the team, summarizing the recommended approach for updating all five volumes of the CPA report. For this step, a "Report Outline" will resemble a table of contents documenting the sections and subsections for the updated report. For each of these categories, AEG will provide a brief description of what will be included and, if

applicable, include “mock-up” versions of updated tables and figures to include. At this time, AEG will also meet with planners from the Energy Trust of Oregon and PacifiCorp Customer Solutions to solicit their thoughts and suggestions on how to integrate or compare the Oregon EE methodology/results within the larger CPA report. Content added will be based on documentation from the methodology reviews noted earlier in this section, highlighting differences as well places where AEG, PacifiCorp, and ETO worked to align.

After reviewing the outline internally, AEG will circulate it to the PacifiCorp project team for feedback and to ensure the approach retains valuable information from the prior version and aligns with the team’s future use cases. The result of this step forms the basis for steps 2 and 3 below.

Step 2: Update Main Report Volumes

In this step, AEG will update the three main volumes of the report. These volumes will follow the report outline developed in Step 1 with details to be determined through discussions with PacifiCorp. We will prioritize the following aspects for each of the three main volumes below, pending discussion with PacifiCorp:

Volume 1: Executive Summary and Introduction

- Updates will be focused on summarizing data in more succinct ways and drawing conclusions at the state and program-levels
- Priority will be placed on developing summary tables and charts over key findings in text

Volume 2: Energy Efficiency Analysis

- In this volume, we will look to summarize energy efficiency results at both the state and sector levels. We will draft other sections on this volume to inform key energy efficiency findings
- We will also prioritize summarizing assumptions in a more succinct, table-based fashion
- The study methodology is unlikely to change in substantial ways but may be moved later in the report body

Volume 3: Demand Response and Pricing and Rates DSM Analysis

- We will look to update this volume in a similar fashion to volume 2, prioritizing key findings from the demand response and time-varying rate analysis
- We will also look to either simplify the tables of detailed assumptions or move them into Volume 5: Demand Response and Pricing and Rates Appendices

We will review these updated report volumes with PacifiCorp prior to finalizing.

Step 3: Streamline Report Appendices

To streamline future updates and allow for a more dynamic presentation of results, AEG will streamline the text-heavy sections and table-heavy sections of both volumes listed below.

- Volume 4: Energy Efficiency Analysis Appendix
- Volume 5: Demand Response and Pricing and Rates Analysis Appendix

For example, the current EE Appendix includes hundreds of pages of market profile tables for five states, five sectors, up to fifteen segments, and two vintages. We plan to re-summarize these profiles, and other similar model data, in a dynamic spreadsheet tool. In particular, this update will be made to Volume 4, Section I of the 2019 CPA’s Energy Efficiency Appendix, which is a 2,000+ page summary spreadsheet.

The result of this update will be two smaller, more manageable appendices in Word and a dynamic spreadsheet which may be used to quickly view and summarize detailed assumptions and results from the CPA analysis.

Task 5.2 Ongoing Stakeholder Support Services

Finally, AEG will provide ongoing stakeholder support services during and after completion of the 2021 CPA project. We understand that stakeholder interest in all aspects of the IRP increased significantly during the development of the 2019 CPA, as evidenced by the marked increase in Stakeholder Feedback Forms submitted and time spent reviewing and addressing these forms by AEG and PacifiCorp during the process. AEG is available to, among other things: support and draft responses to stakeholder data requests, summarize and brief PacifiCorp on key details of the CPA analysis, and support or facilitate stakeholder meetings and workshops. We will address the stakeholder support process in two phases, the first includes support for four (4) meetings throughout the CPA development process as requested by PacifiCorp and the second involves follow-up support after finalization of study analysis. Any meeting materials will be provided for PacifiCorp review at least two weeks prior to a scheduled engagement and feedback will be addressed promptly (typically one to two weeks after a feedback solicitation period has closed).

Note that because assessment of Oregon EE in Oregon is outside the scope of the CPA, it will be critical to have robust participation by the Energy Trust of Oregon. AEG will work with the Energy Trust of Oregon as requested by PacifiCorp to develop presentation materials in tandem, ensuring that all six states are addressed during this process.

3

PROJECT SCHEDULE

Schedule

AEG will complete this scope of work in a similar timeframe to that in the 2019 CPA. We have included some key tasks by month in the table below based on the availability of PacifiCorp data, the IRP timeline, and discussions with PacifiCorp.

Task	Timeframe
Task 1: Develop Final Work Plan	October 2019 – January 2020
Task 2: Conduct Research	November 2019 – April 2020
Task 3: Estimate Potential	January 2020 – August 2020
Task 4: Segmentation and Data Presentation	May 2020 – October 2020
Task 5: Summary Report and Stakeholder Support	Meetings: Four Meetings* Report: October 2020 – February 2021 Ongoing Support: August 2019 – July 2021

**The schedule deadlines to incorporate stakeholder feedback will be presented during the first meeting with stakeholders regarding this work.*

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