Opinion Dynamics

Boston | Headquarters

617 492 1400 tel
617 497 7944 fax
800 966 1254 toll free

1000 Winter St
Waltham, MA 02451

Memorandum

AIC Non-Residential Non Energy Impacts Methods

To: Seth Craigo-Snell, SCS Analytics, Fred Wu, AIQUEOUS, Andy Vaughn, Leidos, and Jennifer Morris, ICC Staff

From: Jayden Wilson and Kyle Schultz

Date: March 30, 2022

Re: AIC Non-Residential NEI Estimation Approach

This memo summarizes the methods and assumptions used to estimate the non-energy impacts (NEIs) presented in the marketing collateral delivered to Ameren Illinois Company (AIC) in tandem with this memo. We took a 2-part approach to document and monetize the NEIs experienced by retail, health care, and manufacturing/industrial customers who participated in AIC's Business Program. We estimated NEIs resulting from operations and maintenance (O&M) NEIs using an engineering-based lifecycle cost (LCC) approach and conducted in-depth-interviews with participants to identify and monetize non-O&M NEIs. We detail each step below.

For more details on sample design please refer to the *AIC Non-Residential Non-Energy Impacts Sample Plan provided in September 2021.*

O&M NEIs - Life-Cycle Cost Analysis

We estimated NEIs resulting from O&M cost savings for eleven measures[1] using an engineering-based LCC approach. We estimated O&M cost differences between the program incentivized measures ("efficient measures") and the assumed non-energy efficient baseline measures ("alternative measures") by comparing the amortized net present value (NPV) of the average periodic repair, replacement, and maintenance costs schedules of efficient and alternative technologies. These amortized annual cost differences reflect the O&M cost savings associated with operating and maintaining these efficient technologies that should factor into capital investment decisions when choosing between efficient equipment and their baseline alternatives. Using these results, we calculated the payback period necessary for a participant to recuperate the initial investment in efficient measures accounting for the value of the energy savings, incentives, and O&M cost savings.

We first developed the inputs for the LCC analysis and payback period calculations using secondary data sources then developed an analytical framework to translate these inputs into annual amortized O&M cost for each efficient and alternative measure. We describe both steps in greater detail below.

---

[1] A measure may cover only a portion of equipment installed under an Illinois Technical Reference Manual (IL-TRM) measure category. For example, the efficient measure category "HVAC Cooling Tower or Pump Motor with a VSD" (IL-TRM v9.0 Measure 4.4.17) may be limited to cover the measure "VFD on 10 HP HVAC pump."

Develop Inputs

Repair and Cost Schedules

The primary sources for periodic repair, replacement, and maintenance cost schedules were Coldwell Banker Richard Ellis (CBRE)'s Cost Library[2] and Gordian's RSMeans[3], which are industry standard sources for facility management and cost information. The team downloaded and processed the cost schedule data, which included mapping the measures in Cost Library and RSMeans to measures in AIC's tracking data. The team reviewed the inputs for reasonableness and in in some cases, conducted a secondary research and analysis to revise the cost and/or maintenance schedule assumptions. For example, the team estimated adjusted the frequency of LED lamp replacement from 10.00 years to 13.84 years based on IL-TRM v9.0 assumptions and online research. Table 1 shows an example cost schedule for comparing a metal halide fixture to a LED fixture.

Table 1. Example Cost Schedule – Metal Halide and LED Fixture

Efficient Measure	Task Type	Task Description	Labor Hours	Material Cost	Occurrence (years)
Metal Halide Lighting Fixture w/ Electronic Ballast	Repair	Replace Ballast	0.46	$163.40	11.07
	Replace	Replace	0.34	$531.06	20.00
	Maintenance	Replace Lamp	0.46	$13.86	4.15
LED Lighting Fixture	Repair	Replace Lamp	0.09	$42.54	13.84
	Replace	Replace	0.34	$134.21	19.38

Incentives and Energy Savings

For each efficient measure, the team calculated average incentive amounts and energy savings according to IL-TRM algorithms using segment-specific assumptions for equipment characteristics (e.g., hours of use, motor efficiency, etc.). We based the assumptions on observed characteristics of measures in program tracking data or on average values in the IL-TRM V9.0. We calculated average incentive amounts based on AIC program guidelines and relied on algorithms in the IL-TRM V9.0 to calculate annual energy savings. Finally, we calculated average customer bill savings by multiplying the annual energy savings by the 2021 AIC average DS2 retail rate.

Calculate Results

When comparing the O&M cost schedules of two equipment investment decisions, it is important to consider the same period of time for both measures. Therefore, we defined the analysis period as the predicted lifetime of the efficient equipment for both baseline and efficient equipment and considered all costs that occur in this time period. We calculated the NPV of the stream of costs, by measure and task type, over the analysis period using a discount rate of 4.19%.[4] To calculate the total O&M cost difference, we subtracted the NPV of expected

---

[2] CostLab Cost Library Database, CRBE Business Analytics. (https://costlab.cbre.com/CostLibrary)
[3] Facilities Construction Costs Core Dataset, RSMeans data from Gordian. Gordian, Inc. (https://www.rsmeansonline.com/SearchData)
[4] We selected 4.19% as the discount rate because it is a C&I sector-specific real discount rate, and therefore reflects the average cost of capital customers use when making investment decisions. Sourced from the Stern School of Business, New York University. https://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html (accessed January 5, 2022)

O&M costs of the efficient measures from that of the alternative measures. The annual amortized NEI is this difference amortized over the analysis period.

Table 2. Efficient and Baseline Measure Description and Analysis Period

Efficient Measure	Baseline Measure	Analysis Period [a] (Years)
LED Fixture	Metal Halide (Type B, 113.6 W)	19.38
Efficient Air Compressor	Modulating compressor with blow down ≤ 40 hp	26.85
VFD on 20 HP Chilled Water Pump	20 HP Chilled Water Pump without a VFD	20.65
VFD on 10 HP Chilled Water Pump	10 HP Chilled Water Pump without a VFD	20.65
VFD on 10 HP Hot Water Pump	10 Hot Water Pump without a VFD	18.00
VFD on 15 HP HVAC Supply/Return Fan	No control or bypass damper on 15 HP HVAC Supply/Return Fans	15.39
VFD on 25 HP HVAC Supply/Return Fan	No control or bypass damper on 25 HP HVAC Supply/Return Fans	15.39
VFD on 40 HP HVAC Process Fan	No control or bypass damper on 40 HP Process Fan	24.02
VFD on 40 HP HVAC Process Pump	No control or bypass damper on process pump	20.65
VFD on 25 HP HVAC Supply/Return Fan (Roof Mounted)	Inlet vane dampers on HVAC Supply/Return Fans (Roof Mounted)	24.02
VFD on 15 HP HVAC Supply/Return Fan (Roof Mounted)	Inlet vane dampers on HVAC Supply/Return Fans (Roof Mounted)	24.02

[a] Period of time over which O&M costs are considered. Equal to the effective useful life (EUL) of efficient measure.

Residual Values

In some cases, the lifetime of the baseline equipment is shorter than the efficient equipment, and therefore is assumed to be replaced at least once during the analyis period. Subsequently, at the end of the analysis period (i.e., the lifetime of the efficient equipment) the baseline equipment has a remaining useful life. For example, if the efficient equipment has a lifetime of 30 years, and the baseline equipment has a lifetime of 20 years, at year 20 the baseline equipment will be replaced and at the end of the analysis period it will have a remaining useful life of 10 years. In order to correctly account for the value of this remaining useful life at the end of the analysis period, we calculated a residual value by linearly prorating the equipment's initial capital cost[5]. We included residual values in the O&M cost savings calculations as negative costs.

Payback Period

The final step in the analysis was to calculate the payback period required for a participant to recuperate their additional initial investment in an efficient measure compared to an alternative measure. This calculation

[5] For example, an HVAC system that has an initial capital cost of $10,000, has an expected useful life of 15 years, and is replaced in year 10 of a 15 year study period, would have a residual value of $\frac{10-5}{15} = \frac{1}{3}$ of its initial cost at the end of the analysis period (i.e., at year 15), which, assuming a 4.19% discount rate, equates to a NPV of $1,801 at year 0.

compared the incremental cost of the efficient measure to the amortized annual O&M NEI, average bill savings, and the one-time AIC incentive.

Non-O&M NEIs - In-Depth Interviews

For the second part of the study, we conducted in-depth interviews (IDIs) with program participants across different industry segments to identify and, where possible, monetize non-O&M NEIs resulting from non-O&M cost differences, as well as other non-cost related NEIs such as changes to worker and equipment productivity and sales. We used the data collected through the interviews to construct case studies to communicate actual customer experiences of how program participation impacted their bottom line.

Opinion Dynamics contacted customers in the manufacturing/industrial, health care, and retail segments who completed energy efficiency projects through the 2020 Standard Initiative. We prioritized customers who installed multiple measures or enduses. We primarily conducted outreach via email, but supplemented outreach attempts with phone calls for hard-to-reach segments (i.e., retail and large industrial/ manufacturing). We conducted interviews in November and December 2021 and achieved our goal of ten interview completes. The team asked respondents to think about the changes their organization experienced for up to two measure categories (Table 3). Some respondents were only asked about changes from one measure category (e.g., HVAC) and were also asked a series of questions related to the potential benefit of and applications of advanced lighting controls for their facility.

Table 3. Respondent Summary

Respondent	Segment	Measure Category 1	Measure Category 2
1	Manufacturing/ Industrial (Discrete)	Compressed Air	Lighting
2		Lighting	Advanced lighting controls
3	Manufacturing/ Industrial (Process)	Lighting	Advanced lighting controls
4		Lighting	Advanced lighting controls
5	Health Care	HVAC	Advanced lighting controls
6		Lighting	N/A
7		HVAC	Advanced lighting controls
8		Lighting	Advanced lighting controls
9		HVAC	Advanced lighting controls
10	Retail	Lighting	HVAC

Interviewers first asked respondents what changes their organization experienced as a result of their energy upgrade then asked the respondent to estimate the value of those changes. If respondents were unable to provide an estimate of the dollar value of the changes, the interviewer asked a series of probes to obtain information necessary to monetize the NEI. For example, one manufacturing respondent said they noticed an increase in lighting quality after their energy upgrade. When asked what specifically changed, the respondent stated that the old high bay lights used to take 30 minutes to warm up, whereas the new lights turn on instantly. The team probed on whether there was a reduction in staff labor hours associated with not needing to wait for the fixtures to warm up, the hourly wage of the staff, and the number of times a week staff would have to come in early to turn the lights on before the upgrade. In some cases, the same NEI (e.g., reduced administration costs associated with ordering new light bulbs) was reported by more than one respondent. In these cases, we aggregated the responses and reported the range of benefits given by the respondents.

The team also asked most respondents to consider the potential benefits associated with installing advanced lighting controls. The team asked questions about the applicability of asset tracking, predictive maintenance, lighting optimization, scene/mood lighting, and circadian lighting in the respondent’s facility as well as the respondent’s willingness to pay for each benefit.