

Tacoma Power Demand Response Potential Analysis Memo

To: Tacoma Power, Tacoma Public Utilities
From: ICF International
CC:
Date: May 26, 2025
Re: Tacoma Power 2024 CPA-DR Potential Assessment

Introduction

In late 2024, Tacoma Power engaged ICF International (ICF) to perform Tacoma Power's 2025 Conservation Potential Assessment (CPA), supporting its conservation and resource planning activities. This study continues the long working relationship between Tacoma Power and Applied Energy Group (ICF), which was acquired by ICF in 2025. Tacoma Power's previous demand response potential assessment covered the 20-year period between 2023 and 2042, while the current study covered the 20-year period beginning in 2026 and ending in 2045¹. This memo presents the methods, key data sources, and inputs into the analysis and summarizes the results of ICF's demand response potential assessment.

The following sections detail the key steps in the potential assessment and provide results:

- [Data Collection](#)
- [Program Characterization](#)
- [Baseline Peak Demand Forecast](#)
- [Potential Estimation](#)
- [Levelized Costs](#)

Data Collection

Table 1 presents the key data sources and data elements ICF used to perform the demand response potential assessment. Consistent with the previous study, ICF relied heavily on the Northwest Power and Conservation Council's (Council) 2021 Power Plan, which characterizes demand response programs using regional sources. Where available, ICF incorporated data specific to Tacoma Power's service territory to develop program assumptions about participation, impacts, and costs.

Table 1 Data Sources

Source	Data Gathered
Tacoma Power Studies	<ul style="list-style-type: none">• 2025 Tacoma Power Conservation Potential Assessment (CPA)• Water Heater DR Pilot• Cadmus Electrification Study

¹ Separate IRP inputs covering the period through 2050 were provided separately to Tacoma Power

Source	Data Gathered
Northwest Power Council 2021 Power Plan ²	<ul style="list-style-type: none"> Demand Response program characterization (e.g. Participation impacts, costs) Program ramp rates
Other Regional Studies	<ul style="list-style-type: none"> Program Characterization

Program Characterization

The program options included in the analysis are presented in Table 2. The Council’s 2021 Power Plan largely dictated sector eligibility for each program option.

Table 2 Program Options Included in the Study

Program Option	Program Description	Eligible Sector(s)
Connected Thermostat Direct Load Control (DLC)	Internet-enabled control of thermostat set points	Residential and Small Commercial
Electric Vehicle (EV) Behavioral Charge Management	Encourage customers to reduce charging at times of high stress on the electric grid through behavioral messaging and limited incentives	Residential
EV Direct Charge Management	Optimize EV charging times to reduce their impact on system peak load through direct control of EV chargers or vehicle telematics	Residential
EV Fleet Direct Charge Management	Optimize EV fleet charging times to reduce their impact on system peak load through direct control of EV chargers or vehicle telematics	Commercial (Retail, School, and Warehouse Segments)
Battery Storage DLC	Internet-enabled control of battery charging and discharging	All Sectors
Grid Interactive Water Heater	Direct control of electric water heaters through CTA-2045 or other integrated communication port	Residential
Domestic Hot Water Heater (DHW) DLC	Direct control of electric water heaters through a traditional DLC switch installed on customer equipment	Residential
HVAC DLC	Direct control of heating and cooling load through traditional DLC switch installed on customer’s HVAC equipment	Residential, Small-Medium Commercial
Time-of-Use (TOU)	Encourage customers to reduce their demand by setting a higher rate for a particular block of hours that occurs every day	Residential
Critical Peak Pricing (CPP)	Establish a significantly higher rate for a particular block of hours that occurs only on event days to encourage customers to	All Sectors

² In addition to the 2021 Council inputs, ICF also used several updated residential assumptions (HVAC, water heating, and EV charging programs) from the NWPCC DRAC meeting (3/26/2025) that will be included in the next version of the Power Plan.

Program Option	Program Description	Eligible Sector(s)
	reduce their demand during times of high stress on the grid	
Behavioral DR	Voluntary DR reductions in response to behavioral messaging. Example programs exist in CA and other states. Requires AMI technology.	Residential
Electric Vehicle TOU	Higher rate for a particular block of hours (usually in the evening) that occurs every day. Requires either on/off peak meters or AMI technology to run.	Residential, Commercial Fleet Vehicles
Peak Time Rebate (PTR)	Variable hourly rates based on real-time utility production costs. Requires AMI technology to run.	All Sectors
Third Party Contracts	Commercial and industrial customers with peak demand of at least 150 MW enact their customized, mandatory curtailment plan when called upon during times of high stress on the electric grid (often managed through third-party aggregators)	Medium-Large Commercial and Industrial Customers

After developing the program option list, ICF worked with Tacoma Power staff to develop key assumptions used to calculate the potential and cost estimates for each program option. The following section describes these assumptions in greater detail.

Participation Rates, Impacts, and Costs

ICF began with assumptions from the Council’s 2021 Power Plan, then updated these values with information from Tacoma Power’s existing programs or service territory, where available. Deviations from Council assumptions included the following.

- ICF used preliminary findings from Tacoma Power’s Water Heater DR Pilot to inform impacts for electric-resistance water heaters. Impacts aligned well with the 2018 BPA CTA-2045 Water Heater Demonstration study.³
- During the previous study, Tacoma Power provided estimates of third-party vendor costs for monitoring electric vehicle telematics that ICF incorporated into program startup and annual administration costs for all EV charge management program options.
- ICF characterized both a bring-your-own-thermostat (BYOT) and direct install (DI) version of the Connect Thermostat DLC program option. These were treated as separate channels under a single program option such that program costs and potential could be stacked across both without double counting.
- The Council’s 2021 Power Plan provides cost assumptions from a total resource cost (TRC) perspective, whereby a portion of the incentive costs are used as a proxy for customer costs to participate. To support Tacoma Power’s IRP, ICF calculated costs from the Utility Cost Test (UCT) perspective and counted the full incentives costs towards the programs.

³ <https://www.bpa.gov/-/media/Aep/energy-efficiency/emerging-technologies/ET-Documents/demand-response-final-report-110918.pdf>

- Consistent with the Council’s 2021 Power Plan, ICF did not burden the rates programs with the costs of infrastructure or software upgrades that may be required for Tacoma Power to deliver demand-focused rates to its customers.
- ICF characterized a commercial EV fleet demand response program, which the Council’s 2021 Power Plan does not include. At the time of the study, limited industry data existed to inform several key assumptions. Therefore:
 - ICF used preliminary EV fleet adoption rates forecasted in the 2023 Tacoma Power electrification study, which estimated the number of EV ports used for fleet charging at retail, school, and warehouse segments of the commercial sector. ICF used these forecasts to determine the number of customers eligible for a demand response program targeting EV fleets and estimate the number of chargers (and capacity available to reduce) during system peak hours.
 - Lacking information about expected participation rates, ICF used the Council’s 2021 Power Plan assumptions for commercial curtailment (5% of eligible customers at program maturity).
 - ICF estimated peak impacts for an EV fleet program using the assumed nameplate capacity for DC Fast Chargers and Level 2 chargers (125kW and 11 kW, respectively). However, given the nature of (and limited information about) fleet charging habits, we assumed that only 50% of these impacts could be achieved during called peak events. This assumption attempts to control for uncertainties around fleet charging schedules and locations.

Enabling Equipment

Some of the demand response program options rely on enabling equipment and technology. ICF used equipment saturation forecasts estimated through Tacoma Power’s energy efficiency potential assessment, including:

- ICF used the saturation of central cooling/heating systems developed through the energy efficiency study market characterization to inform the pool of customers eligible to participate in Connected Thermostat DLC (Residential and Small Commercial), and HVAC DLC (Residential and Small/Medium Commercial).
- The analysis assumed that all new water heater purchases would be grid-enabled water heaters (e.g., CTA-2045), per WAC 194-240-180 in Washington. The overall saturation of electric water heaters aligns with the energy efficiency market characterization, but the distribution of units assumed to be grid-enabled increases throughout the forecast period as existing water heaters turn over.
- Tacoma Power’s 2025 Electrification study provided residential EV adoption forecasts, which ICF used to determine the eligible customer population for the EV Behavioral, TOU, and Direct Charge Management programs. Similarly, the electrification study provided estimated charger adoptions for EV fleet charging, which ICF used to define the population of retail, school, and warehouse customers eligible for this program option. For this study, the EV TOU program was the only EV-type program that included level 1 chargers. The remaining EV programs were only eligible for customers with level 2 chargers and above.

Program Option Hierarchy

Some of the program options target the same peak load. To avoid double counting demand response potential for these competing resources, ICF worked with Tacoma Power to develop the program hierarchy shown in Table 3. In general, the hierarchy prioritizes customers for firm resources first followed by rate options by removing participants of programs higher in the hierarchy from the pool of customers eligible for programs lower in the hierarchy.

However, not all program options would compete for the same peak load. ICF allowed dual enrollment in program options targeting separately metered equipment (e.g., EV charge management) or distinct end uses (e.g., Connected Thermostat DLC and Water Heating DLC). Limited research exists on the interactions between rates and DLC programs, so ICF did not allow for dual enrollment in these types of program options.

Table 3 Program Hierarchy

Hierarchy Group	Residential	Commercial	Industrial
Firm Resources	1. EV Behavioral Charge Management	1. Third Party Contracts	1. Third Party Contracts
	2. EV Direct Charge Management	2. EV Fleet Charge Management	2. Battery Storage DLC
	3. Connected Thermostat DLC	3. Connected Thermostat DLC	
	4. HVAC DLC	4. HVAC DLC	
	5. Water Heater DLC	5. Battery Storage DLC	
	6. Grid-Interactive Water Heating		
	7. Battery Storage DLC		
Rates	8. Behavioral DR	6. Critical Peak Pricing	3. Critical Peak Pricing
	9. EV TOU	7. Peak Time Rebates	4. Peak Time Rebates
	10. Critical Peak Pricing	8. Time-of-Use	5. Time-of-Use
	11. Peak Time Rebates		
	12. Time-of-Use		

Baseline Peak Demand Forecast

ICF developed the peak demand forecast shown in Figure 1 by:

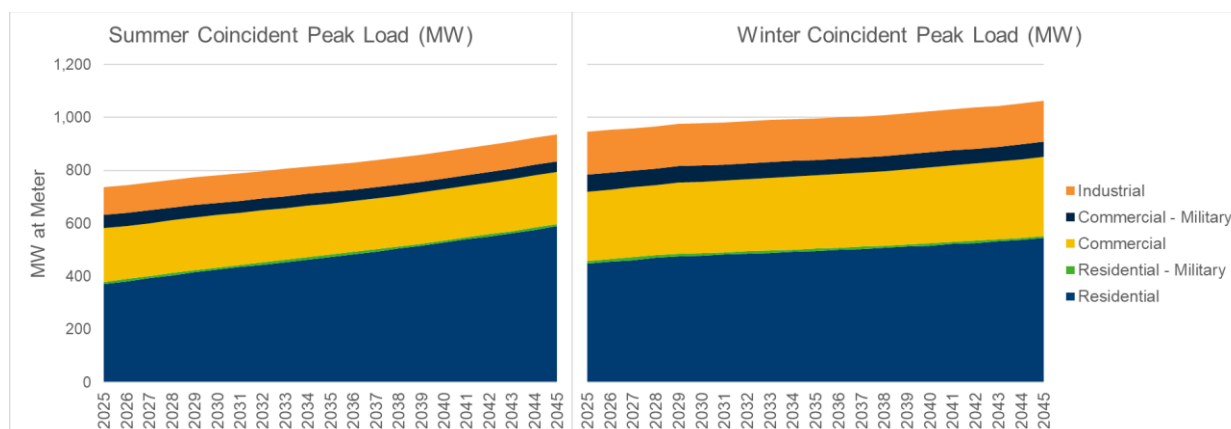
- Using the system-level peak demand forecast estimated for the energy efficiency potential study, and
- Segmenting the system-level peak demand forecast into sector and customer size using customer-level data provided by Tacoma Power and the market segmentation and characterization from the energy efficiency potential study, and

Demand responses potential estimates are incremental to the peak demand impacts from energy efficiency. Figure 1 shows the sector contributions to the peak demand forecast for summer and winter for each year of the study.⁴ As shown, Tacoma Power’s system peak demand increases through the study period across both seasons. Tacoma Power is a winter-peaking utility with peak contributions coming from electric water heating and electric heating equipment saturations. The residential sector

⁴ The baseline peak demand does include any impacts of fleet vehicle electrification forecasted in Tacoma Power’s 2023 electrification study.

in summer is projected to increase from 371 MW in 2025 to 590 MW by 2045 reflecting projected electrification patterns and increased electric vehicle saturations by the end of the study.

Figure 1 Peak Demand Forecast by Season



Potential Estimation

ICF calculated the demand response potential for each program by:

1. Determining the eligible customer population using enabling equipment saturations and removing the participation from programs higher in the program hierarchy,
2. Applying participation, attrition, and event non-performance rates to estimate the number of eligible customers likely to participate in the program option, and
3. Multiplying the per-customer impacts by the number of participants to estimate the total impacts (potential) for each program option in each year of the forecast period.

Figure 2 shows the estimated demand response potential. The solid lines show the baseline peak demand, while the dotted lines show the estimated potential forecast after demand response programs have been implemented. The difference between these lines (shown as percentage of peak demand bars on the graph) reflects the estimated potential for each year of the study.

By the end of forecast period, ICF estimates that demand programs could reduce the summer and winter peak demand by approximately 6%. Potential from demand response programs increases over the five to ten years as the programs enroll participants and reach full maturity. Most of the potential comes from the residential sector, where ICF estimated that residential programs have the potential to contribute 70% of the overall reduction in summer peak demand and 77% of winter peak demand by 2045.

Figure 2 Total Demand Response Potential Forecast

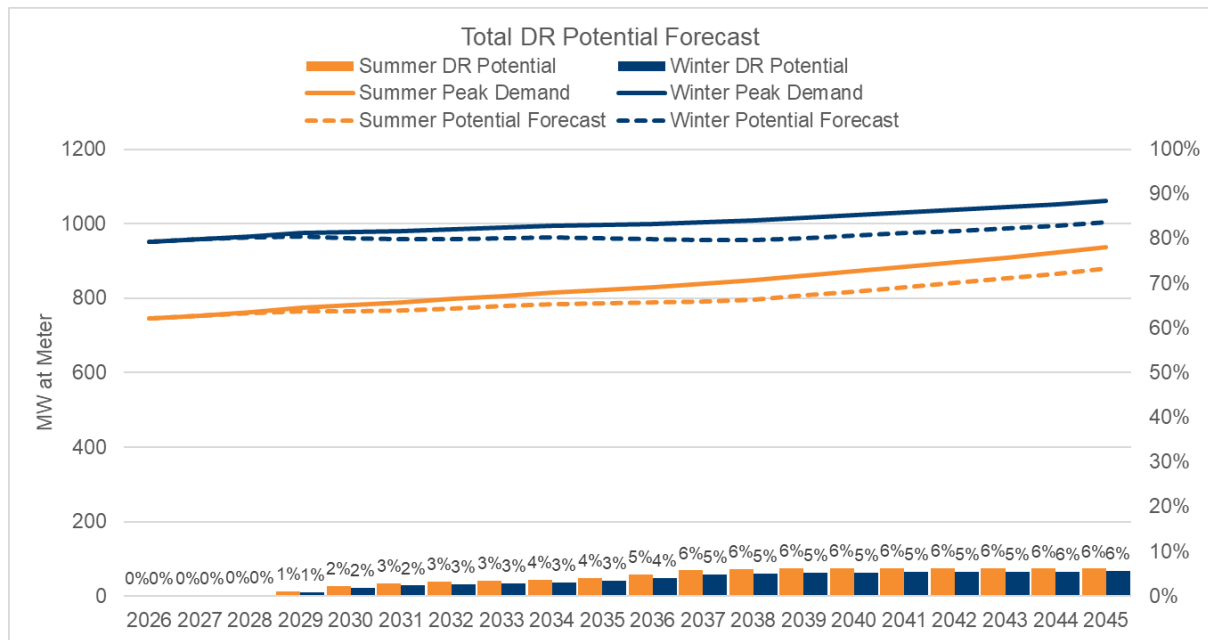


Figure 3 and Figure 4 show the potential generated by demand response programs over the select years in the forecast period for summer and winter, respectively. The early years show how the potential changes as programs mature, and the later years show what programs generate after reaching maturity. Most programs are assumed to start in 2028, a delay of two years from the start of the forecast period, to account for the time Tacoma Power would realistically need to launch programs⁵. Rate and Behavioral DR programs were further delayed until 2035⁶ given the major infrastructure changes required to Tacoma Power’s billing systems to be able to offer these types of programs.

As shown, ICF estimates that Tacoma Power could generate 57.6 MW of demand reduction in the summer and 59.2 MW in the winter through demand response programs by 2045. In winter, Grid-Interactive Water Heaters (23%), HVAC DLC (13%), Connected Thermostat DLC (12%), and Electric Vehicle Direct Charge Management (12%) make up 60% of the total program potential. In summer, Connected Thermostat DLC (19%), Critical Peak Pricing (15%), HVAC DLC (16%), and Electric Vehicle Direct Charge Management (12%) contribute to 62% of the total program potential. The next highest contributors to potential load reduction across both seasons are Electric Vehicle TOU and Third-Party Contracts.

Most programs contribute similarly to summer and winter potential. Some notable exceptions include Critical Peak Pricing, which assumes that more customers would be willing to respond to summer events than to winter events (higher per-participant percent impact). Potential from Grid Interactive Water Heaters increases in the winter, when water heaters work less efficiently and the capacity to reduce peak demand is higher.

⁵ Discussions with Tacoma Power suggested that 2028 would likely be an aggressive start time where program planning would likely have to begin in 2025.

⁶ RPA will need sufficient pilot work needs to be in place prior to a regular rate offering and at present, there would not be a sufficient rate differential to make it worthwhile and finally, a TOU rate would likely require considerable TPU board and City Council meetings.

Figure 3 Summer Demand Response Program Potential for Select Years

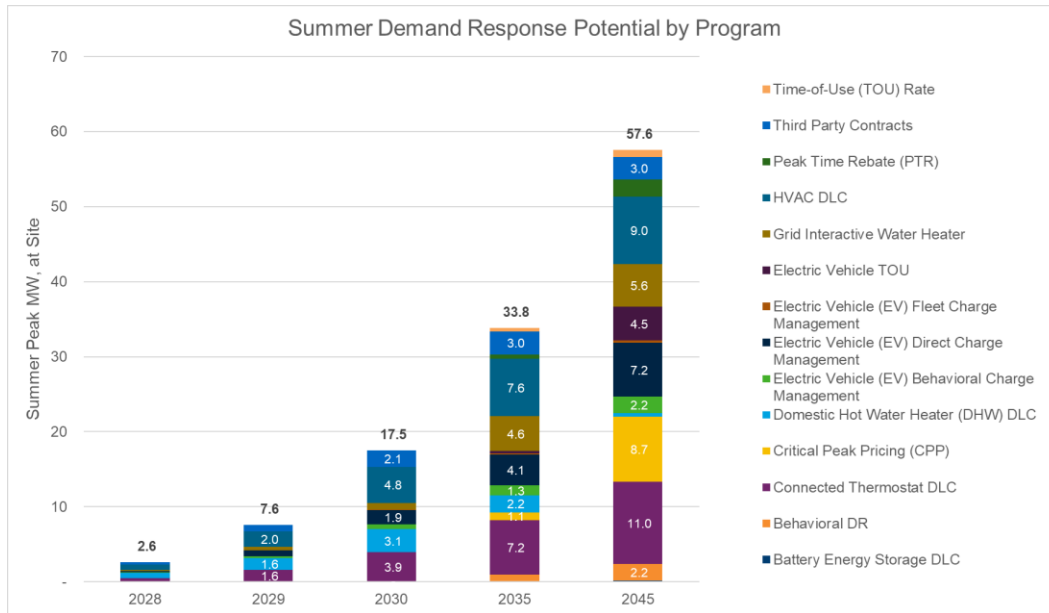
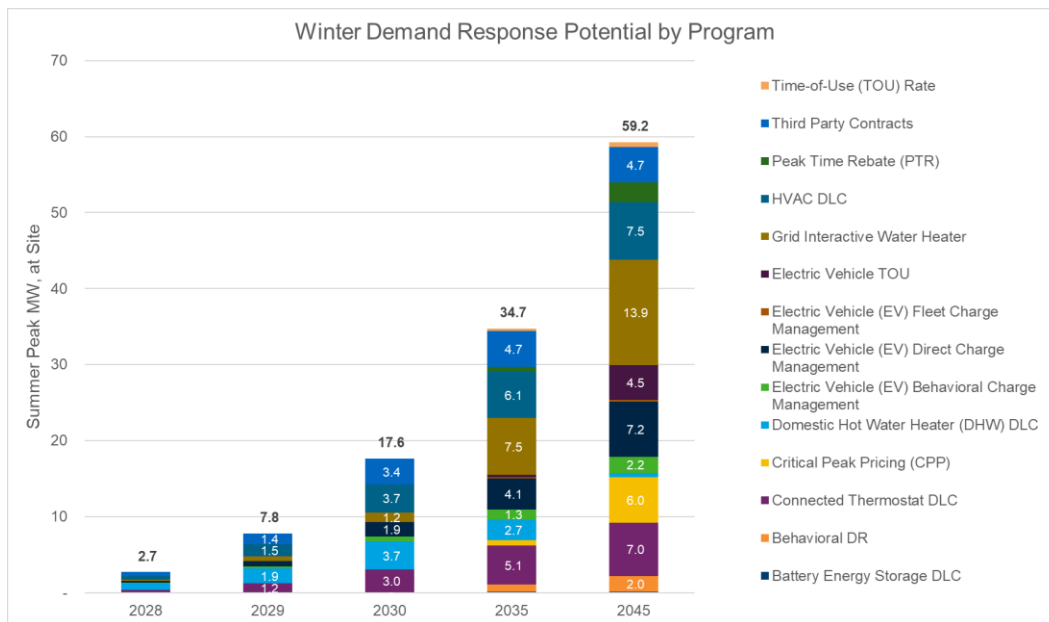


Figure 4 Winter Demand Response Program Potential by Selected Years



Levelized Costs

ICF calculated levelized costs for each program option, shown in Figure 5. Because of the staggered start times of the rates and behavioral programs (2035) compared to the remainder of the programs (2028), ICF used the full forecast horizon (2026–2045) to estimate levelized costs.

All the assessed program options have the potential to generate peak demand reductions in both summer and winter, and the levelized costs shown here only apply if programs run in both seasons. Costs for single-season programs would be higher (equaling the sum of summer and winter split costs minus any season-specific incentives that are no longer applicable).

Figure 5 shows the levelized costs estimated over the first twenty years of each program’s life, from a UCT perspective (i.e., including full participant incentives and additional implementation costs). If Tacoma Power requires monthly costs for the IRP model, ICF recommends replicating the costs shown here in each applicable month (i.e., summer costs in the summer months and winter costs in the winter months). Costs in the shoulder months would be \$0/kW as the impacts would not be available. While this method would likely overstate the total cost if the IRP model selected demand response as a resource in all eligible months, it would avoid understating the costs Tacoma Power only needed the capacity in one month.

As shown, Rate programs (CPP, EV TOU, PTR, and TOU) provide the least expensive potential, which stems from the assumption that any billing system and infrastructure upgrades needed to offer a demand-focused rate to customers is already in place. In general, internet-enabled or grid-connected program options (Connected Thermostat DLC and Grid Interactive Water Heater) offer demand response potential at lower costs than their switch-based alternatives (HVAC DLC and DHW DLC) because of the costs associated with purchasing and installing switches on customers’ equipment. The three EV charge management programs were some of the more expensive program options because they carry additional costs required to access the vehicle telematics data through third-party vendors.

Figure 5 Ten-Year Levelized Costs

