PACIFICORP DEMAND-SIDE RESOURCE POTENTIAL ASSESSMENT FOR 2015-2034

Volume 1: Executive Summary

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INTRODUCTION

In 2013, PacifiCorp commissioned Applied Energy Group, with subcontractor The Brattle Group, to conduct this Demand-Side Resource Potential Assessment. This study provides estimates of the potential for electric demand-side management (DSM) resources in PacifiCorp's six-state service territory,[1] including supply curves, for the 20-year planning horizon of 2015–2034 to inform the development of PacifiCorp's 2015 Integrated Resource Plan (IRP) and satisfy state-specific requirements associated with forecasting and DSM resource acquisition.

Since 1989, PacifiCorp has developed biennial Integrated Resource Plans (IRPs) to identify an optimal mix of resources that balance considerations of cost, risk, uncertainty, supply reliability/deliverability, and long-run public policy goals. The optimization process accounts for capital, energy, and ongoing operation costs as well as the risk profiles of various resource alternatives, including: traditional generation and market purchases, renewable generation, and DSM resources such as energy efficiency, and capacity-focused resources i.e. demand response and direct load control. Since the 2008 IRP, DSM resources have competed directly against supply-side options, allowing the IRP model to selectively choose the right mix of resources to meet the needs of PacifiCorp's customers while minimizing cost and risk. Thus, this study does not assess cost-effectiveness.

This study primarily seeks to develop reliable estimates of the magnitude, timing, and costs of DSM resources likely available to PacifiCorp over the 20-year planning horizon mentioned above. The study focuses on resources assumed achievable during the planning horizon, recognizing known market dynamics that may hinder resource acquisition. Study results will be incorporated into PacifiCorp's 2015 IRP and subsequent DSM planning and program development efforts. This study serves as an update of similar studies completed in 2007, 2011, and 2013.[2]

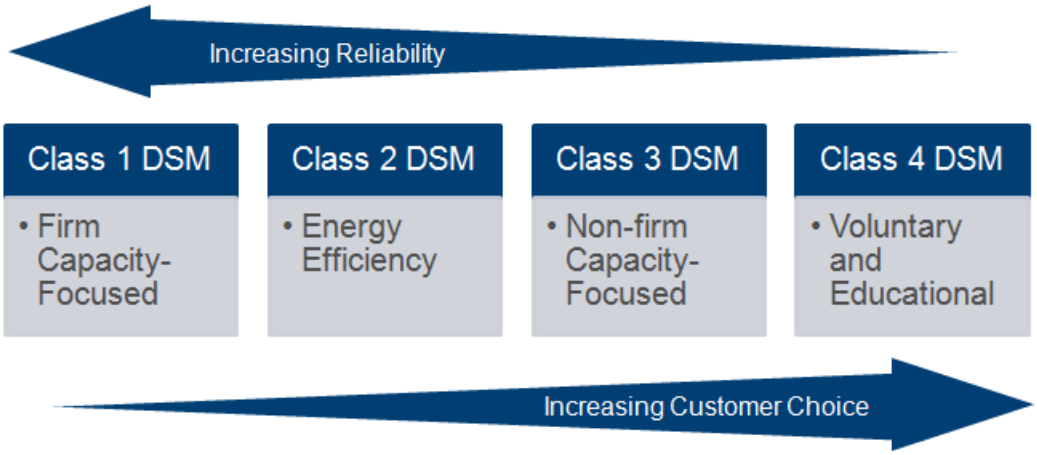
DSM Resource Classes

For resource planning purposes, PacifiCorp classifies DSM resources into four categories, differentiated by two primary characteristics: reliability and customer choice (see Figure 1-1). These resources are captured through programmatic efforts promoting efficient electricity use through various intervention strategies, aimed at changing: energy use peak levels (load curtailment), timing (price response and load shifting), intensity (energy efficiency), or behaviors (education and information).

From a system-planning perspective, Class 1 and Class 2 DSM resources (particularly Class 1 direct load control programs) are considered the most reliable, as once a customer elects to participate in a Class 1 DSM program, the resource is under the utility's control and can be dispatched as needed. Similarly, when a customer invests in a home or business efficiency improvement, the savings are locked in as a result of the installation and will occur during normal operation of the end use. In contrast, behavioral savings, resulting from energy education and awareness actions included in Class 4 DSM, tend to be the least reliable, as savings will vary due to greater customer control and the need for customers to take specific and consistent actions to lower their usage during peak periods.

[1] Class 2 analysis for Oregon is excluded from this report because it is assessed statewide by the Energy Trust of Oregon.
[2] The previous potential studies can be found at: http://www.pacificorp.com/es/dsm.html

Figure 1-1 Characteristics of DSM Resource Classes



PacifiCorp commissioned this DSM resource potential assessment to inform the Company's biennial IRP planning process, to satisfy other state-specific DSM planning requirements, and to assist PacifiCorp in revising designs of existing DSM programs and in developing new programs. The study's scope encompasses multi-sector assessments of long-term potential for DSM resources in PacifiCorp's Pacific Power (California, Oregon, and Washington) and Rocky Mountain Power (Idaho, Utah, and Wyoming) service territories. This study excludes an assessment of Oregon's Class 2 DSM potential, as this potential has been captured in assessment work conducted by the Energy Trust of Oregon[3], which provides energy-efficiency potential in Oregon to PacifiCorp for resource planning purposes. This study does not include assessments of Class 4 DSM resources. Unless otherwise noted, all results presented in this report represent savings at generation; that is, savings at the customer meter have been grossed up to account for line losses.

Interactions Between Resources

This assessment includes multiple resources, actions, and interventions that would interact with each other if implemented in parallel. As explained in more detail later in this report, we take specific actions to account for these interactions to avoid double-counting the available potential. The interactive effects that we have analyzed occur within the major analysis sections; meaning that the interactions of energy efficiency resources are considered across all Class 2 DSM resources. Likewise, the analysis of capacity-focused Class 1 and 3 DSM resources explicitly considers interactions. It should be noted, however, that this study does not attempt to quantify potential interactions between energy-focused and capacity-focused resources. Though an important factor to recognize, this study did not attempt to quantify such interactions due to uncertainties regarding resources likely to be found economic and pursued.

[3] The Energy Trust of Oregon's 2014 Energy Efficiency Resource Assessment Report can be found here: http://energytrust.org/library/reports/Energy_Efficiency__Resource_Assessment_Report.pdf

Report Organization

This report is presented in five volumes as outlined below. This document is **Volume 1, Executive Summary**.

- Volume 1, Executive Summary
- Volume 2, Class 2 DSM Analysis
- Volume 3, Class 1 and 3 DSM Analysis
- Volume 4, Class 2 DSM Analysis APPENDIX
- Volume 5, Class 1 and 3 DSM Analysis APPENDIX

The above introduction is repeated in Volumes 2 and 3 for completeness and ease of reference. This Executive Summary volume includes only high-level results from Volumes 2 and 3. Additional detail on approach, data development, and other information are available in the main report volumes (2 and 3) and detailed background and assumptions can be found in their respective supplemental appendix volumes (4 and 5).

SUMMARY OF RESULTS

This chapter presents a summary of the identified cumulative potential in 2034 from energy-focused Class 2 (energy efficiency) and capacity-focused Class 1 (dispatchable or scheduled firm) and 3 (price responsive) DSM resources. These savings draw upon forecasts of future consumption, absent projected future PacifiCorp DSM program intervention. While the baseline projection accounted for past PacifiCorp Class 2 DSM resource acquisition, the identified estimated potential is inclusive of (not in addition to) future planned program savings.

Class 2 DSM (Energy Efficiency) Resources

Table 2-1 summarizes the 2034 cumulative achievable technical potential for Class 2 DSM resources by state and sector, both in MWh and as a percentage of projected 2034 baseline sector loads. At the system level,[4] the identified achievable technical potential by 2034 is nearly 11 terawatt-hours, or roughly 20 percent of projected baseline loads. The commercial sector accounts for the largest portion of the achievable technical potential, followed by residential then industrial. Irrigation and street lighting, with much smaller baseline loads, contribute a smaller amount of potential relative to the larger sectors. Class 2 DSM methodology, data sources, assumptions, technical potential, and detailed results are provided in Volume 2 of this report.

Table 2-1 Cumulative Class 2 DSM Achievable Technical Potential by in 2034 (MWh @ generator)

						Total	
Sector	California	Idaho	Utah	Washington	Wyoming	Achievable Technical Potential	% of Base-line
Residential	92,703	183,908	2,024,856	391,590	247,232	2,940,288	21.0%
Commercial	91,175	195,043	4,016,783	394,703	612,671	5,310,374	31.2%
Industrial	7,547	33,015	1,369,130	145,363	925,113	2,480,169	11.1%
Irrigation	9,386	54,377	18,364	13,282	2,137	97,546	9.6%
Street Lighting	792	1,245	24,620	2,971	3,266	32,893	31.1%
Total	**201,603**	**467,588**	**7,453,753**	**947,909**	**1,790,419**	**10,861,270**	**19.9%**

Class 1 and Class 3 (Capacity-Focused) DSM Resources

This section presents high-level potential analysis results for Class 1 and 3 DSM options based on the assumptions and methodologies outlined in Chapter 2 of Volume 3 of this report. The results are given on a standalone basis, meaning that the results shown in this section have not been adjusted for the inherent interactions that exist between Class 1 and 3 DSM resources, and thus, the results are not additive across classes. For results of the integrated analysis that considers interactive effects between the two resource classes, see Section G of Volume 5 of this report.

Within the Class 1 DSM resource analysis, there are no overlapping programs that target the same customer segment or end-use load, so there are no interactions to account for (i.e., no

[4] Class 2 DSM analysis for Oregon is excluded from this report because it is assessed statewide by the Energy Trust of Oregon.

chance of double counting the impact for the individual program options). Within the Class 3 DSM resource analysis, however, some of the same customers are eligible for multiple dynamic pricing options (TOU, CPP, and RTP). To account for this, AEG made assumptions about the choices eligible customers would make if competing options were offered in parallel, based on observed customer preference in such pilots and full-scale deployments.

Class 1 DSM Market Potential

Table 2-2 shows total Class 1 DSM potential results in 2034 by option for each state. This combines the effects of existing Class 1 DSM resources with new options that have incremental potential in future years. Incremental potential above current program impacts is presented in Volume 3 of this report. Note, the market potentials indicate the magnitude of the opportunity, but do not consider the economics of delivery, local need for capacity management, or portability of resources (transmission constraints). These factors are addressed within PacifiCorp's Integrated Resource Plan when determining whether to pursue Class 1 DSM resources.

Key observations are:

- Utah and Idaho are the top contributors to Class 1 DSM potential. Approximately 80% of the savings potential in 2034 is derived from these two states. Note, as shown above, approximately 60% of the total potential in these states is already captured through existing Class 1 DSM program offerings. While Idaho potential is derived primarily from Irrigation Load Control, Utah derives its potential mostly from residential Direct Load Control (DLC) and C&I Curtailable Agreements.
- Oregon has the third highest potential savings, derived primarily from C&I Curtailable Agreements and residential DLC, which show roughly equal potential.
- Wyoming has the fourth highest potential, with majority of the savings derived from C&I Curtailable option. This is driven by the presence of a relatively large industrial customer base in the state.
- In California, more than half of the savings are derived from Irrigation Load Control.

Table 2-2 Class 1 DSM Total Market Potential by Option and State in 2034 (MW)

State	Res DLC-Cooling	Res DLC-WH	C&I DLC-Cooling	C&I DLC-WH	Irrigation Load Control	Curtailable Agreements	Total
California	1.59	0.55	0.39	0.03	4.20	1.03	**7.8**
Idaho	1.67	0.94	0.44	0.04	195.94	2.31	**201.3**
Oregon	18.41	6.57	5.74	0.41	8.67	32.86	**72.7**
Utah	163.43	-[5]	19.21	-	39.12	92.61	**314.4**
Washington	8.90	2.23	1.77	0.09	5.12	9.47	**27.6**
Wyoming	3.10	1.52	1.36	0.06	1.47	46.84	**54.4**
Total	**197.10**	**11.81**	**28.92**	**0.62**	**254.52**	**185.11**	**678.1**

Class 3 DSM Market Potential

For Class 3 DSM resources, potential results associated with pricing options represent a voluntary, "opt-in" type of offering for dynamic pricing programs. For comparison purposes only, pricing potential associated with an "opt-out" type of offering is presented in Volume 5 of this report. The dynamic pricing options of Critical Peak Pricing (CPP) and Real-Time Pricing (RTP)

[5] The current Cool Keeper program in Utah targets only eligible cooling equipment. The DLC savings potential in Utah are based on the existing program offer. Therefore, in Utah, DLC savings are derived through control of cooling equipment only and electric water heater control is not included. In all other states, where new DLC programs are assumed to be launched, savings are derived through control of both cooling and water heating equipment.

are assumed to be offered only after Advanced Metering Infrastructure (AMI) has been deployed. Although PacifiCorp does not currently have AMI in any of its service territories, for planning purposes, the study assumes that all territories are AMI-enabled by the end of 2019 to allow for an assessment of the opportunity for dynamic pricing programs under such a scenario. Demand Buyback potential is treated separately because it is the only non-pricing or non-rate-based Class 3 DSM option. Its impacts are small relative to the pricing options.

Table 2-3 shows the total potential from Class 3 DSM resources by state and option, as they would be configured in 2034. This combines the effects of existing Class 3 DSM resources with new options that have incremental potential in future years; see Volume 3 for estimates of the impacts of existing Class 3 DSM offerings.

Key observations from our analysis results are:

- In Utah, residential CPP has the highest contribution to potential. C&I CPP and TOU combined have roughly equal potential as residential CPP.
- Oregon has the second highest potential, after Utah. Residential pricing (TOU and CPP) constitute more than half of the potential in Oregon.
- Wyoming ranks third in terms of potential contribution from pricing options. Most of the potential is derived from C&I customers in the state, particularly large sized industrial customers.
- In Idaho, more than half of the savings opportunities from pricing options are in the irrigation sector.
- In Washington and California, the residential sector constitutes almost half the total savings potential from pricing options.

Table 2-3 Class 3 DSM Total Potential by Option and State in 2034 (MW)

State	Res TOU	Res CPP	C&I TOU	C&I CPP	C&I RTP	Irrig. TOU	Irrig. CPP	Dem. Buyback	Total
CA	0.3	1.4	0.4	0.5	0.1	0.2	0.6	0.1	**3.5**
ID	0.7	2.8	0.8	1.1	0.1	1.8	5.1	0.2	**12.6**
OR	6.2	26.2	12.4	12.6	1.9	0.5	1.4	3.1	**64.3**
UT	15.7	66.3	33.0	36.2	5.2	0.5	1.5	8.1	**166.5**
WA	1.8	7.8	3.3	4.4	0.5	0.3	0.9	0.8	**19.9**
WY	1.9	8.1	24.1	15.2	2.7	0.1	0.2	6.4	**58.9**
Total	**26.6**	**112.5**	**74.1**	**70.0**	**10.5**	**3.5**	**9.7**	**18.7**	**325.6**

Comparison to 2013 Assessment

As noted, this assessment builds upon studies completed in 2007, 2011, and 2013. This section reviews key updates leading to differences between the current study findings and those presented in the 2013 Assessment.

Class 2 DSM Resources

For the Class 2 DSM analysis, the following aspects of the current analysis served as key drivers of changes:

- Accounts for updated state energy codes and equipment efficiency standards enacted as of January 31, 2014, even if they have not yet taken effect
- Takes into account PacifiCorp's actual and projected DSM program accomplishments through 2014

- Incorporates adjustments to measure savings, based on recent evaluation results, data available from the Regional Technical Forum (RTF), and other updated secondary sources available before January 31, 2014
- Applies 2012 customer and sales information to determine segmentation; and utilizes updated sales and customer forecasts
- Includes new emerging technologies; most notably updated assumptions around applicability, cost, and efficacy of LED lighting

The total, system-wide, 20-year, Class 2 DSM achievable technical potential increased from 648 aMW to 1,248 aMW between the two studies. A detailed comparison of the identified potential in the two studies, along with explanations of large changes, is provided in Volume 2 of this report.

Class 1 and 3 DSM Resources

Key observations from a comparison of 20-year system-level market potential for Class 1 and 3 DSM resources are provided below, with additional detail provided in Volume 3 of this report:

- The 20-year incremental potential for Class 1 DSM in the current study is 368 MW, which is roughly one third larger than the 20-year potential estimate in the 2013 assessment.
    - The increase is primarily due to higher incremental potential estimates for DLC-Cooling and Irrigation Load Control, given new information about program implementation, customer growth assumptions, saturation of applicable equipment, and estimated participation rates that are detailed further in the following sections.
    - Potential for Curtailable Agreements is similar between the two studies.
- The Class 3 DSM potential estimate in the current study is also higher than the 2013 study, due largely to the consideration of new program options and rate designs in the current study. The current study estimates 260 MW of incremental Class 3 DSM potential in 2034, as compared to 66 MW in 2032 from the previous study.
    - Residential pricing potential in the current study is estimated at 138 MW in the final year, vs. 25 MW in the previous assessment. This difference is entirely driven by the fact that the previous assessment did not consider a Critical Peak Pricing (CPP) offering for residential customers. This option is enabled in the current study by the assumption that AMI will be in place in PacifiCorp's service territory by 2020. If AMI deployment does not occur, this would constitute a significant obstacle to attaining this potential at the cost identified in this study.
    - The C&I pricing potential in the current study of 90 MW in 2034 is also substantially larger than the corresponding value of 3.5 MW from the previous study. The previous study did not show any potential for two of the three options considered by the current study (TOU and RTP), and had varying assumptions surrounding the comparable CPP option.
    - The two studies provide almost identical potential estimates for the Demand Buyback program option.

About Applied Energy Group (AEG)

Founded in 1982, AEG is a multi-disciplinary technical, economic and management consulting firm that offers a comprehensive suite of demand-side management (DSM) services designed to address the evolving needs of utilities, government bodies, and grid operators worldwide. Hundreds of such clients have leveraged our people, our technology, and our proven processes to make their energy efficiency (EE), demand response (DR), and distributed generation (DG) initiatives a success. Clients trust AEG to work with them at every stage of the DSM program lifecycle – assessing market potential, designing effective programs, supporting the implementation of the programs, and evaluating program results.

The AEG team has decades of combined experience in the utility DSM industry. We provide expertise, insight and analysis to support a broad range of utility DSM activities, including: potential assessments; end-use forecasts; integrated resource planning; EE, DR, DG, and smart grid pilot and program design and administration; load research; technology assessments and demonstrations; project reviews; program evaluations; and regulatory support.

Our consulting engagements are managed and delivered by a seasoned, interdisciplinary team comprised of analysts, engineers, economists, business planners, project managers, market researchers, load research professionals, and statisticians. Clients view AEG's experts as trusted advisors, and we work together collaboratively to make any DSM initiative a success.

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