
To: Brian Tholl, City of Fort Collins Utilities
From: Noah Lieb, Jon Koliner, Christina Carlson Apex Analytics
Subject: Updated assessment of the Income Qualified Assistance Program
Date: September 2, 2022

This memo details the research and findings from an update to a statistical billing analysis for the City of Fort Collins Income Qualified Assistance program (IQAP).

Background

When Fort Collins Utilities launched its time of day (TOD) rates in October 2018, it also introduced an Income Qualified Assistance Program (IQAP) to ensure its rate structure remained equitable. The IQAP provides a 23 percent reduction on electric and water bills for Utilities customers who qualify for Colorado’s Low-income Energy Assistance Program (LEAP) through Energy Outreach Colorado. The IQAP program was originally (starting in 2019) offered to Fort Collins utility customers who have received LEAP during the previous or current season, with offers for customers to opt-in to the reduced rate. Starting in the fall 2020 enrollment period, Fort Collins redesigned the delivery of the IQAP rate offering program to be exclusively opt-out, ensuring any income-qualified customer was automatically enrolled in the reduced rate.

As part of the eligibility for receiving the IQAP rates, Utilities has an educational and engagement requirement for customers to participate in conservation activities.¹ The potential for increased engagement with qualified customers, who have traditionally been underrepresented in efficiency programs, and the resulting opportunity to reduce energy use and achieve non-energy benefits was an important motivator for Utilities to offer the rate discount.

To help support ongoing program efforts and document potential energy impacts of the IQAP program, Utilities had engaged (in 2019) Apex to conduct a statistical analysis of bill impacts to IQAP participants. Apex found IQAP participants had increased their household electricity usage after receiving the reduced IQAP rates. With the change to program design and several years since the original IQAP participants received their reduced rates, Utilities sought to revisit the billing analysis with two primary objectives:

- › **Opt-out versus opt-in:** Determine whether new opt-out income qualified households have realized electric energy consumption changes as a result of their IQAP participation, and if there was any statistically significant difference in energy consumption changes resulting from the opt-out relative to the original opt-in group.
- › **Impact Persistence:** Determine the persistence in energy consumption changes attributable to the original opt-in cohort included in the previous billing analysis.

¹ IQAP participants receive “Utilities Insights”, a monthly newsletter with tips to save energy and water to lower utility bills and are occasionally contacted directly regarding efficiency programs. There is no requirement for IQAP participants to attend workshops or participate in other conservation programs.

Methodology

Apex conducted a statistical billing analysis to assess electric energy consumption changes as a result of IQAP participation but ran two separate models for each group (original opt-in and new opt-out group). To explain differences in monthly consumption, we modeled monthly energy consumption as a function of participation status (participant versus non-participant comparison households), time period (whether the period was pre- or post-IQAP rate introduction) and weather (monthly heating and cooling degree days). Apex developed two energy estimates: one for the actual year and one weather normalized to account for longer-range climate conditions.

Utilities provided data on households participating in IQAP. The analysis included 538 homes that received the IQAP rates as original IQAP opt-in program participants between October and December 2018 and remained as active status in the IQAP dataset.² The second group included 450 IQAP participants that were part of the new IQAP opt-out group, and all received the new IQAP rate in September 2021. Apex matched the original opt-in IQAP participant households to LEAP-qualified homes that did not participate in IQAP using a ranked comparison of households based on the pre-installation period consumption (usage between October 2017 and September 2018) to create a comparison group.³ For the new opt-out group, Apex matched the IQAP participants using the same logic but opened to the entire residential customer database (exclusive of former IQAP participants). Statistical testing showed that both comparison groups' pre-participation energy consumption closely matched – and was therefore roughly equivalent – to each of the participant groups usage.⁴

Key Findings

This section addresses findings related to each of the primary research questions.

- › **Post IQAP rate impacts to opt-out group:** Determine whether new auto-enroll opt-out income qualified households have realized electric energy consumption changes as a result of their IQAP participation and whether there was any statistically significant difference in energy consumption changes resulting from the opt-out relative to the original opt-in group.

The updated opt-out analysis group had a similar number of total available households as the original opt-in group but had lower attrition from data merging and outlier analysis, losing only 12% of premises relative to the original 18% of premises. The updated opt-out group also had marginally higher annual mean load, at 7,548, relative to the opt-in use of

² There were an additional 167 participants that were inactive, having received the rate for a short duration of time and were removed from the program due to closing of accounts among other reasons.

³ Specifically, Apex identified the most equivalent non-participant comparison household match based on Euclidean distance (i.e., the lowest absolute difference in monthly usage compared to the participants).

⁴ Apex modeled a period to quantify the “drift” of each comparison group relative to the participant homes electric usage. Using 2017 as a baseline matching period, we then examined the 2018 electric usage before IQAP participation to quantify the “drift” of the average comparison group versus participant group usage. The LEAP comparison group showed the lowest “drift”, with electric usage remaining almost perfectly aligned with the participant homes between January and September 2018.

7,408. A summary of the original opt-in and opt-out groups analysis are compared in **Table 1** below.

Table 1. Active IQAP Participant Data Summary

Analysis Group	Group	IQAP Start Date	Household Count Basis	Household Count Final	Analysis Attrition	Mean Annual Load
Opt-in	Participant	10/1/2018	538	442	18%	7,408 kWh
	Comparison	N/A	538	442		
Opt-out	Participant	9/1/2021	450	396	12%	7,548 kWh
	Comparison	N/A	450	396		

Like the original opt-in group, the opt-out analysis group's energy consumption increased after they received the IQAP rate reduction, but to a lesser degree. The new opt-out group experienced a 2.9% increase in annual use versus 5.1% from the original opt-in group. Both analyses were, individually, statistically significant with strong explanatory power. However, with overlapping confidence intervals, we cannot reject the hypothesis that the values are the same. The analysis would require approximately double the participation rates in order to narrow the confidence intervals sufficiently to validate the difference between the two group point estimates.

Table 2. Mean Annual IQAP Billing Analysis Results

Model	Change in Mean Study Period Household Usage	Weather Normal Household Usage Change	Mean Annual Load	Change as % of Annual Load	Explanatory Power (R ²)	90 % Confidence Interval	Statistically Significant
Opt-in	+363 kWh	+380 kWh	7,408 kWh	+5.1%	0.76	+/- 155 kWh	Yes
Opt-out	+220 kWh	+220 kWh	7,548 kWh	+2.9%	0.75	+/- 145 kWh	Yes

- › **Persistence in post-IQAP Rate changes to consumption:** Determine the persistence in energy consumption changes attributable to the original opt-in cohort included in the previous billing analysis.

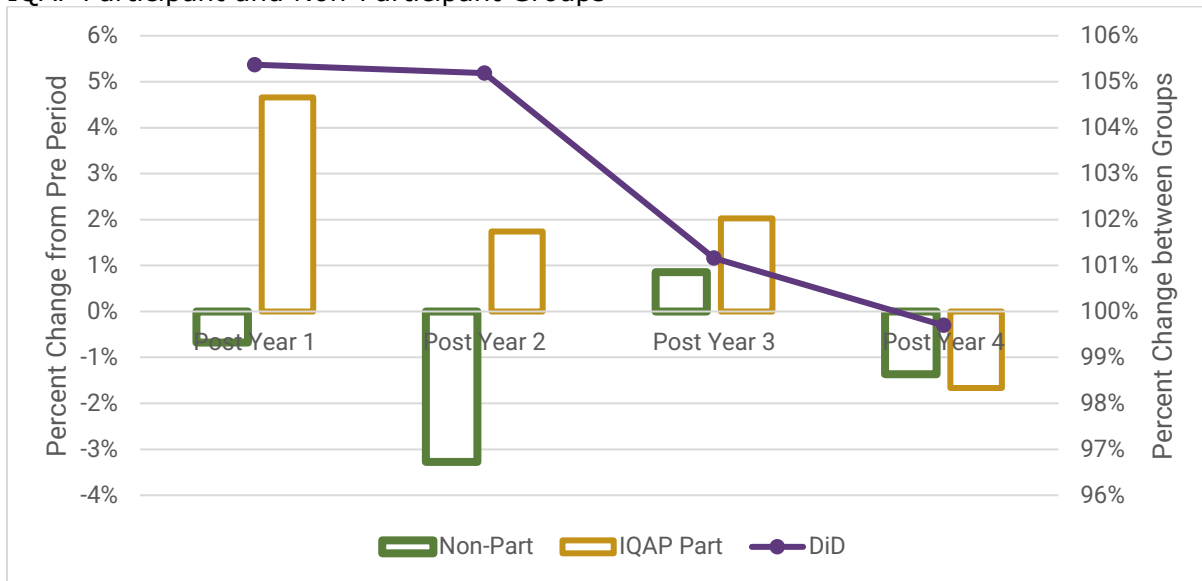
The original opt-in IQAP participants showed sustained increased usage during the first two years after receiving the reduced IQAP rate. Yet, over the following two-year period the opt-in participants use eventually reverted back to “normal” and was not statistically different than the non-participant comparison group. A summary of the annual difference in use between pre-and-post IQAP rate between the participant and non-participant comparison group is shown in Table 3 below.

Table 3. Original opt-in IQAP Persistence in Use

Post Year	Percent Increase in Use	Annual Pre-IQAP rate kWh	IQAP Participant Increased Use	Statistically Significant Difference
1	5.4%	6,759	363	Yes
2	5.2%	6,759	351	Yes
3	1.2%	6,759	78	No
4	-0.3%	6,759	-21	No

Viewing the same data but graphically demonstrates the year over year changes to usage relative to the pre-IQAP rate and the resulting percent change between groups (displayed as the purple difference-in-difference⁵ - “DiD” in Figure 1 below). The most notable shift after the initial post year use (“post year 1”) occurs between year two and year three - coincident with COVID. We see there is a shift in use for the non-participant group from negative 3% to positive 1% - and this explains the majority of decrease in the DiD. Stated more succinctly, non-participant increased use in year three was primarily responsible for drop in the IQAP impacts (displayed as the purple DiD line).

Figure 1. Annual Percent Change from Pre-IQAP Rate offering and percent change between IQAP Participant and Non-Participant Groups

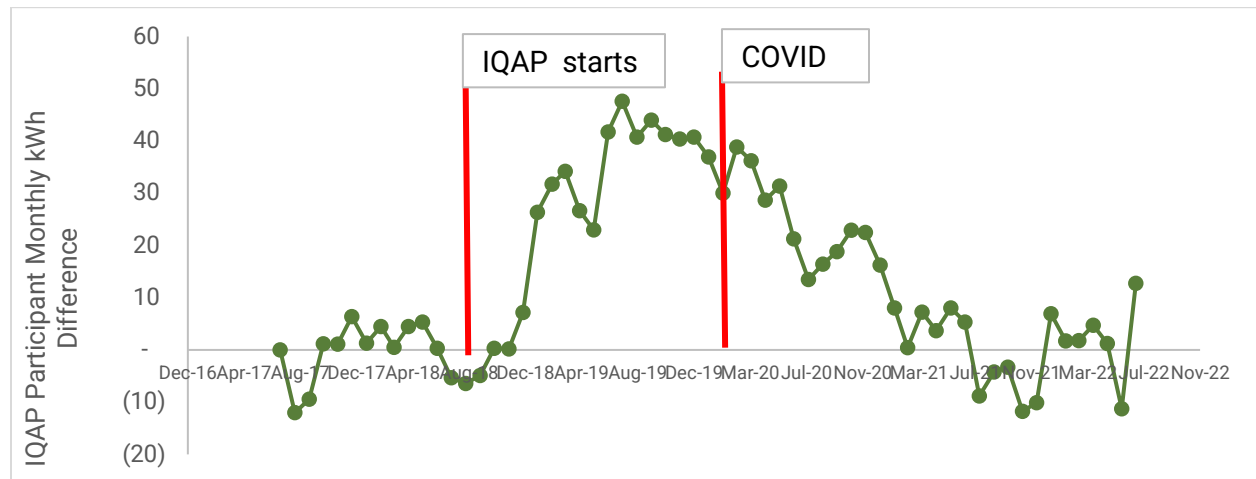


An examination of the monthly difference in use between the IQAP participants and non-participant comparison group demonstrates the evolution of impacts over time (Figure 2). IQAP participants displayed a steadily increasing average usage relative to non-participants immediately following the new reduced rates. Unfortunately, the timing of COVID appears to have confounded the influence of the drop in the IQAP participant usage where a statistical model could not distinguish between natural reversion to equivalent use and COVID-induced

⁵ The DiD curve reflects the difference in percent change in use between the IQAP participant and non-participant, e.g., in post year 1, the +4.7% increase for IQAP parts plus the negative 0.7% decrease to non-parts equals the 5.4% DiD result.

changes. It is likely, though not certain, that COVID magnified the degradation of IQAP rate impacts.

Figure 2. Average Monthly kWh Difference between IQAP Participants and Non-Participants



Conclusions

The new opt-out design of the IQAP rate program showed that households still tend to increase their energy consumption after receiving the discounted rate, yet at a lower degree than the original opt-in group. Though point estimates were almost 50% different between the original opt-in and new opt-out group, the analysis would require almost double the participants in order to conclude that the change in use were statistically different between groups. Consistent with the prior analysis, our findings suggest that this increase in energy consumption reflects households that are no longer as concerned about paying their energy bills choosing to keep their homes at a more comfortable temperature. Yet, with the new opt-out design, IQAP participants may not be as aware, conscious about the rate change, or might be less sensitive to their bills as the prior opt-in group. Additional customer feedback research would be required to help support these theories.

The analysis of the persistence of IQAP-based changes to consumption showed IQAP participants usage matched non-participant group usage by the third year, with no discernable difference in use by year four. Unfortunately, COVID’s impacts on both groups usage in the post period prevents us from concluding the reversion in usage was influenced more by COVID or if IQAP participants were no longer increasing their use with lower bills. Evidence suggests the change may have been influenced more by the non-participant groups increased usage, though we don’t know what drove this other than suspecting COVID.