Memo to:

Massachusetts Program Administrators Research Team and Energy Efficiency Advisory Council EM&V Consultants

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TWGA CI Portfolio Modelling Findings and Conclusions

Table 1 summarizes the findings and conclusions from an analysis of the potential impact on savings of complying with three new evaluation practices outlined in the Baseline Framework[1]. Prior to the Baseline Framework, these practices were present, but not systematically implemented in the evaluation and reporting of C&I portfolio savings. The three analysed practices are:

- Industry standard practice (ISP). The baseline framework requires ISP baselines (except for unique measures) for lost opportunities (new construction or replace on failure measures). This practice may induce more frequent use of an ISP instead of a customer-specific baseline or the relevant codes and standards. As ISP tends to be better than code, the change could reduce savings.
- Lost Opportunity – Retrofit Reclassification (LORR). The appropriate reference baseline, either lost opportunity or retrofit, will be established based on the preponderance of evidence supporting the selection. Reassignment from retrofit to lost opportunity usually results in less savings while the converse results in more savings.
- Dual baseline. Considering the effects of dual baseline calculations on lifetime savings of early retirement measures instead of always using single baseline savings over the measure life will reduce lifetime savings.

Table 1. Projected Impact of Practices on 2016 CI Portfolio Net Savings

	2016 Value	ISP	LORR	Dual Baseline	Likely	Most Savings	Least Savings
CI Electric Portfolio							
Net lifetime savings (MWh)	9,818,026	-4%	0%	-7%	-11%	*-7%*	*-35%*
Net annual savings	846,268	-3%	0%	0%	-3%	*-3%*	*-6%*
Net summer savings (MW)	150,109	-2%	0%	0%	-3%	*-2%*	*-5%*
Average measure BCR	3.7	-4%	0%	65%	+61%	*+31%*	*+27%*
CI Natural Gas Portfolio							
Net lifetime savings (MMBTU)	13,160,305	-11%	0%	-2%	-13%	*-5%*	*-17%*
Net annual savings	932,000	-10%	0%	0%	-11%	*-4%*	*-15%*
Average measure BCR	3.8	-8%	0%	21%	+11%	*-4%*	*+3%*

Table 1 summarizes the estimated impact of the systematic application of the three new practices on the 2016 CI portfolio savings using the assumptions that are described in Attachment A. The table shows the estimated percent change in 2016 portfolio savings estimates if we were to evaluate it today using the Baseline Framework.

[1] http://ma-eeac.org/wordpress/wp-content/uploads/MA-Commercial-and-Industrial-Baseline-Framework.pdf

Important findings and conclusions:

- Most of the 2016 retrofit lighting measures already incorporated some level of dual baseline treatment via adjustments to measure lives which mitigated the impact of a more formal dual baseline practice.
- ISP changes were already reflected in some 2016 measures. For example, the 2016 natural gas portfolio already included the ISP effects from a recent boiler market study. The result of that study reduced boiler planned measure savings by about 50%, but that effect was already included in 2016 evaluated savings.
- The LORR and ISP effects were estimated using recent impact evaluations that incorporated the new practices. The analysis showed that while changes in baseline can have a significant impact on a single end-use, the frequency of the change is relatively small and therefore, the program level impact is moderated.
- Change to measure BCR are approximate. The BC Model total resource cost (TRC) data is not adequate for a refined analysis, since it is highly aggregated and, in many cases, calculated as a multiple of the incentives. Additional data, such as incremental costs, are required to calculate dual baseline cost. However, dual baseline BCRs tend to increase, even with decreased lifetime savings, because the costs associated with the second baseline are deducted from the TRC. The ISP and LORR BCRs generally have reduced BCRs because savings is reduced while TRCs remain the same.
- The Most Savings scenario reflects only the effects that are more narrowly applied. The electric savings in the Least Savings scenario is primarily driven by an aggressive assumption about LED market penetrations, impacting both lost opportunity and dual baseline savings estimates. The impact of other measures is limited because a) ISP effects have already been identified for some measures and further research is not expected in the program cycle (like boilers); b) some measures aren't impacted by standard practice or dual baseline (most add-on measures or stable technologies like food services).

It is important to note that key assumptions underlying the results of Table 1 are the subject of ongoing research. The final results of P56 (CDA impact evaluation), P75 (lighting market research), P73B (ISP research for a mix of measures), and P77 (for natural gas volume DHW) could suggest alternate assumptions affecting Table 1 significantly. Other work which has bearing on Table 1 results includes the net-to-gross methodology research of P73C and measure life research of P73D. Ongoing research is summarized at the end of this memo.

1. Methods

The more universal application of these practices are expected to impact annual energy savings (sometimes called first-year savings), demand, net lifetime savings, other fuels, net lifetime savings benefits, and measure costs. To better account for all effects, the changes were simulated using the actual Benefit Cost model (BC model) spreadsheets the PAs used to report 2016 results. This has the benefit of testing the impacts of the practices against the entire CI portfolio, as it was reported, with all the calculations correctly propagated through the BC model's complicated algorithms, and with PA specific assumptions.

To model the changes, the measure specific BC model input variables of annual gross savings, measure life, and measure cost were adjusted to reflect the Team's best estimates of the impacts of the practices on those variables for a measure. These are the same variables the PAs populate in the BC model to characterize program production for planning and reporting. Changes in either annual gross savings or measure life ripples through the model affecting all the other calculation streams. Other assumptions in the BC model (such as the line loss, attribution, net-to-gross, and avoided costs) were left unchanged. It should be noted that Table 1 findings could change significantly with the results of other studies.

Although linking the PA BC model spreadsheets together and mapping over a thousand unique measures to measure families and end-uses was challenging, the heart of the analysis is estimating the adjustments. These adjustments were derived primarily from analysis of the savings impact of ISP changes in previous evaluations and the results of recent market studies and ISP research. As an example, the code compliance study, P70, found that typical new construction lighting designs in the 2012 period produces lighting power densities (LPDs) that were about 75% of code maximums. This translates to a 40% reduction in new construction lighting savings compared to using the code maximums as baselines, which was the baseline assumption for the 2016 portfolio. A 40% reduction factor was applied to new construction lighting savings in the portfolio model to simulate this effect.

Attachment A, "MA CEIC TWGA Portfolio Modelling Assumptions ", provides a more detailed explanation of the modelling methods and of the assumptions for the electric and natural gas CI portfolio. Attachment B is a companion spreadsheet identifying the measure specific assumptions for the electric and natural gas portfolios. The analysis accounted for any existing ISP, LORR, and dual baseline effects that were already present in 2016 savings to avoid double counting. For example, many lighting measures already factored in some level of dual baselines effects via reduced measure life assumptions.

2. Findings and Conclusions

This section summarizes key findings and conclusions. Please refer to Attachment A for a more detailed description of the definitions and methods. The estimates of adjustment on portfolio savings were based on analysis of similar adjustment in other evaluations, including three previous state wide custom natural gas impact evaluations (study number by program year (PY): P14: PY2009, P24: 2010, P43: PY2011)[2], an industrial process impact evaluation (P47: PY2013)[3], the boiler market characterization study (P49)[4], preliminary findings from the comprehensive design program impact evaluation (P56: PY2015), an upstream lighting impact evaluation (P58: 2015)[5], and two code compliance studies (for buildings permitted under IECC 2009 (P24) and IECC 2012 (P70))[6].

a. ISP Practice Effects on Lost Opportunity Measures

The new ISP practice affects lost opportunity measures only. Note, future ISP is addressed in a subsequent section.

The portfolio modelling shows that ISP impacts are expected to have a relatively small impact on the 2016 electric portfolio (about -5%) and a larger impact on natural gas (-11%). A larger impact might have been expected for natural gas, because of the higher proportion of lost opportunity savings (58% vs. 20%), however, gas measures appear to have fared well in the CDA impact evaluation (although results are not final) and the impact of ISP on boilers was already accounted for in 2016 savings.

The code compliance study, P70, determined standard practice lighting design is significantly better than code, which reduced new construction lighting savings by 40%. The impact of this finding was muted,

[2] http://ma-eeac.org/wordpress/wp-content/uploads/Impact-Evaluation-of-2010-Custom-Gas-Insatllations.pdf; http://ma-eeac.org/wordpress/wp-content/uploads/Impact-Evaluation-of-2011-Custom-Gas-Installations-6.17.13.pdf;2013 is not online.

[3] http://ma-eeac.org/wordpress/wp-content/uploads/MA-2013-CI-Custom-Process-Impact-Evaluation.pdf

[4] http://ma-eeac.org/wordpress/wp-content/uploads/CI-Boiler-Market-Characterization-Study-Final-Report.pdf

[5] http://ma-eeac.org/wordpress/wp-content/uploads/Upstream-Lighting-Initiative-Impact-Evaluation-PY2015.pdf

[6] http://ma-eeac.org/wordpress/wp-content/uploads/Commercial-New-Construction-Energy-Code-Compliance-Follow-up-Study.pdf; 2nd study is not published.

however, since new construction lighting is only about 9% of the lighting end-use and 5% of CI portfolio savings.

In contrast, the impact of an ISP adjustment on a measure or on a project can be large. For example, in the P47 study, six sites had ISP baseline adjustments (three IMM, an ice rink, a chiller, and a desiccant dryer projects) which reduced savings at individual sites by up to a 100% of tracking savings, although the final impact on the program realization rate (both lost opportunity and retrofit) was -12%.

b. LORR Practice Effects on Retrofit Measures

LORR practices affect retrofit measures only. The portfolio modelling shows that LORR impacts are expected to have about a 0-1% impact on the electric and gas portfolios based on an analysis of P14 and P47 reclassifications. These two evaluations showed that about 5% of the sites experienced a measure reclassification with a significant impact on site savings (a reduction of between a quarter and a third of end-use tracking savings on average). Again, while the impact on an individual site is large, the impact is mitigated when aggregated to a program level.

Reclassifications are more likely to occur in projects with large capital budgets or where old equipment is replaced. LORR adjustments may also increase the savings of some measures, as they did at one site in P14.

c. Dual Baseline on Retrofit Measures

Prior to this effort, there was a fear that portfolio savings would be devastated by the application of dual baseline practices. However, Table 1 shows a significant, but relatively modest reduction in portfolio savings from to dual baseline practice effects (-7% electric, -2% natural gas). The electric portfolio savings already accounted for some dual baseline effects in the 2016 portfolio by using reduced measure lives throughout the retrofit programs, which reduced the impact of the more rigorous practices envisioned in the Baseline Framework. The natural gas portfolio did not account for dual baseline effects in 2016, but the retrofit savings are a smaller portion of the portfolio (43%) with a large portion of add-on measures not subject to dual baseline calculations.

Modelling of dual baseline requires identifying a future standard practice baseline. The future ISP represents what the customer would install in the future, if they didn't participate in the program and needed to finally replace the worn-out existing equipment some years hence (after the remaining useful life of the existing equipment). The future ISP is expressed as a fraction of first year gross annual savings. For example, if a lighting early replacement project reports a 50,000 kWh of savings, the first period annual savings is 50,000 kWh, but the second period saving is calculated as the product of the first year savings and the F-FISP (or 50,000 * 60% = 30,000 kWh, for the first row in Table 1)

Table 2 presents different, credible future ISP estimates from different sources and what the impact might be on the future ISP.

Table 2. Plausible Future ISP Factors for Dual Baseline

	LED Linear Lighting	LED Spot Lighting	Portfolio Impact

2016 reported in BC model. future ISP values for lighting measures reported as early retirement measures in 2016. **Value used in the Likely Scenario.**	60%	60%	Neutral
EISA analysis, 2016. PAs have calculated a progressively increasing baseline line due to EISA mandates for 2019-2021 which was applied spot type lamps**. Value used in the Most Savings scenario**.	70%	65%	Increase savings
EISA analysis for year 2017.	70%	60%	Neutral
EISA analysis for year 2018	70%	44%	Decrease savings
Future ISP based on data collected under P24, which examined new construction in 2014/2015, permitted under IECC 2009	60%	60%	Neutral
P70 (preliminary) based on data in new construction in late 2014 to present permitted under IECC 2012. **Least Savings Scenario.**	20%	20%	Decrease savings
P75, LED market model – in progress	Study is not complete and results are unknown		

The electric portfolio rises and falls with the characterization of the future state of the lighting market more than any other single factor.

Although the 2016 reported natural gas savings did not include any early retirement measure treatment, the impact of that new practice is relatively modest. First, the number of measures subject to early retirement is relatively small and most importantly, unlike lighting, the technologies are relatively stable and are not characterized by rapid and dramatic increases in efficiency.

d. Measure Lives and BCRs

For the ISP and LORR analysis, the measure lives remained unchanged from the assumptions built into the 2016 BC model data. The BCRs dropped proportional to the reduction in savings due to the reduced savings with no change in costs.

However, the dual baseline calculations resulted in significant manipulation of measure life to calculate the lifetime savings with both the incremental ISP efficiency component (for the effective useful life of the high efficiency equipment) plus the retrofit to energy efficiency savings component (for the remaining useful life of the old equipment).

The measure life calculations were further complicated because the 2016 model used an 'equivalent life' method to represent early retirement measures. For these measures, the measure lives were manipulated to produce a net lifetime savings which was equivalent to the dual baseline calculation.

Measure life is a topic of research for P73D. The scope of work includes the establishment of methods for measure life research, as well as the determination of measure lives for select measures. The outcome of this research could impact the Table 1 results.

e. Summer Demand and FCM

The summer demand savings were affected by the ISP and LORR practices, since those effects reduce annual gross savings proportional to the factors applied. The dual baseline practice does not affect annual gross savings, therefore the summer demand savings do not change with dual baseline treatment. However, the measure persistence – that is the number of years the measure is expected to stay in place, will change with more rigorous dual baseline practice.

The reduction in measure persistence is similar to the change in portfolio savings, or -6%. It has not been resolved whether early retirement measures will be reported using the two-part dual baseline or an equivalent life methodology. This decision will impact how FCM is reported.

f. Scenarios

Table 1 presents the assumptions behind three scenarios: Most Savings, Most likely, and Least Savings scenarios. The scenarios incorporate different assumptions for practice factors and the measure to which they apply. Table 3 summarizes differences in the assumptions behind the scenarios.

Table 3. Scenario Assumptions for the Electric C&I Portfolio

	Most Savings	Likely	Least Savings
Lighting lost opportunity ISP and future ISP factor.	65%. Based on PA EISA analysis for spots in 2016.	60%. Based on P24 and P58 data.	20%. Based on preliminary P70 code compliance results.
	P75 should provide definitive results.		
In progress ISP studies (natural gas DHW replacements, EMS, compressed air, unit heaters.)	Assumes 90% factor for only those measures affected by current studies.	Assumes 90% factor for all custom HVAC measures and 72% for all other custom measures.	Assumes 72% for all custom measures based on P47 results.
LORR.	Maximum risk of 5% with 75% of savings retained. Based on P14 and P47	Maximum risk of 5% with 75% of savings retained. Based on P14 and P47	Maximum risk of 16% with 67% of savings retained. Based on P14 only.
Subject to dual baseline.	No custom measures.	All custom measures.	All custom measures.

The Least Savings scenario reflects:

- For lighting, a further evolution of the market with new construction practices adopting LED may reduce savings further. A preliminary finding from P70 is that buildings permitted in the 2014-2015

period are now designed at lighting power densities that are 52% of code minimums, which drives the ISP to 20% (or more). However, according to P70, 73% of installed fixtures are LEDs, so this may represent a natural inflection point.

- The least savings scenario assumes that both custom electric and gas measures currently undergoing research (custom electric and natural gas, ISP for large DHW, EMS, infrared heaters, compressed air) require the 72% adjustment identified for P47.
- Measures which have been recently researched (like boilers and custom process) or where no ISP adjustments are expected (like food services), are included in the "not subject to further ISP research" category.

3. Unresolved Issues

Over the course of conducting this study, numerous issues were raised, some of which were not fully resolved. These are summarized in this section.

a. Form of the Early Retirement Calculations

Throughout this effort, the Working Group has considered both the 'equivalent life' and the 'two parts' representations of dual baseline. Both methods have been used in the BCR model and in FCM reporting. Earlier in the research, the Working Group favoured the two part representation, although that conclusion was less clear as Track A draws to a close. The form of the equation has the most impact on the BC model, therefore, the Common Assumptions Group, a Massachusetts working group responsible for the BCR model is an important stakeholder in the decision.

The form of the incremental cost equation will also be a topic that should be queued up to the Common Assumptions Group.

It has been recommended that the Common Assumptions Group be apprised of the findings of Track A and weight in on the decision, as well as other related decisions such as the calculation of incremental dual baseline costs. The P73 Track F Application of Results will identify this as a subtask, subject to approval by the Impact Evaluation Group.

b. Refinement of Unique and Legacy (Immortal) Definitions

Stakeholders have requested further refinements of the definition for unique or legacy measures that would affect baselines and early retirement treatment. Better definitions will provide 'brighter lines' in distinguishing measures that meet the unique or legacy definitions.

c. Utility of Formal Adoption of Measure Classifications

Stakeholders have requested a more formal association of measures with the measure baseline type classifications (add-on single vs. dual baseline treatment, for example). This will allow measures to be processed more efficiently in terms of data collection requirements and tracking.

4. Ongoing Research

Numerous studies are underway which could impact the results of Table 1. This section discusses those.

a. P75 LED Market Monitor

P75 will be the source of the critical future ISP parameter (see Table 2) which will determine the percentage of first year annual gross savings that is retained for the second period of the measure. The higher the percentage, the larger the lifetime savings. This parameter is the largest single driver of portfolio outcomes. The study results are expected in the first quarter of 2018.

b. P77 Upstream Water Heater Savings Impact Evaluation

P77 includes ISP research as well as the impact evaluation of natural gas domestic hot water and could modestly impact Table 1 results. DHW is not a large part of the portfolio, therefore the impact on the portfolio is limited.

c. P56 Comprehensive Design Impact Evaluation

P56 evaluates custom lighting and HVAC measures combined into a single comprehensive design package. The final evaluated results should provide insights into how more rigorous ISP might impact program savings. The model results of this study have already incorporated the ISP findings for lighting and ECM motors. P56 final results will provide additional data points for determining an ISP factor for custom HVAC measures. Table 1 incorporates a 90% ISP factor for HVAC custom measures as a placeholder.

d. P73B ISP Research

P73B is tasked with conducting ISP research for compressed air, EMS, lighting and infrared heaters xxx. The P73B team will also translate the P75 values that can be directly used by PAs for reporting savings. Table 1 incorporates a 90% factor for EMS and compressed air new construction measures ISP factors and for the future ISP. The study should determine a new ISP factor for these numbers and might lead to adjustments of the future ISP.

e. P73C Net to Gross Research

The portfolio model used the 2016 NTGR factors without any adjustments. It is possible that this double counts free-riders. P73C is tasked with revising net-to-gross methods to ensure that attribution accounts for baseline changes, which could result in lower NTG ratios. A revision to NTG ratios for ISP impacted measures would alter Table 1 results.

f. P73D Measure Life Research

The 2016 BC models, and hence the portfolio model presented in this document, depends on TRM definitions of measure life. P73D is tasked with defining best practices methods for researching measure lives and determining measure lives for select measures. A revision to measure lives could potentially impact all three practices which would alter Table 1 results.

Appendix A – End-use Results

ELECTRIC

Net Lifetime Savings (MWh)					
		% change			
End Use	Reported 2016	ISP	POE	Dual	Total
BCS	16,170	0%	0%	0%	0%
C-Air	141,606	-17%	-1%	0%	-17%
CDA	167,367	-20%	0%	-1%	-21%
CHP	1,488,948	0%	0%	0%	0%
Controls	49,019	0%	-1%	38%	37%
DHW	1,726	0%	-1%	-7%	-8%
Envelope	834	0%	0%	0%	0%
Food Service	2,448	0%	0%	0%	0%
HVAC	779,547	-4%	-1%	-4%	-9%
Lighting	5,839,684	-4%	0%	-10%	-14%
Motors & VFD	654,143	0%	0%	0%	0%
Other - Custom	185,945	0%	-1%	-7%	-8%
Process	473,179	-13%	-1%	-4%	-17%
Refrig	17,409	0%	0%	0%	0%
Grand Total	**9,818,026**	**-4%**	**0%**	**-7%**	**-11%**

Total Benefits ($)					
		% change			
End Use	Reported 2016	ISP	POE	Dual	Total
BCS	1,470,344	0%	0%	0%	0%
C-Air	18,614,647	-17%	-1%	0%	-17%
CDA	22,529,666	-21%	0%	-1%	-22%
CHP	146,305,967	0%	0%	0%	0%
Controls	32,731,382	0%	0%	15%	14%
DHW	273,900	0%	-1%	-6%	-8%
Envelope	349,682	0%	0%	0%	0%
Food Service	754,556	0%	0%	0%	0%
HVAC	140,412,796	-4%	-1%	-4%	-9%
Lighting	877,094,574	-3%	0%	-17%	-20%
Motors & VFD	79,386,493	0%	0%	0%	0%
Other - Custom	38,985,165	0%	-2%	-12%	-14%
Process	67,555,769	-13%	-1%	-5%	-19%
Refrig	2,575,496	0%	0%	0%	0%
Grand Total	**1,429,040,439**	**-4%**	**0%**	**-11%**	**-15%**

Summer Demand (kW)					
		% change			
End Use	Reported 2016	ISP	POE	Dual	Total
BCS	1	0%	0%	0%	0%
C-Air	1,430	-17%	-1%	0%	-18%
CDA	1,565	-20%	0%	0%	-21%
CHP	13,320	0%	0%	0%	0%
Controls	11,303	0%	0%	0%	0%
DHW	4	0%	-1%	0%	-1%
Envelope	0	0%	0%	0%	0%
Food Service	33	0%	0%	0%	0%
HVAC	16,487	-3%	0%	0%	-3%
Lighting	94,820	-2%	0%	0%	-2%
Motors & VFD	5,994	0%	0%	0%	0%
Other - Custom	940	0%	-1%	0%	-1%
Process	4,071	-11%	-1%	0%	-11%
Refrig	140	0%	0%	0%	0%
Grand Total	**150,109**	**-2%**	**0%**	**0%**	**-3%**

BCR						
		% change				New
End Use	Reported 2016**	ISP	POE	Dual	Total	BCR
C-Air	5.2	-17%	-1%	1%	-17%	4.3
CDA	3.5	-21%	0%	34%	13%	4.0
CHP	4.7	0%	0%	0%	0%	4.7
Controls	5.6	0%	0%	45%	44%	8.1
DHW	5.3	0%	-1%	151%	149%	13.2
Envelope	5.0	0%	0%	70%	70%	8.5
Food Service	10.3	0%	0%	0%	0%	10.3
HVAC	2.1	-4%	-1%	18%	13%	2.4
Lighting	3.7	-3%	0%	138%	135%	8.7
Motors & VFD	5.2	0%	0%	0%	0%	5.2
Other - Custom	4.3	0%	-2%	127%	125%	9.8
Process	5.3	-13%	-1%	38%	24%	6.6
Refrig	2.2	0%	0%	0%	0%	2.2
BCS	NA	NA	NA	NA	NA	NA
Grand Total	**3.7**	**-4%**	**0%**	**65%**	**61%**	**5.9**

**Note for BCR filtered out all measures that did not have a cost or a cost of 0

Net Annual Savings (MWh)					
		% change			
End Use	Reported 2016	ISP	POE	Dual	Total
BCS	1,155	0%	0%	0%	0%
C-Air	10,358	-15%	-1%	0%	-16%
CDA	10,359	-20%	0%	0%	-20%
CHP	80,010	0%	0%	0%	0%
Controls	4,970	0%	-1%	0%	-1%
DHW	169	0%	-1%	0%	-1%
Envelope	39	0%	0%	0%	0%
Food Service	185	0%	0%	0%	0%
HVAC	61,237	-3%	-1%	0%	-4%
Lighting	578,841	-2%	0%	0%	-3%
Motors & VFD	49,155	0%	0%	0%	0%
Other - Custom	12,076	0%	-1%	0%	-1%
Process	35,869	-11%	-1%	0%	-12%
Refrig	1,846	0%	0%	0%	0%
Grand Total	**846,268**	**-3%**	**0%**	**0%**	**-3%**

NATURAL GAS

Net Lifetime Gas Savings (MMBTU)					
		% change			
End Use	Reported 2016	ISP	LORR	Dual	Total
Boiler	614,906	0%	0%	0%	0%
CDA	1,034,041	0%	0%	0%	0%
Codes, Standards, Behavioral	37,914	0%	0%	0%	0%
Controls	113,144	0%	0%	0%	0%
DHW	1,700,360	-22%	0%	0%	-22%
Envelope	959,864	0%	-1%	0%	-1%
Food Service	99,998	0%	0%	0%	0%
Heating	5,041,022	-10%	0%	-3%	-13%
Process	3,101,827	-18%	-1%	-4%	-23%
Traps	457,229	0%	0%	0%	0%
Totals	**13,160,305**	**-11%**	**0%**	**-2%**	**-13%**

Net Annual Gas Savings (MMBTU)					
		% change			
End Use	Reported 2016	ISP	LORR	Dual	Total
Boiler	25,084	0%	0%	0%	0%
CDA	55,539	0%	0%	0%	0%
Codes, Standards, Behavioral	1,896	0%	0%	0%	0%
Controls	8,039	0%	0%	0%	0%
DHW	119,744	-18%	0%	0%	-18%
Envelope	53,429	0%	-1%	0%	-1%
Food Service	8,265	0%	0%	0%	0%
Heating	380,944	-10%	-1%	0%	-11%
Process	202,857	-19%	-1%	0%	-19%
Traps	76,205	0%	0%	0%	0%
	932,000	**-10%**	**0%**	**0%**	**-11%**

Total Benefits ($)					
		% change			
End Use	Reported 2016	ISP	LORR	Dual	Total
Boiler	5,316,568	0%	0%	0%	0%
CDA	8,973,695	0%	0%	0%	0%
Codes, Standards, Behavioral	327,408	0%	0%	0%	0%
Controls	2,106,419	0%	0%	0%	0%
DHW	23,396,506	-12%	0%	0%	-12%
Envelope	10,588,411	0%	-1%	0%	-1%
Food Service	1,879,309	0%	0%	0%	0%
Heating	50,421,423	-10%	-1%	-4%	-15%
Process	28,195,139	-18%	-1%	-4%	-22%
Traps	10,476,910	0%	0%	0%	0%
Grand Total	**141,681,787**	**-9%**	**0%**	**-1%**	**-10%**

BCR						
		% change				New
End Use	Reported 2016	ISP	LORR	Dual	Total	BCR
Boiler	1.9	0%	0%	0%	0%	1.9
CDA	4.8	0%	0%	0%	0%	4.8
Controls	7.3	0%	0%	0%	0%	7.3
DHW	4.6	-13%	0%	0%	-13%	4.0
Envelope	3.3	0%	-1%	0%	-1%	3.3
Food Service	3.0	0%	0%	0%	0%	3.0
Heating	3.2	-10%	-1%	42%	31%	4.2
Process	4.5	-18%	-1%	38%	20%	5.4
Traps	8.5	0%	0%	0%	0%	8.5
Total	**3.8**	**-9%**	**0%**	**21%**	**11%**	**4.2**