PacifiCorp Demand-Side Resource Potential Assessment for 2017-2036

AEG
Applied Energy Group

Volume 1:
Executive Summary

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INTRODUCTION

In 2015, 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 2017–2036 to inform the development of PacifiCorp's 2017 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 of demand-side resources.

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 2017 IRP and subsequent DSM planning and program development efforts. This study serves as an update of similar studies completed in 2007, 2011, 2013, and 2015.[2]
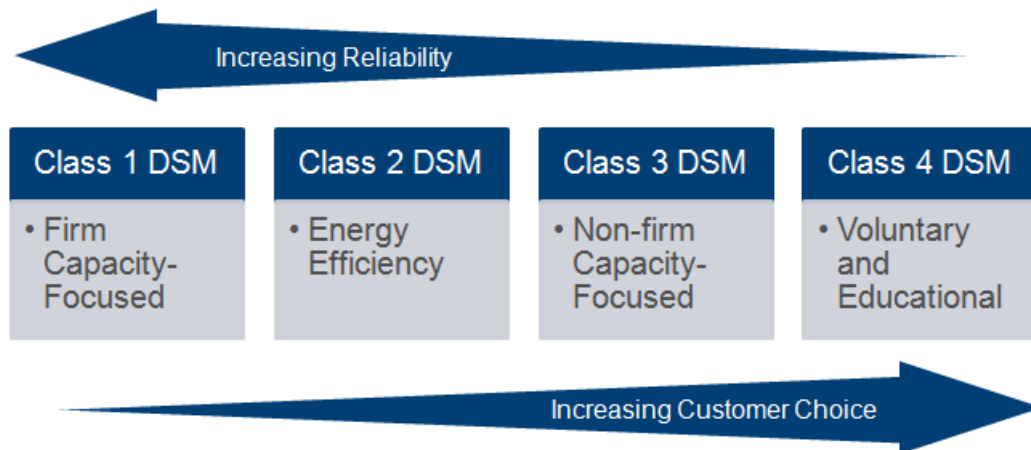
DSM RESOURCE CLASSES

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 equipment. In contrast, 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.

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[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, which provides Oregon energy-efficiency potential 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 due to uncertainties regarding resources likely to be found economic and pursued.

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

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Summary of Results

This chapter presents a summary of the identified cumulative potential in 2036 from energy-focused Class 2 (energy efficiency) DSM resources as well as 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 accounts 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 (Energy Efficiency) DSM Resources

Table 2-1 summarizes the 2036 cumulative achievable technical potential for Class 2 DSM resources by state and sector, both in MWh and as a percentage of projected 2036 baseline sector loads. At the system level,[3] the identified achievable technical potential by 2036 is nearly nine terawatt-hours, or roughly 17 percent of projected baseline loads. Achievable technical potential represents potential which can reasonably be acquired through all available mechanisms, regardless of how conservation is achieved, and ignoring cost-effectiveness considerations. The cost-effectiveness of the identified potential is assessed within PaciCorp's IRP model through direct comparison with supply-side resource alternatives.

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. Savings as a percentage of baseline is largely influenced by the presence of various end uses in each sector. 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 2036 (MWh @ generator)

Sector	California	Idaho	Utah	Washington	Wyoming	All States Achievable Technical Potential	% of Baseline
Residential	96,625	168,158	1,547,355	347,281	219,045	2,378,465	17.8%
Commercial	54,812	223,592	3,251,218	402,599	580,920	4,513,141	26.3%
Industrial	7,225	37,037	918,749	73,480	866,265	1,902,755	9.8%
Irrigation	8,254	48,114	16,959	13,717	1,906	88,950	7.5%
Street Lighting	1,053	1,282	35,010	4,656	5,462	47,464	41.0%
Total	**167,969**	**478,183**	**5,769,291**	**841,733**	**1,673,598**	**8,930,775**	**17.4%**

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

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

provided 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 resource 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.

Whereas the 2015 potential study only assessed capacity-focused resources at the time of the overall system peak, which occurs in the summer, this study also includes an assessment of resources targeted at the winter peak. We focus our present discussion of findings on summer impacts since this is still PacifiCorp's primary planning objective and controlling system constraint, but refer to Volume 3 for more detail on winter impacts.

Within the Class 1 resources, some customers are eligible for multiple competing Class 1 options (e.g., DLC Cooling and DLC Smart Thermostats). This is also true for the Class 3 options. To account for this, our analysis made assumptions within each resource class about the choices that 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 2036 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:

- Total savings potential at the end of the study horizon are 857 MW, or 6.9% of the projected summer system peak.

- Utah and Idaho are the top contributors to Class 1 DSM potential. Approximately 70% of the savings potential in 2036 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 DLC and C&I Curtailable Agreements.

- Oregon has the third largest potential savings, derived primarily from C&I Curtailable Agreements and residential DLC programs, which show roughly equal potential.

- Wyoming has the fourth highest potential, with the 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 2036 (MW)

Program	CA	ID	OR	UT	WA	WY	Total
Residential DLC Central AC	1.0	2.4	18.4	174.4	6.6	3.7	**206.5**
Residential DLC Space Heating	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	***n/a***
Residential DLC Water Heating	0.8	1.4	15.8	15.3	5.7	1.4	**40.2**
Residential DLC Smart T-Stats	1.0	2.4	18.4	53.1	6.6	3.7	**85.2**
Residential DLC Smart Appliances	0.3	0.6	4.2	7.8	0.9	1.0	**14.7**
Residential DLC Room AC	0.2	0.5	2.0	3.9	1.0	1.0	**8.5**
Residential DLC EV Chargers	0.1	0.4	11.1	9.9	0.5	0.2	**22.2**
C&I DLC Central AC	0.7	0.7	5.2	19.2	1.80	2.1	**29.7**
C&I DLC Space Heating	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	***n/a***
C&I DLC Water Heating	0.2	0.2	1.8	1.4	0.4	0.4	**4.4**
DLC Irrigation	5.3	192.3	14.0	26.3	7.5	2.1	**247.6**
Ice Energy Storage	0.5	0.9	5.1	5.8	1.2	1.8	**15.3**
Curtailment Agreements	1.2	2.1	38.0	85.9	9.9	45.8	**182.9**
Total	**11.2**	**203.9**	**134.1**	**402.9**	**42.1**	**63.2**	**857.3**

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 pricing options are assumed to be offered only after Advanced Metering Infrastructure (AMI) has been deployed. PacifiCorp does not currently have comprehensive AMI in any of its service territories, so in order to assess the potential for dynamic pricing options, this study assumes that PacifiCorp makes a staggered deployment of AMI in Oregon in 2020, Idaho in 2021, and all other territories in 2025.

Total savings potential at the end of the study horizon is 449 MW, or 3.6% of the projected summer system peak.

- In Utah, residential Critical Peak Pricing (CPP) has the highest contribution to potential. The three C&I pricing options combined have roughly equal potential to residential CPP.

- Oregon has the second highest potential, after Utah. Residential pricing (Time-of-Use, Time-of-Use Demand Rate w/Electric Vehicle, 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, just about half of the savings opportunities from pricing options are in the irrigation sector.

- In Washington and California, the residential sector constitutes nearly half the total savings potential from pricing options.

Table 2-3 shows the total potential from Class 3 DSM resources by state and option, as they would be configured in 2036. Key observations from our analysis results are:

- Total savings potential at the end of the study horizon is 449 MW, or 3.6% of the projected summer system peak.

- In Utah, residential Critical Peak Pricing (CPP) has the highest contribution to potential. The three C&I pricing options combined have roughly equal potential to residential CPP.

- Oregon has the second highest potential, after Utah. Residential pricing (Time-of-Use, Time-of-Use Demand Rate w/Electric Vehicle, 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, just about half of the savings opportunities from pricing options are in the irrigation sector.

- In Washington and California, the residential sector constitutes nearly half the total savings potential from pricing options.

Table 2-3   Class 3 DSM Total Market Potential by Option and State in 2036 (MW)

Program	CA	ID	OR	UT	WA	WY	Total
Residential TOU Demand Rate	0.6	2.1	9.8	60.4	3.5	5.6	81.8
Residential TOU Demand Rate w EV	0.1	1.8	23.9	44.1	1.0	1.0	71.9
Residential TOU	1.0	-	16.9	43.0	6.0	4.0	70.9
Residential CPP	1.3	2.0	22.5	57.3	8.0	5.3	96.3
C&I TOU	0.1	0.3	2.5	6.3	1.0	1.1	11.3
C&I CPP	0.7	1.1	17.6	40.4	5.6	17.9	83.2
C&I RTP	0.1	0.2	3.1	6.7	0.8	4.2	14.9
Irrigation TOU	0.2	2.2	0.6	0.5	0.3	0.1	4.0
Irrigation CPP	0.8	8.7	2.2	2.1	1.2	0.3	15.3
Total	4.9	18.3	98.9	260.7	27.2	39.4	449.4

COMPARISON TO 2015 ASSESSMENT

As noted, this assessment builds upon studies completed in 2007, 2011, 2013, and 2015. This section reviews key updates leading to differences between the current study findings and those presented in the most recent 2015 Assessment.

CLASS 2 DSM RESOURCES

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

- Incorporates substantial updates to measure assumptions and achievable ramp rates corresponding to the recently published Northwest Power and Conservation Council's (NWPCC's) Seventh Power Plan.

- Accounts for state energy codes and equipment efficiency standards enacted as of January 31, 2016, even if they have not yet taken effect.

- Takes into account PacifiCorp's actual and projected DSM program accomplishments through 2016.

- 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, 2016.

- Applies 2014 customer and sales information to determine segmentation; and utilizes updated sales and customer forecasts.

- Includes new emerging technologies and updates assumptions around applicability, cost, and efficacy of LED lighting.

The total, system-wide, 20-year, Class 2 DSM achievable technical potential decreased from 10,878,788 MWh to 8,930,775 MWh between the two studies. This is primarily driven by changes in measure

assumptions based on PacifiCorp program evaluations, the RTF, the Seventh Power Plan, new Seventh Power Plan ramp rates, and the baseline forecast. 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

For the Class 1 and 3 DSM analysis, the following aspects of the current analysis served as key drivers of changes:

- Takes into account new industry data, updated PacifiCorp forecasts, and recent program experience from PacifiCorp's existing resources through 2016.

- Does not revisit an analysis of existing PacifiCorp Class 3 rate options. We estimated the embedded impacts for these rates in the previous assessment, and no substantive changes to their implementation have occurred in the interim, so please see that report for details.

- Investigates several new technology and rate options that have recently become more relevant in light of declining costs or emerging industry trends

- Investigates the winter peak demand impacts of Class 1 and 3 resources in addition to summer peak demand, which was the only metric explored in the previous assessment.

The total, system-wide, 20-year, incremental potential for Class 1 DSM in the current study is 552 MW, which is roughly one third larger than the 20-year Class 1 DSM potential estimate in the 2015 assessment of 373 MW. The difference is driven largely by new savings from smart thermostat DLC programs and from electric vehicle related programs, and is most pronounced in OR and UT. The Class 3 DSM potential estimate in the current study is also higher than the 2015 study, due largely to the addition of new rate options, namely TOU Demand Rates. The current study estimates 438 MW of incremental Class 3 DSM potential in 2036, which compares to 260 MW in 2034 from the previous study. A detailed comparison of the identified potential in the two studies, along with explanations of large changes, is provided in Volume 3 of this report.