PY2022 EM&V Key Findings and Recommendations 2021-2024 CDMF Retrofit Program

No.	KEY FINDINGS	2022 EM&V RECOMMENDATIONS	IMPACT	IESO RESPONSE
1.	**Incentive levels were generally considered too low.** When asked if incentives for specific energy-efficient equipment or models offered through the program were appropriate, over one-half of applicant representatives and contractors (54%) reported they were too low. Nearly one-third of applicant representatives and contractors (31%) found incentives were too low generally; others listed a variety of equipment types where the incentives were too low, such as linear fixtures (14%), flat panels (10%), and LED troffers (10%). More than one-fourth of participants (26%) said they could not install equipment of interest due to insufficient program incentives. IESO and delivery vendor staff reported that incentives were generally considered too low to keep up with rising costs, with some staff providing recommendations for specific equipment that may require increased incentives (i.e., low-bay lighting, motors, rooftop units).	Consider revisiting overall program incentive levels or key measures of interest, given concerns over incentives not keeping pace with rising costs. Measures of interest could include those with high contribution to the Retrofit program and with the highest benefits to cost ratio, including lighting (LED medium/high bay fixture, T8 LED tube/u-bend replacement lamp, and T5 LED tube replacement lamp) and non-lighting (variable frequency drive, VSD compressed air, and ECMs for HVAC application (fam motor replacement).	High	The IESO will continue to review prescriptive measure assumptions, incentives and incentive caps on a regular basis. Additionally, the introduction in May 2023 of a new custom stream with increased incentive rate will enable the program to provide more incentive support for non-standard projects.

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2.	**HOU and conservation case wattages for horticultural lighting measures**. The differences between deemed and verified annual HOU and conservation case wattages are the main drivers of the low average realization rate (81%) for lighting greenhouse measures. To obtain better precision in verified values, the results from a combined PY2021 and PY2022 rolling sample were utilized to analyse the operating hours and conservation case wattages for the "Horticultural Inter-Lighting LED Grow Light Fixture" and "LED Grow Lights – Vegetable Greenhouses" measures. The "LED Grow Lights - Cannabis Warehouses" measure was not included in the analysis due to a limited sample size. The average deemed HOU, average verified HOU, and precision (at 90% confidence) of the verified values for the two measures from the PY2021 and PY2022 rolling sample are presented below: • "Horticultural Inter-Lighting LED Grow Light Fixture" ○ Deemed HOU: 5,327 ○ Verified HOU: 4,953 ○ Verified HOU precision: 1% • "LED Grow Lights – Vegetable Greenhouses" ○ Deemed HOU: 2,400 ○ Verified HOU: 2,842 ○ Verified HOU precision: 6% The average deemed conservation case kW, average verified conservation case kW, and precision (at 90% confidence) of the verified values for the two measures from the PY2021 and PY2022 rolling sample are presented below: • "Horticultural Inter-Lighting LED Grow Light Fixture" ○ Deemed kW: 0.096 ○ Verified kW: 0.112 ○ Verified kW precision: 2%. • "LED Grow Lights – Vegetable Greenhouses" ○ Deemed kW: 0.540 ○ Verified kW: 0.636 ○ Verified kW precision: 9%.	Regularly review and consider updating the HOU and conservation case assumptions for horticultural lighting measures. The combined results of EM&V from multiple years can be utilized to determine the appropriate values, as they involve the collection and analysis of actual data during the evaluation of horticultural measures. While the evaluation results presented in the tables above present verified parameters with strong precision, they are based on relatively small samples and could change in the future.	Medium	The IESO will continue to collect information on horticultural lighting technologies, and regularly review measure assumptions as more information becomes available.

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3.	**Horticultural lighting measures deemed summer peak demand savings**. The deemed summer peak demand savings for horticultural lighting measures are expected to be significantly low as it is assumed that during the summer peak demand period, the horticultural lighting measures are either non-operational or operating at a minimal capacity. For instance, the assumed coincidence factor for the Inter-lighting LED grow light fixtures, indicating their usage during the summer peak demand, is only two percent (2%). However, upon evaluating the Inter-lighting LED grow light fixtures using available hourly data, it was confirmed that they were used for extended periods during the summer peak demand period. After analyzing hourly data from ten projects, the average coincidence factor for summer peak demand savings was approximately 18%.	Regularly review and consider updating horticultural lighting measures deemed summer peak demand savings. To increase confidence in verified peak demand savings, it is recommended to collect additional data in future evaluations until a large enough sample is collected. This will help with future frameworks assumptions. Alternatively, a supplementary metering study on the horticultural lighting measures can be completed and integrate the obtained data into the current EM&V analyzed data. This can contribute to a more appropriate load shape development and coincidence factor selection for the summer peak demand period, aligning it better with the actual usage patterns of the horticultural lighting measures.	Medium	The IESO will continue to collect information on horticultural lighting load shapes and peak demand savings, and explore options for updating this assumption.
4.	**Lighting End-Uses MAL assumed HOU**. The evaluation team compared the average verified HOU from the impact sample to the Measure and Assumption List (MAL) deemed values for PY2022 and for a rolling sample of PY2021 and PY2022 projects. The "Warehouse Wholesale" and "Large Non-Food Retail" end-uses had a high representation of measures in the 2021-2024 CDM Retrofit program and the deemed HOU were found to be outside the error bounds of the verified HOU values. The deemed HOU, verified HOU, and error bounds of the verified values from the PY2021 and PY2022 rolling sample are below: • "Warehouse Wholesale" ○ Deemed HOU: 3,759 ○ Verified HOU: 4,408 ○ Verified HOU error bounds: 4,068 – 4,749. • "Large Non-Food Retail" ○ Deemed HOU: 4,089 ○ Verified HOU: 3,121 ○ Verified HOU error bounds: 2,826 – 3,415.	Consider updating the deemed HOU values for "Warehouse Wholesale" and "Large Non-Food Retail" after discussions with the program team regarding the makeup of the PY2021 and PY2022 population and sample and how representative that may be of the future program populations.	Medium	The IESO will review lighting HOU assumptions and explore options for appropriately capturing this in the future.

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5.	**Horticultural lighting measures deemed base case wattage.** Deemed base case wattages used in the horticultural lighting measures were based on specific assumptions. For example, the baseline wattage for Inter-lighting LED grow-light fixture measures assumes that ten T8 fluorescents would provide equivalent brightness at the same distance from the vertical growing surface as one energy-efficient fixture. This assumption is difficult to verify and creates a large amount of savings per unit, which, soon, could be quickly adopted as the market baseline.	Continue research into the horticulture lighting market to assess the need for additional measures and what the current market baselines are for existing measures. This is particularly relevant to the Inter-lighting LED grow light fixtures and LED grow lights – vegetable greenhouses as they gain popularity.	Medium	The IESO will continue to collect information on the horticultural lighting market, including trends, technologies and baselines. Measure assumptions will be reviewed as more information becomes available. The introduction of the new custom stream will provide incentives for non-standard projects and operating conditions, which may reduce the demand for additional horticultural measures.
6.	**Lighting measures conservation case MAL assumed wattages.** The evaluation team compared the average verified conservation case wattage estimates from the impact sample to the MAL deemed values for PY2022 and for a rolling sample of PY2021 and PY2022 projects. The conservation measures "LED HIGH BAY FIXTURE >= 20,100 Lumens & < 305W" and "2' x 4' LED troffer / 4' LED linear ambient fixture (>= 3000 Lumens)" had a high representation of measures in the 2021-2024 CDM Retrofit program and the deemed efficient case wattage for both the measures was higher than the verified value and fell outside of the error bounds of the verified wattage values. The deemed, verified, and error bounds of the verified conservation case wattage from the PY2021 and PY2022 rolling sample are below: • "LED HIGH BAY FIXTURE >= 20,100 Lumens & < 305W" o Deemed kW: 0.194 o Verified kW: 0.161 o Verified kW error bounds: 0.156 kW - 0.167 kW. • "2' x 4' LED troffer / 4' LED linear ambient fixture (>= 3000 Lumens)" end-use range from 0.042 kW to 0.045 kW. o Deemed kW: 0.055 o Verified kW: 0.043 o Verified kW error bounds: 0.0426 kW - 0.045 kW.	Consider updating the conservation case wattage assumption for the "LED HIGH BAY FIXTURE >= 20,100 Lumens & < 305W" and "2' x 4' LED troffer / 4' LED linear ambient fixture (>= 3000 Lumens)" fixtures after discussions with the program team regarding the makeup of the PY2021 and PY2022 population and sample and how representative that may be of the future program populations.	Medium	The IESO will review lighting wattage assumptions and will update, as required.

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7.	**Possible misprint for MAL measures wattages.** The deemed base and conservation case wattages in MAL for the "Measure mix of T8s and T12s" were found to be extremely high. After further review and comparison with verified parameters, measure IDs 305611, 305608 and 305616 seem to have deemed wattages that are 1000 times higher than actual values. • 305611 – Deemed base case (6,122 W) and deemed efficient case (6,093 W) • 305608 – Deemed base case (3,122 W) and deemed efficient case (3,093 W) • 305616 – Deemed base case (11,122 W) and deemed efficient case (11,093 W)	Although this finding did not have a huge impact on the verified net energy savings due to the difference between the overstated wattages being consistent, it is recommended to update the MAL to accurately reflect the base case and efficient case wattages for these measures.	Low	The IESO will update the MAL to accurately reflect wattages for these measures.
8.	**In-Suite Temperature Controls (ISTC) deemed assumptions and delivery**. In-Suite Temperature Controls contribute 15% of the verified net energy savings for Prescriptive HVAC projects in the population, but importantly has the highest verified net energy savings per project (231 MWh). This measure was implemented in three projects and all three projects were evaluated. The verified net energy savings were generally lower than the deemed savings because the deemed savings for each temperature control installed is estimated based on air source heat pumps sized with electric space cooling and heating, whereas the ISTC projects evaluated were verified to be high rise apartments with central electric space cooling and non-electric space heating.	Ensure the delivery agent and technical reviewers are aware of measure eligibility criteria and program rules. The ISTC measure worksheet published on the IESO Save on Energy website indicates that the measure is eligible for electric spaces heating and cooling only. Consider reviewing the deemed savings of the ISTC to develop sub-measure categories depending on the system specification (for example, electric vs non-electric heating, or systems with electric heating and no cooling).	Medium	The IESO will work with delivery agents and technical reviewers to enforce measure eligibility and program rules, and update eligibility criteria and/or assumptions as appropriate. The new custom stream will now be available for projects that do not conform to prescriptive measure eligibility criteria. This alleviates the need for sub-measure categories for non-eligible system types.

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9.	**Increasing non-lighting applications is possible with additional program support.** When asked how the program could increase the number of non-lighting applications, IESO staff said they are considering further outreach, education, and potential incentive increases. Similarly, delivery vendors suggested more funding and more engagement, with one delivery vendor noting the importance of bringing contractors on board and well-stocking with product. One delivery vendor noted that reintroduction of the custom path and introduction of midstream lighting program will substantially help increase the share of non-lighting projects for the Retrofit Program. Applicant representatives and contractors indicated that adding a wider variety of non-lighting measures (41%) and increasing the incentives for non-lighting measures (33%) would increase the number of non-lighting applications the program receives.	Support the submission of non-lighting applications by identifying sectors and businesses most likely to express interest in non-lighting projects. Further support these projects by providing appropriate incentives (see Recommendation 1) and by engaging contractors and encouraging stocking of efficient products. Perform a jurisdictional scan to identify prescriptive measure offerings that are not currently offered under the Retrofit Program.	Medium	The IESO will review engagement strategies and seek additional opportunities to enhance marketing, education and outreach, where possible. This may include developing communication materials and strategies that highlight the benefits of non-lighting projects and providing contractors the training and resources to help them in promoting the program and its offerings. The IESO regularly conducts jurisdictional research, and is currently reviewing the non-lighting prescriptive incentive levels. The introduction of the custom stream in 2023 will reduce the need for new prescriptive measure offerings.
10.	**Expanding the scope of equipment offerings was a common improvement suggestion**. Nearly three-fourths of applicant representatives and contractors (73%) indicated their customers could typically install all equipment in which they displayed interest. Applicant representatives and contractors, however, provided numerous suggestions for additional equipment for consideration in the program, including exterior lighting (21%), battery storage (11%), EV batteries/chargers (11%), and solar PV (11%). A total of 23% of participants provided equipment suggestions that included additional HVAC equipment (17%), expanded lighting offerings (15%), and automation systems/controls (12%). IESO and delivery vendor staff suggested including DER, more heat pump technologies (e.g., ground source), custom horticultural lighting offerings, exterior lighting, HVAC measures (e.g., high-efficiency fans), and solar.	Explore the feasibility of additional equipment that aligns with program goals and cost-effectiveness targets (see Recommendation 9 for measure-related recommendations).	Medium	The IESO is continually working to expand the scope of equipment offered, with a focus on measures that have a potential for peak demand savings.The IESO periodically reviews recommendations from the new measure submission process and adds new measures when they are cost-effective and meet the goals of the program. . Meanwhile, the introduction of a new custom stream is enabling the program to provide incentives for non-standard measures and projects. The IESO is exploring ways to incorporate DERs into energy efficiency programs. A recently introduced expansion to the Greenhouses Stream includes incentives for photovoltaic (PV) panels in combination with battery storage, available for greenhouse operations in the southwest region.

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11.	**The bi-annual change process continued to work well.** IESO staff said the bi-annual program change process that occurs in spring and fall worked well in PY2022. As part of this process, new equipment types may be added to the program or incentive levels adjusted. IESO staff recommended continuing to include this process once the custom track is reintroduced as the consistency it provides to the market in terms of knowing when program changes will occur. Delivery vendor staff said spring and fall updates were well communicated, customers were interested, and they typically received an influx of new submissions in the Retrofit application portal at those times. Participants reported low awareness (11%) and usage (four respondents) of the change request form on the Save on Energy website, which allows the public to submit new equipment suggestions that the IESO considers during the bi-annual change process.	Continue to offer the bi-annual program change process in spring and fall as delivery vendors, applicant representatives, contractors, and customers found this helpful in knowing when to anticipate program changes. Consider better ways to promote the change request form on the program website (e.g., posting about it on social media, describing how to use it at in-person events or on customer calls).	Medium	The IESO is continuously reviewing participant feedback and seeking ways to enhance our marketing, education and outreach. The introduction of the new custom stream allows participants to receive incentives for measures that fall outside the prescriptive stream, reducing the significance of the change request form itself. The bi-annual change process will continue to be adhered to in support of managing customer expectations.
12.	**Opportunities exist to better support under-subscribed areas.** When asked if any measure categories or building types were under-represented in the program, IESO staff reported more opportunities may be available in the multi-unit residential building category, though program incentives are currently limited to common areas. One delivery vendor reported Save on Energy one-pagers specific to certain equipment types have proven effective, especially for commercial and industrial facilities. Delivery vendors also suggested greater outreach to hotels and chains and reported the industrial sector is generally underserved.	Consider performing targeted outreach to under-subscribed sectors, such as multi-unit residential buildings, hotels, chains, or the industrial sector. Developing additional sector-specific case studies and relevant equipment sell sheets may help delivery vendors and contractors better upsell the program in these customer categories. Explore the feasibility of extending the program to cover in-unit equipment upgrades in multi-unit residential buildings.	Medium	The IESO will continue to support contractors in order to promote the program and other offerings. This includes engaging sectors that have been under-subscribed, and exploring opportunities to develop sector-specific case studies. In-unit upgrades in residential buildings are not eligible under the Retrofit program, which is intended to serve the commercial market.

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13.	**Some customers would be interested in receiving guidance and financial support to further electrify their facilities**. Close to one-half of participants (47%) had not completed or had no plans to complete electrification projects at their facilities to address GHG emissions. They most commonly did not complete electrification projects due to insufficient capital (35%) or the equipment did not need replacement (16%). Participants suggested higher incentives, assistance from an electrification specialist, and incentives for additional measures would aid in completing electrification projects, were they to consider completing such projects in the future.	Explore the feasibility of supporting customers interested in completing electrification projects with financial incentives and information on upgrades and costs of electrification projects.	Medium	The IESO recognizes the growing importance of efficient electrification to customers. Although the program's near-term focus is on providing electricity energy and peak demand savings, this recommendation may inform the design of future program offers.