Utah Program Update Report

Submitted by Nexant

May 1st, 2014




CONTENTS

1 EXECUTIVE SUMMARY

1.1 OVERVIEW

In July of 2013, PacifiCorp retained Nexant, Inc. (Nexant) to evaluate new and existing commercial measures for the FinAnswer Express/wattsmart Business program and make recommendations for updates in light of current market conditions, changes to industry standards, State energy codes and/or Federal efficiency regulations, and new energy efficiency research from publicly available sources.

This report presents the results of the analysis conducted for the Utah service area. The analysis is broken into three tasks, described below.

Task 1 – Non Lighting Program Measure Updates

Review all current, eligible, non-lighting program measures to confirm their appropriateness and update as necessary current incentive levels, costs, savings, and measure delivery mechanisms. In addition, review new non-lighting measures for possible inclusion in the program based on the criteria that they are market-ready technologies expected to result in cost-effective, justifiable savings.

Task 2 – Lighting Program Measure Updates

Evaluate the appropriateness of current prescriptive lighting incentives and provide a recommendation of whether to change incentive levels or structures based on available technologies, program participation, and realized savings.

Task 3 – Linear Fluorescent Baseline Assessment

Conduct a comprehensive market assessment of general service fluorescent lighting (GSFL) impacted by federal efficacy standards and recommend a revised baseline and schedule for adopting the baseline.

A summary of recommendations is provided below in Section 1.2, followed by a description of the approach to work and analysis methodology in Section 1.3.2. A summary of the program impacts is provided in Section 1.3. An overview of the report structure and contents is provided in Section 1.4.1.

1.2 SUMMARY OF RECOMMENDATIONS

Nexant recommends the following changes and enhancements to the existing FinAnswer Express program and eligible measures, summarized by task below.

1.2.1 Task 1 – Non-Lighting Program Measure Updates

Nexant reviewed existing commercial measures in six categories (Appliances, Electronics, Envelope, Food Service, HVAC, Motors & VFDs) and screened new measures for inclusion into the wattsmart Business program. Recommended changes to the eligibility or incentives for existing measures are summarized in Table 1-1 and for new measures in Nexant identified a list of candidate measures for addition to the program. The candidate measures and recommendations for adding to the program are shown in Table 1-2.

Table 1-2 Candidate New Measures

Measure Category	Candidate Measure	Include in Program?	Description
Appliances	ENERGY STAR Electric Water Heater (Commercial)	No	No high efficiency specification currently exists for electric commercial water heaters. Reconsider measure inclusion when ENERGY STAR specification includes commercial heat pump water heaters.
Electronics	ENERGY STAR Enterprise Servers	No	Despite the presence of an ENERGY STAR specification, there remain numerous equipment combinations with significant variation in costs, making this measure poorly suited to a prescriptive incentive. Incentivize this measure through the more traditional custom measure route at $0.15/kWh saved.
	ENERGY STAR Uninterruptible Power Supplies (UPS)	No	Selecting a UPS is a site-specific assessment that requires measured inputs on voltage characteristics and electric load. Savings cannot be reasonably predicted without collecting pre/post operation data. Costs will also vary significantly based on application of the technology, making this measure poorly suited to a prescriptive incentive. Incentivize this measure through the more traditional custom measure route at $0.15/kWh saved.

Measure Category	Candidate Measure	Include in Program?	Description
	Large Network Equipment	No	ENERGY STAR Version 1.0 specification still under development. Reconsider measure inclusion once specification is finalized.
	Small Network Equipment	No	ENERGY STAR Version 1.0 specification still under development. Reconsider measure inclusion once specification is finalized.
	Data Center Storage	No	Savings cannot be estimated with the necessary degree of accuracy for scenarios outlined by ENERGY STAR. Incentivize this measure through the more traditional custom measure route at $0.15/kWh saved based on savings verified from pre/post installation monitoring.
Food Service	Demand-Controlled Kitchen Ventilation	Yes	A simplified calculator tool should be utilized to estimate savings based on kitchen operating hours, climate, and HVAC system efficiency. Incentives offered on a $/kWh saved basis.
	Anti-Sweat Heater Controls	Yes	Offer prescriptive incentives (per linear foot of refrigerated case) for anti-sweat heater controls installed in low-temperature (freezing) and medium-temperature (refrigerated) retrofit applications. Align deemed savings/costs with recently approved RTF UES data.
	Other Grocery Refrigeration	No	With the exception of anti-sweat heater controls and LED case lighting/occupancy sensors, RTF currently lists all other grocery refrigeration measures as “Out-of-Compliance” until such time that further research validates UES measure assumptions.
HVAC	Variable Refrigerant Flow Heat Pump	Yes	Offer a prescriptive incentive for VRF systems, which are an increasingly requested HVAC option in small/medium commercial buildings. Align eligibility requirements with CEE high-efficiency HVAC specification and calculate savings based on building type, climate and size of system.

Measure Category	Candidate Measure	Include in Program?	Description
	Evaporative Pre-Cooling	Yes	Offer a prescriptive incentive (based on air conditioning equipment size) for equipment that pre-cools air before it reaches the air conditioner condenser coil.
Motors & VFD	Variable Frequency Drives (Non-HVAC Applications)	No	Savings do not vary uniformly based on technology or application. Savings cannot be reasonably predicted without collecting pre/post operation data.

Table 1-3 contains a summary of the proposed cost/savings reporting methodology for each new commercial measure recommended for inclusion in the wattsmart Business program. Additional information on recommended baselines, measure eligibility requirements, measure cost, savings and incentives is provided as part of the Measure Worksheet for each measure in the XX Section.

Table 1-3 Reported Costs/Savings for New Measures

Recommended Measure	Reported Costs			Reported Savings		
	Actual	Deemed Based on Project	Deemed Based on Measure	Simplified Analysis	Deemed Based on Project	Deemed Based on Measure
Demand-Controlled Kitchen Ventilation	✓			✓		
Anti-Sweat Heater Controls		✓			✓	
Variable Refrigerant Flow Heat Pump	✓			✓		
Evaporative Pre-Cooling	✓				✓	

1.2.2 Task 2 – Lighting Program Measure Updates

Nexant reviewed existing lighting and lighting control measures for both the Retrofit and New Construction/Major Renovation components of the program. Recommended changes to the Retrofit measures are summarized in Table 1-4 and New Construction/Major Renovation measures in Table 1-5 below.

Table 1-4 Retrofit Lighting Measure Recommendations

Measure Category	Measure	Recommendations
Linear Fluorescent	Premium T8	Incentives for Premium T8 have been high to encourage greater adoption. With the shift to a revised GSFL baseline (See Section 1.2.5), adjust incentives downward in alignment with reduced savings. To encourage installation of lower wattage CEE T8, offer a higher incentive for CEE T8 Reduced Wattage lamps than for CEE T8 High Performance Lamps
	T5/T8 Relamp	Reduced Wattage relamps are a significant new opportunity for savings relative to the revised GSFL baseline. Increase the Relamp incentive to cover a higher portion of the relamp cost and encourage more customers to electively replace standard T8 lamps with Premium CEE T8.
	T5/T8 High-Bay	Tier the per lamp high-bay incentives to align incentives more closely with fixture costs and pay a more uniform percentage across all high-bay fixture sizes. This change will encourage "right-sizing" of high-bay fixtures.
Induction	Induction Fixture	Reduce the incentive to $75/fixture based on recent analysis showing reduced costs of available fixtures.
LED	Other LED	The categories and applications of LED technologies are shifting rapidly, and costs are rapidly declining. With the exception of LED Screw-In Lamps and Recessed Downlight kits, offer incentives at a single rate of $0.15/kWh saved for all LED technologies. Removing defined categories and specific incentives per fixture enables the incentive to evolve with the technology and market and maintain a cost-effective result.

Measure Category	Measure	Recommendations
Lighting Control	Occupancy, Daylighting & Advanced Daylighting Control	Pay incentives based on connected wattage to encourage control of more watts, rather than installation of more sensors. Per watt connected incentives will also accommodate newer, more sophisticated control systems (i.e. wireless communication and configuration) that operate across a broader range of fixtures with fewer sensors.
	Dimming Ballast	The dimming ballast is a necessary component to enable daylighting control. Incentivize the dimming ballast as part of the daylighting control measure incentive instead of offering a separate incentive.

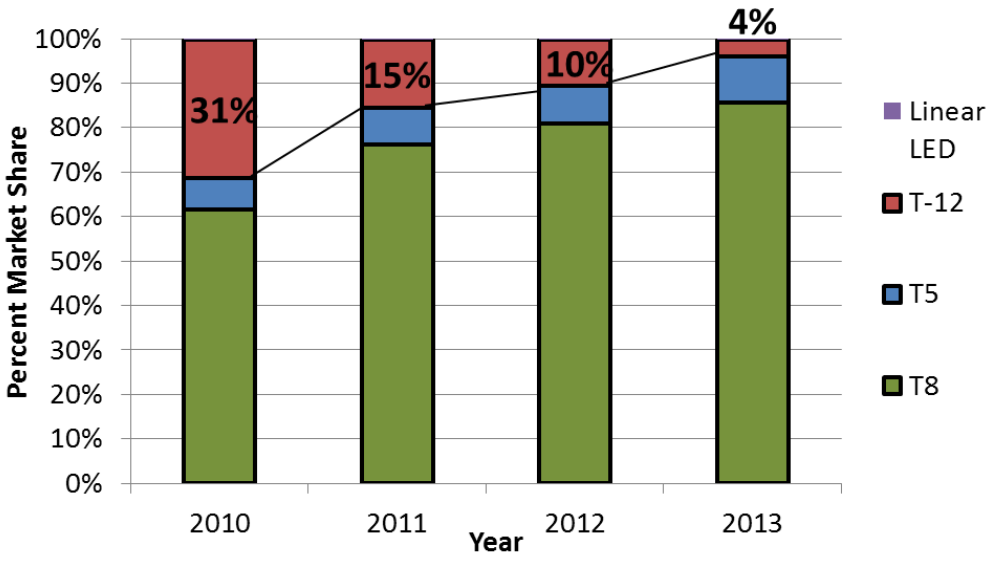
Table 1-5 New Construction/Major Renovation Lighting Recommendations

Measure Category	Measure	Recommendations
Interior Lighting	Lighting	No change to incentive, but savings will be reduced with Utah's adoption of IECC 2012, which mandates lower Lighting Power Densities (LPD) for regulated spaces. The minimum connected lighting power must be at least 10% lower than the interior lighting power allowances calculated under Section 405 for Major Renovation projects, and Section 406 or New Construction Projects.
Exterior Lighting	Lighting	With increasing prevalence and lower costs of LED's, expand the categories/equipment types offered a prescriptive incentive. The new categories are aligned with currently available products and established categories on the DesignLights Consortium Qualified Product List.
	Lighting Control	Pay incentives based on connected wattage to encourage control of more watts, rather than installation of more sensors. Per watt connected incentives will also more easily accommodate newer, more sophisticated control systems (i.e. wireless communication and configuration) that operate across a broader range of fixtures with fewer sensors.

1.2.3 Task 3 – Linear Fluorescent Baseline Assessment

Primary research conducted by Nexant as part of this study indicates that T12 GSFL lamps now represent a very small share of current GSFL sales (~4%), T12s are less than 10% of existing stock saturations, and there is limited evidence of stockpiling. These findings are supported by a distinct decline in T12 lamp sales complemented with an increase in T8 sales, now representing over 80% of the market share of GSFL lamps, as seen in Figure 1-1.

Figure 1-1 Reported PacifiCorp Linear Fluorescent Lamp Sales by Type



General market trends, combined with federal GSFL efficacy standards that became effective July 14th, 2012 have resulted in an 81% decrease in sales of T12 lamps in PacifiCorp territory. As T8 lamps and electronic ballasts now comprise a significant majority of equipment currently sold, Nexant recommends revising the GSFL baseline to align with industry standard practice to be based on 32W T8 lamps and electronic ballasts.

Current GSFL Baseline – Lamp Type: 34W T12; Ballast Type: Energy Efficiency Magnetic Ballast

Recommended GSFL Baseline – Lamp Type: 32W T8; Ballast Type: Electronic Ballast

Nexant recommends the revised GSFL baseline be implemented in alignment with the effective date of proposed program changes. PacifiCorp should update the lighting table referenced on the Company website to show revised baseline wattages for impacted fixtures and update the lighting tool to report savings using the revised baseline for projects started on or after the effective date of program changes.

below.

Table 1-1 Recommended Eligibility/Incentive Changes to Existing Measures

Measure Category	Measure	Recommendations
Appliances	Commercial Clothes Washer	Update incentives, deemed costs/savings to align with market data for ENERGY STAR qualified models and revised minimum federal efficiency requirements. Remove incentives for CEE Tier 3 qualified models as CEE has suspended its commercial clothes washer specification.
Electronics	Network Power PC Management	Update deemed savings and costs to align with data from NWPCC 6th Plan RTF since RTF measure is now limited to K-12 schools. Update eligibility criteria to include only controlled desktop computers for higher savings certainty and reduce the incentive from $7/pc to $5/pc. The incentive is sufficiently below market cost to justify removing the measure cost cap.
Food Service	Commercial Dishwasher	Update deemed savings/costs and incentive to align with ENERGY STAR specification update and current industry standard baseline. Remove eligibility requirement of electrically heated domestic hot water (DHW), but require electric booster heater to increase program participation. Report savings based on DHW energy source.
	Commercial Refrigerators & Freezers	Discontinue offering incentives for solid door refrigerators/freezers due to very limited savings potential relative to industry standard baseline. Revise incentives for transparent door refrigerators/freezers based on updated cost data.
	Electric Insulated Holding Cabinet	Maintain ENERGY STAR eligibility requirements and update deemed savings/costs and incentive to align with revised ENERGY STAR specification.

Measure Category	Measure	Recommendations
	Electric Combination Oven	Update deemed savings/costs and incentive to align with revised ENERGY STAR specification (effective 1/1/2014). Add additional size category to account for large differences in incremental costs/incentives between oven sizes.
	Electric Convection Oven	Update deemed savings/costs and incentive to align with revised ENERGY STAR specification (effective 1/1/2014).
	Electric Griddle	Discontinue offering incentives for ENERGY STAR Tier 1 electric griddles as a result of negligible incremental cost difference and small savings between standard and ENERGY STAR Tier 1 qualified products. Adjust eligibility requirements to incentivize ENERGY STAR Tier 2 qualified models only and update deemed costs/savings.
	Electric Steam Cooker	Update deemed costs/savings in response to new market data for Tier 1. Adjust eligibility requirements and deemed savings/costs and incentive to align with revised RTF data for Tier 2.
	Electric Commercial Fryer	Adjust eligibility requirements and deemed savings/costs and incentive to align with revised RTF data for Tier 2.
	Residential Dishwasher (used in a Business)	Discontinue incentives for Residential Dishwasher in alignment with the HES program.
HVAC	PTAC/PTHP Occupancy Based Controller	Revise eligibility to include door-key occupancy sensors in addition to infrared/ultrasonic sensors.
	Portable Classroom HVAC Control	Revise eligibility to include occupancy based thermostat control in addition to 365/366 scheduling.
	Residential Room Air Conditioner (used in a Business)	Update eligibility/incentives and reported costs/savings to align with the Home Energy Savings program.

Nexant identified a list of candidate measures for addition to the program. The candidate measures

and recommendations for adding to the program are shown in Table 1-2.

Table 1-2 Candidate New Measures

Measure Category	Candidate Measure	Include in Program?	Description
Appliances	ENERGY STAR Electric Water Heater (Commercial)	No	No high efficiency specification currently exists for electric commercial water heaters. Reconsider measure inclusion when ENERGY STAR specification includes commercial heat pump water heaters.
Electronics	ENERGY STAR Enterprise Servers	No	Despite the presence of an ENERGY STAR specification, there remain numerous equipment combinations with significant variation in costs, making this measure poorly suited to a prescriptive incentive. Incentivize this measure through the more traditional custom measure route at $0.15/kWh saved.
	ENERGY STAR Uninterruptible Power Supplies (UPS)	No	Selecting a UPS is a site-specific assessment that requires measured inputs on voltage characteristics and electric load. Savings cannot be reasonably predicted without collecting pre/post operation data. Costs will also vary significantly based on application of the technology, making this measure poorly suited to a prescriptive incentive. Incentivize this measure through the more traditional custom measure route at $0.15/kWh saved.
	Large Network Equipment	No	ENERGY STAR Version 1.0 specification still under development. Reconsider measure inclusion once specification is finalized.
	Small Network Equipment	No	ENERGY STAR Version 1.0 specification still under development. Reconsider measure inclusion once specification is finalized.

Measure Category	Candidate Measure	Include in Program?	Description
	Data Center Storage	No	Savings cannot be estimated with the necessary degree of accuracy for scenarios outlined by ENERGY STAR. Incentivize this measure through the more traditional custom measure route at $0.15/kWh saved based on savings verified from pre/post installation monitoring.
Food Service	Demand-Controlled Kitchen Ventilation	Yes	A simplified calculator tool should be utilized to estimate savings based on kitchen operating hours, climate, and HVAC system efficiency. Incentives offered on a $/kWh saved basis.
	Anti-Sweat Heater Controls	Yes	Offer prescriptive incentives (per linear foot of refrigerated case) for anti-sweat heater controls installed in low-temperature (freezing) and medium-temperature (refrigerated) retrofit applications. Align deemed savings/costs with recently approved RTF UES data.
	Other Grocery Refrigeration	No	With the exception of anti-sweat heater controls and LED case lighting/occupancy sensors, RTF currently lists all other grocery refrigeration measures as "Out-of-Compliance" until such time that further research validates UES measure assumptions.
HVAC	Variable Refrigerant Flow Heat Pump	Yes	Offer a prescriptive incentive for VRF systems, which are an increasingly requested HVAC option in small/medium commercial buildings. Align eligibility requirements with CEE high-efficiency HVAC specification and calculate savings based on building type, climate and size of system.
	Evaporative Pre-Cooling	Yes	Offer a prescriptive incentive (based on air conditioning equipment size) for equipment that pre-cools air before it reaches the air conditioner condenser coil.

Measure Category	Candidate Measure	Include in Program?	Description
Motors & VFD	Variable Frequency Drives (Non-HVAC Applications)	No	Savings do not vary uniformly based on technology or application. Savings cannot be reasonably predicted without collecting pre/post operation data.

Table 1-3 contains a summary of the proposed cost/savings reporting methodology for each new commercial measure recommended for inclusion in the wattsmart Business program. Additional information on recommended baselines, measure eligibility requirements, measure cost, savings and incentives is provided as part of the Measure Worksheet for each measure in the XX Section.

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Anti-Sweat Heater Controls		✓			✓	
Variable Refrigerant Flow Heat Pump	✓			✓		
Evaporative Pre-Cooling	✓				✓	

1.2.4 Task 2 – Lighting Program Measure Updates

Nexant reviewed existing lighting and lighting control measures for both the Retrofit and New Construction/Major Renovation components of the program. Recommended changes to the Retrofit measures are summarized in Table 1-4 and New Construction/Major Renovation measures in Table 1-5 below.

Table 1-4 Retrofit Lighting Measure Recommendations

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LED	Other LED	The categories and applications of LED technologies are shifting rapidly, and costs are rapidly declining. With the exception of LED Screw-In Lamps and Recessed Downlight kits, offer incentives at a single rate of $0.15/kWh saved for all LED technologies. Removing defined categories and specific incentives per fixture enables the incentive to evolve with the technology and market and maintain a cost-effective result.

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	Dimming Ballast	The dimming ballast is a necessary component to enable daylighting control. Incentivize the dimming ballast as part of the daylighting control measure incentive instead of offering a separate incentive.

Table 1-5 New Construction/Major Renovation Lighting Recommendations

Measure Category	Measure	Recommendations
Interior Lighting	Lighting	No change to incentive, but savings will be reduced with Utah's adoption of IECC 2012, which mandates lower Lighting Power Densities (LPD) for regulated spaces. The minimum connected lighting power must be at least 10% lower than the interior lighting power allowances calculated under Section 405 for Major Renovation projects, and Section 406 or New Construction Projects.
Exterior Lighting	Lighting	With increasing prevalence and lower costs of LED's, expand the categories/equipment types offered a prescriptive incentive. The new categories are aligned with currently available products and established categories on the DesignLights Consortium Qualified Product List.
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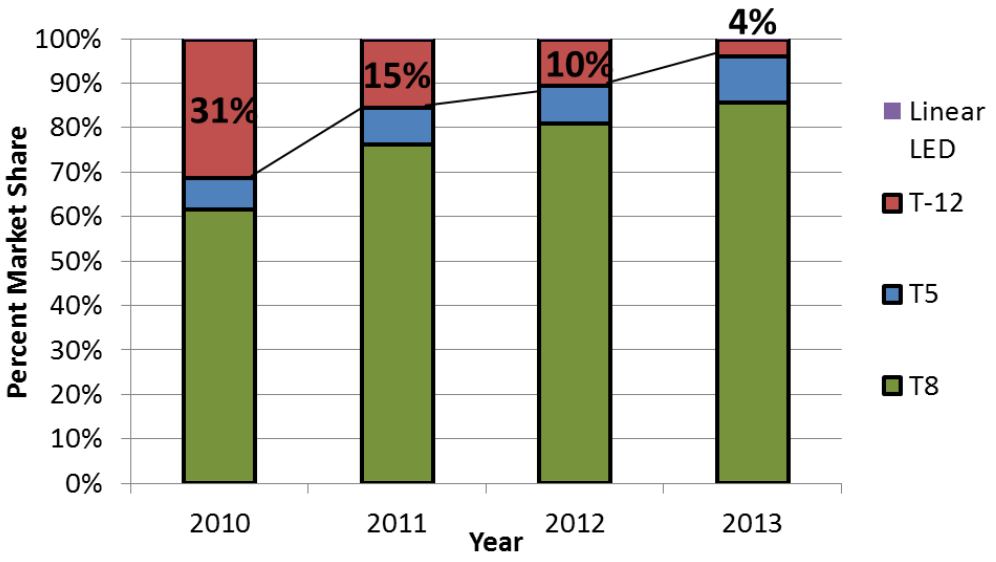
1.2.5 Task 3 – Linear Fluorescent Baseline Assessment

Primary research conducted by Nexant as part of this study indicates that T12 GSFL lamps now represent a very small share of current GSFL sales (~4%), T12s are less than 10% of existing stock saturations, and there is limited evidence of stockpiling. These findings are supported by a distinct decline in T12 lamp sales complemented with an increase in T8 sales, now representing over 80% of the market share of GSFL lamps, as seen in Figure 1-1.

Figure 1-1 Reported PacifiCorp Linear Fluorescent Lamp Sales by Type



General market trends, combined with federal GSFL efficacy standards that became effective July 14th, 2012 have resulted in an 81% decrease in sales of T12 lamps in PacifiCorp territory. As T8 lamps and electronic ballasts now comprise a significant majority of equipment currently sold, Nexant recommends revising the GSFL baseline to align with industry standard practice to be based on 32W T8 lamps and electronic ballasts.

Current GSFL Baseline – Lamp Type: 34W T12; Ballast Type: Energy Efficiency Magnetic Ballast

Recommended GSFL Baseline – Lamp Type: 32W T8; Ballast Type: Electronic Ballast

Nexant recommends the revised GSFL baseline be implemented in alignment with the effective date of proposed program changes. PacifiCorp should update the lighting table referenced on the Company website to show revised baseline wattages for impacted fixtures and update the lighting tool to report savings using the revised baseline for projects started on or after the effective date of program changes.

1.3 PROGRAM IMPACTS

Table 1-6 summarizes the estimated incremental costs, savings, and incentive impacts associated with these recommendations, both for the Trade Ally delivery path and projects directly managed by Rocky Mountain Power. Additional administrative costs presented in Table 1-6 for commercial measure categories assume an implementation cost of $0.06 per new kWh/yr of gross customer energy savings.

Table 1-6 Incremental Program Impacts from Recommended Changes

Measure Category/Year[1]	Gross Annual Energy Savings[2] (kWh/yr)	Gross Customer Incremental Costs[3] ($/yr)	Incentives	Administrative Costs[4] ($/yr)
Appliances				
Year 1	0	$(130)	$750	$-
Year 2	0	$(130)	$750	$-
Year 3	0	$(130)	$750	$-
Envelope				
Year 1	0	$-	$-	$-
Year 2	0	$-	$-	$-
Year 3	0	$-	$-	$-
Food Service				
Year 1	335,398	$189,531	$(19,619)	$20,124
Year 2	420,523	$210,581	$(14,169)	$25,231
Year 3	433,273	$212,681	$(13,269)	$25,996
HVAC				
Year 1	279,953	$456,563	$63,172	$16,797
Year 2	344,377	$551,838	$77,061	$20,663
Year 3	412,164	$649,055	$91,766	$24,730
Lighting				
Year 1	-4,508,423	$900,434	$(78,667)	$-
Year 2	-4,654,956	$927,766	$(80,969)	$-
Year 3	-4,806,449	$955,934	$(83,338)	$-
Motors				
Year 1	0	$-	$-	$-
Year 2	0	$-	$-	$-
Year 3	0	$-	$-	$-
Other				
Year 1	0	$-	$(596)	$-
Year 2	0	$-	$(596)	$-
Year 3	0	$-	$(596)	$-
Total				
Year 1	-3,893,072	1,546,398	$(34,959)	$36,921
Year 2	-3,890,057	1,690,055	$(17,923)	$45,894
Year 3	-3,961,012	1,817,540	$(4,686)	$50,726

1 Estimates are for a full year program period.

2 Energy and demand savings reflect gross impacts at the customer meter.

3 Customer costs represent the gross values and do not include the impacts of available incentives.

4 Administration cost estimates are estimated at $0.06 per new kWh/yr savings.

1.3.1 Explanation of Program Impacts

The program impacts are explained by measure category as follows. Details of measure-specific adjustments to incentive, deemed savings, and deemed costs can be found in the individual Measure Works sheets found in Section 2.

Appliances. Minor adjustments of customer costs and incentives for Residential measures in alignment with HES changes contribute to a decrease in customer costs and increase in incentives. Adjustments to the eligibility criteria and incentives for commercial clothes washers results in a slight negative contribution to incentives.

Envelope. No changes to eligibility criteria or incentives for envelope measures are necessary as a result of the adoption of IECC 2012 by Utah. As a result, there is no anticipated change to participation forecasts or resulting impacts on program costs, incentives, or savings.

Food Service. The addition of new measures (Kitchen Demand Controlled Ventilation, Anti-Sweat Heater Controls) adds additional savings, incentives, and program costs. However, these gains are offset by the reduction in savings and incentives associated with more stringent ENERGY STAR specifications for many of the Food Service measures.

HVAC. The addition of new measures (Evaporative Pre-Cooling, Variable Refrigerant Flow Heat Pumps) adds additional savings, incentives, and program costs.

Lighting. Lighting is the category most impacted by changes outlined in this report, primarily resulting from the General Service Fluorescent Baseline adjustment. A historical analysis of 785 completed retrofit lighting projects in Utah indicated that 41.8% of the fixtures installed are affected by this baseline adjustment, resulting in an anticipated reduction of reported savings by 8.2%. The impact will lessen over time as the prevalence of existing T12 and Standard T8 fixtures continues to decline, but is expected to have an acute impact on reported lighting savings in the next 2 – 3 years. At a project level, retrofit project costs are expected to rise by 3-5% in the next three years as a result of higher prevalence of higher cost LED's, and incentives are expected to decline by 2-3% as a result of reduced incentives recommended for more traditional fluorescent lighting.

Additionally, the adoption of IECC 2012 and lower maximum lighting power densities required by Section 406 of the code are expected to reduce reported savings from new construction/major renovation lighting projects by as much as 15%. Project costs are expected to rise as a result of higher prevalence of higher cost LED's.

Motors. No changes in incentives or eligibility requirements were recommended or motors, and resulting program impacts are negligible.

Other. Incentives for Network Power PC Management software have been reduced from $7/pc to $5/pc, resulting in a reduction of incentives paid over a three year period.

Even as new measures are added to the program, the net program impacts for recommended changes to commercial measures in Utah are generally indicative of increasing customer costs to acquire more difficult savings from traditional resources. Baselines for most equipment continue to become more efficient as a result of more stringent energy codes at the state and federal level, reducing the savings potential and driving up acquisition costs.

1.3.2 Forecast Assumptions for Updated Measures

The table below shows the forecasting assumptions utilized for gauging the impact of recommended program changes. Savings, cost, and incentive amounts are average/estimated values and may vary by measure category or size. Please reference the measure worksheets in Section 2 for specific details of measures level savings, costs, and incentives.

Measure	Unit	Savings (kWh/yr)	Cost ($)	Incentive ($)	Forecast Participation		
					Year 1	Year 2	Year 3
Commercial Clothes Washer	Each	391	$200	$100	25	25	25
Network Power PC Management	PC	103	$12	$5	10,000	10,000	10,000
Commercial Dishwasher	Each	9,345	$950	$1,000	36	36	36
Commercial Refrigerators	Each	908	$110	$65	216	216	216
Electric Insulated Holding Cabinet	Each	3,017	$578	$300	21	21	21
Electric Combination Oven	Each	30,610	$1,814	$638	<5	<5	<5
Electric Convection Oven	Each	3,040	$806	$350	<5	<5	<5
Electric Griddle	Each	2,595	$0	$130	36	36	36
Electric Steam Cooker	Each	29,041	$303	$215	6	6	6
Electric Commercial Fryer	Each	2,285	$490	$225	50	50	50
Demand-Controlled Ventilation	Each	9,871	$10,000	$1,481	<5	<5	<5
Anti-Sweat Heater Controls	Ln. ft.	306	$42	$18	150	175	225
VRF Heat Pump	Ton	450	$850	$75	500	600	700
Evaporative Pre-Cooling	Ton	299	$230	$75	124	155	194
Retrofit Lighting	Project	32,723	$14,433	$3,329	1,582	1,629	1,678
NC/MR Lighting	Project	37,090	$4,457	$3,163	92	97	102

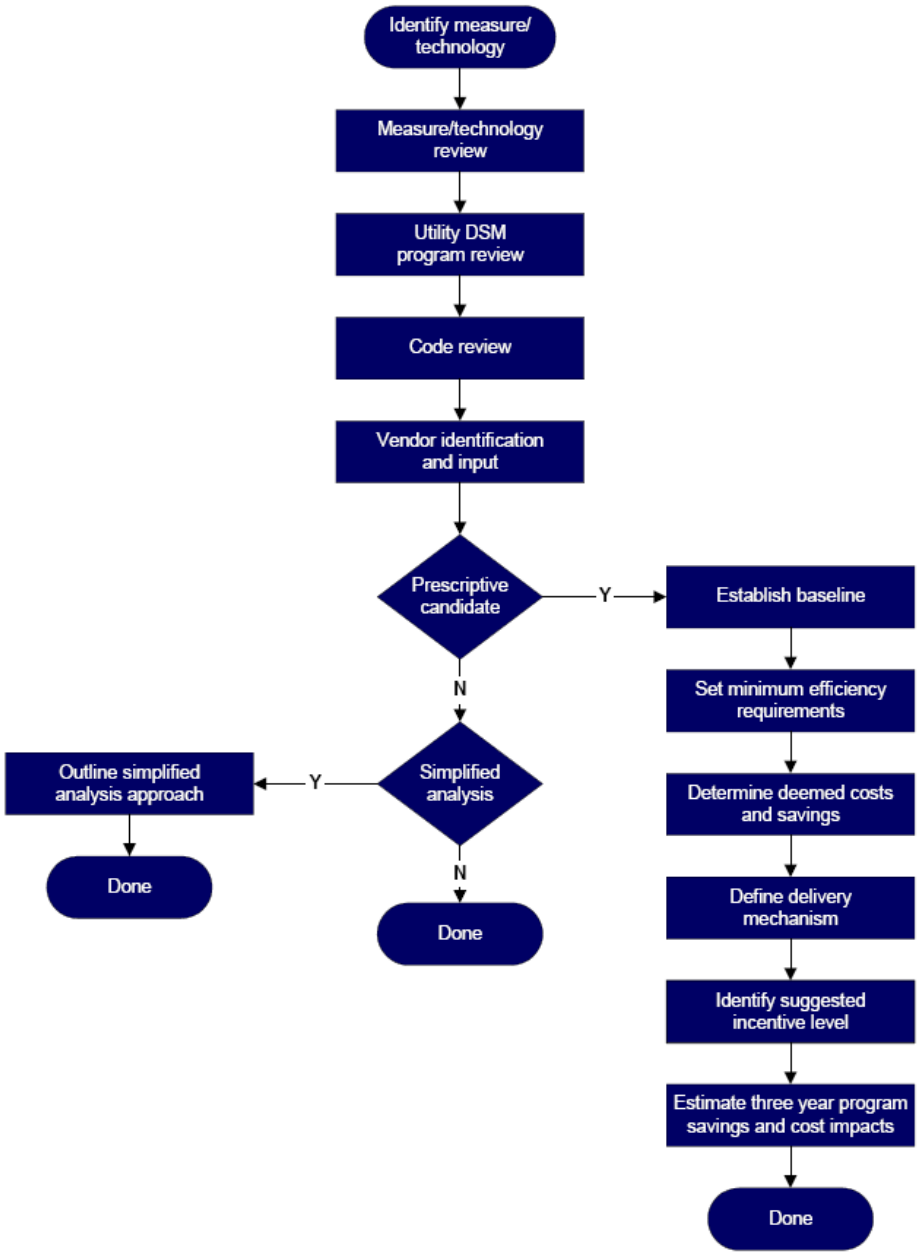
1.4 Approach to Work

The approach to work for Task 1 and 2 is detailed below. A description of the Approach to Work for Task 3 is included in Section 3 to this Utah Program Update report.

1.4.1 Program Measure Updates

Nexant followed a proven, systematic approach to evaluate each candidate commercial energy efficiency measure, as outlined in Figure 1-2.

Figure 1-2 Approach to Work Diagram



Nexant identified a list of potential candidate commercial measures, including all current eligible program measures, and suggested new measures listed in

Table 1-7 below. For each measure, an analysis was performed to define incentive levels, estimate incremental costs, and estimate savings.

Table 1-7 New Measures Evaluated

Measure
ENERGY STAR Electric Water Heater (Commercial)
ENERGY STAR Enterprise Servers
ENERGY STAR Uninterruptible Power Supplies
Large Network Equipment
Small Network Equipment
Data Center Storage
Demand Controlled Kitchen Ventilation
Anti-Sweat Heater Controls
Grocery Refrigeration Measures
Variable Refrigerant Flow AC & HP
Evaporative Pre-Cooling
Variable Frequency Drives (Non-HVAC Applications)

Measure/Technology Review. Initial analysis efforts for each measure consisted of a review of existing data sources to compile available cost/savings data and measure information. For this analysis, a core set of resources listed below in Table 1-8 was utilized.

Table 1-8 Measure/Technology Review Resources

Data Source Name
Consortium for Energy Efficiency (CEE)
Database of Energy Efficiency Resources (DEER)
ENERGY STAR
Regional Technical Forum (RTF)
Department of Energy (DOE) – Energy Efficiency, Building and Industrial Technology Programs
PacifiCorp Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources (2013)
Colorado DSM Market Potential Assessment (2010 & 2013 Update)
The Sixth Northwest Electric Power and Conservation Plan
2010 FinAnswer Express Market Characterization & Program Enhancements
FinAnswer Express Third-Party Program Evaluations

Utility DSM Program Review. Nexant performed a review of existing energy efficiency programs to identify and compare prescriptive incentives for the commercial measures investigated as part of this work. Information on eligibility requirements and incentive levels for evaluated measures was collected as part of this effort. The review efforts was focused on program offerings from major

utilities and energy efficiency organizations with service territories close to PacifiCorp or with program offerings structured similarly to wattsmart Business (see Table 1-9 below).

Table 1-9 Utility Programs Reviewed

Utility Resources	CA	ID	UT	WA	WY
Arizona Public Service			✓		✓
Avista		✓	✓	✓	
Bonneville Power Authority (BPA)		✓	✓	✓	✓
Energy Trust of Oregon	✓	✓		✓	
Idaho Power		✓	✓	✓	
Mid-American Energy	✓	✓	✓	✓	✓
Nevada Power		✓	✓		✓
Pacific Gas & Electric	✓			✓	
Puget Sound Energy		✓		✓	
Xcel Energy (Colorado)			✓		✓

Code Review. To assess the appropriateness of current baseline assumptions for existing measures and to help establish baselines for potential new prescriptive measures, Nexant reviewed applicable or pending code requirements impacting Utah, as listed in Table 1-10. Review efforts focused on both state and federal codes and efficiency regulations and included current code requirements and planned future code updates where available.

Table 1-10 Codes(s) Reviewed

Code(s) Reviewed
Code of Federal Regulations, Title 10, Parts 430-431
DOE Efficiency Rulemakings
IECC 2009
IECC 2012

Vendor Identification and Input. Three (3) equipment manufacturers, distributors, or dealers for each investigated measure category (Appliances, Office, Building Envelope, HVAC, Motors, Refrigeration & Food Service) were contacted informally to discuss estimated measure cost and savings data collected as part of the above activities. Vendors were asked to provide input on local activity and the expected market response to prescriptive incentives for high-efficiency measures.

Identification of Candidate Prescriptive Measures. Based on the collected data, Nexant evaluated each measure and either recommended changes to existing measures, or inclusion of new measures (See Section 1.2 for recommendations), based on the following criteria, among others:

- Savings potential (measure volume, per unit savings)
- Prevalence of incentive offerings from other utilities

- Suitability for prescriptive incentive delivery mechanism,
- Availability of qualifying equipment and market support
- Industry-recognized high-efficiency eligibility criteria (i.e. ENERGY STAR, CEE, RTF)

Recommended measures were more fully analyzed as described in the remaining steps outlined below, and documented in the Measure Worksheets included in Section 2 of this report.

Establish Baseline. Baselines were established for new potential prescriptive measures and reviewed for existing measures. Existing or pending federal or state code requirements are typically used as the baseline value. For measures where no code requirement exists, current industry practices identified during the evaluation activities were used.

Set Minimum Efficiency Requirements. Establish recommended minimum efficiency levels for prescriptive measures based on findings from the evaluation activities. In general, minimum efficiency requirements are set to match current market levels established by others such as the Consortium for Energy Efficiency (CEE), ENERGY STAR, RTF or other regional utilities to leverage existing market awareness.

Determine Deemed Unit Cost and Savings. Estimate incremental cost and savings values for prescriptive measures based on the proposed minimum efficiency requirements and associated baselines. Deemed values published by other organizations, particularly the Regional Technical Forum and DEER, were utilized where deemed savings/costs analysis assumptions align with recommended measure eligibility criteria. Where a deemed or unit energy savings approach was not appropriate, a savings and cost reporting method was recommended.

Identify Incentive Level. Incentive levels for prescriptive measures were developed through an iterative process that considers the following factors:

- Percentage of incremental customer cost
- Incentive levels offered by other utilities or organizations (RTF) for similar measures
- Reduction of simple payback period for qualifying measures from incentive
- Incentive rate ($/kWh) alignment with other PacifiCorp programs and cost-effectiveness criteria
- Feedback from vendors
- The value of savings achieved by the measure
- Technology evaluation (market penetration/savings potential of emerging technology)

Incentive levels were generally established to insure that the incentive amount is not greater than the incremental cost, results in a large enough reduction in simple payback to encourage customers/vendors to purchase qualifying equipment, aligns with the incentive rate ($/kWh) offered by other PacifiCorp programs, and is consistent with incentives offered by other regional utilities.

1.5 REPORT ORGANIZATION

The balance of this report presents results from the analysis approach described above, and the structure is outlined as follows:

Section 2 contains specific Measure Worksheets containing analysis results for each measure with recommended changes to incentive amounts or eligibility requirements. Each worksheet includes a measure description for each evaluated measure, a summary of similar utility prescriptive offerings, a review of pertinent state and federal codes, a summary of vendor feedback, identification of the baseline for calculating savings, a recommendation of minimum eligibility requirements and incentive amount, and a summary of reported energy and demand savings, incremental customer cost, and measure life.

Section 3 contains the analysis of the General Service Fluorescent Baseline, including a description of the approach to work, summary of findings, and recommendation on the appropriate GSFL baseline. Market actor and program participant survey instruments are also found in this section.

Section 4 contains a brief synopsis of the Small Business Lighting approach and forecasted participation, customer costs, incentives, and administrative costs

2 TASK 1, 2: MEASURE UPDATES

2.1.1 Commercial Clothes Washer

Measure Category	Measure Type	Measure Sub-type
Appliances	Clothes Washers	Commercial Clothes Washer

Description (s)	Source
The definition of commercial clothes washers was taken from the Code of Federal Regulations: "Commercial clothes washer means a soft-mounted front-loading or soft-mounted top-loading clothes washer that 1) has a clothes container compartment that for horizontal-axis clothes washers, is not more than 3.5 cubic feet and for vertical-axis clothes washers is not more than 4.0 cubic feet; and 2) is designed for use in applications in which the occupants of more than one household will be using the clothes washer, such as multi-family housing common areas and coin laundries; or other commercial applications" (10 CFR part 431.152). This definition is consistent with that used by ENERGY STAR and the current Washington and California state appliance standards.	11

Measure Research Summary	Source
See Table 1-1 for a detailed breakout of measure research reporting sources.	3, 5
Federal minimum efficiency standards apply to commercial clothes washers, and are in the process of being reevaluated by DOE with proposed changes becoming effective in 2015. ENERGY STAR and CEE both maintain high-efficiency specifications for commercial clothes washers, but the CEE specification is currently suspended pending changes to federal standards and ENERGY STAR criteria. ENERGY STAR evaluated and released a new specification (v.7.0) which will be effective March 7, 2015. Front-loading models are the only versions that currently qualify for ENERGY STAR certification. DOE research suggest the most common commercial use of washers is in landromats and multi-family facilities.	

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Commercial Clothes Washer Tier 1	Modified Energy Factor (MEF) – 2.00 Water Factor (WF) – 6.0	Federal Standard MEF – 1.26 WF – 9.5			CEE Commercial Clothes Washer Specifications active Jan 1, 2011 – Jan 8, 2013. Given recent changes to federal minimum efficiency standards and ENERGY STAR® criteria for commercial clothes washers, the CEE Commercial Clothes Washer Specification is not currently active. Revised specifications expected to be active by mid-2014. Data should be revised at that point. Federal Standards listed were effective Jan 1, 2007 – Jan 8, 2013 and applicable to both front and top loading models.	1
Commercial Clothes Washer Tier 2	MEF – 2.20 WF – 4.5	Federal Standard MEF – 1.26 WF – 9.5				
Commercial Clothes Washer Tier 3	MEF – 2.40 WF – 4.0	Federal Standard MEF – 1.26 WF – 9.5				
					DEER data is not applicable, information is only available for residential units.	2
Energy Star Commercial Clothes Washer	MEF ≥ 2.2 WF ≤ 4.5	Federal Standard Front-Loading MEF – 2.0 WF – 5.5 Top-Loading MEF – 1.6 WF – 8.5	$200/unit	Range Low-92 kWh/yr (Front-Loading, multi-family, Gas DHW, Gas dryer) Range High-1,042	Energy Star specifications Version 6.1 effective Feb 1, 2013. Only front and top loader clothes washers with capacities of greater than 1.6 ft3 are eligible to earn the ENERGY STAR Savings vary based on model type (Front or Top Loading), application (Laudromat or Multi-family), DHW energy	3

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
				kWh/yr (Top-Loading, laudromat, Elec DHW, Elec dryer)	source (Electric or Gas), and dryer heating energy source (Electric or Gas). It is important to note that there are no Top-loading models on the current Energy Star list. (High range savings for front-loading is 278 kWh/yr)	
Energy Star Commercial Clothes Washer in Laundromat Electric DHW & Dryer	Energy Star qualifying models average MEF - 2.36 WF - 4.1	Current Practice – MEF – 2.08 WF – 5.9	$200	828 kWh/yr	RTF measure life 7 yrs Sunset Date March 31, 2015 Baseline is a calculated average based on commercial clothes washers in the California Energy Commission (CEC) database meeting the 2013 Federal Standard (Including Energy Star qualified models). Savings are a calculated average based on commercial clothes washers in the California Energy Commission (CEC) database meeting Energy Star V 6.1 specifications.	4
Energy Star Commercial Clothes Washer in Laundromat Electric DHW/Gas Dryer	Energy Star qualifying models average MEF - 2.36 WF - 4.1	Current Practice – MEF – 2.08 WF – 5.9	$200	508 kWh/yr		4
Energy Star Commercial Clothes Washer in Laundromat Gas DHW & Dryer	Energy Star qualifying models average MEF - 2.36 WF - 4.1	Current Practice – MEF – 2.08 WF – 5.9	$200	78 kWh/yr		4
Energy Star Commercial Clothes Washer in Laundromat Gas DHW & Electric Dryer	Energy Star qualifying models average MEF - 2.36 WF - 4.1	Current Practice – MEF – 2.08 WF – 5.9	$200	398 kWh/yr		4
Top-Loading Commercial Clothes Washer-Shipment weighted for Multi-family and Laundromat	NA	Federal Standard Top-Loading MEF – 1.6 WF – 8.5	NA	NA	CEE based data indicates a market share split of 85% multi-family and 15% laundromats. Producing an averaged 1,388 cycles per year. TSD Chapter 11 No higher effeciency levels were analyzed above the current federal standard. Annual electrical	5

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
					energy usage is 812 kWh.	
Front-Loading Commercial Clothes Washer-Shipment weighted for Multi-family and Laundromat	MEF-2.35 WF – 4.4	Federal Standard Front-Loading MEF – 2.04 WF – 5.5	$83	73 kWh/yr	CEE based data indicates a market share split of 85% multi-family and 15% laundromats. Producing an averaged 1,388 cycles per year. TSD Chapter 11 Baseline annual electrical energy usage is 683 kWh. Efficient case annual electrical energy usage is 610 kWh.	5
Clothes Washer – ENERGY STAR	ENERGY STAR Clothes Washer - MEF 2.0 and WF 6.0 (Electric DHW & Dryer)	Standard Clothes Washer – MEF 1.48 and WF 9.5 (Electric DHW & Dryer)	$152	249 kWh/building		6
					Colorado DSM Market Potential Assessment only provides information on residential units	7
High Efficiency Commercial Washer - 2009 Energy Star	MEF 1.8	MEF 1.6	$297	558 kWh/yr	Data has not been updated since 2009	8
High Efficiency Commercial Washer - 2011 Energy Star	MEF 2	MEF 1.6	$400	715 kWh/yr		8
High Efficiency Commercial Washer - Top 10%	MEF 2.16	MEF 1.6	$486	825 kWh/yr		8
High-Efficiency Clothes Washer - Commercial Laundromat - ENERGY STAR Qualified	Energy Star qualified Must have Electric Water Heating		$370	998 kWh/yr		9
High-Efficiency Clothes Washer Commercial (Coin-operated/Laundromat) - CEE Tier 3	CEE Tier 3 qualified Must have Electric Water		$455	1226 kWh/yr		9

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
	Heating					

Code Research	Source
State and Federal codes were reviewed to assist in determining appropriate baselines for commercial clothes washers. The Code of Federal Regulations recently revised efficiency requirements for both top-loading and front loading units. California 2012 Appliance Efficiency Regulations also has minimum efficiency requirements for commercial clothes washers. However, California's minimum Modified Energy Factor is below Federal requirements, and is superceeded by federal efficiency standards. See Table 1-2 for a detailed breakout of code research reporting sources.	11, 12, 13, 14, 15, 16, 17, 18

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Commercial Clothes Washer- Top Loading	Code of Federal Regulations, Title 10	10 CFR 431.152	MEF ≥ 1.60 and WF ≥ 8.5	Effective Jan 8, 2013	11
Commercial Clothes Washer- Front Loading	Code of Federal Regulations, Title 10	10 CFR 431.152	MEF ≥ 2.00 and WF ≥ 5.5	Effective Jan 8, 2013	11
Commercial Clothes Washer	DOE Efficiency Rulemakings	NA	NA	Aug 13, 2012 DOE issued frame work for revisions to efficiency standards to be effective Jan 1, 2015. No specific information available yet.	12
Commercial Clothes Washer	IECC 2006	NA	NA	NA	13
Commercial Clothes Washer	IECC 2009	NA	NA	NA	14
Commercial Clothes Washer	IECC 2012	NA	NA	NA	15
Commercial Clothes Washer	WSEC 2012	NA	NA	NA	16
Commercial Clothes Washer	Title 24 – 2008	NA	NA	NA	17
Commercial Clothes Washer	CA 2012 Appliance Efficiency Regulations	Section: 1605.1(p) Table: P-2	≥ 1.26 Energy Factor ≥ 9.5 Water Factor		18

Peer Utility DSM Review	Source
Several applicable peer utility DSM offerings were reviewed for this measure. In most cases, the energy efficiency requirements are based on Energy Star requirements. One utility had higher minimum efficiency requirements than Energy Star. Incentive offerings for this measure vary between $50 and $300, and restrictions may apply to the end-use of the washing machine (laundromats, multi-family, hotel, etc.). See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	19, 20, 21, 22, 24, 26, 27

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
High Efficiency Clothes Washer Tier 1	MEF ≥ 2.0 & WF ≤ 6.0	$50.00	N/A	19
High Efficiency Clothes Washer Tier 2	MEF ≥ 2.2 & WF ≤ 4.5	$100.00	N/A	19
High Efficiency Clothes Washer Tier 3	MEF ≥ 2.4 & WF ≤ 4.0	$150.00	N/A	19
High Efficiency Clothes Washer Tier 4	MEF ≥ 2.6 & WF ≤ 3.5	$200.00	N/A	19
Commercial Clothes Washer	Energy Star Qualified or CEE List	$200.00	N/A	20
Energy Star Commercial Clothes Washer	Electric water heater and electric dryer	$200.00	N/A	21
Energy Star Commercial Clothes Washer	Electric water heater and gas dryer	$100.00	N/A	21
Energy Star Commercial Clothes Washer	Gas water heater and electric dryer	$100.00	N/A	21
Energy Star Commercial Clothes Washer	Gas water heater and gas dryer	$25.00	N/A	21
Commercial/Common-Area Laundry	Must have an MEF of 2.0 or greater and a WF of 6.0 or lower. ***With Electric water heater***	$300.00	N/A	22
Clothes Washer, Residential Grade	Must be energy star-qualified and use Mid- American Energy fuel for drying and/or water heating.	$50.00	Confirmed incentive for commercial accounts.	24
High Efficiency Clothes Washer	CEE Tier 3 or higher. MEF of 2.4 or greater, WF of 4.0 or less	$50.00	N/A	26
High Efficiency Commercial Clothes Washer	CEE Qualified. Must be Tier 2 or higher.	$200.00	N/A	27

Vendor Survey Findings Summary
Informal vendors surveyed indicated that electric high-efficiency commercial clothes washers are available, most being Energy Star qualified. Due to requirement for electrically heated domestic hot water, vendors feel there will be very little interest/participation because natural gas is the predominant fuel for water heating in this region. Regional vendor survey respondents included Evans Laundry and Lundquist Sales.

Vendor Name	Vendor Description
Evans Laundry	Retailer of commercial laundry equipment
Lundquist Sales	Wholesaler/Retailer of standard and high efficiency water heating equipment

Measure Recommendations		Source #
Summary	Savings exsist and the measure should continue to be offered. Incentive offering and savings should be adjusted based on new data. Savings should reflect revised federal baseline. The CEE Commercial Clothes Washer specification was suspended, so the second tier eligibility requirement should also be removed. Eligibility requirements should align with ENERGY STAR. All recommendations are based upon the minimum eligibility requirements listed below.	
Implement?	Yes	
Incentive	$100/unit	

Minimum Eligibility Requirements		Source #
Summary	Eligibility requirements should be tied to effective Energy Star specification Only clothes washers with electric DHW are eligible	3
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	Energy Star qualified	
Rating Standard	Handled by Energy Star	
Testing/Certifications	Handled by Energy Star	

Baseline	Source
Align with RTF calculation methodology, modified for weighted average of 1,388 cycles per year. See Table 1-2 for a detailed description of the applicable codes used to establish the baseline.	4,5

Savings Calculation Summary		Source #
Savings Estimate	391 kWh/year (Weighted average based on prevalence of elec/gas dryers)	
Savings Calculation Methodology	Weighted average of RTF Calculator results for Electric DHW configurations, modified for weighted average of 1,388 cycles per year. Assuming an hour per cycle, kW= 0.28 (391/1388)	4,5
Savings Estimate Conclusions	Electric DHW and Dryer- 525 kWh/year Electric DHW and Gas Dryer- 322 kWh/year Per DOE, 34 and 66 percent of dryers are electric and gas, respectively (525 x 34%)+(322 x 66%) = 391 kWh/year	4,5
RTF Alignment	Not Aligned, based on weighted annual washing cycles and electric/gas dryer market shares.	4,5

Cost Calculation Summary		Source #
Cost Estimate	$ 200/unit	
Costs Utilized to Determine Incremental Cost	Aligned with Energy Star and RTF estimate	3,4
Development of Deemed Incremental Cost	RTF used weighted average of available units and DOE cost values.	

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-Purchase Application	
Measure Parameters	Energy Star Qualified models, served by electrically heated domestic hot water. Units served by gas heated domestic hot water are not eligible.	
Required Verification for Processing	▪ Energy Star Qualified (Copy of listing) ▪ DHW energy source (Through application table)	

Table 1-4: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source#
Incremental Cost	$200	$200	$200	$200	$200	
kWh/Year Saved	391	391	391	391	391	
kW/Month Saved	0.28	0.28	0.28	0.28	0.28	
Recommended Incentive	$100	$100	$100	$100	$100	
Unit	Measure	Measure	Measure	Measure	Measure	
Measure Life	10.6	10.6	10.6	10.6	10.6	4

Table 1-5: Reference and Source Tracking for Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)	2011	CEE Commerical Clothes Washer Initiative	N/A	Effective 1/1/2011	1	N/A	CEE	http://www.cee1.org/content/commercial-clothes-washer-specification-suspension
2	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
3	ENERGY STAR	2013	ENERGY STAR® Program Requirements Product Specification for Clothes Washers	V.6.1	N/A	N/A	N/A	U.S. Department of Energy	http://www.energystar.gov/ia/products/products_for_partners/partners/prod_development/revisions/downloads/commercial_clothes_washers/Clothes_Washers_Program_Requirements_Version_6_1.pdf
4	Regional Technical Forum	2013	Commercial: Appliances – Clothes Washers Measure Workbook	Version 2.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/measure.asp?id=90#
5	U.S. Department of Energy (DOE)	2010	Commercial Clothes Washers Final Rule Technical Support Document	2010-01-19	N/A	N/A	N/A	U.S. Department of Energy	http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0127-0118
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
8	The Sixth Northwest Electric Power and Conservation Plan	2009	Clothes Washers and Dryers – Multifamily Supply Curve	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available
10	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy		Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
12	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
19	Arizona Public Service	2013	High Efficiency Clothes Washers	N/A	N/A	N/A	N/A	Arizona Public Service	http://www.aps.com/en/business/savemoney/solutionsbyequipmenttype/Pages/appliances.aspx

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
20	Avista Utilities	2013	Washington Commercial Clothes Washer Rebate Agreement	N/A	N/A	1 & 2	N/A	Avista Utilities	http://www.avistautilities.com/business/rebates/washington/washer/Documents/WA_CommercialClothesWasherRebate_0213.pdf
21	Bonneville Power Administration	2013	Conservation Program Implementation Manual	October, 2013	N/A	59	N/A	Bonneville Power Administration	https://www.bpa.gov/energy/n/archives/pdf/2014-02-2014_Updated_October_2013_ImplementationManual.pdf
22	Energy Trust of Oregon	2013	Clothes Washers	N/A	N/A	1	N/A	Energy Trust of Oregon	http://energytrust.org/commercial/incentives/multifamily/equipment-upgrades-remodels/appliances/ClothesWashers
23	Idaho Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24	Mid-American Energy	2013	Commercial Kitchen equipment Program	N/A	N/A	3	N/A	Mid-American Energy	http://www.midamericanenergy.com/ee/include/pdf/ia_kitchen.pdf
25	Nevada Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	Pacific Gas & Electric Company	2013	2013-2014 Business Rebate List	N/A	N/A	2	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/Business_Rebates_List.pdf
27	Puget Sound Energy	2013	High-Efficiency Commercial Clothes Washer Rebate	N/A	N/A	1	N/A	Puget Sound Energy	http://pse.com/savingsandenergycenter/ForBusinesses/Pages/High-efficiency-Commercial-Clothes-Washers.aspx
28	Xcel Energy (Colorado)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

2.1.2 Network Power PC Management

Measure Category	Measure Type	Measure Name
Electronics	Office Equipment	Network PC Power Management Software

Description (s)	Source
Installation of a centralized energy management system that controls when desktop computers and monitors plugged into a network power down to lower power states.	

Measure Research Summary	Source
Many programs exist to incentivize Network PC Power Management Software at various building types. Savings and costs varied by building size (i.e. number of computers), building heating sources, and state. Costs typically ranged from $10 - $15 per connected computer, and savings were typically around 100-200 kWh/year per computer depending on use. Most sources documented this measure as very cost effective.	4, 6, 7, 8, 9

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Network Computer Power Management	Computer's Energy Management Control: 85% activated Monitor's Energy Management Control: 85% activated	Computer's Energy Management Control: 20% activated Monitor's Energy Management Control: 75% activated	$12 /computer	68-128 kWh/yr per computer depending on environment	Only investigated K-12 schools with various HVAC heat sources. Actually has therm penalty with gas heat, but still deemed cost effective.	4
Network PC Power Management	Network PC Power Management software installed	No Network PC Power Management software installed	$15-876 /building	207-11,837 kWh/yr per commercial building (avg 162 kWh/yr per computer)	Varies by state and facility type, mostly due to average building size changing by state	6
PC Network Power Management Enabling	PC Network Power Management Enabled	No PC Network Power Management	$0.005/kWh	100.6 GWh	State-wide program savings for this measure	7
Network PC Power Management - Retro	PC Network Power Management enabled	No PC Network Power Management	$12/computer	103 kWh/yr per computer 64 kWh/yr per laptop	Savings per computer are averages from different facility types with different space heating types.	8
Computer Network Power Management Software	Active computer network power management software	Computer network without power management software	$12/computer	162 kWh/yr per computer		9
PC Power Management	PC Network Power Management enabled	No PC Network Power Management	$10 / license	200 kWh/yr	Approved product list with 14 different options	22

Code Research	Source
Network Power PC Management software is not a code-required measure in any adopted state energy codes or state/federal efficiency regulations. See Table 1-2 for a detailed breakout of code research reporting sources.	

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Network PC Power Management Software	Code of Federal Regulations, Title 10	N/A	N/A	N/A	11
Network PC Power Management Software	DOE Efficiency Rulemakings	N/A	N/A	N/A	12
Network PC Power Management Software	IECC 2006	N/A	N/A	N/A	13
Network PC Power Management Software	IECC 2009	N/A	N/A	N/A	14
Network PC Power Management Software	IECC 2012	N/A	N/A	N/A	15
Network PC Power Management Software	WSEC 2012	N/A	N/A	N/A	16
Network PC Power Management Software	Title 24 – 2008	N/A	N/A	N/A	17
Network PC Power Management Software	Title 24 – 2013	N/A	N/A	N/A	18

Peer Utility DSM Review	Source
Multiple utilities offer incentives for Network Power PC Management software, with incentives ranging between $8 and $15 per connected computer. Eligibility requirements generally mandate that networked computers power settings can be automatically controlled at the server level, and that the server has the capability to report the number of connected computers and associated power settings. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Source #
Information Technology	Measure: Install software to allow computers to be put into low-power settings during appropppriate hours. • The software installed must automatically control the power settings of networked personal computers at the server level. • Software must be capable of managing power consumption for each individual PC and must be capable of reporting energy-savings results. • A report directly from the network energy management software that verifies the number of PCs controlled by the system must be supplied. Report must include an individual identifier for each computer. • Individual computers are eligible for one incentive once every six years. If software license is transferred to a new computer, the six-year period transfers with the license. • A schedule identifying the computers by ID numbers or serial numbers must accompany the Final Application.	$8.00 per computer	19
Power Management for Personal Computer(PC) Networks	• Provide regular (at least quarterly) energy-use reports with overall average PC energy savings as well as average PC energy savings by similar groups of PCs. • Control every available level of power management offered by your PC hardware and monitor at the time of installation (e.g., CPU on, CPU off or hibernating, CPU suspended, monitor on, monitor off or hibernating, monitor suspended). Available levels of control may differ based on operating system. • Reset user override capabilities to network specifications every 24 hours at a minimum. • Achieve a minimum average savings of 100 annual kWh per controlled PC. • Provide usage data prior to installation of controls. The data should be for two consecutive weeks during a normal operating period and indicate usage by similar groups of PCs. This data will be used for comparison of usage once controls are installed. • Remain in operation for a minimum of three years with the ability for continued reporting every six months with savings/use data upon Avista's request.	$10.00 per controlled PC	20
Network Computer Power Management	Networked Computer Power Management software must be installed in a commercial setting and must do the following: 1. Give the IT administrator easily - accessible, central control over the power management settings of networked workstations, with the capability to override user settings. 2. Have the capability to (a) cause a workstation's power- energy savings mode to be remotely enabled or disabled for centrally distributed software updates (e.g., wake on LAN capability); (b) monitor disk and central processing unit activity in determining whether a workstation is idle; and (c) apply specific	$10.00 per workstation	21

Measure Description	Minimum Efficiency Requirements	Incentive	Source #
	power management policies to network groups. 3. Be compatible with multiple operating systems and hardware configurations in the same network.		
PC Power Management	To qualify for Energy Trust standard equipment incentives for PC Power Management: 1. A minimum of 20 desktop computers must be licensed and configured to run approved PC Power management software to qualify for incentives.	$10.00 Per license (20 Desktop minimum)	22
PC Network Power Management	System controls must provide a network-level management interfacefor the control power functions of networked PCs. Qualifying products use time-regulated power schemes to switch PCs into low power states when users are away from their PSs during work hours, or turned off during non-working hours.	$10.00 per PC	23
PC Power Management Systems	Required to contact program manager	N/A	25

Network Desktop Computer Power Management Software	• In order to qualify for this rebate, customers must install qualifying software which can be found on the list at www.pge.com/powermanagement software. Please note that some software is only compatible with specific operating systems.
	• Installation must allow centralized, server-level control of the power management settings (sleep mode and shutdown) of the desktop computers on a distributed network.
	• The software must have a reporting feature that allows monitoring and validation of energy savings.
	• Customers must agree to keep the software installed and operating for a period of five years from the initial installation date.
	• A printed copy of a report generated directly from the installed network power management software must be included with your application that shows:
	  • The location (installation address) of desktop computers that are being controlled by the system.
	  • The number of desktop computers that are being controlled by the system, grouped and totaled by each location.
		$15.00 per desktop computer	26

PC Power Management	The software must meet the following requirements in order to be eligible for a rebate: 1. Workstation is defined as the computer monitor and the desktop, both of which must have power management settings enabled. Laptops are not eligible for a rebate. 2. Equipment must be installed at a site that has a PSE electric service account. 3. The software shall have wake-on-LAN capability to allow networked workstations to be remotely wakened from or placed into any power-saving mode and to remotely boot or shut down ACPI-compliant workstations.	$8.00 per workstation	27

Measure Description	Minimum Efficiency Requirements	Incentive	Source #
	4. The software shall give the IT administrator easily-accessible central control over the power management settings of networked workstations that optionally overrides settings made by users. 5. The software shall be capable of applying specific power management policies to network groups, utilizing existing network grouping capabilities. 6. The software shall be compatible with multiple operating systems and hardware configurations on the same network. 7. The software shall monitor workstation keyboard, mouse, CPU and disk activity in determining workstation idleness. 8. User or software must provide a trend log and confirm the type of PC on which the software is installed. 9. Remain in operation for a minimum of four years, with the ability for continued reporting every six months upon PSE's request.		
Network Power PC Management	The installed software must automatically control power settings of networked computers at the server level, manage power consumption for each individual PC, and have the capability to report energy savings results. Incentives are for desktop computers only. Controlled laptop computers are not eligible for incentives. A copy of the Software License Agreement must be included with the application, listing the number of computers authorized per license, and a report directly from the software must be included with this application that verifies the number of PCs and the energy consumption and savings for each PC.	$7/PC, up to 100% of the measure costs	29

Vendor Name	Vendor Description
NCSI	Software and Network Equipment Design

Vendor Survey Findings Summary
Energy efficiency is generally not the primary concern of inquiring customers, unless they are the person directly responsible for paying the power bill. Incentives/ENERGY STAR has increased awareness of energy usage of computing equipment and vendors advise of energy savings as part of the sales process using a calculation tool. Costs for energy-efficient network, server products and equipment vary greatly depending on quantity, size, and specifications. Incentives very helpful for making a sale to customers by reducing the up-front cost.

Measure Recommendations		Source #
Summary	PacifiCorp should continue to offer prescriptive incentives for this measure to qualifying customers. Most sources recommended the implementation of this measure because it is very cost effective. The reported numbers showed good market impact, and the recommendation here matches the findings above. Program participation shows considerable volume discounts of network power pc management software, and most program participants are large institutions with 1,000's of computers. Lower incentive to target 30-50% of customers costs based on volume pricing. Remove 100% cost cap, as the proposed incentive is not near 100% of customer cost. Current reported savings align with RTF, who recently adjusted savings to align specifically with K-12 applications of the technology. Adopt more conservative savings estimate from NWPCC that applies to all building types to be consistent with eligibility criteria.	4, 6, 7, 8, 9
Implement?	Yes	
Incentive	$5 per PC	

Minimum Eligibility Requirements		Source #
Summary	• Software automatically controls power settings of networked computers at the server level. • Software manages power consumption for each individual PC. • Software has capability to report energy savings results listing the number of computers authorized per license and verifying the number of PCs and the energy consumption and savings for each PC • Incentives are for desktop computers only. Controlled laptop computers are not eligible for incentives.	29
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	See Summary	
Rating Standard	N/A	
Testing/Certifications	• A copy of the Software License Agreement is included with application, listing the number of computers authorized per license • A copy of a report directly from the software is included with application that verifies the number of PCs and the energy consumption and savings for each PC	29

Baseline	Source
The baseline energy usage used in the Sixth Northwest Electric Power and Conservation Plan measure workbook are based on equipment wattages multiplied by operating hours by mode as detailed 2008 ICE study by Ecos.	8

Savings Calculation Summary		Source #
Savings Estimate	103 kWh/yr	8
Savings Calculation Methodology	The savings estimate is based on the calculation methodology in the Sixth Northwest Electric Power and Conservation Plan measure workbook where baseline and controlled equipment wattages were multiplied by operating hours by mode as detailed 2008 ICE study by Ecos.	8
RTF Alignment	Not Aligned. The RTF savings numbers are based solely on K-12 School applications where the Sixth Northwest Electric Power and Conservation Plan savings numbers take into account a variety of facility types and sizes.	4, 8

Cost Calculation Summary		Source #
Cost Estimate	$12.00 /computer	4, 8
Costs Utilized to Determine Incremental Cost	The incremental cost estimate is based values provided in the Sixth Northwest Electric Power and Conservation Plan as well as the RTF measure workbook for Network Computer Power Management .	4, 8
Development of Deemed Incremental Cost	The incremental cost estimate is based on the average of the high and low costs provided in the Sixth Northwest Electric Power and Conservation Plan as well as the RTF measure workbook for Network Computer Power Management. No source is provided for the values. This average value is corroborated by cost data in the RTF measure workbook for Network Computer Power Management. The RTF incremental cost is an average of two costing sources: Commercial Office Plug Load Savings Assessment (2011). Estimate from Kent Dunn, co-founder of Verdiem software; software manufacturer (2012), http://www.verismic.com/pdf/Power_Manager.pdf.	4, 8

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-Purchase Application	
Measure Parameters	• Software automatically controls power settings of networked computers at the server level. • Software manages power consumption for each individual PC. • Software has capability to report energy savings results listing the number of computers authorized per license and verifying the number of PCs and the energy consumption and savings for each PC • Incentives are for desktop computers only. Controlled laptop computers are not eligible for incentives.	29
Required Verification for Processing	• A copy of the Software License Agreement is included with application, listing the number of computers authorized per license • A copy of a report directly from the software is included with application that verifies the number of PCs and the energy consumption and savings for each PC	29

Table 1-4: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source #
Incremental Cost	$12.00	$12.00	$12.00	$12.00	$12.00	8
kWh/Year Saved	103	103	103	103	103	8
kW/Month Saved	0.0220	0.0220	0.0220	0.0220	0.0220	8
Incentive	$5.00	$5.00	$5.00	$5.00	$5.00	
Unit	Desktop PC	Desktop PC	Desktop PC	Desktop PC	Desktop PC	
Measure Life	5 Years	5 Years	5 Years	5 Years	5 Years	8

Table 1-5: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
29	Consortium for Energy Efficiency (CEE)						N/A	CEE	www.cee1.org
30	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
31	ENERGY STAR								
32	Regional Technical Forum	2013	Commercial: Non-Res Network Power PC Management Measure Workbook	Version 4.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/measure.asp?id=95
33	Department of Energy (DOE)								
34	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
35	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	
36	The Sixth Northwest Electric Power and Conservation Plan	2009	Network Power PC Management – Supply Curve	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
37	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
38	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
39	U.S. Department of Energy	2006	Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/pkg/CFR-2006-title10-vol3/pdf/CFR-2006-title10-vol3-part430.pdf http://www.gpo.gov/fdsys/pkg/CFR-2006-title10-vol3/pdf/CFR-2006-title10-vol3-part431.pdf
40	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
41	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
42	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
43	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
44	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
45	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
46	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
47	Arizona Public Service	2013	Inforrmation Technology	N/A	N/A	N/A	N/A	Arizona Public Service	http://www.aps.com/en/business/savemoney/solutionsbyequipmenttype/Pages/information-technology.aspx
48	Avista Utilities	2013	Power Management for Personal Computer (PC) Networks	N/A	N/A	N/A	N/A	Avista	http://www.avistautilities.com/business/rebates/washington/pages/incentive_14.aspx

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
49	Bonneville Power Administration	2013	Conservation Program Implementation Manual	October, 2013	N/A	58	N/A	Bonneville Power Administration	https://www.bpa.gov/energy/n/archives/pdf/2014-02-2014_Updated_October_2013_ImplementationManual.pdf
50	Energy Trust of Oregon	2013	Incentives – Data Center Existing Buildings	N/A	N/A	1 & 2	N/A	Energy Trust of Oregon	http://energytrust.org/library/forms/be_pi0195d.pdf
51	Idaho Power	2013	Easy Upgrades Plug Load Worksheet	N/A	N/A	1	N/A	Idaho Power	https://www.idahopower.com/pdfs/EnergyEfficiency/EasyUpgrades/worksheet_Plug.pdf
52	Mid-American Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
53	Nevada Power	2013	Energy Smart Schools incentives	N/A	N/A	N/A	N/A	NV Energy	https://www.nvenergy.com/business/saveenergy/incentives/schools.cfm
54	Pacific Gas & Electric Company	2013	Business Computing Rebate Catalog	N/A	N/A	N/A	3	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/businesscomputing_final.pdf
55	Puget Sound Energy	2013	PC Power management Rebate	N/A	N/A	1	N/A	Puget Sound Energy	http://pse.com/savingsandenergycenter/ForBusinesses/Pages/PC-Power-Management.aspx
56	Xcel Energy (Colorado)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
57	PacifiCorp	2013	Wattsmart Business –Utah Application Supplement: Appliances & Office Equipment	N/A	N/A	N/A	N/A	PacifiCorp	http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/Business/Save_Energy_Money/UT_wattsmart_Business_Appliance_Office_Application.pdf

2.1.3 Commercial Dishwasher

Measure Category	Measure Type	Measure Name
Food Service Equipment	Dishwashers	Commercial Dishwasher

Description (s)	Source
Commercial Dishwasher - A machine designed to clean and sanitize plates, glasses, cups, bowls, utensils, and trays by applying sprays of detergent solution (with or without blasting media granules) and a sanitizing final rinse." Types of commercial dishwashers: Under Counter Dishwasher - A machine with an overall height 38 inches or less, in which a rack of dishes remains stationary within the machine while being subjected to sequential wash and rinse sprays, and is designed to be installed under food preparation workspaces. Under counter dishwashers can be either chemical or hot water sanitizing, with an internal booster heater for the latter. For purposes of this specification, only those machines designed for wash cycles of 10 minutes or less can qualify for ENERGY STAR. Stationary Rack, Single Tank, Door Type Dishwasher - A machine in which a rack of dishes remains stationary within the machine while subjected to sequential wash and rinse sprays. This definition also applies to machines in which the rack revolves on an axis during the wash and rinse cycles. Subcategories of stationary door type machines include: single and multiple wash tank, double rack, pot, pan and utensil washers, chemical dump type and hooded wash compartment ("hood type"). Stationary rack, single tank, door type models are covered by this specification and can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter. Single Tank Conveyor Dishwasher - A warewashing machine that employs a conveyor or similar mechanism to carry dishes through a series of wash and rinse sprays within the machine. Specifically, a single tank conveyor machine has a tank for wash water followed by a final sanitizing rinse and does not have a pumped rinse tank. This type of machine may include a pre-washing section before the washing section. Single tank conveyor dishwashers can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter. Multiple Tank Conveyor Dishwasher - A conveyor type machine that has one or more tanks for wash water and one or more tanks for pumped rinse water, followed by a final sanitizing rinse. This type of machine may include one or more pre-washing sections before the washing section. Multiple tank conveyor dishwashers can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter. Hot Water Sanitizing (High Temp) Machine - A warewashing machine that applies potable hot water to the surfaces of wares to achieve sanitization. Chemical Sanitizing (Low Temp) Machine - A warewashing machine that applies potable water and a chemical sanitizing solution to the surfaces of wares to achieve sanitization."	29

Measure Research Summary	Source
ENERGY STAR maintains the most current specification for commercial dishwashers (V.2.0), effective February 1, 2013. RTF measure status has been listed "Out of Compliance" since 10/24/12 and was deactivated as a UES measure on 11/19/13. CEE maintains a specification, but has not updated it since 2008. Cost data is available from both RTF and CEE, but it is a few years old. See Table 1-1 for a detailed breakout of measure research reporting sources.	

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Under counter High-Temp Electric DHW Under counter High-Temp Gas DHW	Idle Energy ≤ 0.90 kW Water Consumption ≤ 1.00 GPR	NA	$1,000	Booster: Elec-7,369 kWh Gas-4,689 Booster: Elec-2,680 kWh Gas-0 kWh	CEE specifications effective 6-26-2008, in line with previous Energy Star (V 1.1) specification. Baseline was not described, however, safe assumption would be the CFR.	1
Under counter Low-Temp Electric DHW Under counter Low-Temp Gas DHW	Idle Energy ≤ 0.50 kW Water Consumption ≤ 1.70 GPR	NA	$1,000	Booster: Elec-1,196 kWh Gas-1,196 kWh Booster: Elec-0 kWh Gas-0 kWh	CEE specifications effective 6-26-2008, in line with previous Energy Star (V 1.1) specification. Baseline was not described, however, safe assumption would be the CFR.	1
Door Type High-Temp Electric DHW Door Type High-Temp Gas DHW	Idle Energy ≤ 1.0 kW Water Consumption ≤ 0.95 GPR	NA	$2,100	Booster: Elec-13,950 kWh Gas-8,948 kWh Booster: Elec-5,197 kWh Gas-195 kWh	CEE specifications effective 6-26-2008, in line with previous Energy Star (V 1.1) specification. Baseline was not described, however, safe assumption would be the CFR.	1
Door Type Low-Temp Electric DHW Door Type Low-Temp Gas DHW	Idle Energy ≤ 0.60 kW Water Consumption ≤ 1.18 GPR	NA	$2,000	Booster: Elec-11,969 kWh Gas-11,969 kWh Booster: Elec-0 kWh Gas-0 kWh	CEE specifications effective 6-26-2008, in line with previous Energy Star (V 1.1) specification. Baseline was not described, however, safe assumption would be the CFR.	1

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Single Tank Conveyor High-Temp Electric DHW Single Tank Conveyor High-Temp Gas DHW	Idle Energy ≤ 2.0 kW Water Consumption ≤ 0.700 GPR	NA	$3,000	Booster: Elec-18,972 kWh Gas-12,701 kWh Booster: Elec-7,998 kWh Gas-1,728 kWh	CEE specifications effective 6-26-2008, in line with previous Energy Star (V 1.1) specification. Baseline was not described, however, safe assumption would be the CFR.	1
Single Tank Conveyor Low-Temp Electric DHW Single Tank Conveyor Low-Temp Gas DHW	Idle Energy ≤ 1.6 kW Water Consumption ≤ 0.790GPR	NA	$3,000	Booster: Elec-11,228 kWh Gas-11,228 kWh Booster: Elec-0 kWh Gas-0 kWh	CEE specifications effective 6-26-2008, in line with previous Energy Star (V 1.1) specification. Baseline was not described.	1
Multi Tank Conveyor High-Temp Electric DHW Multi Tank Conveyor High-Temp Gas DHW	Idle Energy ≤ 2.6 kW Water Consumption ≤ 0.540 GPR	NA	$4,000	Booster: Elec-33,685 kWh Gas-21,436 kWh Booster: Elec-12,249 kWh Gas-0 kWh	CEE specifications effective 6-26-2008, in line with previous Energy Star (V 1.1) specification. Baseline was not described.	1
Multi Tank Conveyor Low-Temp Electric DHW Multi Tank Conveyor Low-Temp Gas DHW	Idle Energy ≤ 2.0 kW Water Consumption ≤ 0.540 GPR	NA	$4,000	Booster: Elec-17,225 kWh Gas-17,225 kWh Booster: Elec-0 kWh Gas-0 kWh	CEE specifications effective 6-26-2008, in line with previous Energy Star (V 1.1) specification. Baseline was not described.	1
					No data was found in the DEER for commercial dishwashers.	2

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Under counter High-Temp Electric DHW Under counter High-Temp Gas DHW	Idle Energy ≤ 0.50 kW Water Consumption ≤ 0.86 GPR	Market Baseline per Food Service Technology Center research on available models 2013	$120	Booster: Elec-3,171 kWh Gas-2,553 Booster: Elec-2,089 kWh Gas-1,471 kWh	Energy Star 2.0 Specifications effective February 1, 2013. Values from the Commercial Kitchen Equipment Calculator	3
Under counter Low-Temp Electric DHW Under counter Low-Temp Gas DHW	Idle Energy ≤ 0.50 kW Water Consumption ≤ 1.19 GPR	Market Baseline per Food Service Technology Center research on available models 2013	$50	2,540 kWh 0 kWh	Energy Star 2.0 Specifications effective February 1, 2013. Values from the Commercial Kitchen Equipment Calculator	3
Stationary Single Tank Door High-Temp Electric DHW Stationary Single Tank Door High-Temp Gas DHW	Idle Energy ≤ 0.70 kW Water Consumption ≤ 0.89 GPR	Market Baseline per Food Service Technology Center research on available models 2013	$770	Booster: Elec-11,863 kWh Gas-7,850 Booster: Elec-4,840 kWh Gas-827 kWh	Energy Star 2.0 Specifications effective February 1, 2013. Values from the Commercial Kitchen Equipment Calculator	3
Stationary Single Tank Door Low-Temp Electric DHW Stationary Single Tank Door Low-Temp Gas DHW	Idle Energy ≤ 0.60 kW Water Consumption ≤ 1.18 GPR	Market Baseline per Food Service Technology Center research on available models 2013	$0	16,153 kWh 0 kWh	Energy Star 2.0 Specifications effective February 1, 2013. Values from the Commercial Kitchen Equipment Calculator	3
Single Tank Conveyor High-Temp w/electric booster Electric DHW Single Tank Conveyor High-Temp	Idle Energy ≤ 1.50 kW Water Consumption ≤ 0.70 GPR	Market Baseline per Food Service Technology Center research on available models 2013	$2,050	Booster: Elec-9,212 kWh Gas-6,775 kWh Booster: Elec-4,948	Energy Star 2.0 Specifications effective February 1, 2013. Values from the Commercial Kitchen Equipment Calculator	3

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Gas DHW				kWh Gas-2,511 kWh		
Single Tank Conveyor Low-Temp Electric DHW Single Tank Conveyor Low-Temp Gas DHW	Idle Energy ≤ 1.50 kW Water Consumption ≤ 0.79 GPR	Market Baseline per Food Service Technology Center research on available models 2013	$0	13,626 kWh 584 kWh	Energy Star 2.0 Specifications effective February 1, 2013. Values from the Commercial Kitchen Equipment Calculator	3
Multi Tank Conveyor High-Temp Electric DHW Multi Tank Conveyor High-Temp Gas DHW	Idle Energy ≤ 2.25 kW Water Consumption ≤ 0.54 GPR	Market Baseline per Food Service Technology Center research on available models 2013	$970	Booster: Elec-27,408 kWh Gas-18,163 kWh Booster: Elec-11,230 kWh Gas- 1,986 kWh	Energy Star 2.0 Specifications effective February 1, 2013. Values from the Commercial Kitchen Equipment Calculator	3
Multi Tank Conveyor Low-Temp Electric DHW Multi Tank Conveyor Low-Temp Gas DHW	Idle Energy ≤ 2.00 kW Water Consumption ≤ 0.54 GPR	Market Baseline per Food Service Technology Center research on available models 2013	$970	18,811 kWh 0 kWh	Energy Star 2.0 Specifications effective February 1, 2013. Values from the Commercial Kitchen Equipment Calculator	3
Energy Efficient Electric Dishwasher - Low Temp - Electric DHW	Calculated average of top 25% of Energy Star listed washers	Calculated average of remaining Energy Star listed Washers	$2,297	3,801 kWh	RTF measure status is Out of Compliance with a sunset date of November 1, 2013.	4
Energy Efficient Electric Dishwasher - High Temp - Electric DHW			$2,297	4,110 kWh	Official RTF measures listed; information is available for specific washer types and energy source configurations (Undercounter, Door Type, Single Tank Conveyor, Multi Tank Conveyer, Gas/Electric DHW, Gas/Electric	4
Energy Efficient Electric Dishwasher - Low Temp - Gas DHW			$2,297	517 kWh		4
Energy Efficient Electric Dishwasher - High Temp - Gas			$2,297	1,700 kWh		4

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
DHW					boosters) in the RTF workbook. Energy Star version unknown, latest washer market dates in 2009.	
					DOE does not address commercial dishwashers	5
Dishwashing - Commercial - High Temp	High Efficiency Dishwasher (ENERGY STAR)	Standard High Temp Commercial Dishwasher		4,038 kWh/yr	Pacificorp Potential Assesment Appendix C-6	6
Dishwashing - Commercial - Low Temp	Low-Temp Commercial Dishwasher (ENERGY STAR)	Standard High Temp Commercial Dishwasher		3,703 kWh/yr	Pacificorp Potential Assesment Appendix C-6	6
					Colorado DSM Market Potential Assesment (2010-2013) does not address commercial dishwashers	7
					NWPCC 6th Power Plan does not address commercial dishwashers	8
Commercial Dishwasher (Electric Water Heating Only): Undercounter	Energy Star Qualified	Standard Dishwasher	$1,000	2,943 kWh/yr	2010 MC –TRL values Energy Star V 1.1	9
Commercial Dishwasher (Electric Water Heating Only): Stationary Rack, Single Tank, Door Type	Energy Star Qualified	Standard Dishwasher	$2,050	10,458 kWh/yr	2010 MC –TRL values Energy Star V 1.1	9
Commercial Dishwasher (Electric Water Heating Only): Single Tank Conveyor	Energy Star Qualified	Standard Dishwasher	$3,000	11,965 kWh/yr	2010 MC –TRL values Energy Star V 1.1	9

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Commercial Dishwasher (Electric Water Heating Only): Multiple Tank Conveyor	Energy Star Qualified	Standard Dishwasher	$4,000	19,331 kWh/yr	2010 MC –TRL values Energy Star V 1.1	9

Code Research	Source
A review of applicable energy codes determined there are no current minimum energy efficiency requirements for this measure. See Table 1-2 for a detailed breakout of code research reporting sources.	11-18

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Commercial Dishwasher	Code of Federal Regulations, Title 10	N/A	N/A	N/A	11
Commercial Dishwasher	DOE Efficiency Rulemakings	N/A	N/A	N/A	12
Commercial Dishwasher	IECC 2006	N/A	N/A	N/A	13
Commercial Dishwasher	IECC 2009	N/A	N/A	N/A	14
Commercial Dishwasher	IECC 2012	N/A	N/A	N/A	15
Commercial Dishwasher	WSEC 2012	N/A	N/A	N/A	16
Commercial Dishwasher	Title 24 – 2008	N/A	N/A	N/A	17
Commercial Dishwasher	Title 24 – 2013	N/A	N/A	N/A	18

Peer Utility DSM Review	Source
Several applicable peer utility DSM offerings were reviewed for this measure. In most cases, the energy efficiency requirements are based on or defered to ENERGY STAR. Incentives vary based on the type of the unit, but are generaly less than $1,000. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Comm. Dishwasher (Under Counter)	Energy Star Qualified (Electric DHW)	$500	Current Program Offering	9
Comm. Dishwasher (Single Tank Door Type)	Energy Star Qualified (Electric DHW)	$1,000	Current Program Offering	9
Comm. Dishwasher (Single Tank Conveyor)	Energy Star Qualified (Electric DHW)	$1,500	Current Program Offering	9
Comm. Dishwasher (Multi Tank Conveyor)	Energy Star Qualified (Electric DHW)	$2,000	Current Program Offering	9
Comm. Dishwasher (Under Counter)	Energy Star Qualified	$250	Avista - Food Service Equip. Rebates	20
Comm. Dishwasher (Single Tank Door Type)	Energy Star Qualified	$1,000	Avista - Food Service Equip. Rebates	20
Comm. Dishwasher (Single Tank Conveyor)	Energy Star Qualified	$1,500	Avista - Food Service Equip. Rebates	20
Comm. Dishwasher (Multi Tank Conveyor)	Energy Star Qualified	$2,000	Avista - Food Service Equip. Rebates	20
Commercial Dishwasher	Unit must meet RTF efficiency standards. Model must be found on qualifying list. Must install new high efficiency commercial dishwasher.	$100 - $750	BPA - Food Service	21
Dishwasher High Temp Undercounter	Energy Star Qualified	$200	Program Form 194F	22
Dishwasher, High/Low Temp Single TankDoor/Upright	Energy Star Qualified	$400	Program Form 194F	22
Dishwasher, Conveyor, High/Low Temp	Energy Star Qualified	$500	Program Form 194F	22
Standard Dishwasher	Energy Star Qualified	$15	ID - Food Services	23
Dish machine w/ electric booster	Low-temperature Dish machine	$75 per removed booster heater kW	ID - Food Services	23
Dishwasher, Under Counter, Low Temp	Energy Star Qualified	$250	PSE - Food Service.2	27

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Dishwasher, Under Counter, High Temp	Energy Star Qualified	$500	PSE - Food Service.2	27
Dishwasher, Door Type, Low Temp	Energy Star Qualified	$1,000	PSE - Food Service.2	27
Dishwasher, Door Type, High Temp	Energy Star Qualified	$1,000	PSE - Food Service.2	27
Dishwasher, Residential Grade	Must be Energy Star Qualified	$20	MAE - Food Services.1	24

Vendor Survey
Vendors indicated that current eligibility requirements for dish washing equipment to have electrically heated water to qualify for an incentive would mean very few customers would qualify, as most customers domestic hot water is not heated with electricity. Vendors identified that while there is a increased trend in manufacturers providing high-efficiency products, customers looking for replacement equipment remain focused on purchasing the lowest cost product available and consider used equipment in most cases. New equipment is primarily sold into the new construction market. Incentives help, but are generally not enough to cover the full incremental cost difference (estimated at 30% or higher). Most commercial kitchens are plumbed with natural gas, and natural gas equipment and water heating is preferentially purchased over electric-powered equipment. Institutional and government customers are the primary purchasers of high-efficiency food service equipment since procurement guidelines require it.

Vendor Name	Vendor Description
Commercial Kitchen Supply	Distributor, Wholesaler, and Retailer
Bintz Restaurant Supply	Wholesaler/Retailer of standard and high efficiency refrigeration, cooking, and dishwashing equipment
True Manufacturing	Manufacturer, primarily of refrigeration equipment

Measure Recommendations		Source #
Summary	Participation has been historically low and the majority of the applications submitted have not qualified due to domestic supply water being heated with gas. Recommend incenting Energy Star qualified high temperature commercial dishwashers with electric boosters and removing requirement for domestic hot water to be heated with electricity. Account for savings differently based on source of domestic hot water. All recommendations are based upon the minimum eligibility requirements listed below.	3
Implement?	Yes, savings can be significant and adjusted requirements should increase participation.	
Incentive	Incentive levels should change based on revised savings and cost data as described below.	

Minimum Eligibility Requirements		Source #
Summary	Energy Star continues to be an effective standard for dishwashing equipment. As Energy Star qualifications change so will the program. Products meeting Energy Star requirements are readily available. Dishwasher models must be high temperature units with electric boosters.	3
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	Energy Star qualified, high temperature dishwasher with electric booster	
Rating Standard	Handled by Energy Star	
Testing/Certifications	Handled by Energy Star	

Baseline	Source
The baseline is the one detailed in the ENERGY STAR calculator, which assumes higher water use (and subsequently higher energy consumption for water heating) for conventional commercial dishwashers and higher idle power draw for high temperature models. Operation schedules are assumed to be 18 hrs/day, 365 days per year.	3

High Temperature	Annual days of operation	Average daily operation (hours)	Racks washed per day
Under Counter	365	18	75
Stationary Single Tank Door	365	18	280
Single Tank Conveyor	365	18	400
Multi Tank Conveyor	365	18	600

	Water Heater Efficiency		Inlet Water Temperature Increase (^{o}F)
	Electric	Gas	

Building Water Heater	98%	80%	70
Booster Water Heater	98%	80%	40

Savings Calculation Summary		Source #
Savings Estimate	Undercounter- Gas DHW - 2,089 kWh, Electric DHW - 3,171 kWh Stationary Single Tank Door- Gas DHW - 4,840 kWh, Electric DHW - 11,863 kWh Single Tank Conveyor- Gas DHW-4,948 kWh, Electric DHW-9,212 kWh Multi Tank Conveyor- Gas DHW-11,230 kWh, Electric DHW-27,408 kWh	3
Savings Calculation Methodology	As calculated by Energy Star Commercial Kitchen Equipment Calculator. Demand reduction is calculated by dividing the total annual energy savings by the annual operating hours (6570).	3
Savings Estimate Conclusions	Inputs/assumptions from the Commercial Kitchen Equipment Calculator for conventional vs. ENERGY STAR water use and idle energy draw.	3
RTF Alignment	Not Applicable. RTF measure status has been listed "Out of Compliance" since 10/24/12 and was deactivated as a UES measure on 11/19/13.	4

High Temperature	Typical Wash Time (min)		Water Use per Rack (gal)	
	Conventional	ENERGY STAR	Conventional	ENERGY STAR
Under Counter	2.0	2.0	1.09	0.86
Stationary Single Tank Door	1.0	1.0	1.29	0.89
Single Tank Conveyor	0.3	0.3	0.87	0.70
Multi Tank Conveyor	0.2	0.2	0.97	0.54

High Temperature	Idle Power Draw (kW)		Equipment lifetime (years)
	Conventional	ENERGY STAR	
Under Counter	0.76	0.50	10
Stationary Single Tank Door	0.87	0.70	15
Single Tank Conveyor	1.93	1.50	20
Multi Tank Conveyor	2.59	2.25	20

Cost Calculation Summary		Source #
Cost Estimate	Undercounter- $120/unit Stationary Single Tank Door- $770/unit Single Tank Conveyor- $2,050/unit Multi Tank Conveyor- $970/unit	3
Costs Utilized to Determine Incremental Cost	Aligned with Energy Star. All units must be high temperature models with electric hot water boosters.	3
Development of Deemed Incremental Cost	Values from the Commercial Kitchen Equipment Calculator "Difference between a similar ENERGY STAR and non-qualifying model, EPA research using AutoQuotes, 2012"	3

Incentive Delivery/Verification Details		Source #
Delivery Method	Prescriptive, post-purchase	
Measure Parameters	Only high temperature units with electric hot water booster. Low temperature or dual sanitation units and high temperature units with gas boosters are not eligible.	
Required Verification for Processing	▪ Model is on Energy Star qualified list (Provide listing) ▪ Model is a high temperature with electric booster (Manufacture's Spec sheet) ▪ DHW energy source (Through application tables)	

Table 1-6: Incremental Costs, Savings, Recommended Incentives and Unit Details

All States	Under Counter	Stationary Single Tank Door	Single Tank Conveyor	Muli Tank Conveyor	Source#
Incremental Cost	$120/unit	$770/unit	$2,050/unit	$970/unit	3
kWh/Year Saved	Gas DHW – 2,089 kWh Electric DHW – 3,171 kWh	Gas DHW – 4,840 kWh Electric DHW – 11,863 kWh	Gas DHW- 4,948 kWh Electric DHW- 9,212 kWh	Gas DHW- 11,230 kWh Electric DHW- 27,408 kWh	3
kW/Month Saved	Gas DHW – 0.32 kW Electric DHW – 0.48 kW	Gas DHW – 0.74 kW Electric DHW – 1.81 kW	Gas DHW – 0.75 kW Electric DHW – 1.40 kW	Gas DHW – 1.71 kW Electric DHW – 4.17 kW	3
Recommended Incentive	$100/unit	$400/unit	$1,000/unit	$500/unit	
Unit	Measure	Measure	Measure	Measure	
Measure Life	10 years	15 years	20 years	20 years	3

Table 1-7: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)	2009	CEE Program Design Guidance Commercial Dishwashers	N/A	N/A	N/A	Boston	Consortium for Energy Efficiency	http://www.ceeforum.org/content/cee-program-design-guidance-commercial-dishwashers
2	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
3	ENERGY STAR	2013	ENERGY STAR Commercial Kitchen Equipment Calculator	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx
4	Regional Technical Forum (RTF)	2012	Commercial: Appliances – Dishwashers Measure Workbook	Version 1.2	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/measure.asp?id=91
5	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
8	The Sixth Northwest Electric Power and Conservation Plan	2009	Measure Workbook: Cooking Supply Curve	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available
10	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy		Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
12	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/title24/2013standards/
19	Arizona Public Service	2013	Refrigeration	N/A	N/A	1	N/A	Arizona Public Service	http://www.aps.com/en/business/savemoney/solutionsbyequipmenttype/Pages/refrigeration.aspx
20	Avista Utilities	2013	Washington Commercail Food Services Equipment Rebat Agreement	N/A	N/A	4	N/A	Avista	http://www.avistautilities.com/business/rebates/washington/Documents/WA_food_services_0213.pdf
21	Bonneville Power Administration	2013	Conservation Program Implementation Manual	October, 2013	N/A	55	N/A	Bonneville Power Administration	https://www.bpa.gov/energy/n/archives/pdf/2014-02-2014_Updated_October_2013_ImplementationManual.pdf
22	ETO	2013	Incentives – Lodging and Foodservice Equipment	N/A	Form 194F	N/A	N/A	Energy Trust	http://energytrust.org/library/forms/BE_PI0194F.pdf
23	Idaho Power	2013	Easy Upgrades Food Service Equipment Worksheet	N/A	N/A	2	N/A	Idaho Power	https://www.idahopower.com/pdfs/EnergyEfficiency/EasyUpgrades/worksheet_grocery.pdf
24	Mid-American Energy	2013	Commercial Kitchen Equipment Program	N/A	N/A	3	N/A	Mid-American Energy	http://www.midamericanenergy.com/ee/include/pdf/ia_kitchen.pdf
25	Nevada Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	Pacific Gas & Electric Company	2013	Food Service Rebate Catalog	N/A	N/A	8	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/foodservice_catalog_final.pdf

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
27	Puget Sound Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	Xcel Energy (Colorado)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
29	ENERGY STAR	2013	ENERGY STAR® Program Requirements For Commercial Dishwashers	Version 2.0	Product Specification for Commercial Dishwashers	N/A	N/A	U.S. Department of Energy	http://www.energystar.gov/ia/partners/product_specs/program_reqs/Commercial_Dishwasher_Program_Requirements.pdf?20d9-9004

2.1.4 Commercial Refrigerators

Measure Category	Measure Type	Measure Name
Food Service Equipment	Commercial Refrigerators	Refrigerator

Description (s)	Source
From the Code of Federal Regulations, "Commercial refrigerator, freezer, and refrigerator-freezer means refrigeration equipment that— 1. Is not a consumer product (as defined in 10 CFR Part 430.2); 2. Is not designed and marketed exclusively for medical, scientific, or research purposes; 3. Operates at a chilled, frozen, combination chilled and frozen, or variable temperature; 4. Displays or stores merchandise and other perishable materials horizontally, semivertically, or vertically; 5. Has transparent or solid doors, sliding or hinged doors, a combination of hinged, sliding, transparent, or solid doors, or no doors; 6. Is designed for pull-down temperature applications or holding temperature applications; and 7. Is connected to a self-contained condensing unit or to a remote condensing unit."	11

Measure Research Summary	Source
Significant market changes are occuring with commercial refrigerators. DOE is evaluating a revised minimum federal efficiency requirement with a proposed effective date of 2017. Preliminary research indicates that most solid-door units sold are significantly more efficient that the current federal minimum efficiency requirement, and the incremental cost between an industry standard unit and an EnergyStar unit are close to zero. EnergyStar is also revising the specification, and expects to make V 3.0 effective on Oct. 1, 2014, but proposed minimum efficiency levels may still be below the efficiencies currently found in the marketplace. Scope of federal regulations and NOPR research are currently limited to: a) Horizontal Closed Solid Self Contained Medium Temperature (HCS SC M) b) Horizontal Closed Transparent Self Contained Medium Temperature (HCT SC M) c) Vertical Closed Solid Self Contained Medium Temperature (VCS SC M) d) Vertical Closed Transparent Self Contained Medium Temperature (VCT SC M) See Table 1-1 for a detailed breakout of measure research reporting sources.	

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Energy Star V 2.O Solid Door, 0 < V < 15	MDEC = 0.089V+1.411	CFR Jan 10, 2010 MDEC = 0.10 V + 2.04 kWh/day	($461.91)	260 kWh/yr V=7.5	CEE product specifications match Energy Star V 2.0 Data is from CEE Program Guide dated December 2009. More current data was not available from CEE.	1
Energy Star V 2.O Solid Door, 15 ≤ V < 30	MDEC = 0.037V+2.2		$10.17	459 kWh/yr V=22.5		
Energy Star V 2.O Solid Door, 30 ≤ V < 50	MDEC = 0.056V+1.635		$2,647.26	790 kWh/yr V=40		
Energy Star V 2.O Solid Door, 50 ≤ V	MDEC = 0.06V+1.416		$3,031.60	1,140 kWh/yr V=62.5		
Energy Star V 2.O Solid Door, Horizontal	MDEC = 0.125V+0.475		$7.71	443 kWh/yr V=14		
Energy Star V 2.O Transparent Door, 0 < V < 15	MDEC = 0.118V+1.382	CFR Jan 10, 2010 MDEC = 0.10 V + 2.04 kWh/day	($922.10)	720 kWh/yr V=7.5	CEE product specifications match Energy Star V 2.0 Data is from CEE Program Guide dated December 2009. More current data was not available from CEE.	1
Energy Star V 2.O Transparent Door, 15 ≤ V < 30	MDEC = 0.140V+1.050		$2,344.07	672 kWh/yr V=22.5		
Energy Star V 2.O Transparent Door, 30 ≤ V < 50	MDEC = 0.088V+2.625		$4,695.53	728 kWh/yr V=40		
Energy Star V 2.O Transparent Door, 50 ≤ V	MDEC = 0.110V+1.50		$4,402.55	900 kWh/yr V=62.5		
Energy Star V 2.O Transparent Door, Horizontal	MDEC = 0.125V+0.475		$7.71	1,020 kWh/yr V=14		
					DEER addresses Solid Door Reach-in Refrigerators, but did not provide savings or cost data for commercial applications.	2

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Energy Star V 3 Draft Solid Door, 0 < V < 15	MDEC = 0.02V+1.60	CFR Jan 10, 2010 MDEC = 0.10 V + 2.04 kWh/day	NA	380 kWh/yr V=7.5	Energy Star V 3 proposed specifications, expected to be active Oct. 2014. Savings are from Energy Star's commercial kitchen equipment calculator modified to proposed specifications. Equipment cost not yet reported from Energy Star for new specification.	3
Energy Star V 3 Draft Solid Door, 15 ≤ V < 30	MDEC = 0.09V+0.55		NA	626 kWh/yr V=22.5		
Energy Star V 3 Draft Solid Door, 30 ≤ V < 50	MDEC = 0.01V+2.95		NA	982 kWh/yr V=40		
Energy Star V 3 Draft Solid Door, 50 ≤ V	MDEC = 0.06V+0.45		NA	1,493 kWh/yr V=62.5		
Energy Star V 3 Draft Solid Door, Horizontal	MDEC = 0.06V+0.60		NA	730 kWh/yr V=14		
Energy Star V 3 Draft Transparent Door, 0 < V < 15	MDEC = 0.10V+1.07	CFR Jan 10, 2010 MDEC = 0.12 V + 3.34 kWh/day	NA	883 kWh/yr V=7.5	Energy Star V 3 proposed specifications, expected to be active Jan 2014. Savings are from Energy Star's commercial kitchen equipment calculator modified to proposed specifications. Equipment cost not yet reported from Energy Star for new specification.	3
Energy Star V 3 Draft Transparent Door, 15 ≤ V < 30	MDEC = 0.15V+0.32		NA	856 kWh/yr V=22.5		
Energy Star V 3 Draft Transparent Door, 30 ≤ V < 50	MDEC = 0.06V+3.02		NA	993 kWh/yr V=40		
Energy Star V 3 Draft Transparent Door, 50 ≤ V	MDEC = 0.08V+2.02		NA	1,394 kWh/yr V=62.5		
Energy Star V 3 Draft Transparent Door, Horizontal	MDEC = 0.06V+0.60		NA	1,307 kWh/yr V=14		
Energy Star V 2.O Solid Door, 0 < V < 15	Energy Star V 2 Calculated average daily energy use= 1.80 kWh/day	Calculated average daily energy use= 1.80 kWh/day	($30)	0 kWh/yr	Model must be listed as meeting Energy Star 2.0 Specification Baseline Algorithm: Average Estar Daily Energy	4

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Energy Star V 2.O Solid Door, 15 ≤ V < 30	Energy Star V 2 Calculated average daily energy use= 2.60 kWh/day	Calculated average daily energy use= 2.61 kWh/day	($30)	5 kWh/yr	Use (kWh / Day) * Estar Market Share % + Average All Models Energy Use (kWh / Day) * Non-Estar Market Share % Measure life- 12 yrs	
Energy Star V 2.O Solid Door, 30 ≤ V < 50	Energy Star V 2 Calculated average daily energy use= 3.66 kWh/day	Calculated average daily energy use= 3.68 kWh/day	($30)	5 kWh/yr		
Energy Star V 2.O Solid Door, 50 ≤ V	Energy Star V 2 Calculated average daily energy use= 4.74 kWh/day	Calculated average daily energy use= 4.74 kWh/day	($30)	0 kWh/yr		
Energy Star V 2.O Solid Door, Horizontal	Energy Star V 2 Calculated average daily energy use= 2.09 kWh/day	Calculated average daily energy use= 2.17 kWh/day	$1.00	29 kWh/yr		
Energy Star V 2.O Transparent Door, 0 < V < 15	Energy Star V 2 Calculated average daily energy use= 1.93 kWh/day	Calculated average daily energy use= 1.94 kWh/day	$158	5 kWh/yr		4
Energy Star V 2.O Transparent Door, 15 ≤ V < 30	Energy Star V 2 Calculated average daily energy use= 3.70 kWh/day	Calculated average daily energy use= 3.72 kWh/day	$158	7 kWh/yr		
Energy Star V 2.O Transparent Door, 30 ≤ V < 50	Energy Star V 2 Calculated average daily energy use= 5.64 kWh/day	Calculated average daily energy use= 5.66 kWh/day	$158	5 kWh/yr		
Energy Star V 2.O Transparent Door, 50 ≤ V	Energy Star V 2 Calculated average daily energy use= 7.57 kWh/day	Calculated average daily energy use= 7.65 kWh/day	$158	27 kWh/yr		

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Energy Star V 2.O Transparent Door, Horizontal	Energy Star V 2 Calculated average daily energy use= 0.75 kWh/day	Calculated average daily energy use= 1.24 kWh/day	$1	181 kWh/yr		
DOE NOPR Vertical Closed Solid Self Contained Medium Temperature (VCS SC M)	MDEC = 0.03V + 0.53	MDEC = 0.06V + 1.31	$152	543 kWh/yr	Assumes a refrigerated volume of 49 cubic feet.	5
DOE NOPR Horizontal Closed Solid Self Contained Medium Temperature (HCS SC M)	MDEC = 0.02V + 0.37	MDEC = 0.03V + 0.54	$29	84 kWh/yr	Assumes a refrigerated volume of 8.83 cubic feet.	
DOE NOPR Vertical Closed Transparent Self Contained Medium Temperature (VCT SC M)	MDEC = 0.04V + 1.07	MDEC = 0.12V + 3.34	$542	2,283 kWh/yr	Assumes a refrigerated volume of 49 cubic feet.	
DOE NOPR Horizontal Closed Transparent Self Contained Medium Temperature (HCT SC M)	MDEC = 0.02V + 0.51	MDEC = 0.06V + 1.73	$173	587 kWh/yr	Assumes a refrigerated volume of 8.83 cubic feet.	
Case Replacement - Med Temp	Case Replacement - Med Temp	No replacement		536 kWh/yr	PacifiCorp Assesment 2013 Data from Appendix C-6 for the Grocery segment	6
					Colorado DSM Market Potential Assessment does not address commercial refrigerator units, but does consider component upgrades.	7
ESTAR Commercial Refrigerator - Vertical - Solid Doors - Med	Proposed Energy Star Standard	CFR Jan 10, 2010	$124	849 kWh/yr	Considers extrapolated NOPR 2009, uses current CFR standards for savings.	8

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Temp (per appliance)		MDEC = 0.10 V + 2.04 kWh/day			And a proposed ES standard that cannot be confirmed.	
ESTAR Commercial Refrigerator - Vertical - Glass Doors - Med Temp (per appliance)	Proposed Energy Star Standard	CFR Jan 10, 2010 MDEC = 0.12 V + 3.34 kWh/day	$565	761 kWh/yr	Values are averaged for all Energy Star size categories. Data should not be use for current eval, except as a comparison to past performance. Life-10 yrs	
ESTAR Commercial Refrigerator - Horizontal - Any Doors - Med Temp (per appliance)	Proposed Energy Star Standard	CFR Jan 10, 2010 MDEC = 0.10 V + 2.04 kWh/day	$150	593 kWh/yr		
Commercial Glass Door Refrigerator: 0 < V < 15	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.12 V + 3.34 kWh/day	$452	439 kWh/yr	2010 MC Measure life -12 yrs	9
Commercial Glass Door Refrigerator: 15 <= V < 30	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.12 V + 3.34 kWh/day	$452	555 kWh/yr	2010 MC Measure life -12 yrs	
Commercial Glass Door Refrigerator: 30 <= V < 50	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.12 V + 3.34 kWh/day	$452	386 kWh/yr	2010 MC Measure life -12 yrs	
Commercial Glass Door Refrigerator: 50 <= V	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.12 V + 3.34 kWh/day	$452	532 kWh/yr	2010 MC Measure life -12 yrs	
Commercial Glass Door Refrigerator: Chest Configuration	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.12 V + 3.34 kWh/day	$3	365 kWh/yr	2010 MC Measure life -12 yrs	
Commercial Solid Door Refrigerator: 0 < V < 15	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.10 V	$-88	208 kWh/yr	2010 MC Measure life -12 yrs	9

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
		+ 2.04 kWh/day				
Commercial Solid Door Refrigerator: 15 <= V < 30	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.10 V + 2.04 kWh/day	$-88	317 kWh/yr	2010 MC Measure life -12 yrs	
Commercial Solid Door Refrigerator: 30 <= V < 50	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.10 V + 2.04 kWh/day	$-88	428 kWh/yr	2010 MC Measure life -12 yrs	
Commercial Solid Door Refrigerator: 50 <= V	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.10 V + 2.04 kWh/day	$-88	550 kWh/yr	2010 MC Measure life -12 yrs	
Commercial Solid Door Refrigerator: Chest Configuration	Energy Star V 2	CFR Jan 10, 2010 MDEC = 0.10 V + 2.04 kWh/day	$3	365 kWh/yr	2010 MC Measure life -12 yrs	

Code Research	Source
Commercial refrigerators are regulated by federal code. DOE is currently evaluating modifications to the minimum federal efficiency requirements with a proposed effective date of March 27th, 2017. See Table 1-2 for a detailed breakout of code research reporting sources.	

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Refrigerators with solid doors	Code of Federal Regulations	10 CFR 431.66	Maximum Daily Energy Consumption (MDEC) = 0.10 V + 2.04 (kWh/day)	N/A	11
Refrigerators with transparent doors	Code of Federal Regulations	10 CFR 431.66	MDEC = 0.12 V + 3.34 (kWh/day)	N/A	11
Refrigerators/freezers with solid doors	Code of Federal Regulations	10 CFR 431.66	MDEC = the greater of 0.27 AV - 0.71 or 0.70 (kWh/day)	N/A	11
Vertical Closed Transparent Self Contained Medium Temperature (VCT SC M)	DOE Efficiency Rulemakings	Final Rule	MDEC = 0.10 V + 0.86 (kWh/day)	Effective March 27, 2017	12
Vertical Closed Solid Self Contained Medium Temperature (VCS SC M)	DOE Efficiency Rulemakings	Final Rule	MDEC = 0.05 V + 1.36 (kWh/day)	Effective March 27, 2017	12
Horizontal Closed Transparent Self Contained Medium Temperature (HCT SC M)	DOE Efficiency Rulemakings	Final Rule	MDEC = 0.06 V + 0.37 (kWh/day)	Effective March 27, 2017	12
Horizontal Closed Solid Self Contained Medium Temperature (HCS SC M)	DOE Efficiency Rulemakings	Final Rule	MDEC = 0.05 V + 0.91 (kWh/day)	Effective March 27, 2017	12
Refrigerator	IECC 2006	N/A	N/A	N/A	13
Refrigerator	IECC 2009	N/A	N/A	N/A	14
Refrigerator	IECC 2012	N/A	N/A	N/A	15
Refrigerator	WSEC 2012	N/A	N/A	N/A	16
Refrigerator	Title 24 – 2008	N/A	N/A	N/A	17
Refrigerator	Title 24 – 2013	N/A	N/A	N/A	18

Peer Utility DSM Review	Source
Incentives are broadly offered by the peer utilities reviewed in this research. Nearly all utilities reference ENERGY STAR or CEE for minimum efficiency requirements and size categories, and incentives vary between $30 and $225 dollars depending on the size and type of the refrigerator. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
1 Door - Refrigerator	≤30 cubic feet	$75.00		21
2 Door - Refrigerator	≤60 cubic feet	$75.00		21
3 Door - Refrigerator	≤90 cubic feet	$75.00		21
Standard Refrigerator	ENERGY STAR® Refrigerator	$30.00		19
Solid or glass door Refrigerator	Solid or glass door refrigerator< 30 cubic feet, listed on Version 2 ENERGY STAR®QPL	$75.00		19
Solid or Glass Door Refrigerator	Solid or glass door refrigerator30–49.9 cubic feet, listed on Version 2 ENERGY STAR®QPL	$90.00		19
Solid or Glass Door Refrigerator	Solid or glass door refrigerator ≥ 50 cubic feet, listed on Version 2 ENERGY STAR®QPL	$140.00		19
Commercial Solid Door Refrigerators	Internal volume less than 15 ft3 • The refrigeration system must be built-in (packaged). • Must meet ENERGYSTAR Version 2.0 specifications.	$50.00	Exclusions: • No cases with remote refrigerationsystems. • Please note thatENERGYSTARspecification Version 1.0 refrigerators do not qualify for this rebate.	21
Commercial Solid Door Refrigerators	Internal volume between 15 ft3–29.9 ft3 • The refrigeration system must be built-in (packaged). • Must meet ENERGYSTAR Version 2.0 specifications.	$75.00	Exclusions: • No cases with remote refrigeration systems. • Please note thatENERGYSTARspecification Version 1.0 refrigerators do not qualify for this rebate.	21
Commercial Solid Door Refrigerators	Internal volume between 30 ft3–49.9 ft3 • The refrigeration system must be built-in (packaged). • Must meet ENERGYSTAR Version 2.0 specifications.	$125.00	Exclusions: • No cases with remote refrigeration systems. • Please note thatENERGYSTARspecification Version 1.0 refrigerators do not qualify for this rebate.	21
Commercial Solid Door Refrigerators	Internal volume 50 ft3 or greater	$200.00	Exclusions: • No cases with remote refrigeration	21

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
	• The refrigeration system must be built-in (packaged). • Must meet ENERGYSTAR Version 2.0 specifications.		systems. • Please note thatENERGYSTARspecification Version 1.0 refrigerators do not qualify for this rebate.	
Glass Door Refrigerators	Internal volume less than 15 ft3. The refrigeration system must be built-in (packaged). • Must meet ENERGYSTAR Version 2.0 specification.	$75.00	Exclusions: Please note that cases with remote refrigeration systems do not qualify for this rebate.	21
Glass Door Refrigerators	Internal volume 15 ft3 – 29.9 ft3. The refrigeration system must be built-in (packaged). • Must meet ENERGYSTAR Version 2.0 specification.	$100.00	Exclusions: Please note that cases with remote refrigeration systems do not qualify for this rebate.	21
Glass Door Refrigerators	Internal volume 30 ft3 – 49.9 ft3. The refrigeration system must be built-in (packaged). • Must meet ENERGYSTAR Version 2.0 specification.	$125.00	Exclusions: Please note that cases with remote refrigeration systems do not qualify for this rebate.	21
Glass Door Refrigerators	Internal volume 50 ft3 or greater. The refrigeration system must be built-in (packaged). • Must meet ENERGYSTARVersion 2.0 specification.	$150.00	Exclusions: Please note that cases with remote refrigeration systems do not qualify for this rebate.	21
Glass Door Refrigerator (Commercial Grade)	‹ 15 cubic feet. Energy Star Qualified.	$125.00		24
Glass Door Refrigerator (Commercial Grade)	≥ 15 to ‹ 30 cu ft. Energy Star Qualified.	$150.00		24
Glass Door Refrigerator (Commercial Grade)	≥ 30 to ‹ 50 cu ft. Energy Star Qualified.	$175.00		24
Glass Door Refrigerator (Commercial Grade)	≥ 50 cu ft. Energy Star Qualified.	$225.00		24
Solid door Refrigerators (Residential Grade)	Residential grade ≥ 10 cu ft. Energy Star Qualified.	$50.00		24
Solid door Refrigerators (Residential Grade)	‹ 15 cubic feet. Energy Star Qualified.	$100.00		24
Solid door Refrigerators	≥ 15 to ‹ 30 cu ft. Energy Star	$125.00		24

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
(Residential Grade)	Qualified.			
Solid door Refrigerators (Residential Grade)	≥ 30 to ‹ 50 cu ft. Energy Star Qualified.	$150.0		24
Solid door Refrigerators (Residential Grade)	≥ 50 cu ft. Energy Star Qualified.	$200.00		24

Vendor Survey
The vendors surveyed do offer electric high-efficiency kitchen equipment but requests are very low because of the increased incremental cost. They noted that most customers primarily consider cost when making the decision to replace old equipment. Vendors identified that while there is a increased trend in manufacturers providing high-efficiency products, customers looking for replacement equipment remain focused on purchasing the lowest cost product available and consider used equipment in most cases. New equipment is primarily sold into the new construction market. Inline with DOE findings, the vendors surveyed confirmed that the majority of commercial refrigeration equipment meets ENERGY STAR standards. Institutional and government customers are the primary purchasers of high-efficiency food service equipment since procurement guidelines require it. See Table 1-4 for a summary and detailed breakout of reporting sources.

Table 1-4: Vendor Survey Results Summary

Vendor Name	Vendor Description
Commercial Kitchen Supply	Distributor, Wholesaler, and Retailer
Bintz Restaurant Supply	Wholesaler/Retailer of standard and high efficiency refrigeration, cooking, and dishwashing equipment
True Manufacturing	Manufacturer, primarily of refrigeration equipment

Measure Recommendations		Source #
Summary	It is recommended that incentives be discontinued for solid-door refrigerators, as the savings and cost between an efficient ENERGY STAR model and the industry standard baseline identified by DOE research is exceedingly small. Incentives for ENERGY STAR transparent door refrigerators should be continued, but reported savings should be adjusted to reflect the industry-standard baseline identified by DOE. Incentives should be adjusted to be commesurate with updated market costs and reported savings. All recommendations are based upon the minimum eligibility requirements listed below.	
Implement?	Yes, with exception of Solid door, measures continue to provide good savings	
Incentive	Yes, see below.	

Minimum Eligibility Requirements		Source #
Summary	Energy Star Qualified Horizontal Closed Transparent Self Contained Medium Temperature (HCT SC M) Vertical Closed Solid Self Contained Medium Temperature (VCS SC M) Vertical Closed Transparent Self Contained Medium Temperature (VCT SC M)	1
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	Energy Star	
Rating Standard	As governed by Energy Star	
Testing/Certifications	As governed by Energy Star	

Baseline	Source
DOE NOPR study found that market baseline has become more efficient than current CFR requirements. Baselines are established as as follows: VCS SC M - MDEC = 0.06V + 1.31 VCT SC M - MDEC = 0.12V + 3.34 HCT SC M - MDEC = 0.06V + 1.73	20

Savings Calculation Summary		Source #
Savings Estimate	Vertical Solid Door, 0 < V < 15 – 4 kWh/yr 15 ≤ V < 30 – 31 kWh/yr 30 ≤ V < 50 – 131 kWh/yr 50 ≤ V – 314 kWh/yr Vertical Transparent Door, 0 < V < 15 – 883 kWh/yr 15 ≤ V < 30 – 856 kWh/yr 30 ≤ V < 50 – 993 KWh/yr 50 ≤ V – 1,394 kWh/yr Horizontal Transparent Door All – 412 kWh/yr	
Savings Calculation Methodology	Energy Star's commercial kitchen equipment calculator modified to proposed specification V3 and DOE NOPR baseline described above. Savings based on calculated volume as described in CEE program guidance 2009 for each volume category: Vertical Solid Door, 0 < V < 15 – 7.5 15 ≤ V < 30 – 22.5 30 ≤ V < 50 - 40 50 ≤ V – 62.5 Vertical Transparent Door, 0 < V < 15 – 7.5 15 ≤ V < 30 – 22.5 30 ≤ V < 50 – 40 50 ≤ V – 62.5 Horizontal Transparent Door All – 14 Demand savings are calculated using the calculated savings estimates and assumes 8760 operating hours per year.	1, 20,
Savings Estimate Conclusions		
RTF Alignment	Not Aligned, RTF values are based on Energy Star version 2.0 and use CFR 2010 requirements	12

Savings Calculation Summary		Source #
	as baseline	

Cost Calculation Summary		Source #
Cost Estimate	Vertical Solid Door, 0 < V < 15 – $2.33 15 ≤ V < 30 – $6.99 30 ≤ V < 50 – $12.43 50 ≤ V – $19.42 Vertical Transparent Door, 0 < V < 15 – $27.70 15 ≤ V < 30 – $83.15 30 ≤ V < 50 – $147.82 50 ≤ V – $230.97 Horizontal Transparent Door All – $58.77	
Costs Utilized to Determine Incremental Cost	DOE NOPR TSD provided installed costs at multiple efficiency levels. Energy Star efficiency level was compared and a cost was extrapolated. NOPR costs assume refrigerated volumes of 49 cu. ft. and 8.33 cu. ft for vertical and horizontal cases respectively. Incremental costs between Energy Star V3 and NOPR market baseline were broken down into a $/V and multiplied out for each size category. Costs based on calculated volume as described in CEE program guidance 2009 for each volume category: Vertical Solid Door, 0 < V < 15 – 7.5 15 ≤ V < 30 – 22.5 30 ≤ V < 50 - 40 50 ≤ V – 62.5 Vertical Transparent Door, 0 < V < 15 – 7.5 15 ≤ V < 30 – 22.5 30 ≤ V < 50 – 40 50 ≤ V – 62.5 Horizontal Transparent Door All - 14	20,23
Development of Deemed Incremental Cost	See Above	

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-Purchase Customer Incentive	
Measure Parameters	Energy Star Qualified Equipment: Horizontal Closed Transparent Self Contained Medium Temperature (HCT SC M) Vertical Closed Solid Self Contained Medium Temperature (VCS SC M) Vertical Closed Transparent Self Contained Medium Temperature (VCT SC M)	
Required Verification for Processing	(▪ Copy of Energy Star listing	

Table 1-6B: Incremental Costs, Savings, Recommended Incentives and Unit Details Transparent Door

Transparent Door	0 < V < 15	15 ≤ V < 30	30 ≤ V < 50	50 ≤ V	Horizontal	Source#
Incremental Cost	$27.70	$83.15	$147.82	$230.97	$58.77	
kWh/Year Saved	883 kWh/yr	856 kWh/yr	993 KWh/yr	1,394 kWh/yr	412 kWh/yr	
kW/Month Saved	0.102	0.098	0.115	0.161	0.048	
Recommended Incentive	$25	$50	$75	$125	$50	
Unit	Measure	Measure	Measure	Measure	Measure	
Measure Life	12	12	12	12		

Table 1-7: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)	2009	Commercial Refrigerators and Freezers Program Guide	N/A	Dec 2009	N/A	Boston	CEE	http://www.ceeforum.org/sites/default/files/library/4360/cee_commkit_programdesignguidancerefrigeratorsfree_14877.pdf
2	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
3	ENERGY STAR	2013	ENERGY STAR® Program Requirements Product Specification for Commercial Refrigerators & Freezers	V.3.1	N/A	N/A	N/A	U.S. Dept. of Energy	http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CRF
4	Regional Technical Forum	2013	Commercial: Appliances – Refrigerators	Version 3.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org//measures/measure.asp?id=94
5	U.S. Department of Energy (DOE)	2013	Commercial Refrigeration Equipment Final Rule Technical Support Document	2014-02-00	N/A	N/A	N/A	U.S. Department of Energy	http://www.regulations.gov/#!documentDetail;D=EERE-2010-BT-STD-0003-0102
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
8	The Sixth Northwest Electric Power and Conservation Plan	2009	Refrigerators, Freezers, Ice Makers, Beverage Vending Machines Supply Curve	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available
10	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy		Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
12	U.S. Department of Energy	2013	Commercial Refrigeration Equipment Final Rule	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www.regulations.gov/#!documentDetail;D=EERE-2010-BT-STD-0003-0104
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
19	Arizona Public Service	2013	Refrigeration	N/A	N/A	1	N/A	Arizona Public Service	http://www.aps.com/en/business/savemoney/solutionsbyequipmenttype/Pages/refrigeration.aspx
20	Avista Utilities	2013	Washington Commercial Food Services Equipment Rebate Agreement	N/A	N/A	4	N/A	Avista	http://www.avistautilities.com/business/rebates/washington/Documents/WA_food_services_0213.pdf
21	Bonneville Power Administration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
22	ETO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23	Idaho Power	2013	Easy Upgrades Food Service Equipment Worksheet	N/A	N/A	2	N/A	Idaho Power	https://www.idahopower.com/pdfs/EnergyEfficiency/EasyUpgrades/worksheet_grocery.pdf
24	Mid-American Energy	2013	Commercial Kitchen Equipment Program	N/A	N/A	3	N/A	Mid-American Energy	http://www.midamericanenergy.com/ee/include/pdf/ia_kitchen.pdf
25	Nevada Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	Pacific Gas & Electric Company	2013	Food Service Rebate Catalog	N/A	N/A	8	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/foodservice_catalog_final.pdf
27	Puget Sound Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	Xcel Energy (Colorado)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

2.1.5 Electric Insulated Holding Cabinet

Measure Category	Measure Type	Measure Name
Food Service Equipment	Holding Cabinet	Insulated Holding Cabinet

Description (s)	Source
From ENERGY STAR's Program Requirements for Commercial Hot Food Holding Cabinets document, "Commercial Hot Food Holding Cabinet is a heated, fully enclosed compartment with one or more solid or transparent doors designed to maintain the temperature of hot food that has been cooked using a separate appliance."	1

Measure Research Summary	Source
Both ENERGY STAR and CEE maintain a high-efficiency specification for Hot Food Holding Cabinets. ENERGY STAR updated the specification in 2011, increasing requirements to meet or exceed CEE Tier 2 requirements. The Regional Technical Forum has aligned efficiency requirements with ENERGY STAR and completed an independent savings/cost analysis, but maintains different size classifications (Half-Size, Full-Size) than either ENERGY STAR or CEE. RTF reports more conservative savings that other sources due to a derate for the market prevalence of qualifying equipment. derated savings to The Northwest Power and Conservation Council reviewed measure level savings and costs as part of the 6th Power Plan. All sources indicate significant savings potential over a standard or refurbished hot food holding cabinet. See Table 1-1 for a detailed breakout of measure research reporting sources.	1, 11, 12, 13, 21

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Hot Food Holding Cabinets	Tier 1 Energy Star 40 W/cu-ft Idle Energy Use Tier 2 Energy Star + 50% 20 W/cu-ft Idle Energy Use	N/A	N/A	N/A	In measuring idle energy rate, the following test standard must be used: ASTM Standard F2140, Test Method for the Performance of Hot Food Holding Cabinets	10
Insulated Holding Cabinet	Base use = 1.35 kW/hour; Eff use = 0.43 kW/hour	N/A	N/A	N/A	N/A	21
Hot Food Holding Cabinet	0 < V < 13 cu-ft ≤ (21.5*V) Watts Idle Energy 13 ≤ V < 28 cu-ft ≤ (2.0*V + 254.0) Watts Idle Energy 28 ≤ V cu-ft ≤ (3.8*V + 203.5) Watts Idle Energy	40*V Watts Idle Energy	N/A	0 < V < 13 cu-ft 658 kWh 13 ≤ V < 28 cu-ft 2,770 kWh 28 ≤ V < 40 cu-ft 5,624 kWh		1, 11
Hot Food Holding Cabinets	Energy Star v2.0	0 < V < 15 cu-ft 283 Watts Idle Energy 15 ≤ V cu-ft 552 Watts Idle Energy	0 < V < 15 cu-ft $289 15 ≤ V cu-ft $745	0 < V < 15 cu-ft 253 kWh/yr 15 ≤ V cu-ft 820 kWh/yr		12
Efficient Hot Food Holding Cabinet	20*V Watts Idle Energy	40*V Watts Idle Energy	0 < V < 10 cu-ft $736 10 ≤ V < 15 cu-ft $663 15 ≤ V ≤ 20 cu-ft $1,405 Wt Average Size	0 < V < 10 cu-ft 876 kWh/yr 10 ≤ V < 15 cu-ft 1,314 kWh/yr 15 ≤ V ≤ 20 cu-ft 1,752 kWh/yr Wt Average Size		13

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
			$740	1,095 kWh/yr		

Code Research	Source
A review of applicable energy codes determined there are no current minimum energy efficiency requirements for this measure. See Table 1-2 for a detailed breakout of code research reporting sources.	2, 3, 4, 5, 6, 7, 8, 9

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Insulated Holding Cabinet	Code of Federal Regulations, Title 10	N/A	N/A	N/A	2
Insulated Holding Cabinet	DOE Efficiency Rulemakings	N/A	N/A	N/A	3
Insulated Holding Cabinet	IECC 2006	N/A	N/A	N/A	4
Insulated Holding Cabinet	IECC 2009	N/A	N/A	N/A	5
Insulated Holding Cabinet	IECC 2012	N/A	N/A	N/A	6
Insulated Holding Cabinet	WSEC 2012	N/A	N/A	N/A	7
Insulated Holding Cabinet	Title 24 – 2008	N/A	N/A	N/A	8
Insulated Holding Cabinet	Title 24 – 2013	Section 120	N/A	2013 Building Energy Eff. Standards	9

Peer Utility DSM Review	Source
Several applicable peer utility DSM offerings were reviewed for this measure. In most cases, the energy efficiency requirements are based on or defered to ENERGY STAR or CEE Tier 2, although the size classifications varied significantly between utilities. Incentives typically vary between $200 to $500 per unit, depending on the size of the hot food holding cabinet. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	14, 15, 16, 17, 18, 19

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Hot Food Holding Cabinet (Electric)	Energy Star	9 < V ≤ 12 cu-ft $300 12 ≤ V ≤ 18 cu-ft $400 18 < V cu-ft $500		14
Electric Hot Food Holding cabinet	Unit must be listed CEE Tier 2 qualifying list, found under "Hot Food Holding Cabinets" link at http://www.cee1.org/com/com-kit/com-kit-equip.php3 or have an Idle Energy Rate of ≤ 20 Watts/cu-ft.	0 < V < 12 cu-ft $200 12 ≤ V ≤ 20 cu-ft $300 20 < V cu-ft $400		15
Electric Hot Food Cabinet	Energy Star	0 < V < 15 cu-ft $275 15 ≤ V cu-ft $400		16
Insulated Holding Cabinets (Full Size)	Must meet the CEE Tier 2 specification and be fully insulated with solid doors	Half Size $200 Full Size $300		17
Hot Food Holding Cabinet	CEE Tier 2	7 < V ≤ 12 cu-ft $200 12 < V ≤ 20 cu-ft $300 20 < V cu-ft $400		18

Table 1-4: Vendor Survey Details by Measure

Vendor Name	Vendor Description
Commercial Kitchen Supply	Distributor, Wholesaler, and Retailer
Bintz Restaurant Supply	Wholesaler/Retailer of standard and high efficiency refrigeration, cooking, and dishwashing equipment
True Manufacturing	Manufacturer, primarily of refrigeration equipment

Table 1-5: Vendor Survey Results Summary

Vendor Survey Findings Summary
The vendors surveyed do offer electric high-efficiency kitchen equipment but requests are very low because of the increased incremental cost as well as the predominance of natural gas cooking equipment in this region. They noted that most customers primarily consider cost when making the decision to replace old cooking equipment. Vendors identified that while there is a increased trend in manufacturers providing high-efficiency products, customers looking for replacement equipment remain focused on purchasing the lowest cost product available and consider used equipment in most cases. New equipment is primarily sold into the new construction market. Incentives help, but are generally not enough to cover the full incremental cost difference (estimated at 30% or higher). Most commercial kitchens are plumbed with natural gas, and natural gas equipment is preferentially purchased over electric-powered equipment. Institutional and government customers are the primary purchasers of high-efficiency food service equipment since procurement guidelines require it.

Measure Recommendations		Source #
Summary	PacifiCorp should continue to offer prescriptive incentives for this measure to qualifying customers. Incentive structure should be modified to only include one efficiency tier (ENERGY STAR), and remove offers for a second efficiency tier. Deemed savings/costs and eligibility requirements should be updated to align with current market data, as detailed below.	
Implement?	Yes	
Incentive	½ Size (0 < V < 13) - $200 ¾ Size-(13 ≤ V ≤ 28) - $300 Full Size(28 ≤ V) - $400 Where V is the Product Interior Volume in cubic feet.	

Minimum Eligibility Requirements		Source #
Summary	ENERGY STAR v2.0 qualified 0 < V < 13 cu-ft ≤ (21.5*V) Watts Idle Energy 13 ≤ V < 28 cu-ft ≤ (2.0*V + 254.0) Watts Idle Energy 28 ≤ V cu-ft ≤ (3.8*V + 203.5) Watts Idle Energy	1, 10, 12
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	ENERGY STAR v2.0 qualified	1, 12
Rating Standard	Idle Energy Rate	1
Testing/Certifications	ASTM Standard F2140-11, *Test Method for the Performance of Hot Food Holding Cabinets*	1

Baseline	Source
The baseline is the one used by ENERGY STAR or 40W idle energy per cubic foot of internal volume in the Hot Food Holding Cabinet, with an operation schedule of 15 hrs/day, 365 days per year.	11

Savings Calculation Summary		Source #
Savings Estimate	0 < V < 13 cu-ft (Assume V = 6.5 cu. ft.) 658 kWh, 0.12 Average kW 13 ≤ V < 28 cu-ft (Assume V = 20 cu. ft.) 2,770 kWh, 0.51 Average kW 28 ≤ V < 40 cu-ft (Assume V = 34 cu. ft.) 5,624 kWh, 1.03 Average kW	12
Savings Calculation Methodology	Savings are calculated as the difference in the idle energy rate of a conventional unit (40W per cubic foot of internal volume) and the idle energy rate of a ENERGY STAR qualifying unit (see specification), multiplied by 5,475 operating hours per year (15 hrs/day, 365 days per year).	12
RTF Alignment	Not aligned, RTF uses size categories not aligned with ENERGY STAR and actual idle energy rates from a sample of products sold in 2010/2011 to calculate savings.	12

Cost Calculation Summary		Source #
Cost Estimate	½ Size (0 < V < 13) - $323 ¾ Size-(13 ≤ V ≤ 28) - $578 Full Size(28 ≤ V) - $833	12
Costs Utilized to Determine Incremental Cost	Costs reported by ENERGY STAR are $0, calculated as the difference between a similar ENERGY STAR and non-qualifying model using AutoQuotes, 2012. RTF cost data was preferred, based on actual equipment models.	12
Development of Deemed Incremental Cost	RTF reports a cost for Half Size and Full Size units. The cost for a ¾ size unit was estimated as the average value of the Half and Full Size units.	12

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-Purchase Application	
Measure Parameters	Use ENERGY STAR v2.0 minimum efficiency requirements	1
Required Verification for Processing	ASTM Standard F2140-11, *Test Method for the Performance of Hot Food Holding Cabinets*	1

Table 1-6: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source#
Incremental Cost						12
½ Size	$323	$323	$323	$323	$323	
¾ Size	$578	$578	$578	$578	$578	
Full Size	$833	$833	$833	$833	$833	
kWh/Year Saved						11
½ Size	658	658	658	658	658	
¾ Size	2,770	2,770	2,770	2,770	2,770	
Full Size	5,624	5,624	5,624	5,624	5,624	
kW/Month Saved						11
½ Size	0.12	0.12	0.12	0.12	0.12	
¾ Size	0.51	0.51	0.51	0.51	0.51	
Full Size	1.03	1.03	1.03	1.03	1.03	
Incentive						
½ Size	$200	$200	$200	$200	$200	
¾ Size	$300	$300	$300	$300	$300	
Full Size	$400	$400	$400	$400	$400	
Unit	measure	measure	measure	measure	measure	
Measure Life	12 years	12 years	12 years	12 years	12 years	11, 13

Table 1-7: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	ENERGY STAR	2011	ENERGY STAR® Program Requirements Product Specification For Commercial Hot Food Holding Cabinets	Version 2.0	Product Specification for Commercial Hot Food Holding Cabinets		N/A	U.S. Department of Energy	http://www.energystar.gov/ia/partners/product_specs/program_reqs/Commercial_HFHC_Program_Requirements_2.0.pdf
2	U.S. Department of Energy	2013	Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
3	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
4	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
5	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
6	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
7	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
8	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
9	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/title24/2013standards/
10	Consortium for Energy Efficiency	2011	CEE Commercial Kitchens Initiative	N/A	High Efficiency Specifications for Hot Food Holding Cabinets	1	N/A	Consortium for Energy Efficiency	http://library.cee1.org/sites/default/files/library/4346/Hot%20Food%20Holding%20Cabinet%20Specification%20FINAL%2020100101%20Branded.pdf

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
11	ENERGY STAR	2013	ENERGY STAR Commercial Kitchen Equipment Calculator	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx
12	Regional Technical Forum (RTF)	2013	Commercial: Cooking Equipment – Hot Food Holding Cabinets Measure Workbook	Version 2.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/measure.asp?id=99
13	Northwest Power and Conservation Council	2013	Measure Workbook: Cooking	N/A	N/A	N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
14	Avista Utilities	2013	Commercial Food Service Equipment Program	N/A	N/A	1	N/A	Avista Utilities	http://www.avistautilities.com/business/rebates/washington/Documents/WA_food_services_0213.pdf
15	Bonneville Power Administration	2013	EnergySmart-BPA-T&Cs	N/A	N/A	24	N/A	Energy Smart	http://energysmartonline.org/documents/EnergySmart-BPA-T&Cs.pdf
16	Energy Trust of Oregon	2013	Existing Buildings Standard Incentives	N/A	N/A	10	N/A	Energy Trust of Oregon	http://energytrust.org/library/forms/BE_PI_IncentiveBooklet.pdf
17	Pacific Gas & Electric Company	2013	Food Service Rebate Catalog	N/A	N/A	5	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/foodservice_catalog_final.pdf
18	Puget Sound Energy	2013	Qualified Convection Ovens	N/A	N/A	N/A	N/A	Puget Sound Energy	http://pse.com/savingsandenergycenter/ForBusinesses/Documents/5HotFoodHoldingCabs.pdf http://pse.com/savingsandenergycenter/ForBusinesses/Documents/WURERebateApplication2013.pdf

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
19	Rocky Mountain Power	2013	Incentives for food service equipment	N/A	N/A	N/A	N/A	Rocky Mountain Power	http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/Business/Save_Energy_Money/UT_wattsmart_Business_Food_Service_Incentives.pdf
20	PacifiCorp	2010	2010 Market Characterization Data	N/A	N/A	N/A	N/A	Nexant, Inc.	N/A
21	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com

2.1.6 Electric Combination Oven

Measure Category	Measure Type	Measure Name
Food Service Equipment	Cooking Equipment	Electric Combination Oven

Description (s)	Source
A device that combines the function of hot air convection (oven mode), saturated and superheated steam heating (steam mode), and combination convection/steam mode for moist heating, to perform steaming, baking, roasting, rethermalizing, and proofing of various food products. In general, the term combination oven is used to describe this type of equipment, which is self-contained. The combination oven is also referred to as a combination oven/steamer, combi or combo.	1

Measure Research Summary	Source
Several applicable energy-efficiency data sources were reviewed. Energy Star minimum efficiency requirements appear to be the basis of savings/cost estimates with some adjustments for all sources. The main difference in the data pertains to the separation of steam and convection modes as well as equipment size ranges. Some sources account for this while others appear to provide average values across all sizes regardless of mode. See Table 1-1 for a detailed breakout of measure research reporting sources.	1, 12, 13, 20

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Combination Ovens	Steam Mode ≤ 0.133P + 0.6400 kW Idle Energy Rate ≥ 55% cooking efficiency Convection Mode ≤ 0.080P + 0.4989 kW Idle Energy Rate ≥ 76% cooking efficiency	N/A	N/A	N/A	P = Pan Capacity: The number of steam table pans the combination oven is able to accommodate as per the ASTM F-1495-05 standard specification.	1
Combination Ovens	Energy Star v2.0	Steam Mode 0.849P + 0.6400 kW Idle Energy Rate 40% cooking efficiency Convection Mode 0.227P + 0.4989 kW Idle Energy Rate 65% cooking efficiency	6-15 Pan $1,592 16-20 Pan $435	6-15 Pan 12,945 kWh/yr 16-20 Pan 17,665 kWh/yr		12
Combi Ovens	≤ 2.500 kW Idle Energy Rate ≥ 75% cooking efficiency	5.000 kW Idle Energy Rate 50% cooking efficiency	$1,852	11,757 kWh/yr	No data for variation in equipment size or for steam/ convection mode energy usage.	13
Electric Combination Oven	≤ 3.500 kW Idle Energy Rate ≥ 70% Heavy Load Efficiency	Standard efficiency Electric Combination Oven	CA = $16,884 ID = $1,983 UT = $1,983 WA = $1,983 WY =	CA = 17,118 kWh/yr ID = 11,757 kWh/yr UT = 11,757 kWh/yr WA = 11,757 kWh/yr WY = 17,118	All models.	20

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
			$16,884	kWh/yr		

Code Research	Source
A review of applicable energy codes determined there are no current minimum energy efficiency requirements for this measure. See Table 1-2 for a detailed breakout of code research reporting sources.	2, 3, 4, 5, 6, 7, 8, 9

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Electric Combination Oven	Code of Federal Regulations, Title 10	Parts 430-431	N/A	N/A	2
Electric Combination Oven	DOE Efficiency Rulemakings	N/A	N/A	N/A	3
Electric Combination Oven	IECC 2006	N/A	N/A	N/A	4
Electric Combination Oven	IECC 2009	N/A	N/A	N/A	5
Electric Combination Oven	IECC 2012	N/A	N/A	N/A	6
Electric Combination Oven	WSEC 2012	N/A	N/A	N/A	7
Electric Combination Oven	Title 24 – 2008	N/A	N/A	N/A	8
Electric Combination Oven	Title 24 – 2013	N/A	N/A	N/A	9

Peer Utility DSM Review	Source
Several applicable peer utility DSM offerings were reviewed for this measure. There is some variance in the minimum efficiency requirements for both cooking effiency and idle energy rate. Incentive rates also vary, but do not necessarily vary with the respective minimum efficiency requirements.	14, 15, 17, 18a, 18b, 19

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Commercial Combination Oven (Electric)	Must meet or exceed heavy load cooking energy efficiency of ≥60% utilizing ASTM Standard F1639.	$1000		14
Electric Combination Oven	≥ 70% Cooking Efficiency ≤ 3.5 kW Idle Energy Rate Must meet RTF efficiency standards.	$1750		15
Commercial Combination Oven/Steamer (Electric)	≥ 50% Steam Mode/Cooking Efficiency ≥ 70% Convection Mode/Cooking Efficiency Less than 15 pans* ≤ 5.0kW Steam Mode/Idle Energy Rate ≤ 2.0kW Convection Mode/Idle Energy Rate 15-28 pans* ≤ 6.0kW Steam Mode/Idle Energy Rate ≤ 2.5kW Convection Mode/Idle Energy Rate More than 28 pans* ≤ 9.0kW Steam Mode/Idle Energy Rate ≤ 4.0kW Convection Mode/Idle Energy Rate *pan capacity based on maximum capacity of full-size 2 ½ inch deep hotel pans, consistent to meet ASTM F2861	$1000		17
Electric Combination Oven	≥ 50% Steam Mode/Cooking Efficiency ≥ 70% Convection Mode/Cooking Efficiency	$2000		18
Electric Combination Oven	≥ 70% Cooking Efficiency ≤ 3.5 kW Idle Energy Rate	$1000		19

Vendor Survey	Source #
The vendors surveyed do offer electric high-efficiency kitchen equipment but requests are very low because of the increased incremental cost as well as the predominance of natural gas cooking equipment in this region. They noted that most customers primarily consider cost when making the decision to replace old cooking equipment. Vendors identified that while there is a increased trend in manufacturers providing high-efficiency products, customers looking for replacement equipment remain focused on purchasing the lowest cost product available and consider used equipment in most cases. New equipment is primarily sold into the new construction market. Incentives help, but are generally not enough to cover the full incremental cost difference (broadly estimated at 30% higher). Most commercial kitchens are plumbed with natural gas, and natural gas equipment is preferentially purchased over electric-powered equipment. Institutional and government customers are the primary purchasers of high-efficiency food service equipment since procurement guidelines require it. See Table 1-4 and Table 1-5 for a summary and detailed breakout of reporting sources.	

Table 1-4: Vendor Survey Results Summary

Vendor Name	Vendor Description
Commercial Kitchen Supply	Distributor, Wholesaler, and Retailer
Bintz Restaurant Supply	Wholesaler/Retailer of standard and high efficiency refrigeration, cooking, and dishwashing equipment
True Manufacturing	Manufacturer, primarily of refrigeration equipment

Measure Recommendations		Source #
Summary	PacifiCorp should continue to offer prescriptive incentives for this measure to qualifying customers. Deemed savings/costs and eligibility requirements should be updated to align with current market data, as detailed below.	
Implement?	Yes	
Incentive	Breakup the incentive offered based on the equipment size as measured by number of pans to pay a uniform percentage (70%) of the incremental costs as detailed below. 6-15 pans - $1,000 (matches current incentive for all equipment sizes) 16-20 pans - $275	

Minimum Eligibility Requirements		Source #
Summary	ENERGY STAR v2.0 qualified Steam Mode ≤ 0.133P + 0.6400 kW Idle Energy Rate ≥ 55% cooking efficiency Convection Mode ≤ 0.080P + 0.4989 kW Idle Energy Rate ≥ 76% cooking efficiency P = number of pans	1, 12
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	ENERGY STAR v2.0 qualified	1, 12
Rating Standard	Heavy load cooking energy efficiency	1, 12
Testing/Certifications	ASTM F-2861-10, Standard Test Method for Enhanced Performance of Combination Oven in Various Modes	1, 12

Baseline	Source
3 kW Idle Energy Rate (Convection) 65% Cooking Efficiency (Convection) 10 kW Idle Energy Rate (Steam) 40% Cooking Efficiency (Steam)	12

<table>
<tr><th>Savings Calculation Summary</th><th>Source #</th></tr>
<tr><td>Savings Estimate</td><td>6-15 pans - 12,945 kWh/yr per combination oven
16-20 pans - 17,665 kWh/yr per combination oven</td><td>12</td></tr>
<tr><td>Savings Calculation Methodology</td><td>The savings estimate is based on the calculation methodology used in the RTF measure workbook for combination ovens with the inputs shown in the following table:
<table>
<tr><th>Input Parameter</th><th>Conventional</th><th>Energy-Efficient Model</th></tr>
<tr><td>Number of Pans</td><td>12</td><td>12</td></tr>
<tr><td>Preheat Time (min)</td><td>15</td><td>15</td></tr>
<tr><td>Preheat Energy (kWh)</td><td>3</td><td>1.5</td></tr>
<tr><td>Convection Idle Energy Rate (kW)</td><td>3</td><td>1.5*/2.1**</td></tr>
<tr><td>Convection Cooking Energy Efficiency (%)</td><td>65%</td><td>76%</td></tr>
<tr><td>Convection Production Capacity (lbs/hr)</td><td>80</td><td>100</td></tr>
<tr><td>Steam Idle Energy Rate (kW)</td><td>10</td><td>2.2*/3.3**</td></tr>
<tr><td>Steam Cooking Energy Efficiency (%)</td><td>40%</td><td>55%</td></tr>
<tr><td>Steam Production Capacity (lbs/hr)</td><td>100</td><td>120</td></tr>
<tr><td>Average Water Consumption Rate (gal/h)</td><td>30</td><td>20</td></tr>
<tr><td>Operating Hours/Day</td><td>15</td><td>15</td></tr>
<tr><td>Operating Days/Year</td><td>324</td><td>324</td></tr>
<tr><td>Number of Preheats per Day</td><td>1</td><td>1</td></tr>
<tr><td>Pounds of Food Cooked per Day</td><td>200</td><td>200</td></tr>
<tr><td>Percentage Time in Steam Mode</td><td>50%</td><td>50%</td></tr>
<tr><td>ASTM Convection Mode Energy to Food (kWh/lb)</td><td>0.0732</td><td>0.0732</td></tr>
<tr><td>ASTM Steam Mode Energy to Food (kWh/lb)</td><td>0.0308</td><td>0.0308</td></tr>
</table>
*6-15 pans **16-20 pans</td><td>12</td></tr>
<tr><td>RTF Alignment</td><td>Aligned</td><td>12</td></tr>
</table>

Cost Calculation Summary		Source #
Cost Estimate	6-15 pans - $1,425 16-20 pans - $389	12
Costs Utilized to Determine Incremental Cost	The costs used to determine the incremental costs include a sample of both energy-efficient equipment costs and baseline equipment costs from the Regional Technical Forum.	12
Development of Deemed Incremental Cost	The incremental costs are based on subtracting the average costs of baseline equipment from the average costs of energy-efficient equipment for both pan-size categories listed.	12

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-purchase application	
Measure Parameters	Use ENERGY STAR v2.0 minimum efficiency requirements	1, 12
Required Verification for Processing	Listed on Energy Star v2.0 qualifying equipment list, or Manufacturer specifications detailing the use of ASTM F-2861-10, Standard Test Method for Enhanced Performance of Combination Oven in Various Modes	1

Table 1-6: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	All States	Source#
Incremental Cost		12
6-15 pans	$1,425	
16-20 pans	$389	
kWh/Year Saved		12
6-15 pans	12,945	
16-20 pans	17,665	
kW/Month Saved		12
6-15 pans	2.714	
16-20 pans	3.704	
Incentive		
6-15 pans	$1,000	
16-20 pans	$275	
Unit	Measure	12
Measure Life	10 Years	12

Table 1-7: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	ENERGY STAR	2013	ENERGY STAR® Program Requirements For Commercial Ovens	Version 2.0	Product Specification for Commercial Ovens	4	N/A	U.S. Department of Energy	http://www.energystar.gov/products/specs/sites/products/files/Commercial%20Ovens%20Final%20Version%202%200%20Specification_0.pdf?fb19-f71a
2	U.S. Department of Energy	2006	Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
3	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
4	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
5	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
6	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
7	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
8	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
9	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
10	Consortium for Energy Efficiency	2011		N/A	N/A	1	N/A	Consortium for Energy Efficiency	www.cee1.org
11	U.S. Department of Energy	2013	ENERGY STAR Commercial Kitchen Equipment Calculator	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xlsx

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
12	Regional Technical Forum (RTF)	2013	Commercial: Cooking Equipment – Combination Oven Measure Workbkook	Version 2.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/measure.asp?id=101
13	Northwest Power and Conservation Council	2013	Measure Workbook: Cooking	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
14	Avista Utilities	2013	Commercial Food Service Equipment Program	N/A	N/A	1	N/A	Avista Utilities	http://www.avistautilities.com/business/rebates/washington/Documents/WA_food_services_0213.pdf
15	Bonneville Power Administration	2013	EnergySmart-BPA-T&Cs	N/A	N/A	24	N/A	Energy Smart	http://energysmartonline.org/documents/EnergySmart-BPA-T&Cs.pdf
16	Energy Trust of Oregon	2013	Existing Buildings Standard Incentives	N/A	N/A	10	N/A	Energy Trust of Oregon	http://energytrust.org/library/forms/BE_PI_IncentiveBooklet.pdf
17	Pacific Gas & Electric Company	2013	Food Service Rebate Catalog	N/A	N/A	5	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/foodservice_catalog_final.pdf
18	Puget Sound Energy	2013	Qualified Convection Ovens	N/A	N/A	N/A	N/A	Puget Sound Energy	http://pse.com/savingsandenergycenter/ForBusinesses/Pages/Commercial-Kitchen-Equipment.aspx http://pse.com/savingsandenergycenter/ForBusinesses/Documents/9CombiOvens.pdf
19	Rocky Mountain Power	2013	Incentives for food service equipment	N/A	N/A	N/A	N/A	Rocky Mountain Power	http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/Business/Save_Energy_Money/UT_wattsmart_Business_Food_Service_Incentives.pdf
20	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available

2.1.7 Electric Convection Oven

Measure Category	Measure Type	Measure Name
Food Service Equipment	Cooking Equipment	Electric Convection Oven

Description (s)	Source #
Convection Oven – A general-purpose oven that cooks food by forcing hot dry air over the surface of the food product. The rapidly moving hot air strips away the layer of cooler air next to the food and enables the food to absorb the heat energy. For the purposes of this specification, convection ovens do not include ovens that have the ability to heat the cooking cavity with saturated or superheated steam. However, this oven type may have moisture injection capabilities (e.g., baking ovens and moisture-assist ovens). Ovens that include a hold feature are eligible under this specification as long as convection is the only method used to fully cook the food.	1

Measure Research Summary	Source #
Several applicable energy-efficiency data sources were reviewed. In all cases, the energy efficiency requirements defered to Energy Star v2.0, including both equipment sizing as well as cooking energy efficiency and idle energy rate requirements. Of those sources which analyzed energy savings, similar equipment energy-use values were used for both baseline and upgrade scenarios. The variance shown for incremental cost data appears to be due to a difference in timeframe for the cost data analyzed, though the data came from the Regional Technical Forum (RTF) in both datasets where cost data was included. See Table 1-1 for a detailed breakout of measure research reporting sources.	10, 11, 12, 13

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Commercial Convection Ovens	Half Size Cooking Energy Efficiency ≥ 70% Idle Energy Rate ≤ 1.0 kW Full Size Cooking Energy Efficiency ≥ 70% Idle Energy Rate ≤ 1.6 kW	N/A	N/A	N/A	Full-Size: Accepts a minimum of five standard full-size sheet pans measuring 18 x 26 x 1-inch. Half-Size: Accepts a minimum of five sheet pans measuring 18 x 13 x 1-inch.	10
Commercial Ovens: Convection Ovens	Half Size Cooking Energy Efficiency ≥ 70% Idle Energy Rate ≤ 1.0 kW Full Size Cooking Energy Efficiency ≥ 70% Idle Energy Rate ≤ 1.6 kW	N/A	N/A	N/A	Full-Size: Accepts a minimum of five standard full-size sheet pans measuring 18 x 26 x 1-inch. Half-Size: Accepts a minimum of five sheet pans measuring 18 x 13 x 1-inch.	11
Convection Ovens	Meets ENERGYSTAR v2.0 requirements	Current Practice Half Size Cooking Energy Efficiency = 65% Idle Energy Rate = 1.5 kW Full Size Cooking Energy Efficiency = 65% Idle Energy Rate = 2.0 kW	Half Size – $710 Full Size – $901	Half Size – 1,683 kWh/yr Full Size – 1,661 kWh/yr	Full-Size: Accepts a minimum of five standard full-size sheet pans measuring 18 x 26 x 1-inch. Half-Size: Accepts a minimum of five sheet pans measuring 18 x 13 x 1-inch. RTF savings include a 55% derate to account for market saturation of Energy Star products.	12

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Energy Star Electric Convection Oven	Meets ENERGYSTAR v2.0 requirements	Half Size Cooking Energy Efficiency = 67% Idle Energy Rate = 1.2 kW Full Size Cooking Energy Efficiency = 67% Idle Energy Rate = 1.8 kW	Half Size – $201 Full Size – $201	Half Size – 946 kWh/yr Full Size – 1,237 kWh/yr	Full-Size: Accepts a minimum of five standard full-size sheet pans measuring 18 x 26 x 1-inch. Half-Size: Accepts a minimum of five sheet pans measuring 18 x 13 x 1-inch.	13

Code Research	Source #
A review of applicable energy codes determined there are no current minimum energy efficiency requirements for this measure. See Table 1-2 for a detailed breakout of code research reporting sources.	2, 3, 4, 5, 6, 7, 8, 9

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Electric Convection Oven	Code of Federal Regulations, Title 10, Parts 430-431	N/A	N/A	N/A	2
Electric Convection Oven	DOE Efficiency Rulemakings	N/A	N/A	N/A	3
Electric Convection Oven	IECC 2006	N/A	N/A	N/A	4
Electric Convection Oven	IECC 2009	N/A	N/A	N/A	5
Electric Convection Oven	IECC 2012	N/A	N/A	N/A	6
Electric Convection Oven	WSEC 2012	N/A	N/A	N/A	7
Electric Convection Oven	Title 24 – 2008	N/A	N/A	N/A	8
Electric Convection Oven	Title 24 – 2013	N/A	N/A	N/A	9

Peer Utility DSM Review	Source #
Several applicable peer utility DSM offerings were reviewed for this measure. In all cases, the energy efficiency requirements are based on or defered to Energy Star, including both equipment sizing as well as cooking energy efficiency and idle energy rate requirements. Incentive offerings for this measure vary between $200 and $500. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	14, 15, 16, 17, 18

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Comm. Convection Oven (Electric)	Must meet or exceed heavy load potato cooking energy efficiency of ≥70% utilizing ASTM Standard F1496.	$400	Energy efficiency requirements match those for Energy Star v2.0 for cooking energy efficiency	14
Convection Ovens	Energy Star Commercial	$200	N/A	15
Convection Oven Electric (Full Size or half Size)	Energy Star Qualified	$300	N/A	16
Commercial Convection Oven (Electric)	Must have a tested heavy load (potato) cooking energy efficiency of 70 percent or more, utilizing ASTM F1496. – Full-Size – Tested idle energy rate ≤ 1.6 kW – Half-size – Tested idle energy rate ≤ 1.0 kW	$350	PG&E - Food Services	17
Efficient Convection Ovens	Full-size – Tested heavy load potato cooking energy efficiency ≥ 70% and idle energy rate ≤ 1.6 kW utilizing ASTM Standard F1496 and must be listed in the California Energy Commission database. Half-size – Tested heavy load potato cooking energy efficiency ≥ 70% and idle energy rate ≤ 1.0 kW utilizing ASTM Standard F1496 and must be listed in the California Energy Commission database	$500	Energy efficiency requirements match those for Energy Star v2.0 for cooking energy efficiency	18

Vendor Survey	Source #
The was very little response from vendors regarding this measure, other than that this measure is sold or installed very rarely due to this measure traditionally being fueled by natural gas. See Table 1-4 and Table 1-5 for a summary and detailed breakout of reporting sources.	

Table 1-4: Vendor Survey Results Summary

Vendor Name	Vendor Description
Commercial Kitchen Supply	Distributor, Wholesaler, and Retailer
Bintz Restaurant Supply	Wholesaler/Retailer of standard and high efficiency refrigeration, cooking, and dishwashing equipment

Vendor Survey Findings Summary
The vendors surveyed do offer electric high-efficiency kitchen equipment but requests are very low because of the increased incremental cost as well as the predominance of natural gas cooking equipment in this region. They noted that most customers primarily consider cost when making the decision to replace old cooking equipment.

Measure Recommendations		Source #
Summary	It is recommended that this measure continue to be eligible for incentives. Though this measure is not frequently installed, there are significant energy savings when it is.	
Implement?	Yes	
Incentive	No change to current incentive offering of $350/unit	

Minimum Eligibility Requirements		Source #
Summary	Minimum eligibility requirements for this measure should match those of Energy Star qualified convection ovens.	11
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	Energy Star Half Size – Cooking Energy Efficiency ≥ 70%, Idle Energy Rate ≤ 1.0 kW Full Size – Cooking Energy Efficiency ≥ 70%, Idle Energy Rate ≤ 1.6 kW	11
Rating Standard		11
Testing/Certifications	NSF/ANSI Standard 4, Commercial Cooking, Rethermalization and Powered Hot Food Holding and Transport Equipment using ASTM F1496, Standard Test Method for Performance of Convection Ovens.	11

Baseline	Source
Baseline equipment efficiency values used to calculate energy savings are as follows: – 65% Cooking Energy Efficiency – 2.0 kW Idle Energy Rate – Full Size, 1.5 kW Idle Energy Rate – Half Size – 0.0732 kWh/lb ASTM Energy to Food	12

<table>
<tr><th>Savings Calculation Summary</th><th>Source #</th></tr>
<tr><td>Savings Estimate</td><td>3,059 kWh (Half-Size), 3,020 kWh (Full-size)</td><td>12</td></tr>
<tr><td>Savings Calculation Methodology</td><td>The Regional Technical Forum (RTF) calculated energy usage for both baseline and energy-efficient equipment using a common set of input assumptions for daily pre-heats, pre-heat time, operating hours, pounds of food cooked per day, and ASTM energy to food (kWh/lb). The energy savings are the difference in energy usage from the baseline to the energy-efficient equipment.
<table>
<tr><th>Performance</th><th>Baseline Model</th><th>Energy Efficient Model</th></tr>
<tr><td>Preheat Time (min)</td><td>15</td><td>15</td></tr>
<tr><td>Number of Preheats per Day</td><td>1</td><td>1</td></tr>
<tr><td>Preheat Energy (kWh)</td><td>1</td><td>0.9</td></tr>
<tr><td>Idle Energy Rate (kW)</td><td>1.5</td><td>*0.81 / **1.40</td></tr>
<tr><td>Heavy Load Cooking Energy Efficiency (%)</td><td>65%</td><td>*73% / **74%</td></tr>
<tr><td>Production Capacity (lbs/hr)</td><td>45</td><td>*53 / **81</td></tr>
<tr><td>Operating Hours/Day</td><td>15</td><td>15</td></tr>
<tr><td>Operating Days/Year</td><td>324</td><td>324</td></tr>
<tr><td>Pounds of Food Cooked per Day</td><td>100</td><td>100</td></tr>
<tr><td>ASTM Energy to Food (kWh/lb)</td><td>0.0732</td><td>0.0732</td></tr>
<tr><td>Daily Energy Consumption (kWh)</td><td>30.7</td><td>21.2</td></tr>
<tr><td>Annual Energy Consumption (kWh)</td><td>9,921</td><td>6,862</td></tr>
<tr><td>Annual Energy Savings (kWh/yr)</td><td colspan="2">*3,059 / **3,020</td></tr>
</table>
*Half-Size
**Full-Size</td><td>12</td></tr>
<tr><td>RTF Alignment</td><td>Not Aligned. Savings Deflator of 55% based on ENERGY STAR product availability was not included.</td><td>12</td></tr>
</table>

Cost Calculation Summary		Source #
Cost Estimate	Full Size - $901 Half Size - $710	12
Costs Utilized to Determine Incremental Cost	The incremental costs were determined using analysis from the Regional Technical Forum (RTF) comparing baseline equipment costs to energy-efficient equipment costs for full-size and half-size convection ovens.	12
Development of Deemed Incremental Cost	RTF obtained costs for multiple baseline and energy-efficient equipment models and used the difference in average costs between the two.	12

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-purchase application	
Measure Parameters	To qualify for incentives, equipment must be listed on the ENERGY STAR Commercial Ovens Product List.	20
Required Verification for Processing	Current ENERGY STAR Commercial Ovens Product List at the time the equipment was purchased showing the brand and model number of the equipment.	20

Table 1-6: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source#
Incremental Cost						12
– Half-Size	$710	$710	$710	$710	$710	
– Full-Size	$901	$901	$901	$901	$901	
kWh/Year Saved						12
– Half-Size	3,059	3,059	3,059	3,059	3,059	
– Full-Size	3,020	3,020	3,020	3,020	3,020	
kW/Month Saved						12
– Half-Size	0.35	0.35	0.35	0.35	0.35	
– Full-Size	0.35	0.35	0.35	0.35	0.35	
Incentive						19
– Half-Size	$350	$350	$350	$350	$350	
– Full-Size	$350	$350	$350	$350	$350	
Unit	Oven	Oven	Oven	Oven	Oven	12
Measure Life	10	10	10	10	10	12

Table 1-7: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	ENERGY STAR	2013	ENERGY STAR® Program Requirements For Commercial Ovens	Version 2.0	Product Specification for Commercial Ovens	4	N/A	U.S. Department of Energy	http://www.energystar.gov/products/specs/sites/products/files/Commercial%20Ovens%20Final%20Version%202%200%20Specification_0.pdf?fb19-f71a
2	U.S. Department of Energy	2006	Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
3	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
4	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
5	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
6	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
7	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
8	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
9	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
10	Consortium for Energy Efficiency	2011	High Efficiency Specifications for Commercial Convection Ovens	N/A	N/A	1	N/A	Consortium for Energy Efficiency	http://library.cee1.org/sites/default/files/library/7504/CEE_Convection_Ovens_Specification_Final.pdf
11	U.S. Department of Energy	2009	Energy Efficiency Requirements for Convection Ovens	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www.energystar.gov/index.cfm?c=ovens.pr_crit_comm_ovens

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
12	Regional Technical Forum (RTF)	2013	Commercial: Cooking Equipment – Convection Ovens Measure Workbkook	Version 2.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/measure.asp?id=97
13	Northwest Power and Conservation Council	2013	Measure Workbook: Cooking	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
14	Avista Utilities	2013	Commercial Food Service Equipment Program	N/A	N/A	1	N/A	Avista Utilities	http://www.avistautilities.com/business/rebates/washington/Documents/WA_food_services_0213.pdf
15	Bonneville Power Administration	2013	Conservation Program Implementation Manual	October, 2013	N/A	54	N/A	Bonneville Power Administration	https://www.bpa.gov/energy/n/archives/pdf/2014-02-2014_Updated_October_2013_ImplementationManual.pdf
16	Energy Trust of Oregon	2013	Existing Buildings Standard Incentives	N/A	N/A	10	N/A	Energy Trust of Oregon	http://energytrust.org/library/forms/BE_PI_IncentiveBooklet.pdf
17	Pacific Gas & Electric Company	2013	Food Service Rebate Catalog	N/A	N/A	3	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/foodservice_catalog_final.pdf
18	Puget Sound Energy	2013	Qualified Convection Ovens	N/A	N/A	1	N/A	Puget Sound Energy	http://pse.com/savingsandenergycenter/ForBusinesses/Documents/8ConvectionOvens.pdf http://pse.com/savingsandenergycenter/ForBusinesses/Pages/Commercial-Kitchen-Equipment.aspx
19	Rocky Mountain Power	2013	Incentives for food service equipment	N/A	N/A	N/A	N/A	Rocky Mountain Power	http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/Business/Save_Energy_Money/UT_wattsmart_Business_Food_Service_Incentives.pdf
20	U.S. Department of Energy	2013	ENERGY STAR Commercial Ovens Product List	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://downloads.energystar.gov/bi/qplist/Commercial_Ovens_Product_List.pdf

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
21	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available

2.1.8 Electric Griddle

Measure Category	Measure Type	Measure Name
Food Service Equipment	Cooking Equipment	Griddle

Description (s)	Source
From the Food Service Technology Center, "a metal plate heated from underneath by gas burners or electric elements." Griddles generally include a thermostat for controlling the amount of heat delivered to the metal plate and may vary in size, power input, and griddle plate construction depending on the food product.	

Measure Research Summary	Source
ENERGY STAR maintains a specification for energy efficiency griddles with two tiers, differentiated by the normalized energy rate. No federal efficiency standards exist for griddles, nor have they been considered by RTF or CEE. Energy Star recently suspended the cooking-energy efficiency requirements, due to issues with variability in ASTM testing standards. EPA anticipates updating this specification with the revised version of ASTM F1605 when it is complete and plans to reinstate the cooking efficiency requirement for ENERGY STAR certification and verification at that time. Energy Star Commercial kitchen equipment calculator assumes Tier 2 efficiencies, all electric models currently on ES list meet Tier 2 requirements. See Table 1-1 for a detailed breakout of measure research reporting sources.	3

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
					No data published by CEE	1
					Measure not addressed by DEER	2
Energy Star Tier 1	Cooking Energy Efficiency ≥ 70% Normalized Idle Energy Rate ≤ 355 W/ ft²	N/A	N/A	N/A	Tier 1 effective May 8, 2009	3
Energy Star Tier 2	Cooking Energy Efficiency ≥ 70% Normalized Idle Energy Rate ≤ 320 W/ ft² Production Capacity-40	Cooking Energy Efficiency ≥ 65% Normalized Idle Energy Rate ≤ 400 W/ ft² Production Capacity-35	$0	2,595 kWh/yr	Tier 2 effective Jan 1, 2011 Annual hours-4,380 (12 hrs/day, 365 days/yr) Griddle width -3 feet Griddle depth -2 feet Preheats/day – 1 Preheat length -15 min Food cooked/day-100 lbs Life- 12 yrs	3
FSTC Energy Efficient Griddle	Preheat Energy (kWh) – 2.00 Idle Energy Rate (kW) – 1.76 Heavy-Load Energy Efficiency (%) – 75% Production Capacity (lbs/h) – 49.0	Preheat Energy (kWh) – 4.00 Idle Energy Rate (kW) – 2.40 Heavy-Load Energy Efficiency (%) – 60% Production Capacity (lbs/h) – 35.0	NA	3,974 kWh/yr	Griddle width -3 feet Operating Hours per Day (h/day) -12 Operating Days per Year (d/year) -365 Number of Preheats per Day (#/day) -1 Pounds of Food Cooked per Day (lbs/day) -100 http://www.fishnick.com/saveenergy/tools/calculators/egridcalc.php	3
					No data from RTF	4
					No data from DOE	5
Energy Star Restaurant Griddle	70% cooking efficiency	Non-Energy Star	$229 /bldg	943 kWh/yr/bldg	Data based on the Restaurant market segment	6
					Colorado DSM Market Potential does not address electric commercial griddles	7

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
					No data from 6th NW	8
Energy Star Tier 1	Cooking Energy Efficiency -70% Idle Energy Rate- 355 W	Cooking Energy Efficiency -65% Idle Energy Rate- 400 W	$459	1,886 kWh/yr		9
Energy Star Tier 2	Cooking Energy Efficiency -70% Idle Energy Rate- 320 W	Cooking Energy Efficiency -65% Idle Energy Rate- 400 W	$816	2,595 kWh/yr		9
3rd party Eval						10

Code Research	Source
A review of applicable energy codes determined there are no current minimum energy efficiency requirements for this measure. See Table 1-2 for a detailed breakout of code research reporting sources.	11-18

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Electric Griddle	Code of Federal Regulations, Title 10	N/A	N/A	N/A	11
Electric Griddle	DOE Efficiency Rulemakings	N/A	N/A	N/A	12
Electric Griddle	IECC 2006	N/A	N/A	N/A	13
Electric Griddle	IECC 2009	N/A	N/A	N/A	14
Electric Griddle	IECC 2012	N/A	N/A	N/A	15
Electric Griddle	WSEC 2012	N/A	N/A	N/A	16
Electric Griddle	Title 24 – 2008	N/A	N/A	N/A	17
Electric Griddle	Title 24 – 2013	N/A	N/A	N/A	18

Peer Utility DSM Review	Source
Two of the peer utilities reviewed currently offer incentives for electric griddles. Incentives range from $250 to $300 per griddle. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	20,26

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Commercial Griddle (Electric)	Must meet or exceed heavy load cooking efficiency of ≥70% utilizing ASTM Standard F1275.	$250.00	Avista - Food Service Equip. Rebates	20
Commercial Griddle (Electric)	Must have a tested heavy load cooking energy efficiency of 70 percent or greater and an idle energy rate of 355watts per square foot of cooking surface or less, utilizing ASTM F1275.	$300.00	PG&E - Food Services	26

Vendor Survey	Source #
The vendors surveyed do offer electric high-efficiency kitchen equipment but requests are very low because of the increased incremental cost as well as the predominance of natural gas cooking equipment in this region. They noted that most customers primarily consider cost when making the decision to replace old cooking equipment. Vendors identified that while there is a increased trend in manufacturers providing high-efficiency products, customers looking for replacement equipment remain focused on purchasing the lowest cost product available and consider used equipment in most cases. New equipment is primarily sold into the new construction market. Incentives help, but are generally not enough to cover the full incremental cost difference (estimated at 30% higher). Most commercial kitchens are plumbed with natural gas, and natural gas equipment is preferentially purchased over electric-powered equipment. Institutional and government customers are the primary purchasers of high-efficiency food service equipment since procurement guidelines require it.	

Vendor Name	Vendor Description
Commercial Kitchen Supply	Distributor, Wholesaler, and Retailer
Bintz Restaurant Supply	Wholesaler/Retailer of standard and high efficiency refrigeration, cooking, and dishwashing equipment
True Manufacturing	Manufacturer, primarily of refrigeration equipment

Measure Recommendations		Source #
Summary	While participation has been very low and Energy Star reports an incremental cost of $0, PacifiCorp should continue to offer prescriptive incentives for Electric Griddles to qualifying customers based on potential energy savings and a recognition of Energy Star testing requirements. However, with all currently listed Energy Star qualified electric griddles meeting or exceeding Tier 2 requirements, offering should be modified to only one incentive/efficiency level, and the incentive amount should be significantly lowered. Deemed savings/costs and eligibility requirements should be updated to align with current market data, as detailed below.	3
Implement?	Yes	
Incentive	Prescriptive customer incentives should be lowered to align with updated incremental costs and equal approximately $0.05/kWh saved. Energy Star qualified electric griddle - $130/measure	

Minimum Eligibility Requirements		Source #
Summary	ENERGY STAR Tier 2 Specifications Cooking Energy Efficiency ≥ 70% Normalized Idle Energy Rate ≤ 320 W/ ft²	3
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	ENERGY STAR Qualified	
Rating Standard	Cooking Efficiency, Normalized Idle Energy Rate	
Testing/Certifications	As managed by ENERGY STAR	

Baseline	Source
ENERGY STAR default baseline as found in the ENERGY STAR Commercial Kitchen Equipment Calculator. (Food Service Technology Center (FSTC) research on available models, 2011) Note that the ENERGY STAR baseline has a higher efficiency than the FSTC base efficiency model See Table 1-2 for a detailed description of the applicable codes used to establish the baseline.	3,28

Savings Calculation Summary		Source #
Savings Estimate	2,595 kWh/yr	
Savings Calculation Methodology	The savings estimate was generated using the calculation methodology of the ENERGY STAR Commercial Kitchen Equipment Calculator with the default inputs:	3

Input Parameters	Electric	
	Conventional	**ENERGY STAR**
Average daily operation	12	
Annual days of operation	365	
Food cooked per day (lbs)	100	
Griddle depth (feet)	2	
Griddle width (feet)	3	
Cooking energy efficiency	65%	70%
Production capacity (lbs/hr/sq ft)	5.83	6.67
Number of preheats per day	1	1
Preheat length (min)	15	15
Preheat energy rate (W/sq ft)	2,667	1,333
Idle energy rate (W/sq ft)	400	320
ASTM energy to food (Wh/lbs)	139	
Equipment lifetime (years)	12	

Savings Estimate Conclusions		
RTF Alignment	Not applicable	

Cost Calculation Summary		Source #
Cost Estimate	$0/measure	
Costs Utilized to Determine Incremental Cost	As reported by ENERGY STAR, Calculator-"Difference between a similar ENERGY STAR and non-qualifying model, EPA research using AutoQuotes, 2012"	3
Development of Deemed Incremental Cost		

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-Purchase Application	
Measure Parameters	ENERGY STAR minimum efficiency requirements – Tier 2	
Required Verification for Processing	▪ ENERGY STAR product listing	

Table 1-6: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source#
Incremental Cost	$0	$0	$0	$0	$0	3
kWh/Year Saved	2,595 kWh/yr	2,595 kWh/yr	2,595 kWh/yr	2,595 kWh/yr	2,595 kWh/yr	3
kW/Month Saved	0.48 kW	0.48 kW	0.48 kW	0.48 kW	0.48 kW	
Recommended Incentive	$130/unit	$130/unit	$130/unit	$130/unit	$130/unit	
Unit	Measure	Measure	Measure	Measure	Measure	
Measure Life	12 yrs	12 yrs	12 yrs	12 yrs	12 yrs	3

Table 1-7: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)	2013	N/A	N/A	N/A	N/A	Boston	CEE	www.cee1.org
2	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
3	ENERGY STAR	2013	ENERGY STAR® Program Requirements Product Specification for Commercial Griddles	V.1.2	N/A	N/A	N/A	U.S. Dept. of Energy	http://www.energystar.gov/ia/partners/product_specs/program_reqs/Commercial_Griddles_Program_Requirements.pdf?0da1-79e0
4	Regional Technical Forum	2013	N/A	N/A	N/A	N/A	N/A	N/A	http://rtf.nwcouncil.org//measures/
5	Department of Energy (DOE)								
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	
8	The Sixth Northwest Electric Power and Conservation Plan	2009	N/A	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available
10	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy	2013	Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
12	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
19	Arizona Public Service	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20	Avista Utilities	2013	Washington commercial Food Services Equipment Rebate Agreement	N/A	N/A	5	N/A	Avista	http://www.avistautilities.com/business/rebates/washington/Documents/WA_food_services_0213.pdf

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
21	Bonneville Power Administration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
22	Energy Trust of Oregon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23	Idaho Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24	Mid-American Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	Nevada Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	Pacific Gas & Electric Company	2013	Food Services Rebate Catalog	N/A	N/A	4	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/foodservice_catalog_final.pdf
27	Puget Sound Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	Xcel Energy (Colorado)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

2.1.9 Electric Steam Cooker

Measure Category	Measure Type	Measure Sub-Type
Food Service Equipment	Cooking Equipment	Steam Cooker

Description (s)	Source
Commercial Steam Cooker – Also referred to as a "compartment steamer," a device with one or more food steaming compartments in which the energy in the steam is transferred to the food by direct contact. Models may include countertop models, wall-mounted models and floor-models mounted on a stand, pedestal or cabinet-style base.	1

Measure Research Summary	Source
Several applicable energy-efficiency data sources were reviewed. In most cases, the energy efficiency requirements deffered to Energy Star, including both equipment sizing as well as cooking energy efficiency and idle energy rate requirements. One data source used Energy Star efficiency requirements as a baseline for comparison to higher-efficiency requirements. The variances shown for incremental costs and savings data is due to a difference in baseline and high-efficiency equipment efficiency values. See Table 1-1 for a detailed breakout of measure research reporting sources.	10, 11, 12, 13, 20

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Steam Cooker: Electric Steamers	All Sizes – 50% Cooking Efficiency 3-Pan – 400 W Idle Energy Rate 4-Pan – 530 W Idle Energy Rate 5-Pan – 670 W Idle Energy Rate ≥ 6-Pan – 800 W Idle Energy Rate	N/A	N/A	N/A	Tiers 1A and 1B energy performance levels are equivalent to ENERGY STAR® performance levels. CEE includes an additional water consumption performance requirement	10
Electric Steam Cooker	All Sizes – 50% Cooking Efficiency 3-Pan – 400 W Idle Energy Rate 4-Pan – 530 W Idle Energy Rate 5-Pan – 670 W Idle Energy Rate ≥ 6-Pan – 800 W Idle Energy Rate	All Sizes – Boiler-based 26% Cooking Efficiency, 1,000 W Idle Energy Rate	3-Pan - $630 4-Pan - $1,210 5-Pan - $0 ≥ 6-Pan - $0	3-Pan – 11,562 kWh 4-Pan – 14,275 kWh 5-Pan – 16,934 kWh 6-Pan – 19,600 kWh 10-Pan – 31,474 kWh	N/A	11, 20

Measure Description	Efficiency Requirements	Baseline Description	Incremental Cost	Energy Savings	Notes:	Source #
Electric Steamer	All Sizes - 68% Cooking Efficiency, 260 W Idle Energy Rate	Current Practice All Sizes – 26% Cooking Efficiency, 1,000 W Idle Energy Rate	3-Pan $352 4-Pan $134 5-Pan - $263 6-Pan $58 ≥10-Pan $3,992 All Sizes $420	3-Pan 20,866 kWh/yr 4-Pan 27,960 kWh/yr 5-Pan 35,055 kWh/yr 6-Pan 42,150 kWh/yr ≥10-Pan 70,529 kWh/yr	RTF savings include a 38% derate to account for market saturation of Energy Star products	12
Efficient Electric Steamer	All Sizes – 65% Cooking Efficiency 3-Pan – 220 W Idle Energy Rate 5-Pan – 230 W Idle Energy Rate 6-Pan – 250 W Idle Energy Rate	All Sizes – 50% Cooking Efficiency 3-Pan –400 W Idle Energy Rate 5-Pan – 670 W Idle Energy Rate 6-Pan – 800 W Idle Energy Rate	3-Pan – $132 5-Pan – $215 6-Pan – $209	3-Pan – 888 kWh/yr 5-Pan – 1,671 kWh/yr 6-Pan – 2,020 kWh/yr	The baseline used for this source utilizes the Energy Star minimum efficiency requirements	13
Electric Steamers	3, 4, 5 & 6 Pan Sizes Tier 1 – Energy Star Tier 2 – Cooking Efficiency ≥ 65%, 230 W Idle Energy Rate	All Sizes – 26% Cooking Efficiency, 330 W Idle Energy Rate per pan	Tier 1 - $2,490 Tier 2 - $2,675	Tier 1 – 3,773 kWh/yr Tier 2 – 4,436 kWh/yr		21

Code Research	Source
A review of applicable energy codes determined there are no current minimum energy efficiency requirements for this measure. See Table 1-2 for a detailed breakout of code research reporting sources.	2, 3, 4, 5, 6, 7, 8, 9

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Electric Steam Cooker	Code of Federal Regulations, Title 10, Parts 430-431	N/A	N/A	N/A	2
Electric Steam Cooker	DOE Efficiency Rulemakings	N/A	N/A	N/A	3
Electric Steam Cooker	IECC 2006	N/A	N/A	N/A	4
Electric Steam Cooker	IECC 2009	N/A	N/A	N/A	5
Electric Steam Cooker	IECC 2012	N/A	N/A	N/A	6
Electric Steam Cooker	WSEC 2012	N/A	N/A	N/A	7
Electric Steam Cooker	Title 24 – 2008	N/A	N/A	N/A	8
Electric Steam Cooker	Title 24 – 2013	N/A	N/A	N/A	9

Peer Utility DSM Review	Source #
Several applicable peer utility DSM offerings were reviewed for this measure. In most cases, the energy efficiency requirements are based on or defered to Energy Star, including both equipment sizing as well as cooking energy efficiency and idle energy rate requirements. One utility had higher minimum efficiency requirements than Energy Star. Incentive offerings for this measure vary between $100 and $1,350 depending on equipment size. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	14, 15, 16, 17, 18

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Commercial Steam Cooker (Electric)	All Sizes – 50% Cooking Efficiency	3-Pan $450 4-Pan $570 5-Pan $640 6-Pan $720	Energy efficiency requirements match those for Energy Star for cooking energy efficiency	14
Electric Steamer	All Sizes ≥ 65% Cooking Efficiency 3-Pan ≤ 220 W Idle Energy Rate 5-Pan ≤ 230 W Idle Energy Rate 6-Pan ≤ 250 W Idle Energy Rate	3-Pan $100 5-Pan $200 6-Pan $200		15
Gas or Electric Steam Cooker	Energy Star	$1,300		16
Commercial Steam Cooker (Electric)	Heavy load (potato) cooking energy efficiency ≥ 50%, utilizing ASTM F1484.	$1,250	Energy efficiency requirements match those for Energy Star for cooking energy efficiency	17
Connectionless Steamers	Energy Star	$750		18
Electric Steam Cooker	Tier 1 – Energy Star Qualified Tier 2 – Heavy Load Efficiency ≥ 65%, Idle Energy Rate ≤ 0.23 kW	Tier 1 - $750 Tier 2 - $840		19

Table 1-4: Vendor Survey Results Summary

Vendor Name	Vendor Description
Commercial Kitchen Supply	They are a distributor and sells firm
Bintz Restaurant Supply	Wholesaler/Retailer of standard and high efficiency refrigeration, cooking, and dishwashing equipment
True Manufacturing	Manufacturer, primarily of refrigeration equipment

Vendor Survey Findings Summary
The vendors surveyed do offer electric high-efficiency kitchen equipment but requests are very low because of the increased incremental cost as well as the predominance of natural gas cooking equipment in this region. They noted that most customers primarily consider cost when making the decision to replace old cooking equipment. Vendors identified that while there is a increased trend in manufacturers providing high-efficiency products, customers looking for replacement equipment remain focused on purchasing the lowest cost product available and consider used equipment in most cases. New equipment is primarily sold into the new construction market. Incentives help, but are generally not enough to cover the full incremental cost difference (estimated at 30% or higher). Most commercial kitchens are plumbed with natural gas, and natural gas equipment is preferentially purchased over electric-powered equipment. Institutional and government customers are the primary purchasers of high-efficiency food service equipment since procurement guidelines require it.

Measure Recommendations		Source #
Summary	PacifiCorp should continue to offer prescriptive incentives for Electric Steam Cookers to qualifying customers. Deemed savings/costs and eligibility requirements should be updated to align with current market data, as detailed below.	
Implement?	Yes	
Incentive	Prescriptive customer incentives should be lowered to align with updated incremental costs, be more aligned with incentives offered by other regional utilities and equal approximately 70% of incremental customer cost (Tier 1 = $185 (Source 13) Tier 2 = $420 (Source 12)). . Tier 1 – $130 Tier 2 – $300	

Minimum Eligibility Requirements		Source #
Summary	Tier 1 – ENERGY STAR Qualified 50% Cooking Energy Efficiency for all sizes, 3-Pan –400 W Idle Energy Rate 4-Pan – 530 W Idle Energy Rate 5-Pan – 670 W Idle Energy Rate 6-Pan and larger – 800 W Idle Energy Rate Tier 2 – 68% Cooking Efficiency for all sizes, 3-Pan –400 W Idle Energy Rate 4-Pan – 530 W Idle Energy Rate 5-Pan – 670 W Idle Energy Rate 6-Pan & larger – 800 W Idle Energy Rate	13, 20
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	Tier 1 – ENERGY STAR, Tier 2 – ENERGY STAR with increased cooking efficiency to 68%	13, 20
Rating Standard	Heavy load cooking energy efficiency	11
Testing/Certifications	ASTM Standard F1484-99, *Test Method for the Performance of Steam Cookers*	11

Baseline	Source
26% Cooking Efficiency, 1,000 W Idle Energy Rate for all sizes,	13, 20

<table>
<tr><th>Savings Calculation Summary</th><th>Source #</th></tr>
<tr><td>Savings Estimate</td><td>
<table>
<tr><td>(kWh/yr)</td><td>3-pan</td><td>4-pan</td><td>5-pan</td><td>6-pan</td><td>10-pan</td></tr>
<tr><td>Tier 1</td><td>11,562</td><td>14,275</td><td>16,934</td><td>19,600</td><td>31,474</td></tr>
<tr><td>Tier 2</td><td>20,866</td><td>27,960</td><td>35,055</td><td>42,150</td><td>70,529</td></tr>
</table>
Tier 1 – 18,769 kWh/yr per cooker
Tier 2 – 39,312 kWh/yr per cooker
</td><td>12, 20</td></tr>
<tr><td>Savings Calculation Methodology</td><td>Tier 1 - The savings estimate is an average of the 3, 4, 5, 6 and 10 pan sizes using the calculation methodology of the ENERGY STAR Commercial Kitchen Equipment Calculator with the default inputs and eligibility criteria defined in v1.2 of the Energy Star specification:
<table>
<tr><td>Input Parameter</td><td>Conventional</td><td>Tier 1 – Energy Star v 1.2</td></tr>
<tr><td>Water Use</td><td>40 (gal/hr)</td><td>3 (gal/hr)</td></tr>
<tr><td>Time in Constant Steam Mode</td><td>40%</td><td>40%</td></tr>
<tr><td>Cooking Energy Efficiency</td><td>26%</td><td>50%</td></tr>
<tr><td>Production Capacity per pan</td><td>23.3 (lbs/hr)</td><td>16.7 (lbs/hr)</td></tr>
<tr><td># of Preheats per day</td><td>1</td><td>1</td></tr>
<tr><td>Preheat Length</td><td>15 min</td><td>15 min</td></tr>
<tr><td>Preheat energy rate</td><td>6,000 W</td><td>6,000 W</td></tr>
<tr><td>Idle Energy Rate</td><td>1,000 W</td><td>3 – pan = 400 W
4 – pan = 530 W
5 – pan = 670 W
6 – pan & larger = 800 W</td></tr>
<tr><td>ASTM Energy to Food</td><td>30.8 Wh/pound</td><td>30.8 Wh/pound</td></tr>
<tr><td>Operating Hours per day</td><td>12</td><td>12</td></tr>
<tr><td>Operating Days per year</td><td>365</td><td>365</td></tr>
</table>
Tier 2 – Eligibility criteria is aligned with RTF Active UES Measure for Commercial Steamers. Savings estimate is an average of the 3, 4, 5, 6, and 10 pan sizes listed in version 2.0 of the RTF work book.
</td><td>20</td></tr>
<tr><td>RTF Alignment</td><td>Tier 2 is aligned with RTF eligibility requirements and calculated savings . Tier 1 is aligned with ENERGY STAR eligibility requirements and calculated savings. Both Tiers us the same baseline as listed above.</td><td>12, 13, 20</td></tr>
</table>

Cost Calculation Summary		Source #
Incremental Cost Estimate	Tier 1 – $185 (Source 12) Tier 2 – $420 (Source 13)	12, 13
Costs Utilized to Determine Incremental Cost	The costs used to determine the incremental costs include a sample of both energy-efficient equipment costs and baseline equipment costs from the Regional Technical Forum as well as cost data included in the Northwest Power and Conservation Council measure workbook.	12, 13
Development of Deemed Incremental Cost	Tier 1 incremental costs are based on subtracting Tier1-Tier 2 incremental costs provided by the Northwest Power and Conservation Council from Regional Technial Forum incremental costs between Tier 2 energy-efficient compliant equipment cost samples and average baseline equipment cost samples for all equipment sizes. Tier 2 incremental costs are based on Northwest Power and Conservation Council cost data between a Tier 1 Energy Star eligibile unit and a Tier 2 65% cooking efficiency unit.	12, 13

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-purchase application	
Measure Parameters	Tier 1 – Use ENERGY STAR minimum efficiency requirements Tier 2 – Use ENERGY STAR idle energy usage requirements with increased cooking efficiency of 65%	11, 20
Required Verification for Processing	Manufacturer specifications detailing the tested heavy load potato cooking energy efficiency utilizing ASTM Standard F1484.	11

Table 1-6: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source #
Incremental Cost						12, 13
– Tier 1	$185	$185	$185	$185	$185	
– Tier 2	$420	$420	$420	$420	$420	
kWh/Yr Saved						13, 20
– Tier 1	18,769	18,769	18,769	18,769	18,769	
– Tier 2	39,312	39,312	39,312	39,312	39,312	
kW/Mth Saved						20
– Tier 1	4.3	4.3	4.3	4.3	4.3	
– Tier 2	6.0	6.0	6.0	6.0	6.0	
Incentive						
– Tier 1	$130	$130	$130	$130	$130	
– Tier 2	$300	$300	$300	$300	$300	
Unit	Measure	Measure	Measure	Measure	Measure	12
Measure Life	9 years	9 years	9 years	9 years	9 years	12

Table 1-7: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	ENERGY STAR	2013	ENERGY STAR® Program Requirements For Commercial Steam Cooker	Version 1.2	Product Specification for Commercial Steam Cookers	N/A	N/A	U.S. Department of Energy	http://www.energystar.gov/ia/partners/product_specs/program_reqs/Commercial_Steam_Cookers_Program_Requirements.pdf?800f-19cc
2	U.S. Department of Energy	2006	Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
3	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
4	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
5	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
6	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
7	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
8	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
9	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
10	Consortium for Energy Efficiency	2011	Efficiency Requirements for Qualifying Products: Electric Steamers	N/A	N/A	1	N/A	Consortium for Energy Efficiency	http://library.cee1.org/sites/default/files/library/4245/CEE%20Steamer%20Specification%2020100901%20FINAL.pdf
11	ENERGY STAR	2003	Energy Efficiency Requirements for Convection Ovens	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www.energystar.gov/index.cfm?c=steamcookers.pr_crit_steamcookers

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
12	Regional Technical Forum (RTF)	2013	Commercial: Cooking Equipment – Steamer Measure Workbkook	Version 2.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/measure.asp?id=101
13	Northwest Power and Conservation Council	2013	Measure Workbook: Cooking	N/A	N/A	Steamers	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
14	Avista Utilities	2013	Commercial Food Service Equipment Program	N/A	N/A	1	N/A	Avista Utilities	http://www.avistautilities.com/business/rebates/washington/Documents/WA_food_services_0213.pdf
15	Bonneville Power Administration	2013	EnergySmart-BPA-T&Cs	N/A	N/A	1	N/A	Energy Smart	http://energysmartonline.org/documents/EnergySmart-BPA-T&Cs.pdf
16	Energy Trust of Oregon	2013	Existing Buildings Standard Incentives	N/A	N/A	10	N/A	Energy Trust of Oregon	http://energytrust.org/library/forms/BE_PI_IncentiveBooklet.pdf
17	Pacific Gas & Electric Company	2013	Food Service Rebate Catalog	N/A	N/A	5	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/foodservice_catalog_final.pdf
18	Puget Sound Energy	2013	Qualified Convection Ovens	N/A	N/A	1	N/A	Puget Sound Energy	http://pse.com/savingsandenergycenter/ForBusinesses/Pages/Commercial-Kitchen-Equipment.aspx http://pse.com/savingsandenergycenter/ForBusinesses/Documents/6Steamers.pdf
19	Rocky Mountain Power	2013	Incentives for food service equipment	N/A	N/A	N/A	N/A	Rocky Mountain Power	http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/Business/Save_Energy_Money/UT_wattsmart_Business_Food_Service_Incentives.pdf
20	ENERGY STAR	2013	ENERGY STAR Commercial Kitchen Equipment Calculator	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xlsx

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
21	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available

2.1.10Electric Commercial Fryer

Measure Category	Measure Type	Measure Name
Food Service Equipment	Cooking Equipment	Fryer

Description (s)	Source
An appliance, including a cooking vessel, in which oil is placed to such a depth that the cooking food is essentially supported by displacement of the cooking fluid rather than by the bottom of the vessel. Heat is delivered to the cooking fluid by means of an immersed electric element or band-wrapped vessel (electric fryers), or by heat transfer from gas burners through either the walls of the fryer or through tubes passing through the cooking fluid (gas fryers). a. Standard Fryer: A fryer with a vat that measures >12 inches and < 18 inches wide, and a shortening capacity > 25 pounds and < 65 pounds. b. Large Vat Fryer: A fryer with a vat that measures > 18 inches and < 24 inches wide, and a shortening capacity > 50 pounds. c. Split Vat Fryer: A standard or large vat fryer with an internal wall that separates the vat into two equal sides.	3

Measure Research Summary	Source
High-efficiency specifications for commercial fryers are maintained by ENERGY STAR, RTF, FSTC and CEE. Fryers are generally rated on their cooking efficiency and idle energy watts by size of the fryer (standard vs. large). Energy Star has high visibility among manufacturers and customers in the marketplace, and is recognized as the predominant high-efficiency label.	

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
CEE-Electric Standard Vat, Open Deep Fat Fryer	>80% Heavy Load (French Fry) cooking efficiency < 1000 watts at idle energy rate	Standard Efficiency	$2,768.00	80% or 881 kWh	Assuming usage of 12 hours per day, 365 days a year, and 8 year measure life. No details on baseline parameters Besides efficiency requirements, no distinction between standard open and Large Vat Requirements aligned with Energy Star Program Guide April 2009	1
CEE-Electric Large Vat, Open Deep Fat Fryers	>80% Heavy Load (French Fry) cooking efficiency < 1,100 watts energy at idle rate					1
Energy Star-Standard Open Deep-Fat Electric Fryer	Energy Star V-2 Heavy Load Cooking >80% Idle Energy 1,000 watts	Heavy Load Cooking - 75% Idle Energy - 1,050 watts	$210	1,179	Life-12 yrs Annual hours-5,840 Baseline-non-qualifying model, EPA research using AutoQuote 2012 No anticipated changes to specifications Savings,costs,baseline from commercial kitchen equipment calculator	3
Energy Star-Large Vat Open Deep-Fat Electric Fryer	Energy Star V-2 Heavy Load Cooking >80% Idle Energy - 1,100 watts	Heavy Load Cooking - 70% Idle Energy - 1,350 watts	$0	2,659	Life-12 yrs Annual hours-4,380 Baseline-non-qualifying model, EPA research using AutoQuote 2012 No anticipated changes to specifications Savings,costs,baseline from commercial kitchen equipment calculator	3
Efficient Electric Fryer	Average Energy Star V2.0 models Heavy Load Cooking - 85% Idle Energy - 860 watts	Current Practice-Average economy grade fryers FSTC Heavy Load Cooking - 75% Idle Energy -	$688	2449 kWh	Life-8yrs Annual hours-4,772 Weighted average values for standard and large vat fryers. Cost reported in 2006$	4

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
		1,200 watts			RTF discounts annual savings based on a Energy Star market penetration rate of 15% Info found in RTF measure workbook V2.0 Note that RTF has changed analysis structure since the previous market characterization. Previously, RTF considered an efficiency case of less than 10,000 kWh per year. (equivilant to a HL=86.6% and IE=772 W)	
FSTC Energy Efficient Fryer	Preheat Energy (kWh) – 1.9 Idle Energy Rate (kW) – 0.86 Heavy-Load Energy Efficiency (%) – 85%	Preheat Energy (kWh) – 2.4 Idle Energy Rate (kW) – 1.2 Heavy-Load Energy Efficiency (%) – 75%	Not reported	3,061 kWh/yr	Annual hrs – 5,110 Production Capacity (lbs/h) – 71	5

Code Research	Source
A review of applicable energy codes determined there are no current minimum energy efficiency requirements for this measure. See Table 1-2 for a detailed breakout of code research reporting sources.	

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Commercial Fryer	Code of Federal Regulations, Title 10	N/A	N/A	N/A	N/A
Commercial Fryer	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A
Commercial Fryer	IECC 2006	N/A	N/A	N/A	N/A
Commercial Fryer	IECC 2009	N/A	N/A	N/A	N/A
Commercial Fryer	IECC 2012	N/A	N/A	N/A	N/A
Commercial Fryer	WSEC 2012	N/A	N/A	N/A	N/A
Commercial Fryer	Title 24 – 2008	N/A	N/A	N/A	N/A
Commercial Fryer	Title 24 – 2013	N/A	N/A	N/A	N/A

Peer Utility DSM Review	Source
Most utilities offer incentives for ENERGY STAR qualified fryers between $125 and $250 per vat. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Commercail Fryer (Electric)	EnergyStar Qualified or must have a tested heavy load cooking efficiency of ≥ 80% utilizing ASTM Standard F1361.	$150.00	Avista - Food Service Equip. Rebates	20
Electric Fryer	Must install new high efficiency electric fryer. Unit must meet RTF efficiency standards. Qualifying model list found on page 28.	$125.00	BPA - Food Service	21
Commercial electric fryer(vat width<18 inches)	ENERGYSTAR® specifications or must have a tested heavy load cooking energy efficiency of 80% and an idle energy rate less than or equalto 1,000 W, utilizingASTM Standard F1361.	$200.00	PG&E - Food Services • Installation addressmust have a commercial electric account with PG&E.	26
Commercial electric large vat fryer (vatwidth≥18 inches)	ENERGYSTAR specifications or must have a tested heavy load cooking energy efficiency of 80% and an idle energy rate less than or equal to 1,100W, utilizing ASTM Standard F2144.	$200.00	PG&E - Food Services • Installation addressmust have a commercial electric account withPG&E.	26
Energy Star Electric Fryer	Energy Star qualified equipment.	$250.00	PSE - Food Services	27

Vendor Survey	Source #
The vendors surveyed do offer electric high-efficiency kitchen equipment but requests are very low because of the increased incremental cost as well as the predominance of natural gas cooking equipment in this region. They noted that most customers primarily consider cost when making the decision to replace old cooking equipment. Vendors identified that while there is a increased trend in manufacturers providing high-efficiency products, customers looking for replacement equipment remain focused on purchasing the lowest cost product available and consider used equipment in most cases. New equipment is primarily sold into the new construction market. Incentives help, but are generally not enough to cover the full incremental cost difference (estimated at 30% or higher). Most commercial kitchens are plumbed with natural gas, and natural gas equipment is preferentially purchased over electric-powered equipment. Institutional and government customers are the primary purchasers of high-efficiency food service equipment since procurement guidelines require it. See Table 1-4 and Table 1-5 for a summary and detailed breakout of reporting sources.	

Vendor Name	Vendor Description
Commercial Kitchen Supply	Distributor, Wholesaler, and Retailer
Bintz Restaurant Supply	Wholesaler/Retailer of standard and high efficiency refrigeration, cooking, and dishwashing equipment
True Manufacturing	Manufacturer, primarily of refrigeration equipment

Measure Recommendations		Source #
Summary	This measure has seen very little customer participation, due for the most part to a gas dominated market. Measure is still justified base on potential energy savings. Energy Star provides a good standard and RTF analysis recognizes an efficiency level above base Energy Star Standard. Recommend continuing the two tiered incentive offerings with updated cost, savings, and incentive levels based on new information. All recommendations are based upon the minimum eligibility requirements listed below.	3, 4
Implement?	Yes	
Incentive	Minor changes, see details as described below.	

Minimum Eligibility Requirements		Source #
Summary	Tier 1- Energy Star Qualified Tier 2- Energy Star w/ Heavy Load Efficiency ≥ 85%, Idle Energy Rate ≤ 860 W	3,4
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	Tier 1 - Energy Star Qualified Tier 2 - Energy Star w/ Heavy Load Efficiency ≥ 85%, Idle Energy Rate ≤ 860 W	3,4
Rating Standard	As managed by Energy Star	3
Testing/Certifications	ASTM Standard Test Method F1361 or F2144	3

Baseline	Source
FSTC Base Efficiency Fryer Preheat Energy (kWh) – 2.4 Idle Energy Rate (kW) – 1.2 Heavy-Load Energy Efficiency (%) – 75% Production Capacity (lbs/h) – 71	5

Savings Calculation Summary		Source #
Savings Estimate	Tier 1 – 1,689 kWh/yr Tier 2 – 2,881 kWh/yr	
Savings Calculation Methodology	Tier 1 – Energy Star Preheat Energy (kWh) – 1.9 Idle Energy Rate (kW) – 1.0 Heavy-Load Energy Efficiency (%) – 80% Production Capacity (lbs/h) – 71 Tier 2 RTF Efficient case Preheat Energy (kWh) – 1.9 Idle Energy Rate (kW) – 0.86 Heavy-Load Energy Efficiency (%) – 85% Production Capacity (lbs/h) – 71	3, 4, 5
Savings Estimate Conclusions	The Energy Star commercial kitchen equipment calculator was used to calculate savings for both efficiency tiers. The calculator was modified to match FSTC base efficiency fryer specifications and RTF operating parameters (Estimated Operating Hours/Day, Estimated Preheat Time (min), Estimated Number of preheats/Day).	3, 4, 5
RTF Alignment	Tier 1 is not aligned; Efficient case values differ. Tier 2 is not aligned; RTF annual savings (2,449 kWh/yr) is discounted by Energy Star market penetration rate (15%). Recommended savings value is not discounted.	4

Cost Calculation Summary		Source #
Cost Estimate	Tier 1 - $210 Tier 2 - $769	3, 4
Costs Utilized to Determine Incremental Cost	Tier 1 – Utilizes the incremental cost as reported by Energy Star Tier 2 – Utilizes the incremental cost as reported by RTF, without 2006$ deflation multipler	3, 4
Development of Deemed Incremental Cost	Energy Star incremental costs: “Difference between a similar ENERGY STAR and non-qualifying model, EPA research using AutoQuotes, 2012” RTF incremental costs: “Source: August 23, 2012 Work Paper PGECOFST102, Revision 4, PGECOFST102R4Fryers.doc”	3, 4

Incentive Delivery/Verification Details		Source #
Delivery Method	Post Purchase Application	
Measure Parameters	Tier 1: Equipment must be listed on Energy Star qualified list. Electric Fryers only. Tier 2: In addition to Energy Star listing, equipment must achieve a Heavy Load Efficiency ≥ 85% and Idle Energy Rate ≤ 860 W.	3
Required Verification for Processing	▪ Energy Star listing	3

Table 1-6A: Tier 1 Incremental Costs, Savings, Recommended Incentives and Unit Details all States

Measure Description	Tier 1 (All States)	Tier 2 (All States)	Source#
Incremental Cost	$210	$769	3, 4
kWh/Year Saved	1,689 kWh	2,881 kWh	3,4
kW/Month Saved	0.34 kW	0.34 kW	
Recommended Incentive	$150	$300	
Unit	Measure	Measure	
Measure Life	12 yrs	12 yrs	3

Table 1-7: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)	2009	Commercial Fryers Program Guide	N/A	N/A	N/A	Boston	CEE	http://www.ceeforum.org/sites/default/files/library/4388/cee_commkit_programdesignguidancefryers_2009_pdf_45372.pdf
2	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
3	ENERGY STAR	2013	ENERGY STAR® Program Requirements Product Specification for Commercial Fryers	V.2.0	N/A	N/A	N/A	U.S. Dept. of Energy	http://www.energystar.gov/ia/partners/product_specs/program_reqs/Commercial_Fryers_Program_Requirements.pdf?ad0d-512f
4	Regional Technical Forum	2013	Commercial: Cooking Equipment – Fryers	Version 2.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org//measures/measure.asp?id=98
5	Food Service Technology Center (FSTC)	2013	Electric Fryer Life-Cycle Cost Calculator	N/A	N/A	N/A	N/A	FSTC	http://www.fishnick.com/saveenergy/tools/calculators/efryercalc.php
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
8	The Sixth Northwest Electric Power and Conservation Plan	2009	Measure Workbook: Cooking Supply Curve	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available
10	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy		Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
12	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	N/A	
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
19	Arizona Public Service	2013	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
20	Avista Utilities	2013	Washington Commercial Food Service Equipment Rebate Agreement	N/A	N/A	3	N/A	Avista	http://www.avistautilities.com/business/rebates/washington/Documents/WA_food_services_0213.pdf
21	Bonneville Power Administration	2013	Rebate Worksheet	N/A	N/A	2	N/A	ES Energy Smart	http://energysmartonline.org/rebates/index.html
22	Energy Trust of Oregon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A a
23	Idaho Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A a
24	Mid-American Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A a
25	Nevada Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	Pacific Gas & Electric Company	2013	Food Services Rebate Catalog	N/A	N/A	4	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/foodservice_catalog_final.pdf
27	Puget Sound Energy	2013	Commercial Kitchen Equipment Rebate from Washington Utilities	N/A	N/A	2	N/A	Puget Sound Energy	http://pse.com/savingsandenergycenter/ForBusinesses/Documents/WURERebateApplication2013.pdf
28	Xcel Energy (Colorado)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A a

2.1.11 Portable Classroom 366/365 Thermostat

Measure Category	Measure Type	Measure Name
HVAC	Controls and Thermostats	366/365 Day Thermostat

Description (s)	Source
Programmable thermostats are defined by ENERGY STAR as "a device that enables the user to set one or more time periods each day when a comfort setpoint temperature is maintained and one or more time periods each day when an energy-saving setpoint temperature is maintained. A programmable thermostat may be capable of controlling one or more zones of a conditioned space." 366/365 day programmable thermostats allow daily scheduling of the setpoint and setback temperatures. They have practical use in buildings where an ordinary 7-day thermostat would have to be frequently reprogrammed during periods where the buildings is occupied weekly, followed by extended periods of vacation, commonly found in K-12 school schedules.	

Measure Research Summary	Source
Little information on 366/365 thermostats was available among the resources scoped for review in this study. Standard programmable thermostats (5-2 and 7-day) are required by energy code in nearly all jursdictions and are the predominant option used when replacing existing single-zone thermostats, and were previously sunset from the program. 366/365 thermostats still offer savings potential in targeted applications (i.e. K-12 schools, portable classrooms) and should continue to be offered through the program. See Table 2-1 for a detailed breakout of measure research reporting sources.	

Table 2-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Portable Classroom Control	365/366 day thermostatic setback capibility All sizes in portable classrooms with mechanical cooling	Standard thermostat	$250	WY = 1070 kWh/yr CA = 1340 kWh/yr ID = 1210 kWh/yr UT =1210 kWh/yr WA = 1130 kWh/yr		9

Code Research	Source
Various codes require the use of thermostatic setback controls with automatic time clocks or programmable controls cabable of performing setback cabablilites. Some require the programming to allow scheduling for seven different daily schedules per week. Others require the building occupant the ability to program temperature set points for at least four periods within 24 hours. None require 366/365 day programming capability. See Table 2-2 for a detailed breakout of code research reporting sources.	13, 14, 16, 17, 18

Table 2-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Thermostats	Title 24	Section 112	N/A	All unitary heating and/or cooling systems including heat pumps that are not controlled by a central energy management control system (EMCS) shall have a setback thermostat.	17, 18
Thermostats	IECC 2006, 2009	503.2.4.3, 403.2.4.3	N/A	Automatic time clock or programmable controls shall be capable of starting and stopping the system for seven different daily schedules per week	13, 14
Thermostats	WSEC 2012	403.2.4.3.2	N/A	Automatic time clock or programmable controls shall be capable of starting and stopping the system for seven different daily schedules per week	16

Peer Utility DSM Review	Source
Utility incentives range between $20 - $50 per standard programmable thermostat. Requirements for thermostats vary between 7-day, 5-2, and 5-1-1 programming types with the 7-day being the most common. Only one peer utility (PSE) offers incentives for 366/365 day programmable thermostats, which also offers additional incentives for occupancy-based control integrated into the 366/365 day thermostat. See Table 2-3 for a detailed breakout of utility DSM review reporting sources.	19, 23, 24, 29

Table 2-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Programmable Thermostats	Must replace non-programmable thermostat. Thermostat must be capable of 7-day, 5-2, or 5-1-1 programming	$40	Must replace non-programmable thermostat	19
Programmable Thermostats	7-day, two-stage setback thermostat. Thermostat must have 7-day	$40	Must replace non-programmable thermostat	23
Programmable Thermostats	Must have 2 or more setbacks: 5-1-1, 5-2 or 7-day	$20		24
Portable Classroom Control	To be eligible a thermostat must be 365-day programmable. Must be approved list of equipment.	$250	Additional $50 for Occupancy sensor damper control. Additional $50 for occupancy sensor lighting control. Pre-approval is not required unless the selected equipment is not on the eligible list.	29

Measure Recommendations		Source #
Summary	No recommended changes to incentives, reported savings, or costs. Recommend adjusting eligibility to also allow occupancy-based controllers installed in a portable classroom to increase program participation. Occupancy-based controller should approximate a correctly scheduled 366/365 thermostat functionality. All recommendations are based upon the minimum eligibility requirements listed below.	
Implement?	Yes	
Incentive	$150/thermostat - No changes recommended	

Minimum Eligibility Requirements		Source #
Summary	Controller must: - Be installed in portable classroom with mechanical cooling unoccupied during summer months and - Have either 365/366 day thermostatic or occupancy based setback capability	
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	N/A	
Rating Standard	N/A	
Testing/Certifications	N/A	

Baseline	Source
The baseline is a standard code-compliant portable classroom with a 7-day programmable thermostat with identical schedule and setpoints throughout the year. See Table 2-2 for a detailed description of the applicable codes used to establish the baseline.	9

<table>
<tr><th>Savings Calculation Summary</th><th>Source #</th></tr>
<tr><td>Savings Estimate</td><td>CA- 1,340 kWh/yr
ID- 1,310 kWh/yr
UT- 1,210 kWh/yr
WA- 1,130 kWh/yr
WY – 1,070 kWh/yr</td><td>9</td></tr>
<tr><td>Savings Calculation Methodology</td><td>Savings were estimated using an energy model of a portable classroom. The model is a 896 sq. ft. portable classroom with 9 ft. ceilings, heated and cooled by a code-compliant, packaged, single-zone heat pump (Cooling EIR = 0.35, Heating EIR = 0.45). The building has assembly U-values as follows:
<table>
<tr><td>Exterior Face</td><td>U-value (btu/hr sf)</td><td>Square Ft.</td></tr>
<tr><td>Roof</td><td>0.076</td><td>896</td></tr>
<tr><td>Walls</td><td>0.051</td><td>1,080</td></tr>
<tr><td>Floor</td><td>0.083</td><td>896</td></tr>
<tr><td>Windows</td><td>0.468 (center of glass)</td><td>24 (east/west facing)</td></tr>
</table></td><td></td></tr>
<tr><td>Savings Estimate Conclusions</td><td>No new information requires savings to be adjusted from current values.</td><td>9</td></tr>
<tr><td>RTF Alignment</td><td>N/A</td><td></td></tr>
</table>

Cost Calculation Summary		Source #
Cost Estimate	$250/ controller	9
Costs Utilized to Determine Incremental Cost	Incremental costs were estimated based on market costs provided by vendors.	
Development of Deemed Incremental Cost	No new information requires savings to be adjusted from current values.	9

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-purchase Application	
Measure Parameters	Controller must: - Be installed in portable classroom with mechanical cooling unoccupied during summer months and - Have either 365/366 day thermostatic or occupancy based setback capability	
Required Verification for Processing	▪ Thermostat controller specification sheet ▪ Invoice	

Table 2-4: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	CA	ID	UT	WA	WY	Source#
Incremental Cost	$250	$250	$250	$250	$250	9
kWh/Year Saved	1,340	1,310	1,210	1,130	1,070	9
kW/Month Saved	0	0	0	0	0	9
Recommended Incentive	$150	$150	$150	$150	$150	9
Unit	Controller	Controller	Controller	Controller	Controller	9
Measure Life	11 yrs	11 yrs	11 yrs	11 yrs	11 yrs	9

Table 2-5: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)	2013	N/A	N/A	N/A	N/A	Boston	CEE	www.cee1.org
2	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
3	ENERGY STAR	2009	Programmable Thermostats Specification	v.1.2	N/A	N/A	N/A	ENERGY STAR	http://www.energystar.gov/index.cfm?c=archives.thermostats_spec
4	Regional Technical Forum	2011	Residential: Heating/Cooling – Electronic Thermostats	v.2.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/measure.asp?id=132
5	Department of Energy (DOE)								
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	
8	The Sixth Northwest Electric Power and Conservation Plan	2009	N/A	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available
10	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy	2006	Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
12	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
19	Arizona Public Service	2013	Thermostats & Load Control	N/A	N/A	1	N/A	Arizona Public Service	http://www.aps.com/en/business/savemoney/solutionsbyequipmenttype/Pages/thermostats-and-energy-controls.aspx
20	Avista Utilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
21	Bonneville Power Administration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
22	Energy Trust of Oregon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23	Idaho Power	2013	Easy Upgrades HVAC/Controls Worksheet	N/A	N/A	1 & 2	N/A	Idaho Power	https://www.idahopower.com/pdfs/EnergyEfficiency/EasyUpgrades/worksheet_HVAC.pdf
24	Mid-American Energy	2013	Heating and Cooling Equipment Program	N/A	N/A	3	N/A	Mid-American Energy	http://www.midamericanenergy.com/ee/include/pdf/ia_hvac.pdf
25	Nevada Power	N/A	N/A	N/A	N/A	N/A		N/A	N/A
26	Pacific Gas & Electric Company	N/A	N/A	N/A	N/A	N/A		N/A	N/A
27	Puget Sound Energy	2013	PSE Forms	N/A	N/A	N/A	N/A	Puget Sound Energy	http://energysmartonline.org/rebates/index.html
28	Xcel Energy (Colorado)	N/A	N/A	N/A	N/A	N/A		N/A	N/A
29	Puget Sound Energy	2013	Portable Classroom Rebates	N/A	N/A	N/A	N/A	Puget Sound Energy	http://pse.com/savingsandenergycenter/ForBusinesses/Pages/Portable-Classroom-Controls.aspx

2.1.12 Demand-Controlled Kitchen Ventilation

Measure Category	Measure Type	Measure Name
Food Service	Ventilation	Demand Controlled Kitchen Ventilation

Description (s)	Source
Commercial kitchen hood controls for the exhaust and make-up air systems used in conjuction with variable speed fan motors. The proposed system must modulate both the exhaust and make-up air flow rates in response to a measured parameter such as temperature in the exhaust hood. This measure produces significant reduction in both fan energy and space conditioning energy usage.	7, 26

Measure Research Summary	Source
Several applicable energy-efficiency data sources were reviewed, including a number of case studies commissioned by peer utilities. All of the sources referenced show fan energy savings as the predominant source of savings and an approximate simple pay back period of a couple of years when upgrading from a constant volume kitchen exhaust system to one that varies exhaust flow based on demand. Savings vary dramatically based on the usage profile of the kitchen. Higher usage/occupancy increases reported savings. Not all of the sources included the interactive cooling and heating savings associate with this measure. However, those that do show a minimum of approximately 15% additional savings from reduced heating and cooling losses. See Table 1-1 for a detailed breakout of measure research reporting sources.	29, 30, 31, 32, 33, 34, 35

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Commercial Kitchen Demand Control Ventilation	n/a	Backshelf, Proximity, or Low Profile Hood. Operate 24 hours per day. Climate Zone 3. Design Exhaust Airflow Rate (CFM) = 7082 cfm.	n/a	Fan Energy (kWh) & Demand (kW) Reduced: 32% Estimated annual heating and coolin energy savings (kBtu): 109,715	No cooling savings provided. It assumed that outside air is only heated as needed.	29
"Intelli-Hood" Kitchen Demand Control Ventilation	n/a	Constant volume kitchen exhaust and make-up air hood	$18,000	Averages Annaul Fan energy savings = 31,375 kWh Heating Energy Savings = 3,800 therms Cooling Energy Savings = 9,900 kWh	Average payback period of study conducted by the Food Service Technology Center equal to 1.9 years. Efficiency of HVAC systems unknown.	30
Commercial Kitchen System Efficiency Options	n/a	Constant volume kitchen exhaust and make-up air hood	Average cost = $21,833 (2 hotels / 1 fast food restaurant)	Average Savings = $11,025 (73,500 kWh)	3 retrofit projects included in study by SCE. Cooling and Heating savings excluded.	31
Demand Controlled Ventilation — Commercial kitchen ventilation hoods with demand controlled capability	n/a	Contant volume kitchen exhaust and make-up air hood	n/a	n/a	$400 lump-sum (Total) For all Fans under 5 HP. Note that the rebate is not per HP. $120 per Exhaust Fan HP for fans equal to or greater than 5HP but less than 7.5HP $100 per exhaust Fan HP for Fans greater	32

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
					than 7.5HP	
Demand Ventilation in Commercial Kitchens An Emerging Technology Case Study - Intercontinental Mark Hopkins Hotel	n/a	Contant volume kitchen exhaust and make-up air hood	$15,000	127 kWh per day	No cooling or heating savings associated with the case study. The kitchen had scheduled cooking times, which meant there were also many slow periods with little cooking and therefore little demand for full-speed operation of the exhaust hood. The kitchen operated 24 hours a day, 7 days per week, which increased the number of hours in which the fans could run at low speed.	33
Demand Ventilation in Commercial Kitchens An Emerging Technology Case Study - Supermarket	n/a	Contant volume kitchen exhaust and make-up air hood	$18,000	31,370 kWh per year	The annual savings shown here are only the annual fan energy savings. Cooling and heating savings not included.	34
Demand Control Ventilation for Commercial Kitchen Hoods (2 hotels and 3 fast food restaurants)	n/a	Contant volume kitchen exhaust and make-up air hood	n/a	150,819 kWh 60,439 kWh 9,871 kWh 15,061 kWh 7,884 kWh per year	Important to note that all 5 test cases had different hood configurations and operational hours.	35

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #

Code Research	Source
While many of the energy code and standards reviewed address either kitchen exhaust ventilation or demand controlled ventillation, none of the applicable energy codes address demand controlled ventilation for kitchen exhaust hoods. See Table 1-2 for a detailed breakout of code research reporting sources.	11-18

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Demand Controled Kitchen Exhaust Hoods	Code of Federal Regulations	N/A	N/A	N/A	11
Demand Controled Kitchen Exhaust Hoods	DOE Efficiency Rulemakings	N/A	N/A	N/A	12
Demand Controlled Ventillation	IECC 2006	N/A	N/A	N/A	13
Demand Controlled Ventillation	IECC 2009	C403.2.5.1	Spaces >500 ft2 (50 m2) with an average occupancy load of 40 people per 1000 ft2 (93 m2) of floor area (as established in Table 403.3 of the International Mechanical Code)	Ventilation provided for process loads is excluded from requirement.	14
Demand Controlled Ventillation	IECC 2012	C503.2.5.1	Spaces >500 ft2 (50 m2) with an average occupancy load of 25 people per 1000 ft2 (93 m2) of floor area (as established in Table 403.3 of the International Mechanical Code)	Ventilation provided for process loads is excluded from requirement.	15
Kitchen hoods	WSEC 2012	C403.2.5.4.1 Kitchen hoods	N/A	Code does not address efficiency of fan system or operation.	16
Kitchen hoods	Title 24 – 2008	N/A	N/A	N/A	17
Kitchen hoods	Title 24 – 2013	140.9	N/A	Code does not address efficiency of fan system or operation.	18

Peer Utility DSM Review	Source
Only one of the peer utilities scoped offers a prescriptive incentive for demand controlled kitchen ventilation. PG&E offers $350/exhaust fan hp. Measure research revealed that another utility offers incentive from $100 to $120 per exhaust fan hp. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	26,32

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Demand Ventilation Control Electric	Must be a new commercial kitchen exhaust hood control system that is installed in a new or an existing, dedicated commercial kitchen exhaust hood and make-up air system. The control system must be used in conjunction with variable-speed fan motor controls. Only pre-approved control systems will qualify for this incentive. Installation address must have a commercial electric account with PG&E.	$350.00 per exhaust fan hp		26
Demand Ventilation Control Electric	For all Fans under 5 HP.	$400 lump-sum (Total)	Note that the rebate is not per HP.	32
Demand Ventilation Control Electric	Exhaust fan 5 < hp < 7.5	$120 per exhaust fan hp		32
Demand Ventilation Control Electric	Exhaust fan hp > 7.5	$100 per exhaust fan hp		32

Measure Recommendations		Source #
Summary	The implementation of demand controlled ventilation for the exhaust and make-up air fans serving kitchen hoods can produce both fan and HVAC energy savings. As is evident from the case studies and source information previously referenced, the potential savings are highly dependant upon the operational hours of the kitchen, the weather station of the project site and the design and efficiency of the mechanical systems serving the kitchen. It is recommended that PacifiCorp include this measure but should utilize a simplified calculated approach for the quantification of savings and incentive.	29, 30, 31, 32, 33, 34, 35
Implement?	Yes.	
Incentive	This measure should be incentivized at a rate of $0.15/kWh saved, based on savings calculated by a utility calculator tool.	

Minimum Eligibility Requirements		Source #
Summary	Must be a new commercial kitchen exhaust hood control system that is installed in an existing, dedicated commercial kitchen exhaust hood and make-up air system. The control system must be used in conjunction with variable-speed fan motor controls.	26
New Construction	No	
Retrofit	Yes	
Efficiency Criteria	Variable speed fans must be controlled by sensors to vary fan speed depending upon demand of kitchen.	26
Rating Standard	n/a	
Testing/Certifications	n/a	

Baseline	Source
The baseline operation of existing kitchen hoods are the constant volume exhaust and make-up air fans operating at full speed during all hours of kitchen operation.	30, 31

Savings Calculation Summary		Source #
Savings Estimate	Savings are highly dependant upon the operational hours of the kitchen, the weather station of the project site and the design and efficiency of the mechanical systems serving the kitchen. A simplified calculated approach should be developed in order to quantify the potential savings for each application for incentive.	29, 30, 31, 32, 33, 34, 35
Savings Calculation Methodology	The savings calculations in a simplified calculated approach should take the operational hours, the weather station, fan motor efficiency, and the design and efficiency of the mechanical systems serving the kitchen into account.	29, 30, 31, 32, 33, 34, 35
Savings Estimate Conclusions	Application site specific information will need to be gathered for each applicant.	
RTF Alignment	N/A – Not an RTF Measure.	

Cost Calculation Summary		Source #
Cost Estimate	Varies by Application	
Costs Utilized to Determine Incremental Cost	Actual retrofit costs submitted by the customer should be used for incremental costs.	
Development of Deemed Incremental Cost	n/a	

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-Purchase Customer Incentive	
Measure Parameters	As required by a calculation tool, including but not limited to: operational hours, climate (CDD/HDD), fan motor efficiency, and the design and efficiency of the HVAC system	
Required Verification for Processing	On-Site post-installation inspection recommended to verify calculator tool input.	

Table 1-4: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source#
Incremental Cost	Actual	Actual	Actual	Actual	Actual	
kWh/Year Saved	Calculated	Calculated	Calculated	Calculated	Calculated	
kW/Month Saved	Calculated	Calculated	Calculated	Calculated	Calculated	
Recommended Incentive	$0.15/ kWh saved	$0.15/ kWh saved	$0.15/ kWh saved	$0.15/ kWh saved	$0.15/ kWh saved	
Unit	Measure	Measure	Measure	Measure	Measure	
Measure Life	12	12	12	12	12	

Table 1-5: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)	N/A	Commercial Kitchen Ventilation	N/A	N/A	N/A	N/A	CEE	http://www.cee1.org/commercial-kitchen-ventilation
2	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
3	ENERGY STAR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No Product Category Available
4	Regional Technical Forum	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No Product Category Available
5	Department of Energy (DOE)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No Product Category Available
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	
8	The Sixth Northwest Electric Power and Conservation Plan	2009	Demand Control Ventilation Restaurant Hood Supply Curve	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available
10	Navigant Consulting, Inc.	2009-2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy	2006	Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/pkg/CFR-2006-title10-vol3/pdf/CFR-2006-title10-vol3-part430.pdf http://www.gpo.gov/fdsys/pkg/CFR-2006-title10-vol3/pdf/CFR-2006-title10-vol3-part431.pdf
12	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
19	Arizona Public Service	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20	Avista Utilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
21	Bonneville Power Administration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
22	Energy Trust of Oregon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23	Idaho Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24	Mid-American Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	Nevada Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	Pacific Gas & Electric Company	2013	K-12 Schools Rebate Catalog	N/A	N/A	26	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/rebatesincentives/schools_catalog.pdf
27	Puget Sound Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	Xcel Energy (Colorado)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
29	CEE	2013	Summary of Commercial Kitchen Demand Control Ventilation Field Test Reports	N/A	N/A	N/A	Milwaukee	CEE	http://www.cee1.org/commercial-kitchen-ventilation
30	California Energy Commission	2008	Variable Speed Comes to the (Kitchen) 'Hood	N/A	N/A	N/A	N/A	PIER Buildings Program	http://www.energy.ca.gov/2008publications/CEC-500-2008-068/CEC-500-2008-068-FS.PDF
31	California Building Energy Efficiency Standards	2013	Codes and Standards Enhancement Initiative (Case)	N/A	N/A	24	N/A	California Utilities Statewide Codes and Standards Team	http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Nonresidential/Covered_Processes/2013_CASE_ASHRAE5-KitchenVent_09.30.2011.pdf
32	Xcel Energy (Minnesota)	2012	Foodservice Equipment Information	n/a	n/a	2	n/a	Xcel Energy	https://www.xcelenergy.com/staticfiles/xe/Marketing/Files/MN-Bus-Foodservice-Info-

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
			Sheet						Sheet.pdf
33	Food Service Technology Center	2004	Demand Ventilation in Commercial Kitchens	Report 5011.04.17	n/a	n/a	San Francisco	Food Service Technology Center	www.fishnick.com
34	Food Service Technology Center	2006	Demand Ventilation in Commercial Kitchens	Report 5011.06.13	n/a	n/a	Northern California	Food Service Technology Center	www.fishnick.com
35	Design & Engineering Services, Southern California Edison	2009	Demand Control Ventilation for Commercial Kitchen Hoods	n/a	n/a	n/a	(Multiple) California	n/a	http://www.melinkcorp.com/pdf/Case-Studies/Southern%20Cal%20Edison_com_kitch_hoods_final_report.pdf

2.1.13 Anti-Sweat Heater Controls

Measure Category	Measure Type	Measure Name
Food Service	Grocery Refrigeration	Anti-Sweat Heater Controls

Description (s)	Source
Install equipment that senses the relative humidity in the air outside of the display case and reduces or turns off the glass door (if applicable) and frame anti-sweat heaters at low humidity conditions. Equipment must control heaters on frame (mullion) and door, if equipped with heater.	28

Measure Research Summary	Source
A commercial refrigeration equipment manufacturer typically sizes anti-sweat heaters according to the ambient temperature and humidity of a particular operating environment. The end-user must maintain that environment to prevent condensation (i.e., fog) from forming on surfaces such as display case glass. Anti-sweat heater controllers modulate the operation of anti-sweat heaters by reducing anti-sweat heater power when humidity is low. Anti-sweat heater controllers operate most effectively when a constant ambient dew point cannot be maintained. However, in the context of the test procedure, anti-sweat heater controllers will solely serve to keep the power to the anti-sweat heaters at the levels necessary for the test conditions. These fixed conditions of 75 °F and 55 percent relative humidity are the conditions that ASHRAE has determined to be generally representative of commercial refrigeration equipment operating environments and which DOE has adopted in its test procedure. While anti-sweat heater controllers could modulate the anti-sweat power to a further extent in the field so as to account for more or less extreme ambient conditions, a system equipped with anti-sweat heater controllers will not likely exhibit significantly different performance at test procedure conditions than a unit with anti-sweat heaters tuned for constant 75/55 conditions. Therefore, DOE did not consider anti-sweat heater controllers in the engineering analysis. See Table 1-1 for a detailed breakout of measure research reporting sources.	4, 5

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Controls Anti-Sweat Heat - Low Temp	EER = 5.12 / Controlled rated anti-sweat wattage = 83.0W / FLH = 6773	N/A	N/A	N/A	Derived from DOE 2.2R runs for NW climate zones. Complete mix of input values not specified; general case and load values are provided. These are derived from Hussman catalog, field experience, and thousands of parametric runs (GrocerSmart Engineering Specification v3.0)	4
Controls Anti-Sweat Heat -Med Temp	EER = 11.16 / Controlled rated anti-sweat wattage = 46.4W / FLH = 5585	N/A	N/A	N/A	Derived from DOE 2.2R runs for NW climate zones. Complete mix of input values not specified; general case and load values are provided. These are derived from Hussman catalog, field experience, and thousands of parametric runs (GrocerSmart Engineering Specification v3.0)	4
Anti-Sweat (Humidistat) Controls Grocery	Anti-Sweat (Humidistat) Controls Grocery	No Anti-Sweat (Humidistat) Controls	N/A	978	Values repersent low temp anit-sweat heat control and not an average of Low and Med Temp	5
Anti-Sweat (Humidistat) Controls Health	Anti-Sweat (Humidistat) Controls Health	No Anti-Sweat (Humidistat) Controls	N/A	978	Values repersent low temp anti-sweat heat control and not an average of Low and Med Temp	5
Anti-Sweat (Humidistat) Controls	Anti-Sweat (Humidistat)	No Anti-Sweat (Humidistat)	N/A	978	Values repersent low temp anit-sweat heat	5

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Restaurant	Controls Restaurant	Controls			control and not an average of Low and Med Temp	
Anti-Sweat (Humidistat) Controls School	Anti-Sweat (Humidistat) Controls School	No Anti-Sweat (Humidistat) Controls		978	Values repersent low temp anit-sweat heat control and not an average of Low and Med Temp.	5

Code Research	Source
A review of applicable energy codes determined there are no current minimum energy efficiency requirements for this measure. See Table 1-2 for a detailed breakout of code research reporting sources.	

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Anti-Sweat Heater Controls	Code of Federal Regulations, Title 10	N/A	N/A	N/A	11
Anti-Sweat Heater Controls	DOE Efficiency Rulemakings	N/A	N/A	N/A	12
Anti-Sweat Heater Controls	IECC 2006	N/A	N/A	N/A	13
Anti-Sweat Heater Controls	IECC 2009	N/A	N/A	N/A	14
Anti-Sweat Heater Controls	IECC 2012	N/A	N/A	N/A	15
Anti-Sweat Heater Controls	WSEC 2012	N/A	N/A	N/A	16
Anti-Sweat Heater Controls	Title 24 – 2008	N/A	N/A	N/A	17
Anti-Sweat Heater Controls	Title 24 – 2013	N/A	N/A	N/A	18

Peer Utility DSM Review	Source
Incentives for anti-sweat heater controls are offered by a number of the utilities reviewed. Incentives and eligibility requirements are generally different for low-temperature and medium-temperature refrigeration cases. Eligibility requirements may vary by the type of refrigeration case (reach-in, chest or coffin), control methodology (humidity sensing or other) and case temperature (low, medium). Incentives may be established per linear foot of case width, or per case. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Multi Deck LT/MT, Reach-In LT/MT, Single Level LT/MT	Measure: Install device that senses the relative humidity in the air outside of the display case and reduces or turns off the glass door (if applicable) and frame anti-sweat heaters at low-humidity conditions. Technologies that turn off anti-sweat heaters based on sensing condensation (on the inner glass pane) also qualify. The incentive amount is based on the horizontal length of the case.	$12.00	Refrigeration - APS	19
Anti-Sweat Heater (ASH) Controls – with Energy Management System	Must install a device that controls the ASH load of reach-in doors. This measure is relevant for both MT and LT reach -in glass door cases. Existing Equipment Requirements: Medium temperature Case-Uncontrolled ASH present › .20 amps/ft of case (door rail, glass and/or frame heating element combined) Low Temperature Case-Uncontrolled ASH present › .37 amps/ft of case (door rail, glass and/or frame heating element combined). Replacement Equipment	$14.00	An additional separate rebate cannot be claimed for Standard doors to Low. No Anti-Sweat heat Doors for Low Temperature Reach-Ins	20

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
	Requirements: Must automatically modulate door ASH output based on environmental conditions (temperature or relative humidity) as measured by a sensor that is part of the control system.			
Anti-Sweat Heater (ASH) Controls – with Energy Management System – Med Temp	Must install a device that controls the ASH load of reach-in doors. This measure is relevant for both MT and LT reach -in glass door cases. Existing Equipment Requirements: Medium temperature Case-Uncontrolled ASH present › .20 amps/ft of case (door rail, glass and/or frame heating element combined) Low Temperature Case-Uncontrolled ASH present › .37 amps/ft of case (door rail, glass and/or frame heating element combined). Replacement Equipment Requirements: Must automatically modulate door ASH output based on environmental conditions (temperature or relative humidity) as measured by a sensor that is part of the control system.	$40.00	An additional separate rebate cannot be claimed for Standard doors to Low. No Anti-Sweat heat Doors for Low Temperature Reach-Ins	20
Anti-Sweat Heater (ASH) Controls – with Energy Management System – High Temp	Must install a device that controls the ASH load of reach-in doors. This measure is relevant for both MT and LT reach -in glass door cases. Existing Equipment Requirements: Medium temperature Case-Uncontrolled ASH present › .20 amps/ft of case (door rail, glass and/or frame heating element combined) Low	$50.00	An additional separate rebate cannot be claimed for Standard doors to Low. No Anti-Sweat heat Doors for Low Temperature Reach-Ins	20

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
	Temperature Case- Uncontrolled ASH present › .37 amps/ft of case (door rail, glass and/or frame heating element combined). Replacement Equipment Requirements: Must automatically modulate door ASH output based on environmental conditions (temperature or relative humidity) as measured by a sensor that is part of the control system.			
Anti-Sweat Heater (ASH) Controls	Must install a device that controls the ASH load of reach-in doors. This measure is relevant for both MT and LT reach-in glass. Medium temperature Case: Uncontrolled ASH present› .20 amps/ft of case (door rail,glass and/or frame heating element combined)	$40.00	BPA - Refrigeration	21
Anti-Sweat Heater (ASH) Controls	Must install a device that controls the ASH load of reach-in doors. This measure is relevant for both MT and LT reach-in glass. Low Temperature Case: Uncontrolled ASH present ›.39 amps/ft of case (door rail, glass and/or frame heating element combined)	$40.00	BPA - Refrigeration	21
Anti-Sweat Controls	Medium temperature case (between 1°F and 35°F), walk-in reach-in, coffin	$40.00	ETOG - Heat.2	22
Anti-Sweat Controls	Low temperature case (below 0°F), walk-in, reach-in, coffin	$50.00	ETOG - Heat.2	22
Anti-Sweat Heater (ASHI) Controls	Display refrigerators must be equipped with humidity	$25.00	PG&E - Refrigeration	26

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
	sensing controls that reduce the amount of power supplied to the heaters. Must sense the relative humidity in the air surrounding the display case and reduce or turn off the anti-sweat heaters of the glass door (if applicable) and door frame during periods of low humidity. Equivalent technologies that reduce or turn off anti-sweat heaters depending on the level of condensation on the inner glass pane may qualify. Rebate amount is based on the linear footage of the display case. Installation address must have a commercial electric account with PG&E.			
Anti-Sweat Heat - with Energy Management System-Med Temp	Installation must reduce energy consumption of anti-sweat by at least 50 percent in low temperature cases and 80 percent in medium temperature cases.	$14.00	PSE - Anti Sweat	27
Anti-Sweat Heat - with Energy Management System-Low Temp	Installation must reduce energy consumption of anti-sweat by at least 50 percent in low temperature cases and 80 percent in medium temperature cases.	$14.00	PSE - Anti Sweat	27
Anti-Sweat Heat - without Energy Management System-Med Temp	Installation must reduce energy consumption of anti-sweat by at least 50 percent in low temperature cases and 80 percent in medium temperature cases.	$40.00	PSE - Anti Sweat	27
Anti-Sweat Heat - without Energy Management System-	Installation must reduce energy consumption of anti-sweat by at least 50 percent	$50.00	PSE - Anti Sweat	27

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Low Temp	in low temperature cases and 80 percent in medium temperature cases.			
Anti-Sweat Heater Controls	Install equipment that senses the relative humidity in the air outside of the display case and reduces or turns off the glass door (if applicable) and frame anti-sweat heaters at low humidity conditions. Equipment must control heaters on frame (mullion) and door, if equipped with heater.	$60.00	XEC - Appliances	28

Measure Recommendations		Source #
Summary	PacifiCorp should offer prescriptive incentives for Anti-Sweat Heater Controls to qualifying customers.	
Implement?	Yes	
Incentive	Anti-Sweat Heater Controls – Low Temp = $16 per linear foot Anti-Sweat Heater Controls – Med Temp = $20 per linear foot These are typical mid-range incentive values offered by other peer utilities for medium and low temperature doors. Note that this assumes that the average case door is 2.5 feet wide.	21, 22, 26, 27, 28

Minimum Eligibility Requirements		Source #
Summary	Must install a device that reduces the energy consumption of the anti-sweat heaters by at least 50% for the glass door (if applicable) and door frame. Technologies that reduce energy consumption of anti-sweat heaters based on sensing humidity only. Does not apply to doors equiped with low/no anti-sweat heat. "Low temperature" covers evaporator temperatures below 0°F and "Medium temperature" covers evaporator temperatures between 1°F and 35°F. Does not apply to cases with already integrated controls.	4
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	Install equipment that senses the relative humidity in the air outside of the display case and reduces or turns off the glass door (if applicable) and frame anti-sweat heaters at low humidity conditions. Equipment must control heaters on frame (mullion) and door, if equipped with heater.	28
Rating Standard	n/a	
Testing/Certifications	n/a	

Baseline	Source
Heater Run Time: The baseline condition is the anti-condensate heaters operating 100% of the time when uncontrolled. **HVAC Cooling Load:** Constant parameter sources listed used for Store HVAC EER, Controlled Anti-Sweat Heater Wattage, In-Situ Derating Factor, ASH heat load to space, % of year store is cooling, and Case Full Load Hours. All stores assumed to use electric fuel as source for cooling. **HVAC Heating Load:** Constant parameter sources listed used for Store HVAC COP, Controlled Anti-Sweat Heater Wattage, In-Situ Derating Factor, ASH heat load to space, % of year store is heating, and Case Full Load Hours. Multiplied by percent of stores in PNW using electric as heating fuel (16%) and those that use gas (84%). Therm reduction contributes to total savings as a non-energy benefit. **Refrigeration Cooling Load:** Constant parameter sources listed used for EER, Controlled Anti-Sweat Heater Wattage, In-Situ Derating Factor, and ASH heat load to space. Annual EER value produced by EnergySmart Grocer takes into account full year operation, so FLH is 365.25 x 24 = 8,766 Hrs/yr.	4

Savings Calculation Summary		Source #
Savings Estimate	Anti-Sweat Heater Controls – Low Temp = 378.4 kWh per year per linear foot Anti-Sweat Heater Controls – Med Temp = 232.8 kWh per year per linear foot	4
Savings Calculation Methodology	Savings estimates are based on the results of the calculations produced by the RTF. kW=(kWh/yr)/(8,766 Hrs/yr) Low Temp- 0.043 kW Med Temp- 0.027 kW	4
Savings Estimate Conclusions	Savings estimates as produced by the RTF considered valid for use in the estimate of energy savings for medium temperature and low temperature doors on a per linear foot of case basis.	
RTF Alignment	Aligned. Values are equal to the results published by the RTF.	

Cost Calculation Summary		Source #
Cost Estimate	$42 per linear foot	4
Costs Utilized to Determine Incremental Cost	The installation cost estimate is based on the data provided by the RTF.	4
Development of Deemed Incremental Cost	RTF leveraged DEER 2011 data, adjusted for NW regional electrician labor rates. DEER 2011 lists $600 per ASH controller and $368.23 for the labor associated with the ASH controller [215]. The total cost (material and labor) is $968.23 per ASH controller for a 8-door (20 ft case).	4

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-purchase application	
Measure Parameters	The measure parameters to be communicated to the customer as required for delivery of incentive is the total linear feet of case for which anti-condensate heaters are to be installed. Note that equipment must control heaters on frame (mullion) and door, if equipped with heater.	28
Required Verification for Processing	Proof of installation and purchase of anti-condensate heater controls for all cases.	

Table 1-6: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source#
Incremental Cost	$42/linear foot	$42/linear foot	$42/linear foot	$42/linear foot	$42/linear foot	
kWh/Year Saved	Low Temp = 378.4 kWh per year per linear foot Med Temp = 232.8 kWh per year per linear foot	Low Temp = 378.4 kWh per year per linear foot Med Temp = 232.8 kWh per year per linear foot	Low Temp = 378.4 kWh per year per linear foot Med Temp = 232.8 kWh per year per linear foot	Low Temp = 378.4 kWh per year per linear foot Med Temp = 232.8 kWh per year per linear foot	Low Temp = 378.4 kWh per year per linear foot Med Temp = 232.8 kWh per year per linear foot	
kW/Month Saved	Low Temp-0.043 kW Med Temp-0.027 kW	Low Temp-0.043 kW Med Temp-0.027 kW	Low Temp-0.043 kW Med Temp-0.027 kW	Low Temp-0.043 kW Med Temp-0.027 kW	Low Temp-0.043 kW Med Temp-0.027 kW	
Recommended Incentive	Low Temp = $16 per linear foot Med Temp = $20 per linear foot	Low Temp = $16 per linear foot Med Temp = $20 per linear foot	Low Temp = $16 per linear foot Med Temp = $20 per linear foot	Low Temp = $16 per linear foot Med Temp = $20 per linear foot	Low Temp = $16 per linear foot Med Temp = $20 per linear foot	
Unit	Linear foot	Linear foot	Linear foot	Linear foot	Linear foot	
Measure Life	8	8	8	8	8	4

Table 1-7: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)	N/A	Commercial Kitchens Initiative	N/A	N/A	N/A	N/A	CEE	http://library.cee1.org/content/commercial-kitchens-initiative-description
2	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
3	ENERGY STAR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No Product Category Available
4	Regional Technical Forum	2013	Commercial: Grocery – Anti-sweat Heater Controls	Version 2.0	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/measure.asp?id=158
5	Department of Energy (DOE)	2014	Technical Support Document for Commercial Refrigeration Equipment	2014-02-00	N/A	N/A	N/A	DOE-EERE	http://www.regulations.gov/#!documentDetail;D=EERE-2010-BT-STD-0003-0102
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	
8	The Sixth Northwest Electric Power and Conservation Plan	2009	Grocery Store Measures - Supply Curve	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available
10	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy	2006	Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/pkg/CFR-2006-title10-vol3/pdf/CFR-2006-title10-vol3-part430.pdf http://www.gpo.gov/fdsys/pkg/CFR-2006-title10-vol3/pdf/CFR-2006-title10-vol3-part431.pdf
12	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
19	Arizona Public Service	2013	Rebates For Refrigeration	N/A	N/A	1	N/A	Arizona Public Service	http://www.aps.com/en/business/savemoney/solutionsbyequipmenttype/Pages/refrigeration.aspx

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
20	Avista Utilities	2013	Avista Forms	N/A	N/A	N/A	N/A	ES Energy Smart	http://energysmartonline.org/rebates/index.html
21	Bonneville Power Administration	2013	BPA Forms	N/A	N/A	N/A	N/A	ES Energy Smart	http://energysmartonline.org/rebates/index.html
22	Energy Trust of Oregon	2013	Existing Building Standard Incentives	N/A	N/A	12	N/A	Energy Trust of Oregon	http://energytrust.org/library/forms/be_pi_incentivebooklet.pdf
23	Idaho Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24	Mid-American Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	Nevada Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	Pacific Gas & Electric Company	2013	Refrigeration Rebate Catalog	N/A	N/A	3	N/A	Pacific Gas & Electric Company	http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/refrigeration_catalog_final.pdf
27	Puget Sound Energy	2013	PSE Forms	N/A	N/A	1	N/A	ES Energy Smart	http://energysmartonline.org/rebates/index.html
28	Xcel Energy (Colorado)	2013	Commercial Refrigeration Efficiency	N/A	N/A	3	N/A	Xcel Energy (Colorado)	https://www.xcelenergy.com/staticfiles/xe/Marketing/Files/CO-Bus-Commercial-Refrigeration-Efficiency-Rebate-Application.pdf

2.1.14Variable Refrigerant Flow Heat Pump

Measure Category	Measure Type	Measure Name
HVAC	Heat Pump	Variable Refrigerant Flow-Heat Pump

Description (s)	Source
From Code of Federal Regulations Title 10: "Variable Refrigerant Flow Multi-Split Heat Pump means a unit of commercial package air-conditioning and equipment that is configured as a split system heat pump that uses reverse cycle refrigeration as its primary heating source…The equipment incorporates a single refrigerant ciruit, with one or more outdoor units, at least one variable-speed compressor… and muliple indoor fan coil units, each of which is individually metered and individually controled…" The scope of this report is limited to air and water cooled VRF Heat Pumps.	11

Measure Research Summary	Source
Very little data is available from the scoped sources. Both CEE and DOE report estimated savings, but no cost data was found. See Table 1-1 for a detailed breakout of measure research reporting sources.	1,5

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
CEE Tier 1 VRF Heat Pump	CEE Tier 1 VRF Heat pump	Standard heat pump meeting the minimum ASHRAE requirments	NA	21.9-23.8%	CEE HVAC initiative paper CEE acknowledges difficulty of determining a baseline, as baseline will vary by building use/size. CEE has prescribed efficiencies for high efficiency equipment in the same format as Federal standards.	1
N/A	N/A	N/A	N/A	N/A	N/A	2
N/A	N/A	N/A	N/A	N/A	N/A	3
N/A	N/A	N/A	N/A	N/A	N/A	4

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Water Source VRF Heat Pump w/out heat recovery	CFR 10 compliant VRF Heat Pump	ASHRAE Standard VRF Heat Pump	NA	1,484 kWh/year	TSD Chapter 4 For >135kBtu/h Water Source VRF w/out heat recovery Note: As part of the most recent standard update, modifications were only made to the water source VRF heat pumps. All other VRF equipment were previously covered under the broader classes of small, large, and very large commercial package air conditioning equipment before being distinguished as separate equipment classes in the May 16, 2012 final rule. No information has been provided by the DOE specific to air-cooled VRF heat pumps.	5
Water Source VRF Heat Pump with heat recovery	CFR 10 compliant VRF	ASHRAE Standard VRF	NA	1,661 kWh/year	TSD Chapter 4 For >135kBtu/h Water Source VRF with heat recovery Note: As part of the most recent standard update, modifications were only made to the water source VRF heat pumps. All other VRF equipment were previously covered under the broader classes of small, large, and very large commercial package air conditioning equipment before being distinguished as separate equipment classes in the May 16, 2012 final rule. No information has been provided by the DOE	5

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
					specific to air-cooled VRF heat pumps.	
N/A	N/A	N/A	N/A	N/A	N/A	6
N/A	N/A	N/A	N/A	N/A	N/A	7
N/A	N/A	N/A	N/A	N/A	N/A	8
N/A	N/A	N/A	N/A	N/A	N/A	9
N/A	N/A	N/A	N/A	N/A	N/A	10

Code Research	Source
A review of code and standards discovered that VRF heat pump systems are regulated by the Code of Federal regulations. California (Title 24-2013, effective July 1, 2014) and Washington have adopted energy code standards for VRF heat pump systems, but have defaulted to federal standards. The IECC versions do not address VRF systems, and would be superceeded by Federal standards. See Table 1-2 for a detailed breakout of code research reporting sources.	11,16,18

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Variable Refrigerant Flow-Heat Pump (Water Cooled)	Code of Federal Regulations, Title 10	10 CFR 431.97	12 EER 4.2 COP	<135,000 Btu/h without heat recovery. (For multi-split systems with heat recovery subtract 0.2 from EER)	11
Variable Refrigerant Flow-Heat Pump (Water Cooled)	Code of Federal Regulations, Title 10	10 CFR 431.97	10 EER 3.9 COP	≥135,000 Btu/h and <240,000 Btu/h without heat recovery. (For multi-split systems with heat recovery subtract 0.2 from EER)	11
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	Code of Federal Regulations, Title 10	10 CFR 431.97	13 SEER 7.7 HSPF	VRF Multi-Split Heat Pumps (Air Cooled): <65,000 Btu/h - All types of heating	11
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	Code of Federal Regulations, Title 10	10 CFR 431.97	11 EER 3.3 COP	VRF Multi-Split Heat Pumps (Air Cooled): ≥65,000 Btu/h and<135,000 Btu/h - No Heating or Electric Resistance Heating. (For all other heating types subtract 0.2 from EER)	11
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	Code of Federal Regulations, Title 10	10 CFR 431.97	10.6 EER 3.2 COP	VRF Multi-Split Heat Pumps (Air Cooled): ≥135,000 Btu/h and <240,000 Btu/h - No Heating or Electric Resistance Heating. (For all other heating types subtract 0.2 from EER)	11
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	Code of Federal Regulations, Title 10	10 CFR 431.97	9.5 EER 3.2 COP	VRF Multi-Split Heat Pumps (Air Cooled): ≥240,000 Btu/h and<760,000 Btu/h. - No Heating or Electric Resistance Heating.	11

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
				(For all other heating types subtract 0.2 from EER)	
Variable Refrigerant Flow-Heat Pump	DOE Efficiency Rulemakings	N/A	N/A	N/A	12
Variable Refrigerant Flow-Heat Pump	IECC 2006	N/A	N/A	N/A	13
Variable Refrigerant Flow-Heat Pump	IECC 2009	N/A	N/A	N/A	14
Variable Refrigerant Flow-Heat Pump	IECC 2012	N/A	N/A	N/A	15
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	WSEC 2012	Table C403.2.3(1)D	13 SEER 7.7 HSPF	<65,000 Btu/h - Alll types of heating	16
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	WSEC 2012	Table C403.2.3(1)D	11 EER 12.9 IEER 3.3 COP	≥65,000 Btu/h and<135,000 Btu/h - No Heating or Electric Resistance Heating. (For multi-split systems with heat recovery subtract 0.2 from EER and IEER)	16
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	WSEC 2012	Table C403.2.3(1)D	10.6 EER 12.3 IEER 3.2 COP	≥135,000 Btu/h and <240,000 Btu/h - No Heating or Electric Resistance Heating. (For multi-split systems with heat recovery subtract 0.2 from EER and IEER)	16
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	WSEC 2012	Table C403.2.3(1)D	9.5 EER 11.0 IEER 3.2 COP	≥240,000 Btu/h and<760,000 Btu/h - Heating or Electric Resistance Heating. (For multi-split systems with heat recovery subtract 0.2 from EER and IEER)	16
Variable Refrigerant Flow-Heat Pump (Water Source)	WSEC 2012	Table C403.2.3(1)D	12 EER 4.2 COP	<135,000 Btu/h (For multi-split systems with heat	16

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
				recovery subtract 0.2 from EER)	
Variable Refrigerant Flow-Heat Pump (Water Source)	WSEC 2012	Table C403.2.3(1)D	10 EER 3.9 COP	≥135,000 Btu/h and <240,000 Btu/h - (For multi-split systems with heat recovery subtract 0.2 from EER)	16
Variable Refrigerant Flow-Heat Pump (Water Source)	WSEC 2012	Table C403.2.3(1)D	9.8 EER 3.9 COP	≥135,000 Btu/h and <760,000 Btu/h - (For multi-split systems with heat recovery subtract 0.2 from EER)	16
Variable Refrigerant Flow-Heat Pump	Title 24 – 2008	N/A	N/A	N/A	17
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	Title 24 – 2013	Table 110.2-I	13 SEER 7.7 HSPF	<65,000 Btu/h - All types of heating	18
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	Title 24 – 2013	Table 110.2-I	11 EER 12.9 IEER 3.3 COP	≥65,000 Btu/h and<135,000 Btu/h - No Heating or Electric Resistance Heating. (For multi-split systems with heat recovery subtract 0.2 from EER and IEER)	18
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	Title 24 – 2013	Table 110.2-I	10.6 EER 12.3 IEER 3.2 COP	≥135,000 Btu/h and <240,000 Btu/h - No Heating or Electric Resistance Heating. (For multi-split systems with heat recovery subtract 0.2 from EER and IEER)	18
Variable Refrigerant Flow-Heat Pump (Air-Cooled)	Title 24 – 2013	Table 110.2-I	9.5 EER 11.0 IEER 3.2 COP	≥240,000 Btu/h and<760,000 Btu/h - No Heating or Electric Resistance Heating. (For multi-split systems with heat recovery subtract 0.2 from EER and IEER)	18

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Variable Refrigerant Flow-Heat Pump (Water Source)	Title 24 – 2013	Table 110.2-I	12 EER 4.2 COP	<135,000 Btu/h (For multi-split systems with heat recovery subtract 0.2 from EER)	18
Variable Refrigerant Flow-Heat Pump (Water Source)	Title 24 – 2013	Table 110.2-I	10 EER 3.9 COP	≥135,000 Btu/h and <240,000 Btu/h - (For multi-split systems with heat recovery subtract 0.2 from EER)	18
Variable Refrigerant Flow-Heat Pump (Water Source)	Title 24 – 2013	Table 110.2-I	9.8 EER 3.9 COP	≥135,000 Btu/h and <760,000 Btu/h - (For multi-split systems with heat recovery subtract 0.2 from EER)	18

Peer Utility DSM Review	Source
None of the scoped peer utilities offer prescriptive incentives for VRF heat pumps. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
N/A	N/A	N/A	N/A	19
N/A	N/A	N/A	N/A	20
N/A	N/A	N/A	N/A	21
N/A	N/A	N/A	N/A	22
N/A	N/A	N/A	N/A	23
N/A	N/A	N/A	N/A	24
N/A	N/A	N/A	N/A	25
N/A	N/A	N/A	N/A	26
N/A	N/A	N/A	N/A	27
N/A	N/A	N/A	N/A	28

Vendor Survey Findings Summary
Of the vendors surveyed only one had any experience with VRF systems. The vendor had installed two systems within the past year and talks to almost all customers about VRF systems. Due to the relatively recent introduction to the market, most customers don't understand VRF systems or reasons for choosing a much more expensive heating/cooling system. Specific cost data was not provided, but the vendor described the cost difference as "extremely high". Due to the complexity of the installation, VRF systems are almost always installed as part of a New Construction project, or where the HVAC system is completely replaced as part of a building retrofit. Along with other high efficiency HVAC equipment, survey respondants feel the biggest barrier for market adoption is the higher up-front costs as compared to standard efficiency equipment.

Vendor Name	Vendor Description
Case, Lowe, and Hart	Architecture and Design Build Firm
Baker Distributing	HVAC Equipment Distributor
Holbrook HVAC	HVAC service and installation
American Mechanical Systems	HVAC service and installation

Measure Recommendations		Source #
Summary	The implementation of high efficiency variable refrigerant flow heat pumps can produce significant savings over more traditional HVAC equipment options. As mentioned by CEE, savings are highly dependant upon climate, building use type, and building size. It is recommended that PacifiCorp offer prescriptive incentives for VRF systems consistent with other high efficiency heat pump equipment, but should utilize a simplified analysis tool to accurately quantify savings.	1
Implement?	Yes	
Incentive	$75/ton	

Minimum Eligibility Requirements		Source #
Summary	Equipment meeting CEE Tier 1 efficiency requirements at AHRI Standard 1230 conditions.	1
New Construction	Yes	
Retrofit	Yes	
Efficiency Criteria	CEE Tier 1	
Rating Standard	AHRI Standard 1230	
Testing/Certifications	As described by AHRI Standard 1230	

Baseline	Source
In all circumstances, the baseline should be an HVAC system minimally compliant with the state/federal energy code. It is recommended that ASHRAE-Appendix G HVAC system definitions be used to define the HVAC system type based on building size and climate. See Table 1-2 for a detailed description of the applicable codes used to establish the baseline.	

Savings Calculation Summary		Source #
Savings Estimate	Savings will vary based on site-specific circumstances. A simplified analysis approach should be developed in order to quantify the potential savings for each application for incentive.	
Savings Calculation Methodology	Savings should be calculated relative to an HVAC system type minimally compliant with state/federal energy code, which is defined by ASHRAE – Appendix G based on building size and climate. A simplified calculated approach should be used to take the climate, building use type, envelope standards, and building size into account.	
Savings Estimate Conclusions	Site specific information will need to be gathered for each applicant.	
RTF Alignment	N/A, Measure is not addressed by RTF.	

Cost Calculation Summary		Source #
Cost Estimate	Actual Costs as provided by the customer	
Costs Utilized to Determine Incremental Cost	Due to the variability in baselines for this measure, total and estimated incremental costs should be collect from the customer, until more cost data can be collected.	
Development of Deemed Incremental Cost	n/a	

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-Purchase Customer Incentive	
Measure Parameters	As required by a calculation tool, including but not limited to: climate, building use type, envelope standards, and building size.	
Required Verification for Processing	▪ All information as required by calculation tool ▪ Manufacturer's specification sheets ▪ AHRI certification	

Table 1-4: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source#
Incremental Cost	Actual	Actual	Actual	Actual	Actual	
kWh/Year Saved	Calculated	Calculated	Calculated	Calculated	Calculated	
kW/Month Saved	Calculated	Calculated	Calculated	Calculated	Calculated	
Recommended Incentive	$75/ton	$75/ton	$75/ton	$75/ton	$75/ton	
Unit	Measure	Measure	Measure	Measure	Measure	
Measure Life	15 yrs	15 yrs	15 yrs	15 yrs	15 yrs	Matched to DEER data for a standard HP

Table 1-5: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)		CEE High-Efficiency Commercial A/C and Heat Pump Initiative	Jan. 6, 2012	N/A	N/A	Boston	CEE	http://library.cee1.org/sites/default/files/library/5347/CEE_CommHVAC_HECAC__InitDescip.pdf
2	Database of Energy Efficiency Resources (DEER)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	www.deerresources.com
3	ENERGY STAR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	www.energystar.gov
4	Regional Technical Forum	N/A	N/A	N/A	N/A	N/A	N/A	N/A	http://rtf.nwcouncil.org//measures/
5	Department of Energy (DOE)	2012	Commercial Heating, A/C, and Water Heating Equipment Final Rule Technical Support Document	EERE-2011-BT-STD-0029-0039	N/A	N/A	N/A	U.S. Department of Energy	http://www.regulations.gov/#!documentDetail;D=EERE-2011-BT-STD-0029-0039
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
8	The Sixth Northwest Electric Power and Conservation Plan	N/A	N/A	N/A	N/A	N/A	N/A	N/A	www.nwcouncil.org/energy/powerplan/6/supply-curves
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available
10	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy		Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
12	U.S. Department of Energy	2012	Commercial Heating, A/C, and Water Heating Equipment Final Rule	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www.regulations.gov/#!documentDetail;D=EERE-2011-BT-STD-0029-0038
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
19	Arizona Public Service	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20	Avista Utilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
21	Bonneville Power Administration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
22	Energy Trust of Oregon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23	Idaho Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24	Mid-American Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	Nevada Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	Pacific Gas & Electric Company	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	Puget Sound Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	Xcel Energy (Colorado)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

2.1.15 Evaporative Pre-Cooling

Measure Category	Measure Type	Measure Name
HVAC	Cooling	Evaporative Pre-Cooling

Description (s)	Source
Use of evaporative cooling to pre-cool the air passing over a condensing coil included as part of building cooling system. May also be considered as an aftermarket conversion kit for change an air-cooled condenser to an evaporatively-cooled condenser. This measure does not include evaporative pre-cooling used to directly cool supply/make up air (evaporative media on the economizer), which is considered eligible for incentives separately as part of the existing IDEC measure.	

Measure Research Summary	Source
None of the identified scoped sources provided information on evaporative pre-cooling. Xcel Energy (Colorado) has a prescriptive offering, and has published measure level data. Xcel's reported savings are significant, at 38,603 kWh/yr for a 150 ton air cooled air conditioner. A study performed by SoCal Edison found that evaporative pre-coolers can save between 30-300 kWh/yr-ton based on climate zone. Test were performed on small condensing units (1-5 tons), but results are expected to be similar for larger units. PG&E performed an analysis of residential evaporatively cooled condensers. Models considered were not retrofits to existing equipment. However one model is configured in the same way a retrofit pre-cooler would be applied. Savings are estimated to be an average of 12% over a 10 SEER unit. See Table 1-1 for a detailed breakout of measure research reporting sources.	29, 30, 31

Table 1-1: Measure Research

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
					No info available	1
					No info available	2
					No info available	3
					No info available	4
					No info available	5
					No info available	6
					No info available	7
					No info available	8
					No info available	9
					No info available	10
Direct Evaporative Pre-Condensing for Air Cooled Condensers (DEPACC)	Performance efficiency of at least 75% (dry bulb temperature reduction achieved divided by the wet bulb depression)	Existing air cooled condenser	$202	38,603 kWh/yr	Xcel Energy Colorado Costs and savings assume 150 ton unit, Front Range office in CO	29
Condenser Air Evaporative Pre-Cooler	80% effective pre-cooler	Existing air cooled condenser		30-300 kWh/ton-yr	SoCal Edison Study A study performed by SoCal Edison in December 2012 to determine the effectiveness of evaporative pre-coolers for air-cooled condensers. 1-5 ton condensers were tested. Results varied be climate zone from 10-30% demand savings and 3-25% energy savings for an 80% effective pre-cooler. These values equate to an estimated 0.1-0.33 kW/ton demand savings and 30-300 kWh/yr-ton energy savings.	30
"Evapcon" Evaporatively Cooled	"Evapcon" Evaporatively	10 SEER air cooled	$190/	12%	PG&E Evaluation	31

Measure Description	Efficiency Requirements	Baseline Description	Cost	Energy Savings	Notes:	Source #
Condenser	Cooled Condenser	air conditioner	ton	average	In Dec 1998 PG&E evaluated the effectiveness of residential evaporative condensers. Both evaporative condenser models are single units and are not retrofit applications. However, the EvapCon model is configured just as a pre-cooler retrofit.	

Code Research	Source
A review of applicable energy codes determined there are no current minimum energy efficiency requirements for this measure. See Table 1-2 for a detailed breakout of code research reporting sources.	

Table 1-2: Code Details by Measure

Measure Description	Code Title	Code Section	Minimum Efficiency Requirements	Notes:	Source #
Evaporative Pre-Cooler	Code of Federal Regulations, Title 10	N/A	N/A	N/A	11
Evaporative Pre-Cooler	DOE Efficiency Rulemakings	N/A	N/A	N/A	12
Evaporative Pre-Cooler	IECC 2006	N/A	N/A	N/A	13
Evaporative Pre-Cooler	IECC 2009	N/A	N/A	N/A	14
Evaporative Pre-Cooler	IECC 2012	N/A	N/A	N/A	15
Evaporative Pre-Cooler	WSEC 2012	N/A	N/A	N/A	16
Evaporative Pre-Cooler	Title 24 – 2008	N/A	N/A	N/A	17
Evaporative Pre-Cooler	Title 24 – 2013	N/A	N/A	N/A	18

Peer Utility DSM Review	Source
Only two of the reviewed utilities offering prescriptive incentives for evaporative pre-cooling. Both utilities offer the incentive at $100/attached ton. See Table 1-3 for a detailed breakout of utility DSM review reporting sources.	23,28

Table 1-3: Peer Utility DSM Review Details by Measure

Measure Description	Minimum Efficiency Requirements	Incentive	Notes:	Source #
Evaporative Coolers/Pre-Coolers	Standard air cooled AC unit. Pre-Cooler added to condenser. The pre-cooler incentive applies to air cooled air conditioning package units and split systems with evaporative pre-coolers added to the condenser coils.	$100.00/ ton	Installations must comply with manufacturer's guidelines on sizing and air flows. Manufacturer's specification sheets for the equipment must accompany the application.	23
Direct Evaporative Pre-Condensing for Air Cooled Condensers (DEPACC)	• For single units ≥ 120,000 BTUH (≥ 10 tons) air cooled packaged rooftop or matched split system condensers only. • Units must have a performance efficiency of at least 75% (dry bulb temperature reduction achieved divided by the wet bulb depression) provided by the manufacturer. • If sump is used, must have periodic purge control. • Must have enthalpy controls to control pre-cooler operation. • Prescriptive rebate not available for dedicated data centers. • Water supply must have chemical or mechanical water treatment.	$100/to n of installed cooling		28

Vendor Name	Vendor Description
Case, Lowe, and Hart	Architecture and Design Build Firm
Baker Distributing	HVAC Equipment Distributor
Holbrook HVAC	HVAC service and installation
American Mechanical Systems	HVAC service and installation

Vendor Survey Findings Summary
The vendors interviewed indicated they do not actively market or promote evaporative cooling to commercial customers and typically offer evaporative cooling to their customers on an as needed basis. Within evaporative cooling technologies the primary focus is generally directed to IDEC systems. None of the vendors surveyed had installed or designed a system with evaporative pre-cooling.

Measure Recommendations		Source #
Summary	Little reported data was available, but deemed savings can be determined on a per ton of attached cooling capacity basis, using weather data and average air conditioner equipment efficiencies. Estimated savings are significant enough to include in program. Eligibility requirements must include control/purge systems to limit hard water build up and scale deposits on the condenser coil. All recommendations are based upon the minimum eligibility requirements listed below.	
Implement?	Yes	
Incentive	$75/ ton of attached cooling capacity	

Minimum Eligibility Requirements		Source #
Summary	• For single aircooled packaged rooftop or matched splitsystem condensers only. • Units must have a performance efficiency of at least 75% (dry bulb temperature reduction achieved divided by the wet bulb depression) provided by the manufacturer. • If sump is used,must have periodic purge control. • Must have enthalpy controls to control pre-cooler operation. • Prescriptive rebate not available for dedicated data centers. • Watersupply must have chemical or mechanical water treatment.	
New Construction	No, cutomers desiring benefits should install unitary equipment with evaporatively cooled condensers pre-installed	
Retrofit	Yes	
Efficiency Criteria	Performance efficiency of at least 75% (dry bulb temperature reduction achieved divided by the wet bulb depression) provided by the manufacturer	
Rating Standard	NA	
Testing/Certifications	NA	

Baseline	Source
As documented in the "Pre-cooling analysis" worksheet, the baseline is an average efficiency unitary air conditioner. The average efficiency air conditioner was determined from performance data for market available packaged units ranging in size from 6 – 60 tons. Average efficiency is defined relative to outside air temperature as follows:	

Temp. (dF)	kW/ton
75.0	0.68077
85.0	0.82472
95.0	0.92711
105.0	1.07250
115.0	1.28079
125.0	1.52189

See Table 1-2 for a detailed description of the applicable codes used to establish the baseline.

<table>
<tr><th>Savings Calculation Summary</th><th>Source #</th></tr>
<tr><td>Savings Estimate</td><td>CA – 263 kWh/ton/yr, 0.290 average kW/ton
ID – 202 kWh/ton/yr, 0.262 average kW/ton
UT – 299 kWh/ton/yr, 0.286 average kW/ton
WA – 225 kWh/ton/yr, 0.241 average kW/ton
WY – 268 kWh/ton/yr, 0.293 average kW/ton</td><td></td></tr>
<tr><td>Savings Calculation Methodology</td><td>Savings calculation equation is based on Xcel Energy (Colorado) methodology, which uses an adjusted EFLH based on the hours the pre-cooler is be operating when the outside drybulb air temperature is 65 degrees Fahrenheit or higher, as shown in the table below. EFLH are those values currently used in the HVAC calculator tool.

<table><tr><th>State</th><th>EFLH</th><th>EFLH Factor</th></tr><tr><td>CA</td><td>838</td><td>1.08</td></tr><tr><td>ID</td><td>771</td><td>1.11</td></tr><tr><td>UT</td><td>953</td><td>1.10</td></tr><tr><td>WA</td><td>710</td><td>1.32</td></tr><tr><td>WY</td><td>667</td><td>1.38</td></tr></table>
Typical meteorogical year weather data was analyzed for each state to determine the expected hours of pre-cooler operation and average kW/ton improvement based on drop in condensor air temperature during operating hours.
Savings Formula: kWh/ton=EFLH x ave. kW/ton improvement x EFLH Factor
EFLH=Equivalent Full Load Hours, as listed in table
EFLH Factor= Pre-cooler operating hours/EFLH, as listed in table
See attached “Pre-cooling anlysis” spreadsheet for more details.</td><td>29</td></tr>
<tr><td>Savings Estimate Conclusions</td><td></td><td></td></tr>
<tr><td>RTF Alignment</td><td>Not Aligned, measure not addressed by RTF</td><td></td></tr>
</table>

Cost Calculation Summary		Source #
Cost Estimate	Actual project costs as provided by the customer.	
Costs Utilized to Determine Incremental Cost	Where actual project costs care unavailable or indeterminate, a deemed cost may be substitued, as provided by research conducted by Xcel Energy: <table><tr><th>System Tons</th><th>$/ton</th></tr><tr><td>40</td><td>$248.27</td></tr><tr><td>80</td><td>$219.91</td></tr><tr><td>120</td><td>$209.23</td></tr><tr><td>160</td><td>$202.80</td></tr><tr><td>320</td><td>$190.49</td></tr><tr><td>Average</td><td>$214.14</td></tr></table>	29
Development of Deemed Incremental Cost	Reported incremental costs should be the full actual costs reported by the customer for installing aftermarket evaporative pre-coolers on existing air-cooled condenser coils.	

Incentive Delivery/Verification Details		Source #
Delivery Method	Post-purchase application	
Measure Parameters	• For single aircooled packaged rooftop or matched splitsystem condensers only. • Units must have a performance efficiency of at least 75% (dry bulb temperature reduction achieved divided by the wet bulb depression) provided by the manufacturer. • If sump is used,must have periodic purge control. • Must have enthalpy controls to control pre-cooler operation. • Prescriptive rebate not available for dedicated data centers. • Watersupply must have chemical or mechanical water treatment.	29
Required Verification for Processing	▪ Attached unit model(s) and AHRI net cooling capacity/AHRI Reference # ▪ Manufacturer data, detailing water treatment, enthalpy controls, and performance efficiency ▪ Invoice	

Table 1-4: Incremental Costs, Savings, Recommended Incentives and Unit Details by State

Measure Description	UT	WY	ID	WA	CA	Source#
Incremental Cost	Actual	Actual	Actual	Actual	Actual	
kWh/Year Saved	UT – 299 kWh/ton	WY – 268 kWh/ton	ID – 202 kWh/ton	WA – 225 kWh/ton	CA – 263 kWh/ton	
kW/Month Saved	0.286 average kW/ton	0.293 average kW/ton	0.262 average kW/ton	0.241 average kW/ton	0.290 average kW/ton	
Recommended Incentive	$75/ton	$75/ton	$75/ton	$75/ton	$75/ton	
Unit	System tons	System tons	System tons	System tons	System tons	
Measure Life	20 yrs	20 yrs	20 yrs	20 yrs	20 yrs	29

Table 1-5: Reference and Source Tracking for 2013 Measure Worksheet

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
1	Consortium for Energy Efficiency (CEE)	N/A	N/A	N/A	N/A	N/A	Boston	CEE	www.cee1.org
2	Database of Energy Efficiency Resources (DEER)	2008 & 2011		DEER2011 Update	DEER2011	N/A	N/A	CPUC	www.deerresources.com
3	ENERGY STAR	2013	N/A	N/A	N/A	N/A	N/A	U.S. Dept. of Energy	www.energystar.gov
4	Regional Technical Forum	2013	N/A	N/A	N/A	N/A	N/A	Regional Technical Forum (RTF)	http://rtf.nwcouncil.org/measures/
5	Department of Energy (DOE)								
6	PacifiCorp	2013	Assessment of Long-Term, System-wide Potential for Demand-Side and Other Supplemental Resources	2013 Study	I & II	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
7	Kema, Inc.	2013	Update to the Colorado DSM Market Potential Assessment (Revised)	N/A	N/A	N/A	N/A	Xcel Energy	
8	The Sixth Northwest Electric Power and Conservation Plan	2009	N/A	6th		N/A	N/A	Northwest Power and Conservation Council	www.nwcouncil.org/energy/powerplan/6/supply-curves
9	Nexant, Inc.	2010	2010 FinAnswer Express Market Characterization	N/A	N/A	N/A	N/A	N/A	Not publicly available

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
10	Navigant Consulting, Inc.	2009 - 2011	FinAnswer Express Program Evaluation	N/A	N/A	N/A	N/A	PacifiCorp	http://www.pacificorp.com/es/dsm.html
11	U.S. Department of Energy		Code of Federal Regulations, Title 10	N/A	Chapter II, Subchapter D, Parts 430-431	N/A	N/A	U.S. Government Printing Office	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
12	U.S. Department of Energy	2013	DOE Efficiency Rulemakings	N/A	N/A	N/A	N/A	U.S. Department of Energy	http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html
13	International Code Council	2006	IECC 2006	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2006-international-codes.html
14	International Code Council	2009	IECC 2009	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2009-international-codes.html
15	International Code Council	2012	IECC 2012	N/A	N/A	N/A	N/A	International Code Council	http://shop.iccsafe.org/codes/2012-international-codes.html
16	Washington State Building Code Council	2012	WSEC 2012	N/A	N/A	N/A	N/A	Washington State Building Code Council	https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=2670
17	California Energy Commission	2008	Title 24 – 2008	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF
18	California Energy Commission	2012	Title 24 – 2013	N/A	N/A	N/A	N/A	California Energy Commission	http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf
19	Arizona Public Service	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20	Avista Utilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
21	Bonneville Power Administration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
22	Energy Trust of Oregon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23	Idaho Power	2013	Easy Upgrades HVAC/Controls Worksheet	N/A	N/A	1 & 2	N/A	Idaho Power	https://www.idahopower.com/pdfs/EnergyEfficiency/EasyUpgrades/worksheet_HVAC.pdf

Source	Author	Year	Title	Edition	Vol	Page	City	Publisher	URL
24	Mid-American Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	Nevada Power	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	Pacific Gas & Electric Company	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	Puget Sound Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	Xcel Energy (Colorado)	2013	2013 Cooling Equipment Rebate Application	N/A	N/A	N/A	N/A	N/A	http://www.precoolandsave.com/
29	Xcel Energy (Colorado)	2013	DEEMED SAVINGS TECHNICAL ASSUMPTIONS	N/A	N/A	N/A	N/A	Xcel Energy	http://www.xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/CO-DSM/CO-Cooling-Efficiency-File-2013.pdf
30	SoCal Edison	2012	Condenser Air Evaporative Pre-Cooler Test Protocol	N/A	N/A	N/A	N/A	SoCal Edison	http://www.etcc-ca.com/sites/default/files/reports/HT11SCE021_Condenser_Evap_Air_Final.pdf
31	PG&E	1998	Evaluation of Residential Evaporative Condensers in PG&E Service Territory	N/A	N/A	N/A	N/A	PG&E	http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/inforesource/ac2eval1.pdf

3 TASK 3: LINEAR FLUORESCENT BASELINE ASSESSMENT

3.1 EXECUTIVE SUMMARY

The purpose of this study is to assess the market baseline for the general service fluorescent lamp (GSFL or linear fluorescent lamp) for the non-residential sector as impacted by new federal standards implemented by the Energy Policy and Conservation Act (EPACT). These standards went into effect on July 14, 2012, increasing the minimum manufactured GSFL lamp efficacies and effectively eliminating the majority of T12 lamps, which was the legacy technology baseline for non-residential lamp retrofits. Establishing a contemporary (Fall 2013) market baseline for GSFLs within PacifiCorp's service territory is important for accurate characterization of demand side management (DSM) program energy savings calculations, incentive levels and expected program goals, as GSFLs have historically been a large share of DSM non-residential program participation.

The study gathered market research through a combination research activities including:

- Primary sales and survey data collected from:
  - Over 40 market actors, including commercial lighting contractors, distributors and manufacturers in all Pacificorp service territories
  - Over 350 recent Pacificorp DSM commercial program participants in all Pacificorp service territories
- Secondary review of:
  - Northwest Power and Conservation Council (NPCC or Council) 6th Power Plan and 7th Power Plan development work
  - Regional Technical Forum (RTF) measure definitions and protocols
  - Bonneville Power Authority (BPA) interim arithmetic baseline and associated 2013 lamps sales analysis performed by Navigant
  - Other regional and national utility DSM program GSFL definitions and associated data as available

Surveys conducted with commercial lighting contractors, distributors and manufacturers sought to collect contemporary and historical sales data on several GSFL technologies, including T12 and T8 lamps. Also surveys with these market actors collected information on decision maker attitudes, lamp stockpiling, future sales forecasts, and knowledge on existing T12 GSFL lamp saturations. This study also conducted over 350 surveys with recent Pacificorp DSM commercial program participants on similar survey questions including decision maker attitudes, lamp stockpiling, future sales forecasts, and knowledge on existing T12 GSFL lamp saturations. On-site inspections and interviews with non-participants were not included within the study scope.

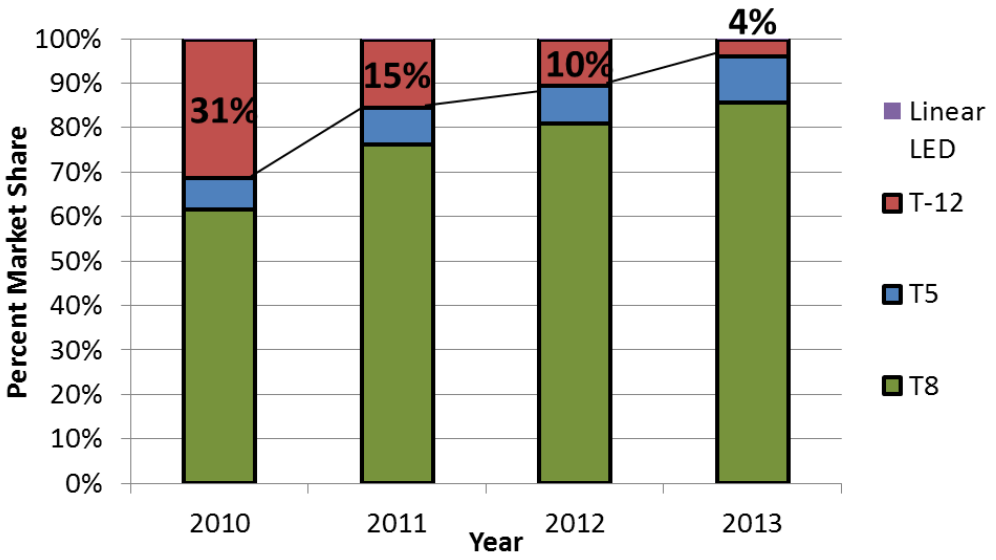
Primary research strongly indicates that T12 GSFL lamps now represent a very small share of current GSFL sales (4%) , T12s are less than 10% of existing stock saturations, and limited evidence of stockpiling was found. These findings are supported by a distinct decline in T12 lamp sales complemented with an increase in T8 sales, now representing over 80% of the market share of GSFL lamps. These T8 and T12 GSFL market share of lamp sales figures are very similar to the findings of the BPA lamps sales analysis study, with 2013 T12 lamps sales representing on 4% of the GSFL market. These findings provide evidence that the market has transformed with the recently enacted federal efficiency standard.

Nexant recommends that the standard efficiency 32-watt T8 lamp with electronic ballast be the new GSFL baseline. Implications and measure parameter data based from this baseline definition will be captured with the state-specific PacifiCorp non-residential market characterization reports.

3.1.1 GSFL Sales Data and T12 Saturation:

Surveys with forty-four commercial lighting contractors, distributors and manufacturers in all Pacificorp service territories sought to obtain data on market and sales trends. Figure 3-1 shows that T12 lamps currently make up less than 5% of the 2013 market share. The decrease in the T12 lamp sales is being made up primarily by sales of T8 lamps as T5 lamp sales has increased a relatively small share.

Figure 3-1: Reported PacifiCorp Linear Fluorescent Lamp Sales by Type



The GSFL sales data collected from market actors in PacifiCorp's service territory was compared to market research recently collected by Bonneville Power Authority. The sales data from the PacifiCorp territory presented in Figure 3-1 shows a faster rate of decline of T12 lamps sales in PacifiCorp's territory between 2010 and 2011than what was seen in BPA data shown. The BPA GSFL

shipment data predicted for 2013 shown in Figure 3-3 below and the 2013 PacifiCorp sales data shown in Figure 3-1 are the same at 4% of the GSFL market.

Figure 3-2: Bonneville Power Authority GSFL Shipments by Type

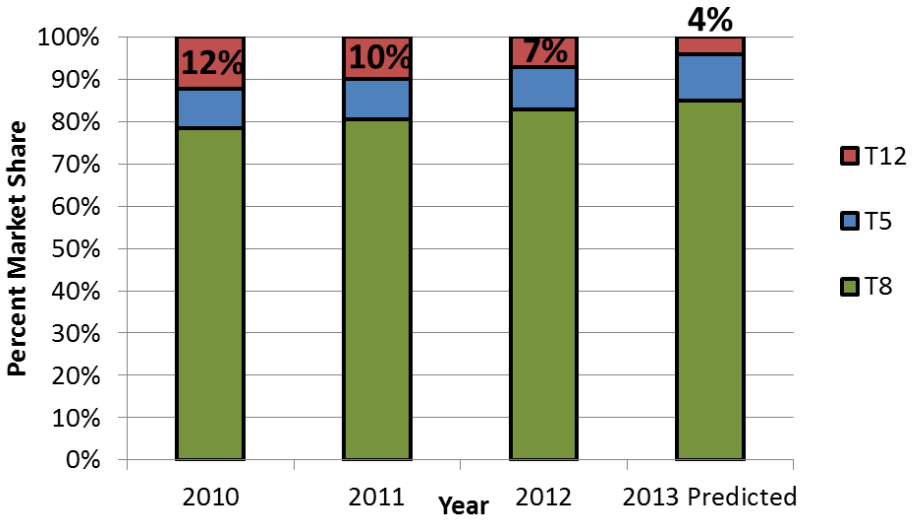
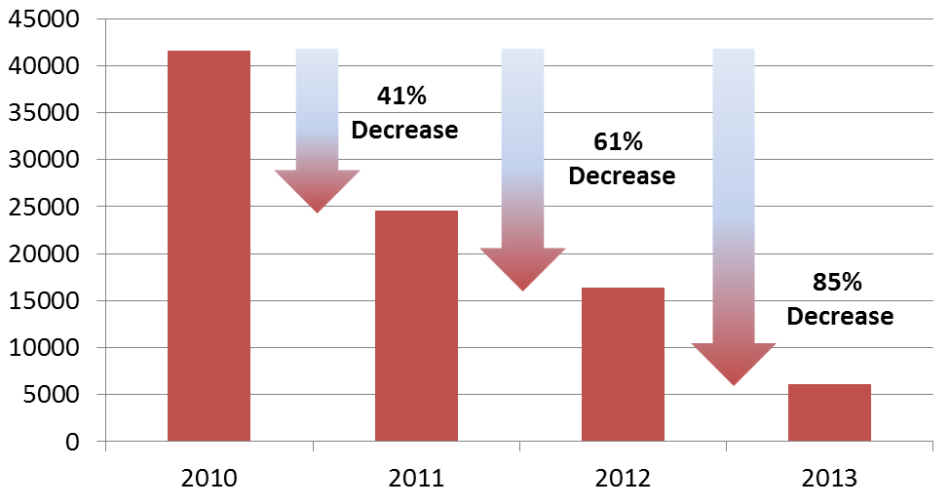


Figure 3-3 shows the magnitude of the change of distributor's reported T12 sales in PacifiCorp's service territories relative to 2010 data. The relative change in T12 sales in the BPA territory between 2010 and 2013 was 67% compared to the 85% relative change reported in the PacifiCorp territory. The trends found in the PacifiCorp data align very closely with the BPA data.

Figure 3-3: Reported Change in T12 Lamp Sales in PacifiCorp's Territory



A survey of recent Pacificorp FinAnswer, FinAnswer Express and Self-Direction Credit program participants revealed that 39% of participants still use T12 lighting in their commercial facilities.

However, of the participants reporting T12s still is use, 68% have T12 lighting making up less than one third of all their lighting fixtures. This conservatively translates to only 9% of commercial lighting using T12 technology. The majority (77%) of the T12 fixtures still in use were reported as functioning properly and 72% of these fixtures were reported to be at least 10 years old and likely to be replaced soon.

Past program participants also reported that approximately 20% do not have any T12 lamps left in storage, 36% have enough T12 lamps in storage to replace 1-20% of the existing T12 lamps in their facility. Only 16% have stockpiled enough T12 lamps in storage to replace 81-100% for their current T12 fixtures.

Retrofit planning:

The majority of PacifiCorp customers are aware of the recent GSFL efficiency standards, with approximately three-quarter of customers having knowledge of the standard. Contractors reported that, on average, 64% of customers are aware of the T12 phase out. Dealers and Manufacturers believe that, on average, 75% of their clients are aware of the T12 phase out. This data was supported by the fact that 77% of past program participants reported understanding the standards had changed and that the majority of T12 lamp manufacturing and importing within the United States is being phased out.

Of the customers implementing lighting projects without a utility incentive, contractors report that, on average, 52% of their customers install T8 technology whereas distributors report 55% of their customers install T8 lighting. Contractors and distributors report that only 16% and 15% of their customers, respectively, who implement projects without an incentive, install T12 technology. And both contractors and distributors report that 20% of their customers who implement projects without an incentive installed T-5 technology. The most popular replacement for T12 lighting was T8 lighting with a total of 83% of the T12 lighting being replaced by T8 lighting.

3.2 INTRODUCTION

General Service Fluorescent lamps (GSFL) are typically designated by their diameter. (e.g T12, T8, etc) The numeric digit that follows the T (the T stands for tubular) represents 1/8s of an inch. Therefore a T12 lamp is 1 1/2" in diameter and a T8 lamp is 1" in diameter. Fluorescent lamps require a ballast to operate, which is an electrical device which limits the amount of current in an electric circuit. The majority of T12 ballasts are magnetic and less efficient than today's T8 electronic ballasts. T12's and T8's require different ballasts to operate.

Within the different lamp sizes, T12 and T8, there are different technology differences that result in different energy consumption and compliance with the federal standard. In the T12 lamp class, there are high color render intensity (CRI) lamps that are exempt from federal standard, but consume the same energy as a standard T12 lamp, 34 or 40 watts. Historically, these lamps have had a very small market share due to their high cost. However, these lamps has recently increased in market share as an option to existing premise owners looking to keep their legacy T12 ballast systems, delaying adoption of the T8 equipment.

Recent technology advancement has allowed for what are commonly known today as high performance (HP) T8's. High Performance T8's have extended life spans and achieve a higher efficacy (lumens / watt) than standard T8's, usually configured to consume less energy, 28 watts as compared to 32 watts.

3.2.1 U.S. Department of Energy Conservation Standard

On July 14, 2009, the Department of Energy (DOE) published a Final Rule for Energy Conservation Standards for General Service Fluorescent Lamps (GSFLs). As a result of this rule, all GSFLS manufactured in the United States, or imported for sale into the United States on or after July 14, 2012 must meet new, more stringent efficacy standards (measured by lumens per watt). The Federal rule mandates lighting efficacies 15-30% higher than previous efficacy standards.

The increase in efficacy standards for GSFLs essentially eliminates the manufacture of most T12 lamps in the United States on or after July 14, 2012, because those lamps do not meet the more stringent efficacy standards. It should be noted that the sale of T12 lamps is not prohibited after July 14, 2012. Customers will to be able to buy bulbs from existing stock for a period of time after July 14, 2012 until available supply is exhausted.

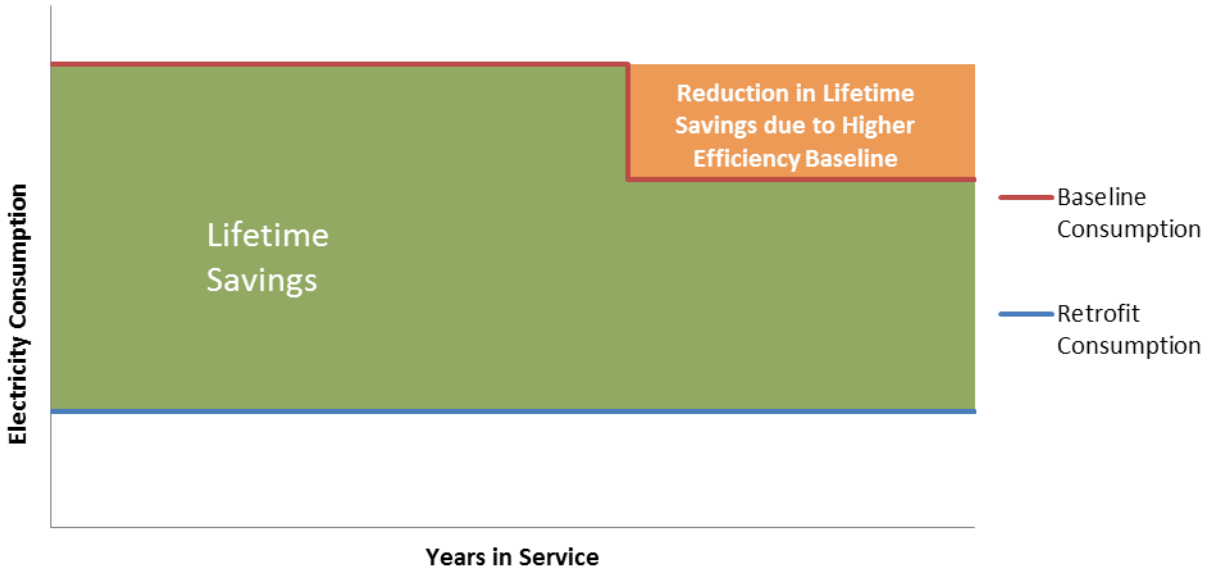
3.2.2 Baseline Definition

In the typical early replacement linear fluorescent scenario, the baseline has historically been defined as the existing equipment as a proxy for what the participant would have continued to utilize in absence of the program. However, with recent U.S. DOE lamp efficiency and efficacy requirements for GSFL, the existing technology is no longer a representative baseline for the entire effective useful life (EUL) of the retrofit equipment. Therefore, in the absence of PacifiCorp's

incentive program, the participant would have had to replace the existing equipment anyway sometime during the timeframe of the retrofit EUL.

In some jurisdictions it has been observed that an adjusted lifetime savings calculation, as demonstrated in Figure 3-4, has been utilized with dual baselines and in other jurisdictions a single adjusted baseline is utilized at a given point in time. It is important that this research be based on market data collected within its service territory and also build upon approaches agreed to in other Demand Side Management (DSM) markets.

Figure 3-4: Illustration of Adjusted Lifetime Savings Calculation



It is also important to note that the timing of baseline adjustments is not fixed by the implementation date of DOE regulations. It may take some time for the stock of inefficient equipment to remove itself from retailer distribution pipelines, and even longer to remove itself from service in facilities. Therefore, in the case of code changes, the baseline shift occurs when a certain technology is no longer available to the average consumer. The timing of the baseline shift is difficult to determine because of the uncertainty surrounding the adoption of the code changes and the uncertainty around when T12 technology will truly be removed from the marketplace. Once manufacturing stopped, it will still take time for the inventory to be removed from distribution pipelines, and therefore the implementation of the code changes has not coincided with their removal from the marketplace. Furthermore, once installed, a T12 lamp still has many years of Remaining Useful Life (RUL) in which it still acts as a viable baseline to T8s. Further complicating the assessment is the presence of potential baseline technologies that are exceptions to the regulations.

3.3 METHODOLOGY

In order to meet the primary study objective in assessing the market baseline for the general service fluorescent lamp (GSFL or linear fluorescent lamp) for the non-residential sector, the research team developed a strategy to collect market research through a combination research activities including:

- Primary sales and survey data collected from:
  - Over 40 market actors, including commercial lighting contractors, distributors and manufacturers in all Pacificorp service territories
  - Over 350 recent Pacificorp DSM commercial program participants in all Pacificorp service territories
- Secondary review of:
  - Northwest Power and Conservation Council (NPCC or Council) 6th Power Plan and 7th Power Plan development work
  - Regional Technical Forum (RTF) measure definitions and protocols
  - Bonneville Power Authority (BPA) interim arithmetic baseline and associated 2013 lamps sales analysis performed by Navigant
  - Other regional and national utility DSM program GSFL definitions and associated data as available

3.3.1 Primary research

Primary data regarding the market baseline technology and timing was collected through surveys with past PacifiCorp program participants and interviews or surveys of the following market actors regarding their specific knowledge in the commercial linear fluorescent marketplace:

- Lighting retrofit contractors
- Lamp manufacturer sales representatives, such as Osram Sylvania, Philips, GE, etc.
- Retailers and electric distributors

3.3.1.1 Participant Surveys

An online survey was conducted with participants of the Rocky Mountain Power's and Pacific Power's Energy FinAnswer, FinAnswer Express and Self-Direction Credit incentive programs. The goal of the survey was to understand how many program participants still had T12 lighting in use, understand what motivated them to implement lighting retrofits and ask what type of lighting technology they may have installed without the utility incentive program.

The survey was developed using the web-based Qualtrics format. Participants were emailed a link and asked to complete the online survey. The PacifiCorp program databases were used to identify participants with a valid email address. Of the 3,768 participants in the PacifiCorp database only

1,927 had email addresses in the database. Of the 1,927 participants contacted via email, a total of 359 participants completed the online survey. Table 3-1 shows the distribution of participant response by state.

Table 3-1: Distribution of Participant Responses by State (n=359)

State	Distribution of Responses
California	3%
Idaho	6%
Utah	60%
Washington	16%
Wyoming	15%

3.3.1.2 Market Actor Surveys

A total of 44 phone or in-person surveys with were completed with lighting contractors, lamp manufacturer representatives, and distributors. The market actors included 19 lighting contractors, 21 distributors, and 4 manufacturers. Table 3-2 summarizes the quantity of each type of market actor contacted during included surveys.

Table 3-2: Summary of Proposed Linear Fluorescent Baseline Interview Data Collection

Market Actor	CA	ID	UT	WA	WY
Lighting Contractors	3	3	6	1	6
Lamp Manufacturer Reps*	2	2	4	2	2
Distributors	1	3	11	2	4

* Two manufacturing reps reported services all five states. A total of 4 manufacturers responded to the survey.

The majority of those surveyed conduct business in the commercial sector. Around 85% of the contractors surveyed state that at least 80% of their work is in the commercial sector. Around 92% of the distributors surveyed conduct 80% or more of their work in the commercial sector. Of the dealers and contractors surveyed, the majority of their clients operate businesses in Wyoming and Utah. A few had customers in Idaho, Washington and California, but the primary markets researched were Wyoming and Utah, due to DSM impacts and the need to gather data to complement the sales data gathered in the Washington and Idaho from the BPA study.

Surveys with these market actors focused on collecting the following data:

- Market trends and/or shifts observed by these market actors from T12 to other technologies
- Customers willingness to convert existing T12 systems to new baseline technologies
- GSFL sales data, as available
  - T12 sales data, preferably including years of 2010 – 2013
    - Sales data for T12 by type, specifically looking to isolate any potential exempt T12 lamps, such as 90 CRI T12.
  - T8 sales data
  - GSFL ballast sales data, as availbvale
  - Retrofit kits for existing T12 sockets

T8 linear fluorescent sales data was collected to understand what share of the GSFL market is using which technology as a baseline practice. Additionally, historical sales data provides evidence of when the market will transform to the next technology baseline.

These surveys were implemented via an on-line Qualtrics software tool. Surveys were distributed on-line or via telephone.

3.3.2 Secondary Research

To further assess the new GSFL market baseline technology and timeline, desk research and reviews of published algorithms to calculate savings and statements of new or future baseline for linear fluorescent lamps was completed. Sources collected for these reviews included available reports that addressed or discussed baseline assessments for GSFLs, any stated conclusions, and what, if any, primary data collected for these assessments. The external sources reviewed include:

Regional Pacific Northwest and Rocky Mountain energy efficiency DSM program lighting standard baseline standards, as published, including Bonneville Power Authority, California DEER, Idaho Power, Xcel – Colorado, Energy Trust of Oregon, etc.

- Broader national energy efficiency DSM program lighting baseline standards, as published, including Massachusetts, NYSERDA, Ohio, Illinois etc.
- Regional Technical Forum (RTF) definitions, activities, and subcommittees.
- Regional Energy Efficiency DSM program planning studies including lighting standard baseline expectations, such as Northwest Power and Conservation Council.

The jurisdiction reviewed include:

- Southern Cal Edison
- PG&E
- Puget Sound Energy
- Seattle City Light
- Regional Technical Forum
- BPA
- NEEA
- Energy Trust of Oregon
- Massachusetts (MassSave)
- Michigan
- Salt River Project
- Xcel Energy (Colorado)
- Idaho Power
- Nevada Energy
- Mid-American Energy
- Avista (Washington State)
- NYSERDA
- Northwestern Energy
- Wisconsin Focus on Energy
- Ameren (Illinois)
- Efficiency Vermont
- Mid-Atlantic Technical Reference Manual
- Pennsylvania
- Ohio Technical Reference Manual
- Maine
- New Jersey
- Duke Energy (Carolinas and Kentucky)

3.4 PRIMARY RESEARCH FINDINGS

3.4.1 Market Actor Surveys

3.4.1.1 Sales Data

Surveys with forty-four commercial lighting contractors, distributors and manufacturers in all Pacificorp service territories sought to obtain data on market and sales trends. Sales data was collected from all three market actor types; however, sales data collect proved to have some challenges as some respondents did not provide complete data. Data from the distributors was the most complete data set with 6 complete responses. The majority of these distributors were based in the Rocky Mountain Power service territory. The other limited responses received from contractors and manufacturers followed the same trends as shown in the distributor data set.

The data collected from distributors in the PacifiCorp territory is shown in Figure 3-5. This shows that T12 lamps currently make up less than 5% of the 2013 market share. The decrease in the T12 lamp sales is being made up by sales of T8 lamps as T5 lamp sales has increased a relatively small amount.

Figure 3-5: Reported PacifiCorp Linear Fluorescent Lamp Sales by Type

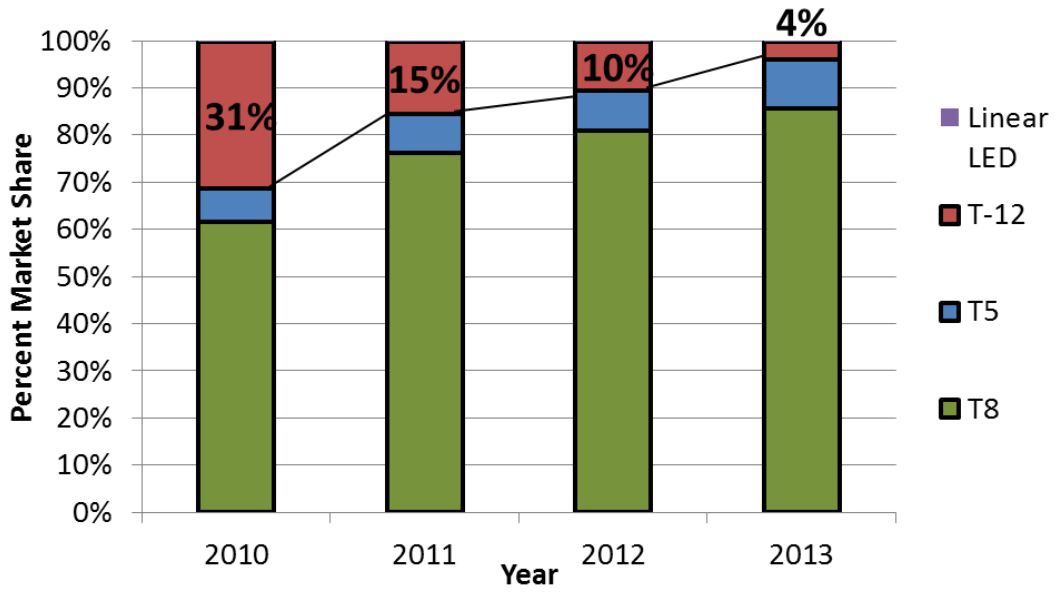
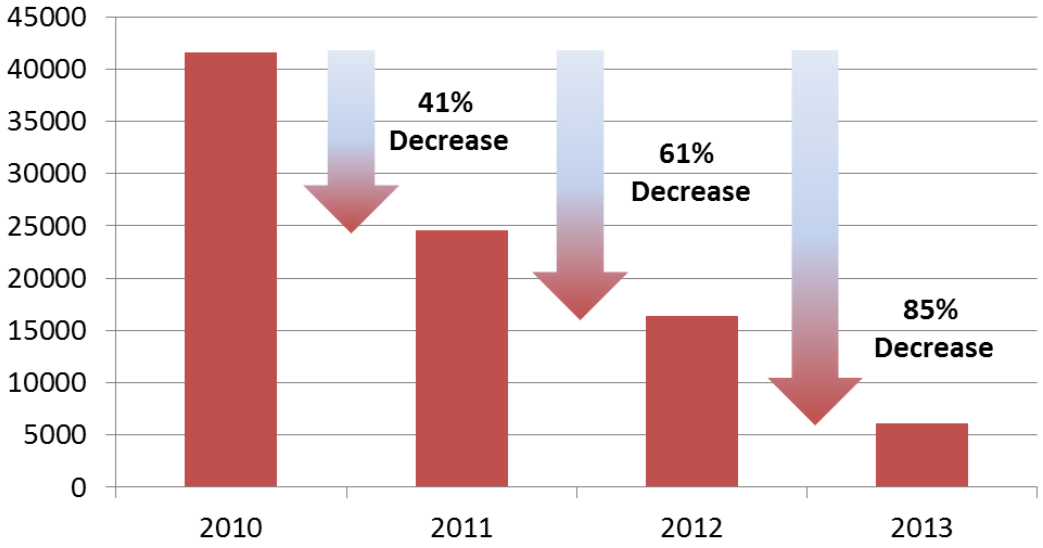


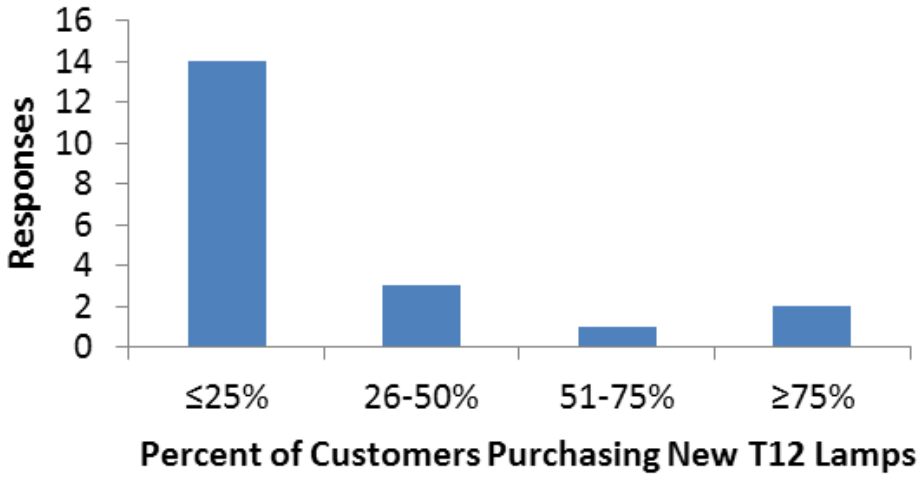
Figure 3-6 shows the magnitude of the change in distributor's T12 sales relative to 2010 data. An 85% decrease in sales of T12 between 2010 and 2013 indicates a very strong shift away from this technology.

Figure 3-6: Reported Change in T12 Lamp Sales in PacifiCorp's Territory



When a 40 watt T12 lamp burns out market actors reported that commercial and industrial customers typically replace it with a T8 lighting system. Figure 3-7 shows that, for most distributors, only a very small portion of their customers would purchase a stockpiled T12 when a T12 burns out. However some contractors found that customers are still using stockpiled T12s.

Figure 3-7: Portion of Distributor's Customers using stockpiled T12s



For those customers moving from T12 lamps to T8 lamps, 2/3 of distributors (n=9) reported that their customers choose 32W T8 and the other 1/3 chose a 28W High Performance T8 (HP T8) for the replacement.

Half of the distributors (n=8) have reported "significant" growth of T8 lighting ballast sales. When asked if they think any growth in sales is attributable to the new efficiency standard, 63% of the distributors believed this growth is due, at least in part, to the new efficiency standards.

The majority of contractors and distributors have sold T12 to T8 conversion kits in the last 3 years. Of the contractors and distributers that have sold conversion kits, it was found that these kits peaked in 2012 and sales seem a bit lower thus far in 2013.

3.4.1.2 Market Trends:

Market actors were asked several questions about the trends they have seen in lighting market over the last several years as well as what they think they will see in the future. These trends describe the overall movement of the market and what technologies that are taking the place of the phased out T12 lamps. In general, market actors consistently reported that T12s are being phased out and are being replaced by T8 lighting. Many customers would like to move to LEDs, but due to the high prices, this option is not yet a feasible option to the majority of their customers. However as LEDs become more affordable in the future, the market actors survey believe LED sales will continue to increase. The following is a summary of each of the sectors responses.

Contractors:

In the past 3 years, there has been a general trend away from T12 lamps, as to be expected, and towards T8 and T-5 lamps with LEDs gaining more popularity in the market. In the past few years contractors have noticed that instead of repairing old T12 lighting systems, customers have been more inclined to buy T12 retrofit kits or install new T8 lighting systems. There are still businesses who cannot afford to do the entire lighting retrofit, so they are doing a partial retrofit or plan on waiting until T12 bulbs are no longer available.

Contractors have noticed their businesses change in the past few years as customers become more aware of energy efficient lighting and as new lighting technologies continue to improve and become available. Sixty percent (60%) of contractors specifically mentioned new opportunities and interest in LED lighting. In the future, 2/3 of contractors expect their businesses to grow as T12s continue to be phased out and LED fixture become more affordable. They are also expecting increases in LED lighting sales as the LED technologies become more affordable. However, as demands for the new lighting technologies continues to increase, some contractors are finding it difficult to stay informed as new LED technologies rapidly move into the market.

Distributors:

Two thirds of distributors reported their sales and businesses improved, driven by T12 conversions, during the past 3 years. Distributors believe incentives helped to push customers to buy new technologies before the T12 lamps burned out. Some distributors started selling retrofit kits to comply with their customers' needs. One dealer reported having stocked piled 50,000 T12 lamps

since 2010 and has seen increased sales of those lamps. Some customers continue to be reluctant to change their T12 lighting, but they know that it is necessary.

In the future distributors expect to see their businesses growing as there is still a market for T12 phase-out and retrofits. They expect their future sales to be T8 lamps and LED lighting technologies. Sixty seven percent (67%) of distributors specifically mentioned that they think LEDs will continue to increase as the prices continue to drop.

Manufacturers:

Of the manufacturers surveyed, one reported that there still are stockpiled T12s that they are being used to replace burnt out 40 watt T12s when incentives are unavailable. However all other reports from manufacturers indicate T12 lamps are disappearing especially as they are no longer available for purchase. In the last few years, manufacturers have seen increases in T8 and LED lighting technologies.

In the future manufacturers expect to see a clear shift to LEDs in the market. Although there may be some increases in T8 sales, the future is definitely in LEDs.

3.4.1.3 Customer Motivation

Market actors were asked what they thought was motivating their customers to retrofit their lighting and what was their willingness to purchase certain technologies. Contractors believe that, on average, 64% of customers are aware of the T12 phase out. Dealers and Manufacturers believe that, on average, 75% of their clients are aware of the T12 phase out. The manufacturers surveyed also commented that those who are un-aware of the phase out most likely live in more rural areas.

Market actors identified multiple motivations for their customers to implement lighting retrofits although they all identified “saving money in the future” and “reduced energy demand” as the two most common factors. Other factors mentioned were “lighting quality” and “improved energy efficiency”.

Contractors, distributors and manufacturers find their customers are not willing to purchase new T12 fixtures but are more neutral about purchasing replacement T12 lamps. Their customers are willing to, and typically do, purchase non-T12 lighting (T8, T-5 or Linear LED).

3.4.1.4 Retrofits Outside the Programs

While most contractors and distributors, 67% and 83% respectively, do have customers who install new lighting technologies without a rebate, contractors report that, on average, only 12% of their lighting projects retrofit their lighting without a utility incentive.

Market actors attributed three primary reasons why projects are completed without an incentive. The first of which are time constraints; there is not enough time to apply for and receive the

incentive before the project start date. The second reason is the project not qualifying because it is too small or outside the utility service area. The third reason is that some customers do not know about the rebates.

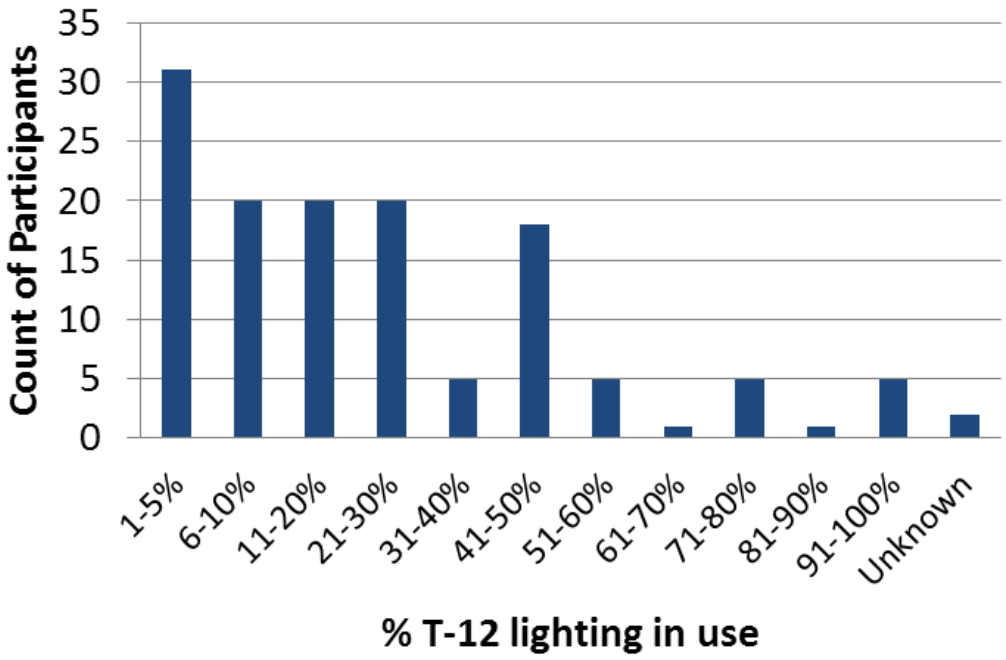
Of the customers who are implementing lighting projects without a utility incentive, contractors see that on average 52% of their customers installing T8 technology whereas distributors see 55% of their customers install T8 lighting. Contractors and distributors report that 16% and 15% of their customers, respectively, who implement projects without an incentive, install T12 technology. And both contractors and distributors report that 20% of their customers who implement projects without an incentive installed T-5 technology.

3.4.2 Program Participant Surveys

3.4.2.1 T12 Saturation

The survey found that 39% of participants still use T12 lighting in their commercial facilities. Figure 3-8 shows the distribution how much T12 lighting remains in the facilities where T12 lighting is still in use. Of the participants reporting T12s still is use, 68% have T12 lighting making up less than one third of all their lighting fixtures. This conservatively translated to an estimate that only 9% of commercial lighting uses T12 technology. The majority (77%) of the T12 fixtures still in use are functioning properly but 72% are at least 10 years old.

Figure 3-8: Percentage of T12 lighting in use in a given facility



The majority of participants have staff who maintains the lighting in their facilities. Of those participants whom maintain their own lighting systems, it was found that around 20% do not have any T12 lamps left in storage, 36% have enough T12 lamps in storage to replace 1-20% of the existing T12 lamps in their facility and around 16% have enough T12 lamps in storage to replace 81-100% of the T12 lamps in their facility. However, 67% of participants claim that they are planning to replace the T12 fixtures that are currently still in use in their facilities.

3.4.2.2 Lighting Retrofit Motivations

Approximately 77% of participants knew that these standards had changed in 2009 including the phasing out of the majority of T12 lamp manufacturing and importing within the United States. In the last 3 years, 81% of participants had replaced T12 fixtures with newer lighting technologies. Of those participants whom had recently replaced their T12 fixtures, 84% claimed that the fixtures were functioning properly and 77% claimed that their lighting was over 10 years old. The three major motivators behind replacing the T12 fixtures was to save and/or reduce energy consumption (20% of participants) closely followed by the desire to save money on electric bills (16% of participants) and the ability to obtain an incentive from their utility company (15% of participants). A chart of the top 5 motivators can be found in Table 3-3.

Table 3-3: T12 fixture removal motivators

Motivator	Percentage
To save/reduce energy consumption	20%
To save money on electric bills	16%
To obtain a utility rebate/incentive	15%
To replace old (but still functioning) equipment	10%
To reduce energy demand	9%

There were several factors considered that motivated participants to elect to install more energy efficient lighting rather than EISA compliant T12 lighting. Although 71% of participants were aware that incentives were available for energy-efficient lighting, the top factor considered was energy-efficiency closely followed by return on investment. The following table is a list of the top 5 factors that contributed to the installation of more efficient lighting.

Table 3-4: Most important factors considered when purchasing energy-efficient lighting

Factors	Percentage
Energy efficiency	18%
Return on Investment	16%
Energy savings pay for the project/incentive	14%
Utility, state, or federal rebates and incentives will pay for the part cost	13%
Light quality	13%

3.4.2.3 Program Feedback

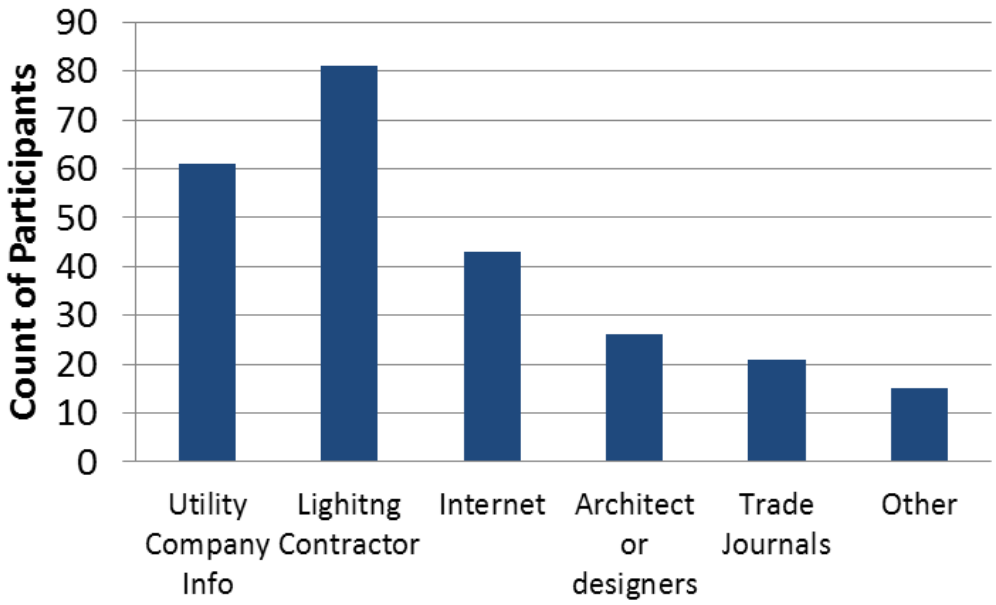
Of the participants who replaced T12 lighting in the last 3 years, 87% received an incentive for their purchase. Around 84% of participants stated that the incentives provided by Rocky Mountain Power and Pacific Power influenced their decision to purchase the lighting that they completed.

It does not appear that many of these retrofits would have occurred without the incentive given that only 28% of participants had included the purchase of new lighting in their capital budgets before participation in the program. If the incentives had not been available, around 45% of participants claim that they would not have bought the more efficient lighting.

In order to make these lighting purchases, the majority of participants obtain new lighting technology information from their lighting contractor closely followed by their utility company. A distribution of this information can be viewed in Figure 3-9. Of those participants whom obtain

information from lighting contractors, the number one reason they were persuaded to update was the potential for a reduction in energy costs.

Figure 3-9: Distribution of the participants' sources for new lighting technologies



3.4.2.4 T12 replacement technology

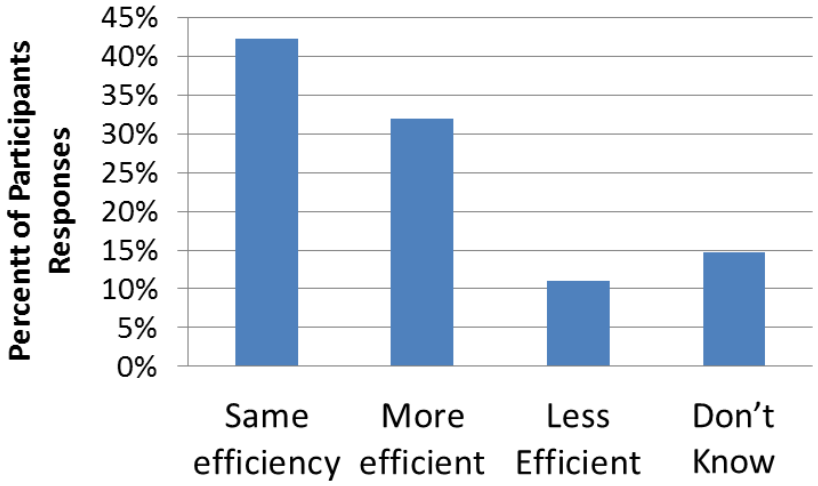
The most popular replacement for T12 lighting was T8 lighting with a total of 83% of the T12 lighting being replaced by T8 lighting. A list of the replacement lighting technologies and their popularity with participants can be seen in Table 3-5. The 'other' category was typically selected if more than one of the technologies listed was utilized. There was at least one instance when a participant used full spectrum lighting.

Table 3-5: Market Share among participants of new lighting technologies to replace T12 lamps

Lighting Technologies	Popularity
LED	3%
T8	83%
T-5	10%
Other	5%

Figure 3-10 depicts the likelihood that lighting with the same level of efficiency would have been purchased without the incentive provided.

Figure 3-10: The probable efficiency level of lighting bought without the incentive



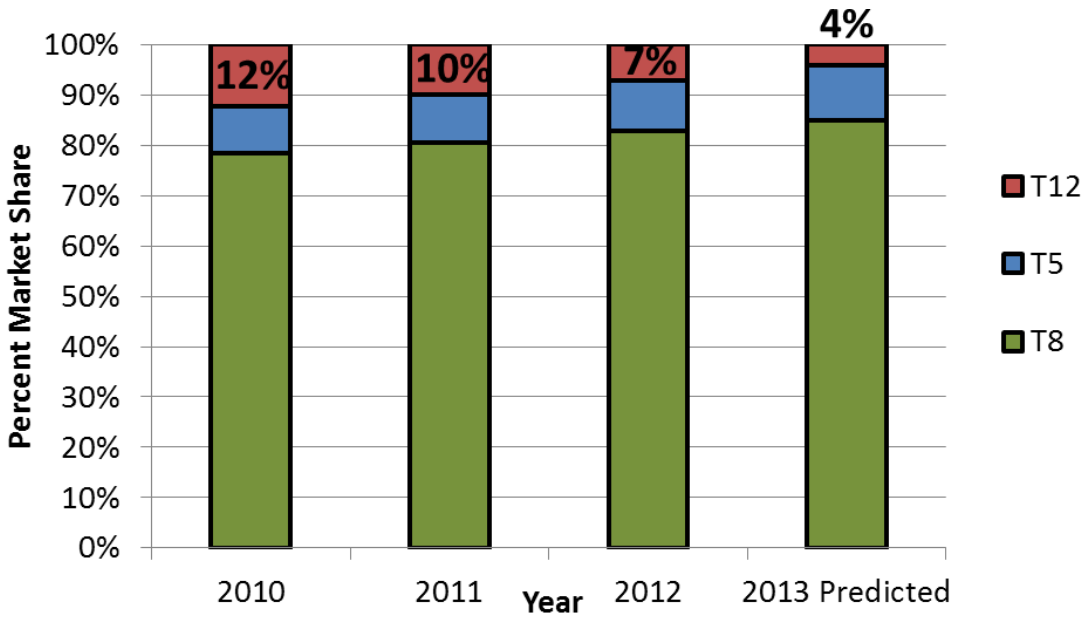
3.5 SECONDARY RESEARCH FINDINGS

Desk research and reviews were conducted to assess the new GSFL market baseline technology and timeline. Sources collected for these reviews included available reports that addressed or discussed baseline assessments for GSFLs, any stated conclusions, and what, if any, primary data collected for these assessments.

3.5.1 Bonneville Power Authority Market Sales Data

Bonneville Power Authority (BPA) has completed research within its Pacific Northwest service territory on the actual market baseline. This data is being used to inform the update of the Regional Technical Forum Lighting Protocols. Figure 3-11 shows preliminary results presented by the BPA at a Regional Technical Forum (RTF) on July 16, 2013. The BPA market research data was collected from 11 complete distributor data sets from all the Northwestern states during in-depth 90-minute interviews. Bonneville Power Authority estimated that they captured 45-50% of the non-residential market within their research.

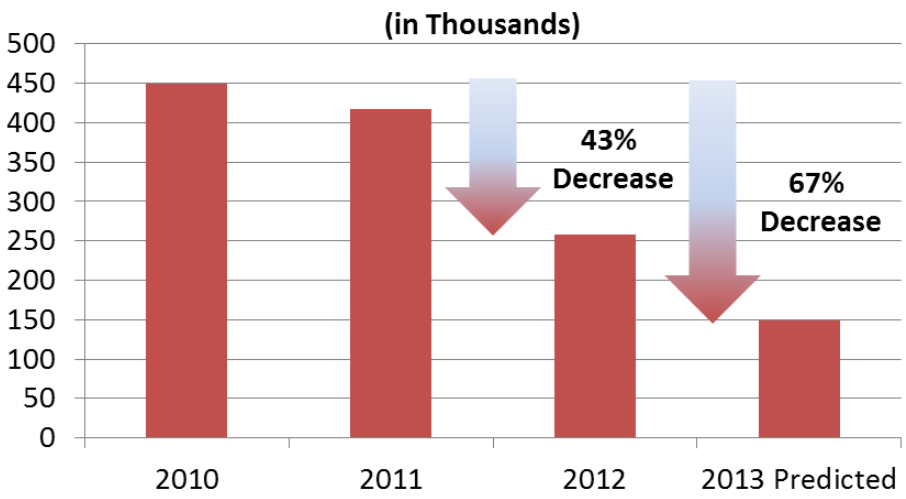
Figure 3-11: Bonneville Power Authority GSFL Shipments by Type



The sales data from the PacifiCorp territory presented in Figure 3-5: Reported PacifiCorp Linear Fluorescent Lamp Sales by Type shows a faster rate of decline of T12 lamps sales between 2010 and 2011 but the 2013 predicted shipment data from BPA and the 2013 sales data from PacifiCorp are the same.

Figure 3-12 shows the relative change in T12 sales in the BPA territory between 2010 and 2013 was 67% compared to the 85% relative change reported in the PacifiCorp territory, shown in Figure 3-6.

Figure 3-12: BPA T12 Lamp Sales



The trends found in the PacifiCorp primary sales data align very closely with the BPA data.

3.5.2 Council 6th Power Plan Review

The Northwest Power and Conservation Council completed a Pacific Northwest regional power plan including, an energy-efficiency potential assessment in 2010, called the 6th NorthWest Conservation and Electric Power Plan[1]. Within the potential assessment, unique energy efficiency measures are considered for all consumer sectors and end-uses, including commercial review. Upon review of the technical worksheets (Pro-Cost models), it is understood that unique commercial lighting measures are not utilized, instead bundles of commercial lighting measures are aggregated to form a lighting power density (LPD) reduction share. Review of the commercial LPD reduction bundle methodology does indicate that unique measures were combined, using both T12 and T8 baselines. Consequently, it is inferred that the 6th Power Plan utilized a market share of both lighting technologies, not dedicated to singular technology.

[1] http://www.nwcouncil.org/energy/powerplan/6/plan/

3.5.3 Regional Technical Forum Review

Review of available Regional Technical Forum data[1] reveals that the RTF has not defined any singular measure for commercial lighting, such as T12 to T8 GSFL replacements. Instead, the RTF has generated a draft commercial lighting protocol and supporting calculator[2] to estimate energy savings for commercial measures. The draft protocol and calculator to not address baselines for specific technologies, but rather establish a framework protocol to used at a premise level to determine baseline and change case conditions. The protocol establishes two main methods for estimating savings:

- Specific technology changes, estimating savings by device
- Aggregated Lighting Power Density (LPD) reductions, comparing baseline installed watts/square foot against baseline code watts/square foot allowances.

While the protocol is agnostic to T12 or T8 baseline conditions, it does note the following for obsolete equipment, noting the obsolete equipment cannot be utilized for baseline conditions:

*"**Obsolete Equipment.** Equipment is considered obsolete if either of the following conditions apply:*

- *Components of the Efficient Case system are no longer available in the market due to the equipment no longer being manufactured, or*
- *Regulatory requirements, such as locally applicable codes and standards for equipment or equipment standards promulgated by the U.S. Department of Energy prohibit sales of the equipment necessary for the Efficient Case system to operate."*

Interpretation of this draft protocol language with respect to observed market sales data and code change executed on July 14, 2012 would imply that T12s cannot be utilized for baseline conditions.

3.5.4 Utility DSM Program Review

The research team reviewed 25 utility DSM programs that offer incentives for non-residential lighting retrofits. Detailed data on GSFL baselines was challenging to discover, as was any measure and/or program changes that were under consideration, but not formally adopted with respect to GSFLs, specifically T12s. Eight programs of note have shifted their linear fluorescent baseline or have set a date in the future when the GSFL baseline shift will occur.

[1] http://rtf.nwcouncil.org/measures/Default.asp

[2] http://rtf.nwcouncil.org/subcommittees/comlighting/

Table 3-6 shows the list of utilities with established dates when the linear baseline will shift to HP T8.

Table 3-6: Timing of GSFL Baseline Shift

Utility / Jurisdiction	Date of Baseline Shift
Southern California Edison	7/1/2012
Pacific Gas & Electric	12/31/2012
Bonneville Power Authority*	4/1/2014
Efficiency Vermont	1/1/2015
Ameren (Illinois)	1/1/2016
Pennsylvania PUC	1/1/2016
Energy Trust of Oregon	1/1/2017
PUC of Ohio	7/14/2017

*Effective date of Lighting Calculator Version 3.0 which is expected to include new market baseline

The following provides further detail of how the T12 baseline shift is being implemented and how T12 to HP T8 retrofits are incentivized for the utilities found to have established a T12 baseline shift deadline.

Southern California Edison and Pacific Gas & Electric (PG&E):

- Adopted the standard T8 lamp as the baseline.
- Both utilities till allow T12 to HP T8 incentives on a $ per unit basis based on standard T8 to HP T8 savings and costs.
- Still allowing T12 to HP T8 incentives on a $ per unit basis based on standard T8 to HP T8 savings and costs

Bonneville Power Authority (BPA)

- In the process of updating its lighting calculator. The updated lighting calculator was originally planned to incorporate an interim arithmetic baseline but is now expected to include a market baseline due to available market research data. Standard T8 is the expected market baseline.
- Still allowing T12 to HP T8 incentives on a $ per unit basis based on standard T8 to HP T8 savings and costs.

Efficiency Vermont

- T12 baseline originally shifted to standard efficiency T8 on 1/1/12 but renegotiations with regulators allowed shift to occur in 1/1/2015

- Still allowing T12 to HP T8 incentives on a $ per unit basis based on standard T8 to HP T8 savings and costs.

Ameren (Illinois)

- For T12 retrofits the baseline becomes the standard T8 on 1/1/2016. Baseline is existing equipment until 2016. Assumes a gradual market shift between 2012 and 2016 based on rated T12 life of 20,000 hours
- T12 to HP T8 are incentivized at a $ per kWh basis.

Pennsylvania PUC

- Based on Ameren (Illinois) approach of assumed RUL of T12s installed in 2012. Baseline will be existing equipment until 1/1/2016

Energy Trust of Oregon

- Claiming incremental savings between EISA compliant T12 and a High performance T8 fixture between 2013 and 2017
- Still allowing T12 to HP T8 incentives on a $ per unit basis based on standard T8 to HP T8 savings and costs.

PUC of Ohio

- Measure life of linear fluorescent measures adjusted to reflect baseline adjustment in 2017. Assumes a 5 year lamp life for lamps installed in 2012. After 2017, effective useful lives of EISA non-compliant baseline equipment, and therefore measure savings, equals zero.

Utilities are basing the timing of the GSFL baseline change based on the market conditions in their territory. The primary market conditions of concern are the current T12 saturation and the amount of market share T12 technology has been able to sustain. The amount of published T12 market research data varies greatly between utility territories. This has left many utility basing their decisions on assumed T12 market saturation, RULs and change out trends.

Southern California Edison, PG&E, Duke Energy (Kentucky and Carolinas), Avista (WA) and Nevada Energy have all removed their T12 to T5/T8 incentives but they all allow the incentives designed for standard efficiency T8 to HP T8 to be eligible for projects retrofitting T12 fixtures.

3.6 MARKET ACTOR SURVEY INSTRUMENT

Q1 My name is _____ from Nexant. How are you? PacifiCorp has contracted Nexant to conduct a survey of the market trends in the lighting sector over the last several years. You have been identified as a person with knowledge of the lighting market in PacifiCorp's territory and we would like to ask you a few questions regarding recent market trends and activity. The main focus of this survey is the phasing out of T-12 lighting as a result of the new standards for fluorescent lighting set forth by the US Department of Energy in the Energy Independence and Security Act of 2009. The results of this evaluation will contribute to future PacifiCorp incentive and rebate programs.

Q2 Would you be able to spend 15 - 20 min to talk to us?

- ❍ Yes (1)
- ❍ No (2)

Q3 Would you be willing to set up a time to talk later or, if you prefer, could we send you an on-line survey to complete when you have time?

- ❍ Yes, Let's schedule time later – Schedule time and then Skip to end (1)
- ❍ Yes, please send me the online survey – send email then Skip to end. (2)

Q3.1 Schedule a better time to talk. Please record in your own outlook calendars!

Date (1)
Time (2)
Best Contact Name (3)
Best Phone Number (4)

Q3.2 Email survey for participant to complete on their own

Best Contact Name (1)
Best Contact Email (2)
Confirm Email (3)

Before we begin, you should know that your participation in this survey is anonymous. Your individual answers will remain confidential and reported only in the aggregate.

Q4 Is your company a… (Please check all that apply)

- ❑ Contractor/Installer (1)
- ❑ Dealer/Distributor (2)
- ❑ Manufacturer (3)

If Contractor/Installer Is Selected, Then Skip To Contractor Questions
If Dealer/Distributer Is Selected, Then Skip To Dealer/Distributer Questions
If Manufacturer Is Selected, Then Skip To Manufacturer Questions

A.1 Contractor Questions

Q5 We would like to first ask you about general trends you're seeing in your industry. How has your lighting business changed in the past three years as a result of T-12 lighting standards?

Q6 How has your lighting business changed in the past three years as a result of developments in new lighting technologies?

Q7 How do you think your lighting business is likely to change over the next three years in response to T-12 lighting standards?

Q8 How do you think your lighting business is likely to change over the next three years in response to changes in lighting industry and lighting technologies?

We would now like to ask you about the types of lighting projects you work on. For the purposes of this interview, we are only interested in project implemented within PacifiCorp's territory in WA, CA, ID, UT and WY.

Q9 What percentage of your lighting work would you say is in the commercial and industrial sector versus the residential sector?

_____ Percentage of lighting work (0)

Q10 Please list the top 5 Northwest cities (within Washington, Oregon, Utah, Wyoming, or California) where your company performs the majority of its work. (Please list up to five cities and their states.)

City, State (1)
City, State (2)
City, State (3)
City, State (4)
City, State (5)

Q11 From what you have seen over the past several years, what do you think is the primary reason your customers are buying more efficient lighting?

- ❑ To comply with the new regulations taking place (1)
- ❑ To save money in the future (2)
- ❑ Due to the demands of their clients and/or employees (3)
- ❑ In an attempt to be more green (4)
- ❑ To reduce energy demand (5)
- ❑ For more efficient lighting (6)
- ❑ For better lighting quality (7)
- ❑ To reduce maintenance costs (8)
- ❑ Other (specify) (9) _____

Q12 Approximately how many units of each of the lighting technologies listed below did you sell in 2010, 2011, 2012 and so far in 2013?

	Year			
	2010 (1)	2011 (2)	2012 (3)	2013 (4)
EISA Non-Compliant T-12 (1)				
EISA Compliant T-12 (2)				
T-8 (3)				
T-5 (4)				
Linear LED (5)				

Q13 What percentage of your total annual sales is from each lighting technologies listed below in 2010, 2011, 2012 and so far in 2013?

	Year			
	2010 (1)	2011 (2)	2012 (3)	2013 (4)
EISA Non-Compliant T-12 (1)				
EISA Compliant T-12 (2)				
T-8 (3)				
T-5 (4)				
Linear LED (5)				

Q14 When a 40 watt T-12 lamp burns out, commercial and industrial customers typically respond by replacing it with which of the following (please estimate likelihood based on your understanding of the market)?

_____ New Compliant T-12 Lamp, Exempt High CRI T-12 Lamp (1)
_____ Stockpiled old T-12 (2)
_____ High Performance T-8 System (3)
_____ Standard T-8 System (4)
_____ T-5 System (5)
_____ Other (Please Specify) (6)

Q15 What percentage of your commercial and industrial customers do you think are aware that most T-12 lighting technology is being phased out?

_____ % of customers aware of phase-out (1)

Q16 What type of areas do you typically see T-12 lamps and fixtures still being used in?

- ❑ Offices (1)
- ❑ Warehouses (2)
- ❑ Retail (3)
- ❑ Food Service (4)
- ❑ Institutional (Churches, Schools) (5)
- ❑ Government Buildings (6)
- ❑ Hospitals (7)
- ❑ Low Use Areas (8)
- ❑ Low Traffic Areas (9)
- ❑ Non Public Areas (10)
- ❑ Other (Specify) (11) _____

Q17 On a scale of 1-5, how willing are customers to purchase T-12 lamps? (1 = Not willing, 5=very willing)

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Q18 On a scale of 1-5, how willing are customers to purchase T-12 Fixtures? (1 = Not willing, 5=very willing)

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Q19 On a scale of 1-5, how willing are customers to purchase non-T-12 fixtures (ex: T-8s, T-5s, Linear LEDs)? (1 = Not willing, 5=very willing)

- ❍ Click to write Choice 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Q20 Have you sold any T-12 conversion kits in the past 3 years?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q21 Approximately how many T-12 Conversion kits did you sell in 2010, 2011, 2012 and so far in 2013?

_____ 2010 (1)
_____ 2011 (2)
_____ 2012 (3)
_____ 2013 (4)

Q22 Do you have any customers replacing lighting lamps and fixtures without a utility incentive?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q23 What type of lamps and fixtures do these customers typically install? (Check all that apply)

- ❑ EISA Non-Compliant T-12 (1)
- ❑ EISA Compliant T-12 (2)
- ❑ T-8 (3)
- ❑ T-5 (4)
- ❑ Linear LEDs (5)
- ❑ Other (Please Specify) (6) _____

Q24 Roughly what percentage of lighting projects (as opposed to the maintenance market) in existing buildings occurs outside of energy efficiency incentive programs? (E.g., Project doesn't qualify for incentives, decision maker unaware of applicable programs, etc.?)

% of lighting projects without an incentive (1)

Q25 Why do these projects not access energy efficiency program incentives? (E.g., Project doesn't qualify for incentives, decision maker unaware of applicable programs, etc.?)

Q26 We've identified five different types of "purchase events" that drive non-residential lighting sales. These "causes" of lamp and ballast sales include:

· New construction;

· Renovation/remodeling projects that replace entire fixtures (e.g., major tenant improvement)

· Lighting upgrades made for energy efficiency purposes (and may be called a "retrofit" and may or may not be incentivized by a utility program);

· Routine maintenance for lamp and ballast failures (also known as 'onesie-twosies' or 'spot replacements');

· Maintenance: Scheduled end-of-life or 'group relamping' (e.g., replacing all lamps in a space when they reach 70% of rated life)

We're interested in learning more about the last two events in this section (routine maintenance and group relamping). Can you speak to how each of the business types below operates with respect to their routine lighting maintenance activities? For example, do they typically replace lamps and ballasts on a schedule or only when they burn out?

Q26.1 Please complete the following:

	More Likely To:		Who makes Decisions on what to Install?					Who Typically does the installation?				
	Only replace when lamps fail (2)	Group Relamp & Reballast (1)	Electrical Contractors (1)	Internal Building Maintenance Staff (2)	Lighting Maintenance Contractors (3)	Building Owners or Operators (4)	Other (5)	Electrical Contractors (1)	Internal Building Maintenance Staff (2)	Lighting Maintenance Contractors (3)	Building Owners or Operators (4)	Other (5)
Large Commercial Office (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Small Commercial Office (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Large Retail (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Small Retail (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
National Chains (National Accounts) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Independent Businesses (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Schools (7)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Hospitals (8)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q27 Thinking about your customers that participant in PacifiCorp's incentive programs, what do you think they would have done if utility incentives were not available?

- Not installed new lighting (1)
- Installed new T-12 lighting (2)
- Installed T-8 lighting that was less efficient than what they installed with the incentive (3)
- Installed the same lighting they installed with the utility incentive (4)

Q28 Your Company is a:

- Contractor/Installer (1)
- Dealer/Distributor (2)
- Manufacturer (3)

A.2 **Dealer/Distributor Questions**

Q29 How do you think the commercial and industrial market changed for lamp and ballast sales between 2010 and July 14, 2012? (Which technologies gained share, which lost share, etc.?)

Q30 How do you think the market has changed since July 14, 2012?

Q31 How do you expect the market to change between now and around this time next year?

Q32 Approximately how many units of each of the lighting technologies listed below did you sell in 2010, 2011, 2012 and so far in 2013?

	Year			
	2010 (1)	2011 (2)	2012 (3)	2013 (4)
EISA Non-Compliant T-12 (1)				
EISA Compliant T-12 (2)				
T-8 (3)				
T-5 (4)				
Linear LED (5)				

Q33 What percentage of your total annual sales is from each lighting technology listed below in 2010, 2011, 2012 and so far in 2013?

	Click to write Column Year			
	2010 (1)	2011 (2)	2012 (3)	2013 (4)
EISA Non-Compliant T-12 (1)				
EISA Compliant T-12 (2)				
T-8 (3)				
T-5 (4)				
Linear LED (5)				

Q34 When a 40 watt T-12 lamp burns out, commercial and industrial customers typically respond by replacing it with which of the following (please estimate likelihood based on your understanding of the market)?

_____ New Compliant T-12 Lamp, Exempt High CRI T-12 Lamp (1)
_____ Stockpiled old T-12 (2)
_____ High Performance T-8 System (3)
_____ Standard T-8 System (4)
_____ T-5 System (5)
_____ Other (Please Specify) (6)

Q35 Of those moving to T-8s from T-12s, which lamp wattage will be most common?

- ❍ 86W (1)
- ❍ 59 W (2)
- ❍ 32 W (3)
- ❍ 28 W (4)
- ❍ 25 W (5)
- ❍ Other (Please Specify) (6) _____

Q36 For those purchases replacing T-12 lamps with T-8 lamps, the estimated distribution by wattage and efficiency is:

_____ 32 watts (1)
_____ 28 watts (2)
_____ 25 watts (3)
_____ Other (Please Specify) (4)

Q37 We've identified five different types of "purchase events" that drive non-residential lighting sales. These "causes" of lamp and ballast sales include:

- New construction;
- Renovation/remodeling projects that replace entire fixtures (e.g., major tenant improvement);
- Lighting upgrades made for energy efficiency purposes (and may be called a "retrofit" and may or may not be incentivized by a utility program);
- Routine maintenance for lamp and ballast failures (also known as 'onesie-twosies' or 'spot replacements');
- Maintenance: Scheduled end-of-life or 'group relamping' (e.g., replacing all lamps in a space when they reach 70% of rated life)

We're interested in learning more about the last two events in this section (routine maintenance and group relamping). Can you speak to how each of the business types below operates with respect to their routine lighting maintenance activities? For example, do they typically replace lamps and ballasts on a schedule or only when they burn out?

Q37.1 Please complete the following:

	More Likely To:		Who makes Decisions on what to Install?					Who Typically does the installation?				
	Only replace when lamps fail (2)	Group Relamp & Reballast (1)	Electrical Contractors (1)	Internal Building Maintenance Staff (2)	Lighting Maintenance Contractors (3)	Building Owners or Operators (4)	Other (5)	Electrical Contractors (1)	Internal Building Maintenance Staff (2)	Lighting Maintenance Contractors (3)	Building Owners or Operators (4)	Other (5)
Large Commercial Office (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Small Commercial Office (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Large Retail (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Small Retail (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
National Chains (National Accounts) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Independent Businesses (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Schools (7)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Hospitals (8)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q38 Are you seeing any significant growth in the sales of high-efficiency fluorescent ballasts either in response to the new lamp standards, or upcoming (2014) changes in efficiency standards for ballasts?

Q39 What share of your fluorescent ballast sales are High Ballast Factor, Normal Ballast Factor, and Low Ballast Factor?

_____ % High BF (1)
_____ % Medium BF (2)
_____ % Low BF (3)

Q40 What trends are you seeing in the industry with regard to stocking practices for T-12 lamps and fixtures?

Q41 Do you have any additional thoughts on the commercial and industrial lighting market that we did not discuss today, but you feel are important for our efforts?

Q42 Your company is a:

- ❑ Contractor/Installer (1)
- ❑ Dealer/Distributor (2)
- ❑ Manufacturer (3)

If Manufacturer Is Displayed, Then Skip To Manufacturer QuestionsIf Dealer/Distributor Is Displayed, Then Skip To End of BlockIf Contractor/Installer Is Displayed, Then Skip To End of Block

A.3 **Manufacturer Questions**

Answer If How do you think the commercial and industrial market cha... Text Response Is Not Displayed

Q43 How do you think the market changed for commercial and industrial lamp and ballast sales between 2010 and July 14, 2012? (Which technologies gained share, which lost share, etc.?)

Q44 How do you think the market has changed since July 14, 2012?

Q45 How do you expect the market to change between now and around this time next year?

Q46 Approximately how many units of each of the lighting technologies listed below did you sell in 2010, 2011, 2012 and so far in 2013?

	Year			
	2010 (1)	2011 (2)	2012 (3)	2013 (4)
EISA Non-Compliant T-12 (1)				
EISA Compliant T-12 (2)				
T-8 (3)				
T-5 (4)				
Linear LED (5)				

Q47 What percentage of your total annual sales is from each lighting technology listed below in 2010, 2011, 2012 and so far in 2013?

	Click to write Column 1			
	2010 (1)	2011 (2)	2012 (3)	2013 (4)
EISA Non-Compliant T-12 (1)				
EISA Compliant T-12 (2)				
T-8 (3)				
T-5 (4)				
Linear LED (5)				

Q48 What trends are you seeing in the industry with regard to stocking practices for T-12 lamps and fixtures?

Q49 Are you seeing any significant growth in the sales of high-efficiency fluorescent ballasts either in response to the new lamp standards, or upcoming (2014) changes in efficiency standards for ballasts?

Q50 What share of your fluorescent ballast sales are High Ballast Factor, Normal Ballast Factor, and Low Ballast Factor?

_____ % High BF (1)
_____ % Medium BF (2)
_____ % Low BF (3)

Q51 Do you have any additional thoughts on the commercial and industrial lighting market that we did not discuss today, but you feel are important for our efforts?

Q52 Thank you for taking the time to complete this survey. Your input will help PacifiCorp improve the FinAnswer program

Q53 Would you like to be entered in the drawing for one of two $50 gift cards?

- ❍ Yes (1)
- ❍ No (2)

Q54 Click to write the question text

First Name (1)
Last Name (2)
Address (3)
City, State, Zip (4)

Q55 In addition to looking at the lighting market, PacifiCorp is also evaluating the current incentives offered through the FinAnswer program. Would it be ok if we contact you for future surveys?

- ❍ Yes (1)
- ❍ No (2)

3.7 PARTICIPANT SURVEY INSTRUMENT

Pacificorp Participant Survey 2013 - Rocky Mountain Power

[Separate survey was sent to Pacific Power participants with references to Pacific Power utility and programs]

Please complete the following:

Company Name: (1)
Zip Code (of the Facility with the retrofit) (2)

Thank you for taking the time for this brief survey! You'll be able to enter the random drawing for the Apple iPad Mini at the end of this survey. Before we begin, you should know that your participation in this survey is anonymous. Your individual answers will remain confidential and reported only in the aggregate.

We will be asking you about the lighting in your business. Specifically, we are interested in lighting that uses T-12 lamps. The picture below shows T-12 lamp and a more modern T-8 lamp to help you identify what a T-12 lamp looks like.

A T-12 lamp has a diameter of 1½ inches and is available in different lengths and wattages. For reference, the term “lamp” refers to the light bulb and the term “fixture” refers to the complete lighting package: bulb, ballast and housing.

Q1 Have you replaced any T-12 fixtures within the last 3 years?

- ❍ Yes (4)
- ❍ No (5)
- ❍ Don't Know (6)

Q2 Approximately how old were the T-12 fixtures you had replaced?

- ❍ 1-3 years (1)
- ❍ 4-6 years (2)
- ❍ 7-9 years (3)
- ❍ 10+ years (4)

Q3 Were the T-12 lamps and fixtures functioning properly?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't know (3)

Q4 Why were the T-12 fixtures removed? (please select all that apply)

- ❑ To save money on electric bills (1)
- ❑ To save/reduce energy consumption (2)
- ❑ To reduce energy demand (3)
- ❑ To obtain a rebate/incentive from Rocky Mountain Power (4)
- ❑ To replace old (but still functioning) equipment (5)
- ❑ To replace broken equipment (6)
- ❑ To acquire the latest technology (7)
- ❑ To reduce maintenance costs (8)
- ❑ Part of a broader remodeling or renovation project (9)
- ❑ To help protect the environment (10)
- ❑ My contractor recommended it (11)
- ❑ The lamps were no longer needed and were not replaced (12)
- ❑ Don’t know (13)
- ❑ Other (please specify) (14) _____

Q5 Thinking back to before you had these fixtures replaced,Were you aware you could receive incentives for removing and replacing T-12 lamps?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't know (3)

Q6 What factors were important in your decision to install energy-efficient lighting? (please check all that apply)

- ❑ Total project cost (1)
- ❑ Return on investment (2)
- ❑ Energy efficiency (3)
- ❑ Energy savings pay for the project/investment (4)
- ❑ Utility, state, or federal rebates and incentives will pay for part of the cost (5)
- ❑ Light quality (6)
- ❑ Product availability (7)
- ❑ Information from contractor, distributor, or salesperson (8)
- ❑ Other (Please Specify) (9) _____
- ❑ Don't Know (10)

Q7a The U.S. Department of Energy amended energy efficiency standards for linear fluorescent lamps in 2009. These new commercial lighting standards took effect in July, 2012 and apply to new products manufactured in the U.S. including the phase-out of the majority of T-12 lamp manufacturing and importation within the U.S. Prior to talking this survey, were you aware that the majority of T-12 lamps would no longer be manufactured or imported into the US after July 2012?

- ❍ Yes (1)
- ❍ No (2)

Q7b The U.S. Department of Energy amended energy efficiency standards for linear fluorescent lamps in 2009. These new commercial lighting standards took effect in July, 2012 and apply to new products manufactured in the U.S. including the phase-out of the majority of T-12 lamp manufacturing and importation within the U.S. At the time that the T-12 fixtures were removed, were you aware that the majority of T-12 lamps would no longer be manufactured or imported into the US after July 2012?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q8 What type of lighting was installed after the T-12 lighting was removed?

- LED (1)
- T-8 (2)
- T-5 (Even smaller diameter than T-8s) (3)
- Other (Specify) (4) _____
- No lighting was installed after the T-12 fixtures were removed (5)

Q9 Did you receive an incentive for the retrofit?

- Yes (4)
- No (5)
- Don't Know (6)

Q10 Without the incentive from the ${e://Field/Program%20Name} program, would you have still purchased lighting that was just as efficient, more efficient, or less efficient than the lighting actually purchased?

- Same efficiency (1)
- More efficient (2)
- Less efficient (3)
- Don’t know (4)

Q11 Would you have purchased the more efficient lighting if the Rocky Mountain Power incentive had not been available?

- Yes (1)
- No (2)
- Don't know (3)

Q12 Did the Rocky Mountain Power rebate influence your decision to purchase the lighting that you did?

- Yes (1)
- No (2)
- Don't know (3)

Q13 Was buying the lighting included in your most recent capital budget BEFORE you participated in the program?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q14 Do you have any T-12 fixtures currently in use at your facility?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q15 Approximately what percentage of the total fluorescent fixtures in your facility contain T-12 lamps?

Q16 Approximately how old are your currently installed T-12 fixtures?

- ❍ 1-3 years (1)
- ❍ 4-6 years (2)
- ❍ 7-9 years (3)
- ❍ 10+ years (4)

Q17 Are all of the T-12s in your facility functioning properly?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q18 Are you planning to replace these T-12 fixtures?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (3)

Q19 Is your business responsible for maintaining the lights in your facility such as replacing lamps when they burn out? OR Is there a maintenance company or building owner who maintains the lights?

- ❍ Our staff maintain the lights (1)
- ❍ An outside contractor or the building owner maintains the lights (2)

Q20 Do you have any T-12 lamps currently in storage? If so, approximately how many spare T-12 lamps do you currently have in storage?

Q21 What percentage of the existing T-12 lamps currently in use could be replaced by the spare lamps you have in storage?

- ❍ 0% (1)
- ❍ 1-20% (2)
- ❍ 21-40% (3)
- ❍ 41-60% (4)
- ❍ 61-80% (5)
- ❍ 81-100% (6)

Q22 Where do you usually get information about lighting technologies that could save energy and money for your business? [please check all that apply]

- ❑ Utility company information (1)
- ❑ Lighting contractor (2)
- ❑ Internet (3)
- ❑ Architect or designers (4)
- ❑ Trade journals (5)
- ❑ Other (please Specify) (6) _____
- ❑ Don't Know (7)

Q22.1 Why did the lighting contractor recommend the T-12s be replaced?

- ❍ Lighting Quality (1)
- ❍ Energy Use (2)
- ❍ Lamp Availability (3)
- ❍ Energy Costs (4)

Q22.2 How influential was the lighting contractor's advice on your decision to replace the lighting? (1 = Not influential at all, 5 = very influential)

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Please enter your information below in order to be entered into the random drawing for a free iPad Mini!

Name (1)
Email Address (2)
Phone Number (3)
Company Name (4)

This survey greatly aids in the development of future incentive and rebate programs. Thank you for taking the time to complete this survey!

4 SMALL BUSINESS LIGHTING

Nexant has designed a small business approach to supplement the wattsmart Business program that will provide a targeted incentive offer to capture additional savings from the harder to reach small/medium business customer segment. The initial offer will include an enhanced retrofit lighting upgrade offering. There is high market potential for energy savings from lighting upgrades in the small/medium business customer segment as evidenced by:

The small business offer is designed to overcome participation barriers for small/medium business customers, as identified by the Center for Energy and Environment:

- Lack of awareness of energy-efficiency opportunities and relative benefits in both customer-owned and leased facilities.
- Lack of time and resources to investigate and implement energy efficiency improvements
- Limited access to capital for energy efficiency projects

As proposed, the small business offer will align with a best-practice approach in use by many other utilities utilizing a pool of Company-approved and managed contractors to approach and work directly with small/medium business customers to identify energy-efficiency upgrades, estimate savings and incentives, and install high-efficiency equipment. Participating customers utilizing an approved contractor will be eligible for an enhanced incentive offer targeted at 80% of the project cost. To reduce the customer's out-of-pocket expenses and minimize cash flow impacts, the customer can assign the incentive to the contractor who will then apply it as an up-front reduction to the overall project cost. Participating contractors will complete and submit the required incentive application and documentation to the Company for payment of the incentive amount that was assigned to them by the customer.

Table 4-1 below outlines the program participation forecast, costs, savings and estimated incentives for the Small Business Lighting offer.

Table 4-1 Small Business Lighting Program Forecast

Forecast Participation					
Measure	Year 1	Year 2	Year 3	Total	Notes
Project Participation	222	517	844	1,583	
Contractor Admin Costs	$144,300	$310,200	$464,200	$918,700	$650/project Year 1, $600/project Year 2, $550/project Year 3
Design Costs	$23,887	$11,943	$11,943	$47,773	
Utility Costs	$7,215	$15,510	$23,210	$45,935	5% of Contractor Admin Costs
Total Costs	$175,402	$337,653	$499,353	$1,012,408	
Energy Savings (kWh)	1,467,864	3,418,404	5,580,528	10,466,796	6,612 kWh/project (35% lighting savings)
Demand Savings (kW/mo)	318	741	1,209	2,268	1.43 kW/mo/project (DDF = 0.78, Annual operation hours = 3,600)
Customer Costs	$733,932	$1,709,202	$2,790,264	$5,233,398	$3,306/project ($0.50/kWh saved)
Incentives	$587,146	$1,367,362	$2,232,211	$4,186,718	Incentive = 80% of Project Cost

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