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Identifying the impacts of Cool Choices' game at Miron Construction

Energy savings from player actions

February 5, 2013

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Acknowledgements

Energy Center of Wisconsin staff who contributed to this project include Scott Pigg, Joe Kramer, and Karen Koski.

We would also like to express our appreciation for the financial and logistical support of Cool Choices without which this analysis would not have been possible and the candid descriptions of Miron employees we interviewed to better understand the actions they took at home when they played the Cool Choices game over a year ago.

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REPORT SUMMARY

Two hundred and twenty employees of Miron Construction participated in a Cool Choices game referred to at Miron as "iChoose" from May through November 2011. They claimed 3,500 unique actions connected with sustainability for which they received points in the game. About half of those actions were new activities by the player, while the other half were actions the person had already taken (but for which he or she received credit in the game anyway).

Our follow-up impact study of a sample of participants indicates that participants took meaningful actions when they played the cards associated with in-home savings of electricity and natural gas. Activities ranged widely for some cards—and often deviated from pre-game assumptions. However, most players took steps that would save them energy. Based on post-game interviews, we estimated annualized electricity savings to be around 700 to 900 kWh per active player, while our billing analysis pointed to somewhat lower usage reductions of 400 kWh (with a 95% confidence interval of 100 to 800 kWh). On average, participants for whom we had usage data consumed about 10,000 kWh per year, so these savings amount to a few percent of total electricity consumption.

Natural gas savings were too low to have a measurable effect on usage across the population of players, although individual participants may have experienced some savings.

We did not explicitly examine the impacts of players' actions related to transportation, water, waste, or indoor environmental quality. However, given what we learned about home energy-related actions, it seems plausible that participants took meaningful actions that resulted in impacts in those areas as well.

INTRODUCTION

As part of a series of efforts to learn from early implementations of Cool Choices' game, the Energy Center of Wisconsin conducted a study of the impact of the game's debut at Miron Construction. We provide background and describe our approach to the study in this chapter. The report continues with the results of our research and analysis. We end the report with a brief discussion of the results' implications and recommendations for future research.

BACKGROUND AND OBJECTIVE

In April 2011, Cool Choices and Miron Construction launched iChoose, an environmental sustainability game for Miron employees. Two hundred and twenty of about 330 Miron employees played the iChoose game between May and November 2011. Players competed both individually and as members of teams by earning points for sustainable actions they took in their personal lives and reported to Cool Choices. Participants had 58 pre-determined sustainable actions available to them, as well as an opportunity to create their own sustainable activities, educate themselves about sustainable issues, or earn bonuses for documenting their activities. The actions spanned the broad themes of household energy (encompassing both electricity and natural gas), transportation, water, waste, and indoor environmental quality.

Early indications of results and player impressions have already been documented in a conference paper titled "How Many Points for That? A Game-Based Approach to Environmental Sustainability" and a report titled *Miron Construction's iChoose Game: Results of a Post-Game Survey and Analysis*. The report is posted on Cool Choices' website at www.coolchoicesnetwork.org.

In all, players reported 3,500 unique actions, of which about half (52%) were reported by players as having been newly taken. (Players also got credit for sustainable actions they were already taking.)

These newly taken actions had the potential to save a huge amount of energy, gasoline, and carbon dioxide. In designing the game, Cool Choices worked with the Energy Center to estimate the potential impacts from each action included in the game based on assumptions about the pre-game situation and actual changes that would be made by players who claim each action as a newly taken activity. Based on these assumptions, Miron employees might have saved hundreds of megawatt-hours of electricity and thousands of therms of natural gas. In fact, those initial assumptions would have resulted in savings estimates of 2,100 kWh and 19 therms per active player.

Truing up those initial assumptions to actual player practices when they played the various iChoose cards and claimed their points was one of the primary objectives of the follow-up research and analysis described in this report. For an empirically-based estimate of total savings, we would need to address such questions as:

- Had players been running their furnace fan continuously year-round when they claimed the points for switching their thermostat setting from *on* to *auto*? Or, was their "always on" usage just seasonal or sporadic?
- What kinds of gaming systems did players turn off more regularly—those with extensive power draws or the ones with minimal energy usage—and how much were the systems running before and after the game anyway? Were those practices continuing a year after the game ended?

- Were players' insulation and air sealing projects significant enough to realize meaningful reductions in heating system energy use?
- What kinds of refrigerators or freezers were players unplugging and how long did they stay unplugged?

In other words, we would need more details than just the fact that a given number of players claimed a particular card. We would need to know the pre-game practice or situation, what people did when they played a particular iChoose card, what kind of appliance or device was involved, and how long the practice persisted. We also wanted to know whether those changes resulted in visible and measurable reductions in participating households' usage of electricity and natural gas as reported on utility bills.

We used two different approaches to get a better understanding of the in-home energy impacts experienced by participants from Miron Construction. For one, we sought to construct an estimate based on actual activities taken by players and described to us in interviews. We call this the interview-based estimate. In this estimate, savings are tied to activities directly related to the game, but imprecision arises from self-reported descriptions of activities and equipment involved, as well as our estimates of the associated energy impacts.[1]

For the other, we compared pre- and post-game electricity and natural gas usage to see how much consumption changed on aggregate among players for whom we had access to billing data. We call this the observed savings, or billing analysis results. This approach is based on a more direct measurement of the actual impact we are seeking to determine—the actual change in usage—but does not distinguish activities related to the game from a myriad of other factors that cause usage to fluctuate from month to month or year to year. Without a control group and a sufficiently large sample size to wash out natural fluctuations and general trends, the observed savings data are inherently noisy and uncertain. One advantage of a comparison of pre- and post-game usage is that the uncertainty inherent in the observed change can be estimated.

We sought to be informed by both approaches, combining the insights provided from each to help us identify the probable range of impacts.

METHODOLOGY

Our post-game impact study comprised three main activities:

- a billing analysis
- interviews
- aggregation of the results to all Miron Construction participants who played the game

[1] One other benefit from this approach is the deeper understanding it provides about how the game produces the estimated savings. This does not directly aid the impact estimate, but provides richer understanding and allows a reality check on whether the overall "story" behind the savings estimate holds up.

Billing Analysis

As part of the game's implementation, Cool Choices had secured billing releases from a subset of players and subsequently obtained actual electric and/or natural gas usage data directly from the applicable utilities for 70 players.[2] These data served as the basis of a billing analysis to estimate the range of observable energy savings among this subset of players.

The players for whom we had billing data resembled the broader population of participants fairly well, allowing us to treat the results of the analysis as representative of Miron Construction participants overall. Table 1 shows how the activity level (represented by the number of relevant cards played) and the nature of the actions reported (represented by the pre-game estimate of the savings associated with the cards played) compared between the billing analysis group and the entire population of players.

Table 1: Comparison of billing analysis group to all players

Fuel	Comparison metric	Billing analysis group (n=70)	Entire population of players (n=220)
electricity	number of cards played		
	mean	3.0	2.6
	median	3	3
	pre-game savings estimate (kwh)		
	mean	2,422	2,100
	median	1,449	1,341
natural gas	number of cards played		
	mean	0.7	0.5
	median	0	0
	pre-game savings estimate (therms)		
	mean	24	19
	median	0	0

The billing analysis group also resembled typical Wisconsin homes, averaging about 10,000 kWh and 800 therms of consumption.

Our period of analysis spanned mostly from April 2010 to May 2012 with the beginning of May 2011 (the start of the game) as the dividing line between the "pre" and "post" game period. This cut-off matched the primary phase of the game during which players took actions to save electricity, which was the target of the first month's iChoose theme. Natural gas-saving measures tended to come a bit later, but still before the winter of 2011-12, during which the vast majority of the post-game natural gas usage occurred.

[2] Among these 70 players, Cool Choices obtained electricity data for 68 and natural gas data for 60.

The billing analysis consisted of weather normalization of heating-related pre- and post-game usage data, followed by a comparison of pre- and post-game consumption.

Interviews

We conducted telephone interviews with a subset of 45 players for whom we had billing data. The purpose of the interviews was to solicit more details about the nature of the actions people took when they claimed cards that we had found to be relatively high impact actions. These high impact actions were:

- replacing 85 percent of incandescent bulbs with CFLs
- removing or unplugging a second refrigerator
- turning off a game console when not in use
- replacing a water heater with a more efficient model
- switching the furnace fan setting from continuous to automatic
- air sealing and insulating to recommended levels
- adjusting the thermostat from 68 to 60 degrees Fahrenheit at night
- adjusting the thermostat from 68 to 60 degrees Fahrenheit when no one is home

Together, these actions comprised 90 percent of the aggregate initial estimate of electricity savings and 76 percent of the initial estimate of natural gas savings for all players. For these actions, we asked about pre-game practices, actions during the game, and post-game practices at the time of the interview (a year after the game ended). Where relevant, we also asked about the equipment involved. Other questions included home characteristics and non-game changes in the household that could have affected energy consumption during our analysis period. The interview guide is attached to this report.

We conducted the telephone interviews between November 9 and December 7, 2012. There was no sampling involved in the interviewee selection. Although we had developed a sampling protocol, we ended up interviewing all players in the billing analysis who responded to our interview requests.

The subset of players who completed an interview resembled the broader population of participants reasonably well, especially for electricity-related actions (see Table 2). They did seem to claim more natural gas-saving actions. The somewhat greater activity levels were not extraordinary, however, and served to give us data on more actions than we would have gotten on average. There is no reason to think that the manner in which the interviewees implemented their energy-saving measures would be substantially different from their colleagues who were not interviewed even if they took a somewhat larger number of actions. Thus, we chose to treat the interviewees' descriptions of their actions as representative of Miron Construction participants generally.

Table 2: Comparison of interviewees to all players

Fuel	Comparison metric	Interviewees (n=45)	Entire population of players (n=220)
electricity	number of cards played mean median	 3.2 3	 2.6 3
	pre-game savings estimate (kwh) mean median	 2,442 1,966	 2,100 1,341
natural gas	number of cards played mean median	 0.9 1	 0.5 0
	pre-game savings estimate (therms) mean median	 28 18	 19 0

Aggregation and cross-checking

With more details about the actions players took and billing analysis results in hand, we were able to update estimates of energy savings and check them against actual usage changes for reasonableness. First, we developed new, interview-based savings estimates for the high impact actions. In doing so, we assumed that the practices of the interviewees represented the activities players commonly took when they played the high impact cards. Using that information to override the initial assumptions, we then computed new average savings we would expect from each of these cards. Next, we attributed those savings to all players who had claimed the high impact cards.

Secondly, we compared the new savings estimates to the billing data results to determine their plausibility.

We have already provided the revised savings assumptions for high impact actions to Cool Choices. The aggregated savings they imply and the observed changes in usage seen in the billing analysis are shown below in the results chapter of this report.

RESULTS

We explored four fundamental questions in our analysis:

- What actions did players actually take when they played the cards they did?
- Did those actions persist beyond the game?
- How much electricity and natural gas did people save from actions taken at home?
- How do the interview-based savings estimates and the observed usage changes from the billing analysis compare?

This chapter presents the results of our analyses and suggests answers to these questions.

WHAT HAPPENS AT HOME WHEN PLAYERS CLAIM POINTS?

One of the fundamental unknowns for iChoose was what people would actually do at home when they claimed certain actions. Did players' actions match what was printed on the iChoose cards? How liberally did players interpret the cards? How well do the assumptions behind the initial impact estimates hold up? The 45 interviews we conducted went a long way toward providing some initial answers to these questions.

Our interviews suggest that players did take real actions when they claim points for activities. We asked the 45 interviewees targeted questions about six specific high-impact actions they could claim. Collectively, the interviewees claimed these actions 77 times.[3] Interviewees' descriptions of the pre-game conditions, their activities during the game, and post-game conditions suggest that the interviewees actually took a relevant new action at the time they claimed the card in 65 of the cases (or 84 percent of the time).

What they actually did varies substantially, however, and does not always fit the assumptions associated with the iChoose cards. As shown in Table 3, actions fit the initial assumptions closely only in 26 cases (or 34 percent of the time).

[3] In each case, the interviewees had indicated that the action was newly taken when they initially reported the action to claim points during the game. We excluded actions they claimed as pre-existing from our analysis, although they received iChoose points in the game, so there was no incentive to report pre-existing actions as new.

Table 3: Summary of high-impact energy actions taken and comparison to initial assumptions

Action	# of interviewees who claimed*	# who described a newly taken action	# whose action fit initial assumption
Replace 85 percent of incandescent bulbs with CFLs	13	13	10
Remove or unplug second refrigerator	17	17	7
Turn off game console when not in use	18	12	1
Replace water heater with more efficient model	6	6	0
Switch furnace fan setting from continuous to automatic	15	10	4
Air seal and insulate to recommended levels	8	7	4

* Only includes interviewees who claimed the action to be newly taken.

We found three primary scenarios among the high-impact actions we cross-checked against interview responses. For some actions, such as replacing incandescent light bulbs with CFLs, the assumptions and reality match well. Nearly all interviewees who played the iChoose card for widespread installation of CFLs started with a modest number of CFLs and increased that number to nearly 100 percent.

For some actions, such as unplugging or removing a second refrigerator, the players' activities matched the assumption well, but the equipment varied greatly. Our underlying assumption had been that people would remove or unplug full-size refrigerators. However, the interviews revealed that significant shares of players removed mini refrigerators or chest-sized freezers instead. Half of the appliances removed or unplugged were smaller refrigerators or freezers, which tend to have lower consumption than their bigger siblings, while the rest were full-size refrigerators or stand-up freezers.

For yet other actions, the activities were different than we had assumed, often encompassing only a partial implementation either because the player only went part of the way to the intended practice or was already partially there and didn't have as much to change as we had assumed. The iChoose card that specified changing furnace fan settings from *on* to *auto* is an excellent example. Indeed, everyone who played that card did seem to end up with the desired furnace fan setting, but only four of the 15 interviewees who claimed this card as a new action had actually been running the furnace fan continuously year-round before the game. Six interviewees had used the furnace fan in the *on* setting some of the time only—often seasonally—and three appear to have already had their furnace fan set to *auto*.[4]

We asked similar questions of two other high-impact actions involving thermostat settings, but without exploring pre-game settings. These inquiries suggest that people were setting back their thermostats—sometimes by fewer degrees than recommended—but for longer periods than specified on the cards they played.

Using these insights and the specific descriptions provided by the interviewees, we developed a revised set of behavioral and equipment assumptions for the eight electricity and natural gas-saving actions that showed the greatest overall impact initially. The new assumptions reflect the actual practices and circumstances described by the interviewees. These revised assumptions reduced the impact tied to the affected iChoose cards and the estimated savings for the players we interviewed, as shown in Table 4. We estimated that high-impact actions provided an average of 900 kWh and 4 therms of savings for the interviewees, whereas pre-game assumptions had estimated 2,200 kWh and 23 therms.

Table 4: Initial and interview-adjusted savings estimates (n=45 interviewed players)

Fuel	Based on...	High-impact actions	All other actions
electricity	pre-game assumptions	2,200 kWh	250 kWh
	post-interview estimate	900 kWh	no basis for revisions
natural gas	pre-game assumptions	23 therms	5 therms
	post-interview estimate	4 therms	no basis for revisions

Electricity and natural gas-saving actions comprise only two of the three main groups of iChoose cards with substantial overall potential impact. Transportation actions round out the triad. While we did not explore transportation actions of interviewees in any detail, the insights gained about electricity and natural gas actions suggests that some downward adjustments to assumed savings for key transportation actions are probably in order as well. As noted above, pre-game assumptions about the in-home actions we studied held in only a third of the cases. The practice—as opposed to the equipment involved—deviated about half of the time, but the degree to which practice matched initial assumptions varies greatly across the various iChoose cards.

DO THE ACTIONS PERSIST?

There is widespread interest in—and speculation about—the persistence of behavior-based energy-savings. Habitual actions save energy only as long as people continue the habits. Fans switched to automatic save electricity only as long as the setting remains on automatic. Refrigerators removed from a

[4] We could not tell how the other two interviewees who claimed this action had set the furnace fan before the game. Either the interview responses were unclear, or the interviewee could not recall.

home stop saving electricity if they are replaced (or save less if their replacement is more efficient). The timing of our 45 interviews gave us an opportunity to learn more about the one-year persistence of the high-impact electricity and natural gas-saving actions included in Cool Choices' game.

As best as we can tell, one-year persistence of the most impactful actions was high with relatively few actions reverting to the pre-game condition. This was true of the one-time actions like removing or unplugging second refrigerators, actions that require more habitual practices such as turning off gaming systems after use, and actions that fall in-between (keeping the thermostat on *auto*). In fact, we asked specific questions of people who had claimed these three measures to understand their persistence.

Among the 17 interviewees who had claimed the refrigerator measure, we found that the action taken during the game remained intact a year later in 15 cases. The iChoose card allowed players to either remove or unplug a second refrigerator (or freezer). Twelve interviewees removed a refrigerator or freezer as part of the game. Only two of them had introduced a new refrigerator or freezer into the home by the time of our interviews a year later. One interviewee even removed an additional freezer not claimed as part of the game, while nine players continued with the same configuration of refrigerators and freezers since the removal of the appliance they claimed. Meanwhile, all five players who had unplugged their appliance continued to keep it off the grid, at least most of the time. (One of the five uses it occasionally for additional food storage capacity during special occasions.)

Among those who claimed to be turning off their gaming system more regularly, we conservatively estimated persistence among 12 of 17 interviewees who could answer our questions. This estimate is based on interview questions about the extent to which gaming systems were turned on after use, both before the game and at the time of the interview. Five interviewees reported very similar runtimes during those two time periods, suggesting that they either didn't change their practice in a meaningful way or their immediate practices after playing the card have reverted to the pre-game habits. Hence, some of these five players may actually have not changed their practice in a meaningful way rather than reverted to pre-game habits. It should also be noted, however, player estimates of gaming system runtimes are inherently uncertain, so our persistence estimate for gaming system practices is uncertain as well.

Conversely, all fifteen interviewees who had claimed to switch their furnace fan to automatic affirmed that the thermostat was still set that way at the time of the interview. This response is most meaningful for the four individuals who had changed from a continuous *on* state, but is also a positive indication for the six individuals who had changed the fan's setting from a seasonal or sporadic *on* state to *auto*. The impression we received during the interviews is that all players who claimed this card now run the fan on automatic all the time for 100 percent persistence.

Generally, we assumed that people would not undo the other high-impact one-time measures—insulation projects, water heater replacements, or wholesale light bulb replacements—so we treated those actions as still in-place unless the interviewees provided some indication to the contrary while describing the actions they took. Although some people did volunteer that the game had little to do with their water heater replacement or that they disliked CFLs, we heard nothing that would make us think any of these measures had been undone since the game. So, we assume complete one-year persistence for these actions.

Table 5 summarizes our best estimate of persistence among the high-impact actions after one year.

Table 5: Summary of one-year persistence by action

Action	Estimated one-year persistence
Replacing 85 percent of incandescent light bulbs with CFLs	complete (100%)
Air sealing and insulating to recommended levels	complete (100%)
Switching furnace fan setting from continuous to automatic	complete (100%)
Replacing water heater with more efficient model	complete (100%)
Removing or unplugging second refrigerator	high (80-99%)
Turning off game console when not in use	moderately high (60-79%)

HOW MUCH ENERGY DID PLAYERS AT MIRON CONSTRUCTION SAVE IN THEIR HOMES?

The combination of follow-up interviews and billing data for a sample of players gives us two empirical means to estimate the total energy savings experienced by iChoose participants from Miron Construction in their homes. Both suggest that a reduction to the initial savings assumptions was in order. Furthermore, they provide two overlapping, but somewhat different estimates of what the new savings estimate ought to be.

Interview-based savings estimates

The combination of interview responses from 45 players and the scoring data from all 220 players suggest that annualized electrical savings per player fell in the 700 to 900 kWh range. Natural gas savings were smaller at perhaps 8 to 13 therms. As shown in Table 6, we estimate that the eight high-impact actions that formed the core of our interviews provided about 700 kWh and 8 therms of savings per player. All other actions contributed up to 200 additional kWh and 5 therms, although those estimates are substantially more speculative.

Table 6: Estimated savings extrapolated from interview results (for all 220 players)

Fuel	High-impact actions (post-interview estimate)	All other actions (pre-game assumptions)
electricity	700 kWh	200 kWh
natural gas	8 therms	5 therms

The savings for high-impact actions are based on the information provided by interviewees who had claimed those actions. We estimated the average savings for these players based on the details they provided about their practices before the game and how they changed as a result of the game. We also took into account the type of equipment involved whenever that was relevant for the savings estimate. We then multiplied that new savings estimate for each high-impact action by the number of players who claimed those same actions (and indicated that the action was a new activity for their household).

The savings associated with all other actions are less certain. Those savings could add another 200 kWh and 5 therms per player. However, those estimates are based on the initial assumptions about what people would do when they played the applicable cards and have not been trued up to empirical information about what those players actually did.

Billing analysis results

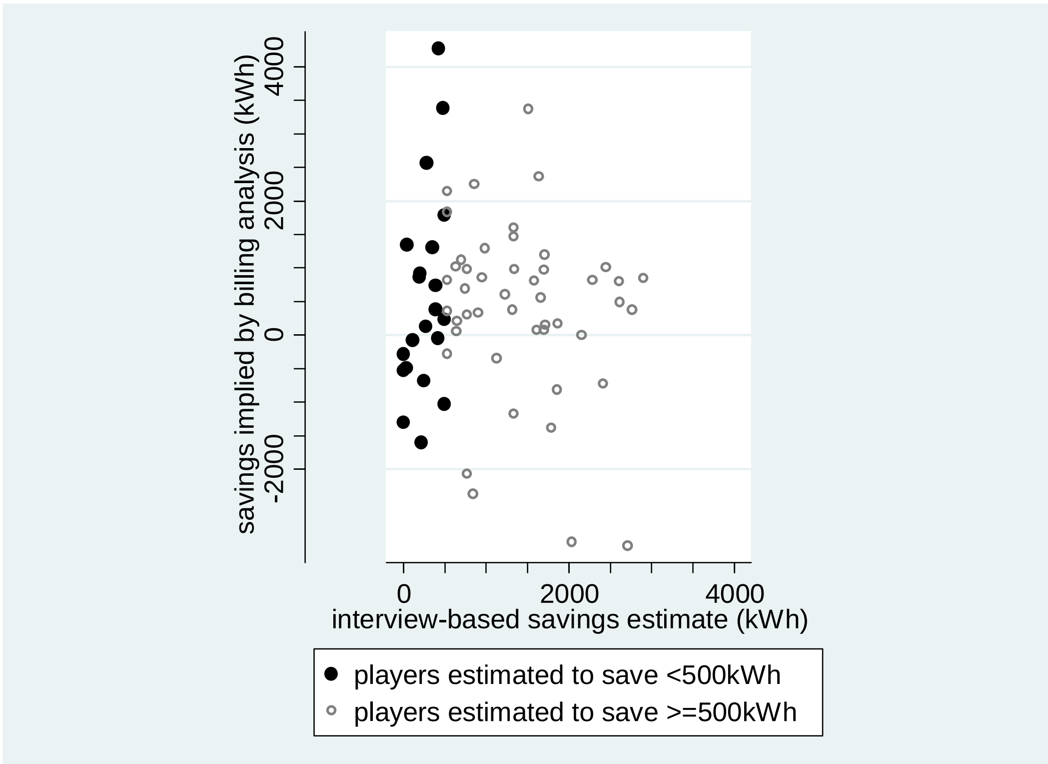
Our billing analysis suggests electrical savings in the 100 to 800 kWh range with a point estimate of about 400 kWh.[5] The natural gas savings are not statistically distinguishable from zero. These results are based on a comparison of 70 players' weather-adjusted usage during the year before the game and the year after its start.

The range of possible electricity savings identified by the billing analysis is so wide because the sample size was relatively small and the usage data were inherently noisy. Furthermore, without a control group, the estimate does not take into account overall trends in electricity usage by residential customers, which can easily move up or down by more than 2,000 kWh for individual households or by a couple of percentage points across an entire utility service area (where household-specific patterns tend to cancel one another out).[6]

Figure 1 shows the wide natural variation in electricity usage. The figure shows the changes in pre/post usage among players for whom we estimated relatively little in savings from claimed actions (see the dark diamonds[7]). These players' changes in usage are probably a reflection of natural variation. This noise in the usage data makes it inherently difficult to tease out actual savings with much precision from modestly sized samples.

[5] Generally, these savings should be due to the game, although the unusually mild post-game winter could have resulted in naturally occurring savings of about 60 kWh per player, on average, that our weather normalization process did not address.
[6] Overall, residential electricity usage has been trending downward in Wisconsin in recent years.
[7] The figure also shows players for whom we estimated meaningful savings as open circles.

Figure 1: Comparison of usage change (billing analysis) to estimated savings



A comparison of 60 players' pre/post natural gas consumption pointed to weather-normalized usage changes that are statistically indistinguishable from zero, meaning that there were not sufficient usage changes to show any trend past the natural variation in the data.[8]

Translating the estimated savings to percentages

One common metric for energy savings is the percentage of pre-intervention usage that was saved. For Miron Construction participants for whom we had usage data (i.e., the billing data sample), our interview-adjusted estimate of electricity savings resulted in a *median* value of nine percent (within a range from 0 to 39 percent[9]), while the billing analysis showed a *median* weather-adjusted usage change of six percent (within a range from -47 percent to +27 percent[10]).[11]

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[8] Our initial billing analysis suggested negative savings with a 95% confidence interval from -58 to -9 therms because an unusually mild post-game winter stretched our weather normalization process's ability to distinguish between space and water heating. With a corrective adjustment, we calculated a savings range of -39 to +10 therms.

[9] For one player with low overall electricity consumption, we had estimated savings of 81 percent of the household's pre-game usage. We treated that player's data as unrealistic and left it out of the computations shown here.

[10] These values exclude 10 players for whom we had information from the interviews about non-game household changes that could overwhelm the game-related savings and thereby introduce a confounding factor.

[11] The overall *mean* savings from the billing analysis amounted to four percent, which reflects the fact that players with high pre-game usage reduced their consumption by a lower percentage than those with lower pre-game usage.

Those players with lower initial consumption had a wider range of percentage savings (because each percent represented fewer kilowatt-hours). Figure 2 and Figure 3 show these results graphically.

Figure 2: Interview-adjusted electricity savings as a percentage of pre-game usage (n=67)

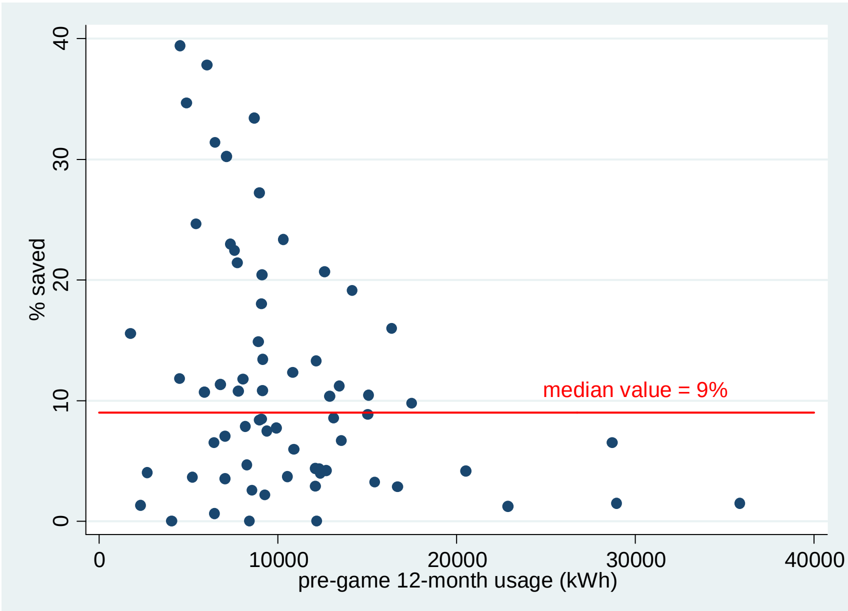
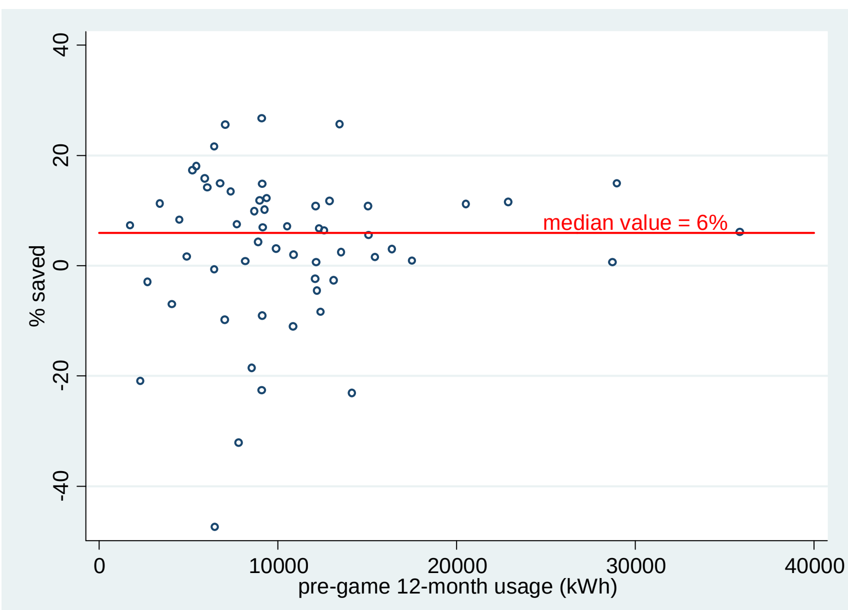
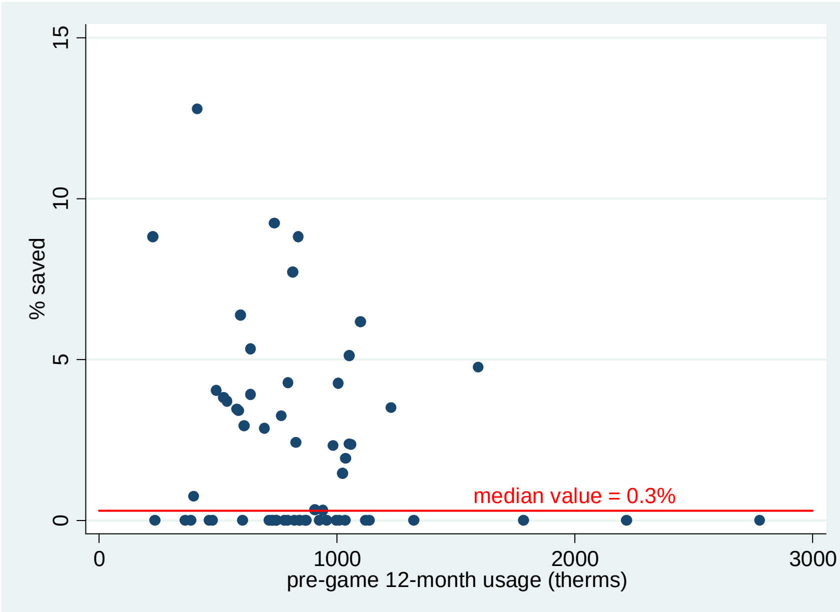


Figure 3: Observed change in usage as a percentage of pre-game usage (n=58)



In contrast, interview-adjusted estimates of natural gas savings suggested *median* savings of less than one percent of pre-game gas usage, while the billing analysis did not pick up measurable savings. The range of interview-estimated savings and their relationship to pre-game usage are shown in Figure 4.

Figure 4: Interview-adjusted natural gas savings as a percentage of pre-game usage (n=60)



DISCUSSION AND FUTURE RESEARCH

This post-game research suggests that the Cool Choices game at Miron Construction resulted in tangible actions by participants that saved electricity (and perhaps some degree of natural gas) in their homes. Participants played a wide range of cards, but a small number of actions provided the bulk of in-home energy savings.

Miron participants appear to have saved electricity as result of their participation in the game, but it is less clear whether they saved any meaningful amounts of natural gas. Both follow-up interviews and a billing analysis indicate that initial savings estimates of 2,100 kWh and 19 therms were too high, but paint somewhat different pictures of what the actual savings were.

Interview-based estimates suggest average annual electricity savings around 700 kWh per active player—or 900 kWh if one were to include minor actions for which we have no empirical insights for a revised savings estimate. Observed changes in consumption (from the billing analysis) point to savings of 400 kWh, but with an uncertainty range that stretches from about 100 to 800 kWh. (There is uncertainty around the interview-based estimate as well, but we have no clear basis for estimating its extent.) On average, participants for whom we had usage data consumed about 10,000 kWh per year, so these savings amount to a few percent of total electricity consumption.

Similarly, interview-based estimates suggest average annual natural gas savings around 8 therms per active player—or 13 therms if one were to include minor actions for which we have no empirical insights for a revised savings estimate. However, any natural gas savings were too low to result in observable changes in usage for players overall. That said, individual participants may have experienced savings as a result of the actions they took.

Indications are that one-year persistence is fairly high.

There are inherent uncertainties in the savings estimates, and we recommend that Cool Choices continue to analyze savings in future renditions of the game. A billing analysis comprising a larger number of players—preferably with a control group of non-players—should be able to corroborate or inform further revisions to interview-based savings estimates, at least in the aggregate. Such a billing analysis would also pick up "spillover" actions that people may have taken as a result of the game but not claimed for points.

At the same time, we recommend that Cool Choices continue to gather data on what people actually did to claim the points available through the game. As we learned through our interviews, the range of activities and equipment involved varies widely for some cards. Understanding the details of what the game cards spur people to do will help Cool Choices continue to calibrate action-specific savings assumptions. We suspect that such information will also prove helpful for ongoing tweaking of the game and player education provided with the individual cards. Post-game interviews proved to be an excellent way to learn what actions people took and to true up assumptions to in-home realities.

Parallel to this report, we have also provided Cool Choices with revised savings estimates for key actions and a database that documents the actual activities taken by interviewees who claimed high-impact cards. The database can serve as an ongoing tool to show the range of actions represented by high-impact cards.

We suggest that Cool Choices add to that database as similar information becomes available from post-game interactions with players in future games.

Ultimately, there may be interest in long-term persistence of actions taken and the savings associated with them. When an opportunity arises, Cool Choices may wish to conduct long-term tracking of persistence through an extended analysis of billing data or check-ins with past participants (or both).

While we did not explicitly examine the impacts of players' actions related to transportation, water, waste, or indoor environmental quality, one could reasonably surmise that Miron employees also took meaningful actions in those areas resulting in real impacts. However, as with home energy, participant activities and the share of the assumed impacts realized may vary.

ATTACHMENT: INTERVIEW GUIDE

Cool Choices follow-up evaluation – Miron Sustainability Pilot

Thank you for taking the time to answer my questions about your sustainability efforts during the iChoose game a year ago. We will ask you about selected things you did while playing the game – especially the actions that have the greatest potential effect on household energy usage. As a reminder your responses will be kept in confidence and no one from Cool Choices or Miron Construction will see your individual responses – we will just report the responses in aggregate. And as a thank you for your participation you will be entered into a drawing for the chance to win one of two - $100 Visa gift cards.

Q1) Did you enjoy playing the iChoose game last year?

What did you like about it?

What didn't you like?

[Ask Q2-Q8 only of respondents who had reported the relevant measure as a newly taken action.]

Q2) One of the actions you took while playing the iChoose game was switching your furnace fan from on to auto. Do you recall that? *[if needed] That would mean you changed the setting of a switch on your thermostat that causes your furnace fan to blow air through your ducts either continuously or only when your heating and cooling system is actively creating warm or cold air.*

We are trying to understand how people interpreted this card and what people did when they played it. There is a switch on most thermostats that has an on setting and an auto setting. Before playing the game, what share of the time was that switch set to "on" so that air would blow through your ducts continuously regardless what your heating and cooling system was doing?

[if some of the time]

When and how often did you keep the fan running continuously?

During particular seasons? Only on the hottest days? Or a fair amount of time?

If seasonal, was it on during the summer? Winter? Spring and fall?

Why did you keep your fan set to "on" during those times and not others?

[if all the time]

Why did you keep your fan set to "on" continuously?

When you decided to switch your furnace fan from "on" to "auto" for the game – did you keep it switched to auto just during the time you were playing the card or did you keep it switched to auto longer than that?

How do you manage your settings now?

Have you switched it back to 'on' since the game? How often? Under what conditions?

[if respondent went from always on to always auto]

> How old is your furnace?
>
> As far as you know, is it a variable speed furnace – so it has two or more heating stages – or is it a traditional furnace that is either just on or off?

Q3) One of the actions you took while playing the iChoose game was to unplug or remove a second refrigerator. Do you recall that?

> What kind of refrigerator was it? (full size, mini)
>
> Where in your home did you keep it?
>
> Before playing the game, were you using this refrigerator? How much of the time was it plugged in?
>
> How many other refrigerators did you generally keep plugged in back then?
>
> For the game, did you keep the unplugged refrigerator in the home, or did you get rid of it entirely?
>
> > [if unplugged] Do you still keep it unplugged?
> >
> > > [if not still unplugged] How long was it unplugged before you plugged it back in yet?
> >
> > [if got rid of it] Have you replaced it since?
> >
> > [time permitting] So, how many refrigerators do you generally keep plugged in now?

Q4) One of the actions you took while playing the iChoose game was to turn off your gaming system while it was not in use. Is that correct?

> What kind of gaming system was it? (Playstation I, II or III, Xbox, Xbox 360, Wii, Nintendo, Gamecube, Nintendo 64, other) Is it online capable?
>
> Before playing the iChoose game, did you keep your gaming system on all the time or was it left running while unused only some of the time? How much of the time was it on but unused (e.g., hrs/week)?

When you decided to turn it off more, is that something you did just for the duration of the game or longer than that?

What share of the time is it on now?

Q5) One of the cards you played was about having at least 85% of your light bulbs be CFLs. Do you recall that?

What share of your light bulbs were CFLs before the game?

What share of your light bulbs are CFLs now?

Q6) One of the cards you played was about air sealing and insulation. Do you recall that?

What did you do when you played the card?

Probe to understand:

air sealing	insulation
Did you do it or hire someone?	Did you do it yourself or hire someone?
What part or parts of the home did you air seal?	Where did you put or add insulation?
[if DIY] How did you do the air sealing?	What kind of insulation did you use/get?
[if DIY] What prompted you to do sealing in those locations?	How much did you add?
[if hired someone] Did the person who did the air sealing use a blower door?	How much was there before?

Q7) One of the cards you played was for replacing a water heater. Do you recall that?

What prompted you to get a new water heater?

What kind of water heater did you have before?

What did you replace it with?

Probe:

change in fuel

change in kind of water heater

change in size of the storage tank

Q8) You also played an innovation card for cooling your home. What did you do to keep cool?

Did your repeat that during this past summer?

[Ask the remaining questions of all applicable interviewees.]

Q9) While playing the game, were there any other actions that you took that we haven't talked about yet that you thought were significant energy savers for your home? [if no transportation-related actions mentioned] What about energy savers on the road or in your transportation?

Probe on any that seem significant

What did you do before the game?

How did you change what you were doing during the game?

What are you doing now?

Q10) In the past two years, have there been changes to your household that would have caused large increases or decreases in energy usage? (people moving in, people moving out, add-ons to your home, air sealing, insulation, adding new equipment such as a refrigerator, freezer, hot tub, pool, sauna)

[Note: For players marked as outliers on list of interviewees, probe a bit harder if there is no initial response.]

Q11) Now, please think about any habits you or your household developed during the game. Are there any things you started doing differently as a result of the game that continue to this day?

Q12) Finally, I have just a few quick questions about your home and then we'll be done. What is the main fuel you use to heat your home (natural gas, electricity, propane, etc.)?

[if natural gas] Do you have a forced air furnace or a boiler?

Are there any other fuels that you use during the winter (wood stove, fireplace, electric space heaters)?

[if yes] probe:

How much do you use these secondary heating sources?

Q12) Does your water heater use natural gas, electricity, or some other fuel?

Q13) Do you have air conditioning?

[if yes] Do you have a central air conditioner or one or more room air conditioners?

Q14) About how old is your home or what year was it built?

Q15) About how many square feet of heated space does your home have?

Q16) At what temperature do you usually keep your home in the winter when you are home?

Is the temperature any different when you are away or asleep? What is it then?

Are these settings any different now than two years ago? In what way?

[if needed, probe for the temperature settings two years ago]

Those are all the questions I had. Do you have any questions for me?

Thank you for your candid responses. You will be notified if you are chosen for one of the two $100 Visa gift cards.