IDAHO POWER COMPANY 2023 DEMAND RESPONSE POTENTIAL ASSESSMENT REPORT

JANUARY 18, 2023

Introduction

In early 2022, Idaho Power Company (Idaho Power) engaged Applied Energy Group (AEG) to assess the available demand response potential in its service territory to model in its 2023 integrated resource plan (IRP). While Idaho Power included demand response as a resource in previous IRPs, modeled potential was based on allocated potential from the Northwest Power and Conservation Council's (Council's) regional power plan rather than a customized analysis for Idaho Power's service area. This memo presents the methods, key data sources, and inputs into the analysis and summarizes the results of AEG's demand response potential assessment.

The following sections detail the following 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 AEG used to perform the demand response potential assessment.

Table 1 Data Sources

Source	Data Gathered
Idaho Power Company	• Peak demand controls over the forecast period • 2021 evaluation reports for Irrigation Peak Rewards, Flex Peak, and AC Cool Credit • Filed 2022 plans for existing program updates
Northwest Power and Conservation Council's (Council) 2021 Power Plan	• Demand response program characterization • Program ramp rates
Idaho Power Energy Efficiency Potential Assessment	• Market segmentation • Realistic Achievable Potential (RAP) peak demand potential forecast • Enabling equipment saturations

Program Characterization

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

Table 2 Program Options Included in the Study

Program Option	Residential	Small Commercial	Medium Commercial	Large Commercial	Industrial	Irrigation
Demand Response (Class 1) Resources						
Irrigation Peak Rewards	-	-	-	-	-	Existing
Flex Peak	-	-	Existing	Existing	Existing	-
A/C Cool Credit	Existing	-	-	-	-	-
Smart Thermostat Direct Load Control (DLC)	✓	✓	-	-	-	-
Electric Vehicle (EV) Charging DLC	✓	-	-	-	-	-
Water Heater (WH) DLC	✓	-	-	-	-	-
Grid-Enabled WH DLC	✓	-	-	-	-	-
Commercial Cooling Switch	-	✓	✓	-	-	-
Battery Energy Storage	✓	✓	✓	✓	-	-
Thermal Energy Storage	-	✓	✓	✓	✓	-
Demand-side Management Rates (Class 3) Resources						
Time-of-Use (TOU)	✓	-	-	-	-	-
Critical Peak Pricing (CPP)	✓	✓	✓	✓	✓	-
Real-Time Pricing (RTP)	-	✓	✓	✓	✓	-

After developing the program option list, AEG worked with Idaho 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, Impacts, and Costs

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

- Included customers' expected bill savings as incentives for the residential TOU rate to reflect the benefit participants receive from the program.
- The Council's development costs for CPP and RTP underestimate the cost of overhauling Idaho Power's underlying billing infrastructure. Idaho Power received a bid for this update to their software and for annual maintenance, which AEG used to inform full administrative and development costs for these rate programs.
- Characterized two energy storage programs that were not included in the Council's 2021 Power Plan: battery energy storage and thermal energy storage.
    - Battery energy storage assumptions came from the National Renewable Energy Laboratory (NREL),[1] which assumes batteries with 3 kW capacities, 4-hour storage, and 86% round trip efficiency. Idaho Power provided the saturation assumptions, which remained constant over the forecast period.
    - Thermal energy storage assumptions came from vendor equipment specifications and costs.

[1] https://atb.nrel.gov/electricity/2021/residential_battery_storage#T2TIPMSS

Enabling Equipment

Some of the demand response program options rely on enabling equipment and technology. AEG used equipment saturation forecasts estimated through Idaho Power's energy efficiency potential assessment.

- AEG allowed for the adoption of smart thermostats assumed in the realistic achievable potential (RAP) scenario to create new opportunities for demand response.
- AEG used the saturation of central cooling systems developed through the energy efficiency study market characterization to inform the pool of customers eligible to participate in A/C Cool Credit (residential) and the Commercial Cooling Switch program.
- Similarly, the energy efficiency study's market characterization informed the saturation of electric vehicle (EV) chargers, which AEG used to identify customers eligible for the EV Charging DLC program.
- The analysis assumed conservative growth in the saturation of grid-enabled water heaters (e.g., CTA-2045). The overall saturation of electric water heaters aligns with the energy efficiency market characterization, but the distribution of those assumed to be grid-enabled remained small throughout the forecast period.
- As noted, Idaho Power provided a constant generation saturation that AEG used to estimate eligibility for the Battery Energy Storage demand response program.

Program Option Hierarchy

Some of the program options target the same peak load. To avoid double counting demand response potential for these competing resources, AEG worked with Idaho Power to develop the program hierarchy shown in Table 3. In general, the hierarchy prioritizes customers for existing programs first, then firm resources, and finally 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. AEG allowed dual enrollment in program options targeting separately metered equipment (e.g., EV Charging DLC) or distinct end uses (e.g., Smart Thermostat DLC and Water Heating DLC). Limited research exists on the interactions between rates and DLC programs, so AEG did not allow for dual enrollment in these types of program options.

Table 3 Program Hierarchy

Hierarchy Group	Residential	Commercial	Industrial	Irrigation
Existing Programs	1. A/C Cool Credit	1. Flex Peak	1. Flex Peak	1. Irrigation Peak Rewards
Firm Resources	2. Smart Thermostat DLC 3. EV Charging DLC 4. Water Heater DLC 5. Grid-Enabled WH DLC 6. Battery Energy Storage	2. Commercial Cooling Switch 3. Smart Thermostat DLC 4. Battery Energy Storage 5. Thermal Energy Storage	2. Thermal Energy Storage	
Rates	7. Time-of-Use 8. Critical Peak Pricing	6. Critical Peak Pricing	3. Critical Peak Pricing 4. Real-Time Pricing	

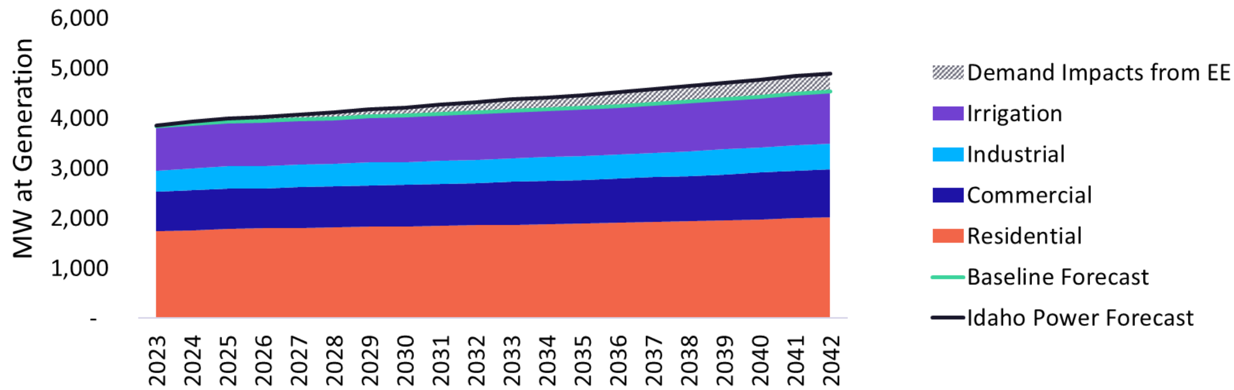
Baseline Peak Demand Forecast

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

- First, segmenting the system-level peak demand forecast provided by Idaho Power using the market segmentation and characterization from the energy efficiency potential study,
- Then, removing the peak demand savings potential generated through energy efficiency adoption in the realistic achievable potential (RAP) scenario.

Demand responses potential estimates are incremental to the peak demand impacts from energy efficiency.

Figure 1 Baseline Peak Demand Forecast



Potential Estimation

AEG calculated the realistic achievable 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,
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, and
4. Adjusting program impacts and participation rates for existing programs as needed to align with actual program achievements.

Figure 2 shows the estimated demand response potential for each program sector. Impacts from existing programs are held constant over the forecast period, allowing customer and participation growth to count towards new resources.

Including existing programs, the potential from demand response represents a decrease in peak demand of between 8% and 10%, incremental to the peak demand reduction potential realistically achievable through energy efficiency initiatives. Most of this potential comes from existing resources, with the current Irrigation Peak Rewards contributing 55% of the overall demand response potential in 2042.

Potential from new demand response resources grows as the programs ramp and contribute estimated reductions of just over 3% in the 20th year of the forecast period.

Figure 2 20-Year Demand Response Potential by Customer Sector

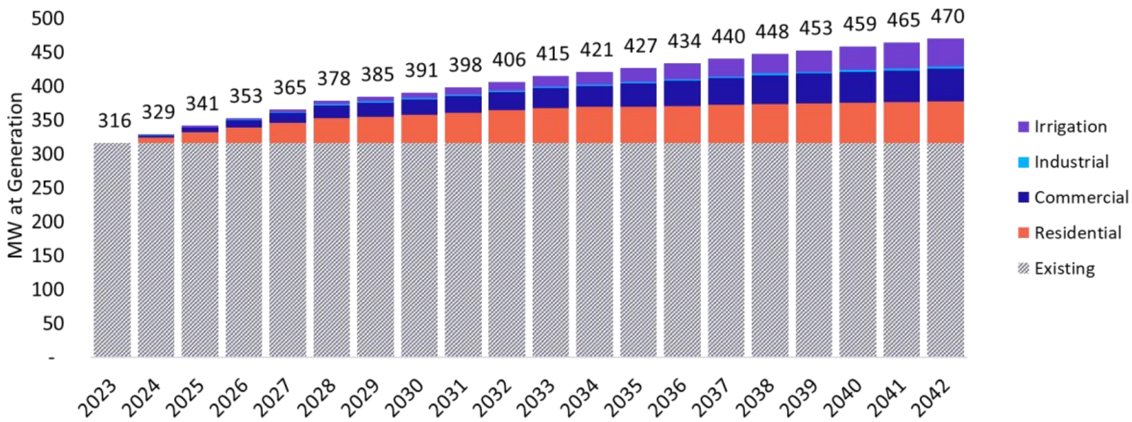
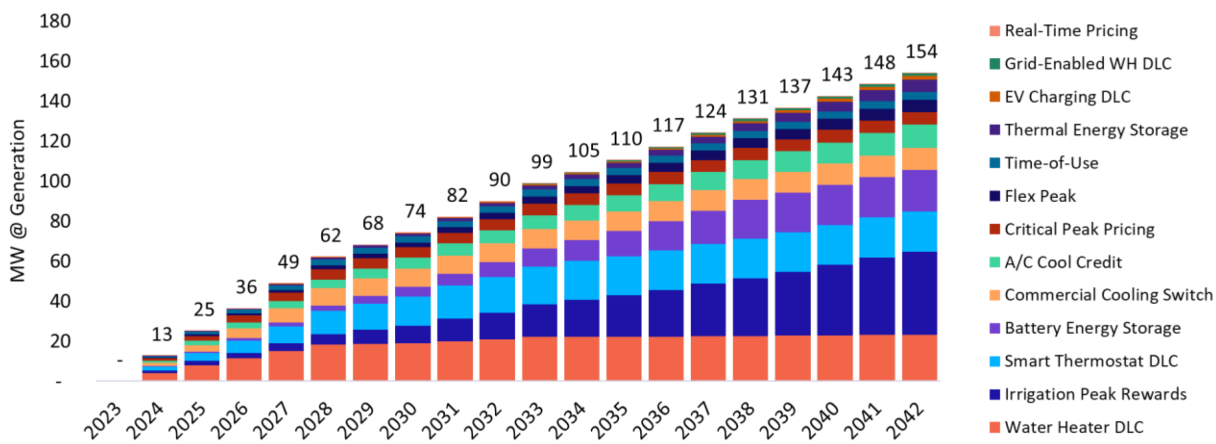


Figure 3 shows the potential generated by new resources for each year in the forecast period. New resources include programs outside of Idaho Power's existing demand response portfolio as well as any potential generated by customer or participant growth. Water Heater DLC, Irrigation Peak Rewards, Smart Thermostat DLC, and Battery Energy Storage represent between 60% and 70% of the total demand response potential from new resources over the 20-year forecast. Growth in most programs flattens after the ramp-up period, which the Council assumes is five years for most programs. Customer and load growth drives any increase in DR potential after the programs are fully ramped, including for existing programs.

Figure 3 20-Year Demand Response Potential for New Resources by Program Option



Levelized Costs

Figure 4 shows the levelized costs estimated for each program option over the 20-year forecast period from a Utility Cost Test perspective. The three existing program options (Irrigation Peak Rewards, Flex Peak, and A/C Cool Credit) offer the least-expensive potential as expected ($40-$50/kW). More expensive programs included Real Time Pricing, which was burdened with high startup costs, and Battery Energy Storage, Grid-Enabled WH DLC, and EV Charging DLC, which either had high equipment and O&M costs or generated low potential.

Figure 4 20-Year Levelized Costs