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ComEd Agriculture Impact Evaluation Report

Energy Efficiency/Demand Response Plan: Program Year 2021 (CY2021) (1/1/2021-12/31/2021)

Prepared for:

ComEd

FINAL

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Table of Contents

List of Figures, Tables, and Equations

1. Introduction

This report presents the results of the impact evaluation of the CY2021 Agriculture Program.

It summarizes the total energy and demand impacts for the program broken out by relevant measure and program structure details. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) analysis inputs. CY2021 covers January 1, 2021 through December 31, 2021.

2. Program Description

The Agriculture Program targets the full market vertical including farms (dairy, poultry, hogs, cash crops, etc.), greenhouses, indoor agriculture facilities, supply houses, and onsite processing facilities, as well as farm facilities on residential properties (excluding the residence) and office space used by agriculturally oriented businesses. This program serves existing and new facilities, offering prescriptive and custom incentives. The program is managed by ComEd and implemented by Franklin Energy Services.

The program's CY2021 activities included the following:

- Franklin Energy advisors reached out to small-to-medium agriculture customers through a combination of channels, including direct farmer outreach, industry associations, dealer networks, and energy efficiency service providers.
- Agriculture customers received ongoing personalized energy advisor support. Energy advisors were the face and voice of the program to farmers, industry associations, dealer networks, and energy efficiency service providers. Interested customers were offered a free walkthrough assessment appropriate for the facility to identify energy efficiency opportunities.
- Based on findings from the initial energy audit, the Agriculture Program's energy advisor worked with the farm owner to determine the optimal program participation level.
- Farmers were then free to work with the contractor of their choice to pursue their projects of interest.
- All prospects and interactions were tracked in ComEd's Salesforce system.

The Agriculture Program offers incentives for a wide range of prescriptive and custom energy efficiency measures, including lighting, Variable speed drives (VSDs), efficient fans, air compressors and ancillary equipment, and other agriculture specific equipment not covered through a prescriptive program.

In CY2021, the program had 211 participants and distributed 14,418 measures (see Table 2-1).

Table 2-1. Number of Participants and Projects

Participation	Quantity
Projects	234
Participants	211
Total Measures	14,418

Source: ComEd tracking data and evaluation team analysis

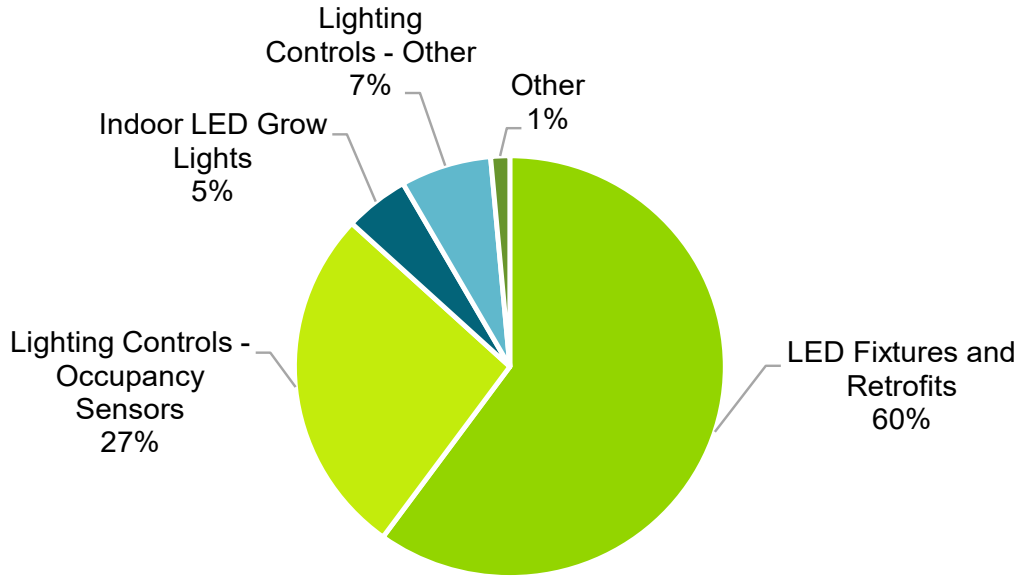
The program included the measures shown in Table 2-2 and Figure 2-1.

Table 2-2. Number of Measures by Type

End Use Type	Research Category	Quantity	Unit
Lighting	LED Fixtures and Retrofits	8,684	Fixtures
Custom	Custom (Lighting)	17	Unique Projects
Custom	Custom (Non-Lighting)	5	Unique Projects
Non-Lighting	Fan Thermostat Controller	2	Controllers
Lighting	Indoor LED Grow Lights	702	Fixtures
Lighting	Lighting Controls - Occupancy Sensors	3,887	Sensors
Lighting	Lighting Controls - Other	988	Sensors
Non-Lighting	Fans, High Speed	123	Fans
Non-Lighting	VSD Air Compressor less than 150 HP†	1	VSD
Non-Lighting	Insulated Livestock Waterer	6	Timers
Non-Lighting	VSD Milk Pump with Plate Cooler Heat Exchanger	1	VSD
Non-Lighting	No-Loss Condensate Drains	1	Drains
	Total	**14,418**	

LED – Light-emitting diode
HP – Horsepower
† The database tracks the quantity for VSDs in terms of horsepower. For consistency with other measures, the quantity shown here is updated to reflect number of VSDs installed as opposed to the horsepower controlled.
Source: ComEd tracking data and evaluation team analysis

Figure 2-1. Share of Measures Installed by Type



Note: The other category consists of the following measures: high speed fans, fan thermostat controller, VSD air compressor less than 150 HP, insulated livestock waterer, VSD milk pump with plate cooler heat exchanger, no-loss condensate drains, custom (lighting), and custom (non-lighting) measures.
Source: ComEd tracking data and evaluation team analysis

3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the Agriculture Program achieved in CY2021. There were no gas savings reported for this program and the evaluation team also did not identify any gas savings associated with the program.

Table 3-1. Total Annual Incremental Electric Savings

Savings Category	Units	Ex Ante Gross Savings	Program Gross Realization Rate	Verified Gross Savings	Program Net-to-Gross Ratio (NTG)	CY2019 Net Carryover Savings	CY2020 Net Carryover Savings	Verified Net Savings
Electric Energy Savings - Direct	kWh	10,446,231	0.97	10,159,378	0.80	N/A	N/A	8,127,502
Electric Energy Savings - Converted from Gas	kWh	-	N/A	-	N/A	N/A	N/A	-
Total Electric Energy Savings	kWh	10,446,231	0.97	10,159,378	0.80	N/A	N/A	8,127,502
Summer Peak§ Demand Savings	kW	2,078	0.95	1,966	0.80	N/A	N/A	1,573

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).

§ The coincident summer peak period is defined as 1:00-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

The “Verified Net Savings” in row one (Electric Energy Savings – Direct) includes primary kWh savings as a result of measure implementation. It does not include carryover savings, secondary kWh savings from wastewater treatment or electric heating penalties as they don’t apply to this program.

Source: ComEd tracking data and evaluation team analysis

4. Cumulative Persisting Annual Savings

Table 4-1 and Figure 4-1 show the measure-specific and total verified gross savings for the Agriculture Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2021. The electric CPAS across all measures installed in 2021 is shown in Table 4-1. The historic rows are the CPAS contribution back to CY2019. The Program Total Electric CPAS is the sum of the CY2021 contribution and the historic contribution. Figure 4-1 shows the savings across the effective useful life (EUL) of the measures.

There were no gas savings reported or evaluated for this program hence the total CPAS is equivalent to electric CPAS.

Table 4-1. Cumulative Persisting Annual Savings – Electric

End Use Type	Research Category	EUL	CY2021 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026
Lighting	LED Fixtures and Retrofits||	14.7	7,834,590	0.80	83,416,170				6,267,672	6,267,672	6,267,251	6,231,149	5,778,774	5,762,034
Custom	Custom (Lighting)	15.0	652,394	0.80	7,828,731				521,915	521,915	521,915	521,915	521,915	521,915
Custom	Custom (Non-Lighting)	15.0	410,741	0.80	4,928,898				328,593	328,593	328,593	328,593	328,593	328,593
Non-Lighting	Fan Thermostat Controller	15.0	364,096	0.80	4,369,156				291,277	291,277	291,277	291,277	291,277	291,277
Lighting	Indoor LED Grow Lights	9.5	420,542	0.80	3,196,117				336,433	336,433	336,433	336,433	336,433	336,433
Lighting	Lighting Controls - Occupancy Sensors	10.0	172,167	0.80	1,377,337				137,734	137,734	137,734	137,734	137,734	137,734
Lighting	Lighting Controls - Other	10.0	110,094	0.80	880,752				88,075	88,075	88,075	88,075	88,075	88,075
Non-Lighting	Fans, High Speed	7.0	92,790	0.80	519,625				74,232	74,232	74,232	74,232	74,232	74,232
Non-Lighting	VSD Air Compressor less than 150 HP	13.0	85,268	0.80	886,790				68,215	68,215	68,215	68,215	68,215	68,215
Non-Lighting	Insulated Livestock Waterer	10.0	9,351	0.80	74,806				7,481	7,481	7,481	7,481	7,481	7,481
Non-Lighting	VSD Milk Pump with Plate Cooler Heat Exchanger	15.0	4,030	0.80	48,355				3,224	3,224	3,224	3,224	3,224	3,224
Non-Lighting	No-Loss Condensate Drains	10.0	3,314	0.80	26,512				2,651	2,651	2,651	2,651	2,651	2,651
CY2021 Program Total Electric Contribution to CPAS			**10,159,378**		**107,553,247**				**8,127,502**	**8,127,502**	**8,127,080**	**8,090,979**	**7,638,604**	**7,621,864**
Historic Program Total Electric Contribution to CPAS‡						**-**	**410,675**	**3,510,720**	**3,510,720**	**3,497,819**	**3,492,399**	**3,492,399**	**3,492,399**	**3,492,399**
Program Total Electric CPAS						**-**	**410,675**	**3,510,720**	**11,638,223**	**11,625,321**	**11,619,479**	**11,583,378**	**11,131,003**	**11,114,263**
CY2021 Program Incremental Expiring Electric Savings§										**-**	**422**	**36,101**	**452,375**	**16,740**
Historic Program Incremental Expiring Electric Savings									**-**	**12,901**	**5,420**	-	-	-
Program Total Incremental Expiring Electric Savings									**-**	**12,901**	**5,842**	**36,101**	**452,375**	**16,740**

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	LED Fixtures and Retrofits||	5,762,034	5,762,034	5,762,034	5,762,034	5,725,996	5,544,936	5,436,292	5,436,292	1,649,967			
Custom	Custom (Lighting)	521,915	521,915	521,915	521,915	521,915	521,915	521,915	521,915	521,915			
Custom	Custom (Non-Lighting)	328,593	328,593	328,593	328,593	328,593	328,593	328,593	328,593	328,593			
Non-Lighting	Fan Thermostat Controller	291,277	291,277	291,277	291,277	291,277	291,277	291,277	291,277	291,277			
Lighting	Indoor LED Grow Lights	336,433	336,433	336,433	168,217								
Lighting	Lighting Controls - Occupancy Sensors	137,734	137,734	137,734	137,734								
Lighting	Lighting Controls - Other	88,075	88,075	88,075	88,075								
Non-Lighting	Fans, High Speed	74,232											
Non-Lighting	VSD Air Compressor less than 150 HP	68,215	68,215	68,215	68,215	68,215	68,215	68,215					
Non-Lighting	Insulated Livestock Waterer	7,481	7,481	7,481	7,481								
Non-Lighting	VSD Milk Pump with Plate Cooler Heat Exchanger	3,224	3,224	3,224	3,224	3,224	3,224	3,224	3,224	3,224			
Non-Lighting	No-Loss Condensate Drains	2,651	2,651	2,651	2,651								
CY2021 Program Total Electric Contribution to CPAS		**7,621,864**	**7,547,632**	**7,547,632**	**7,379,415**	**6,939,220**	**6,758,160**	**6,649,516**	**6,581,301**	**2,794,976**	**-**	**-**	**-**
Historic Program Total Electric Contribution to CPAS‡		**3,449,741**	**3,423,448**	**3,423,448**	**3,375,043**	**3,375,043**	**3,375,043**	**3,375,043**	**2,182,772**	**-**	**-**	**-**	**-**
Program Total Electric CPAS		**11,071,605**	**10,971,079**	**10,971,079**	**10,754,458**	**10,314,264**	**10,133,204**	**10,024,559**	**8,764,073**	**2,794,976**	**-**	**-**	**-**
CY2021 Program Incremental Expiring Electric Savings§		**-**	**74,232**	**-**	**168,217**	**440,195**	**181,060**	**108,644**	**68,215**	**3,786,325**	**2,794,976**	**-**	**-**
Historic Program Incremental Expiring Electric Savings		**42,658**	**26,294**	**-**	**48,404**	**-**	**-**	**-**	**1,192,271**	**2,182,772**	**-**	**-**	**-**
Program Total Incremental Expiring Electric Savings		**42,658**	**100,526**	**-**	**216,621**	**440,195**	**181,060**	**108,644**	**1,260,486**	**5,969,097**	**2,794,976**	**-**	**-**

Note: The green highlighted cell shows program total first-year electric savings. The gray cells are blank, indicating values irrelevant to the CY2021 contribution to CPAS.

* A deemed value. Source: Illinois Stakeholder Advisory Group (SAG) website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

† Lifetime savings are the sum of CPAS savings through the EUL.

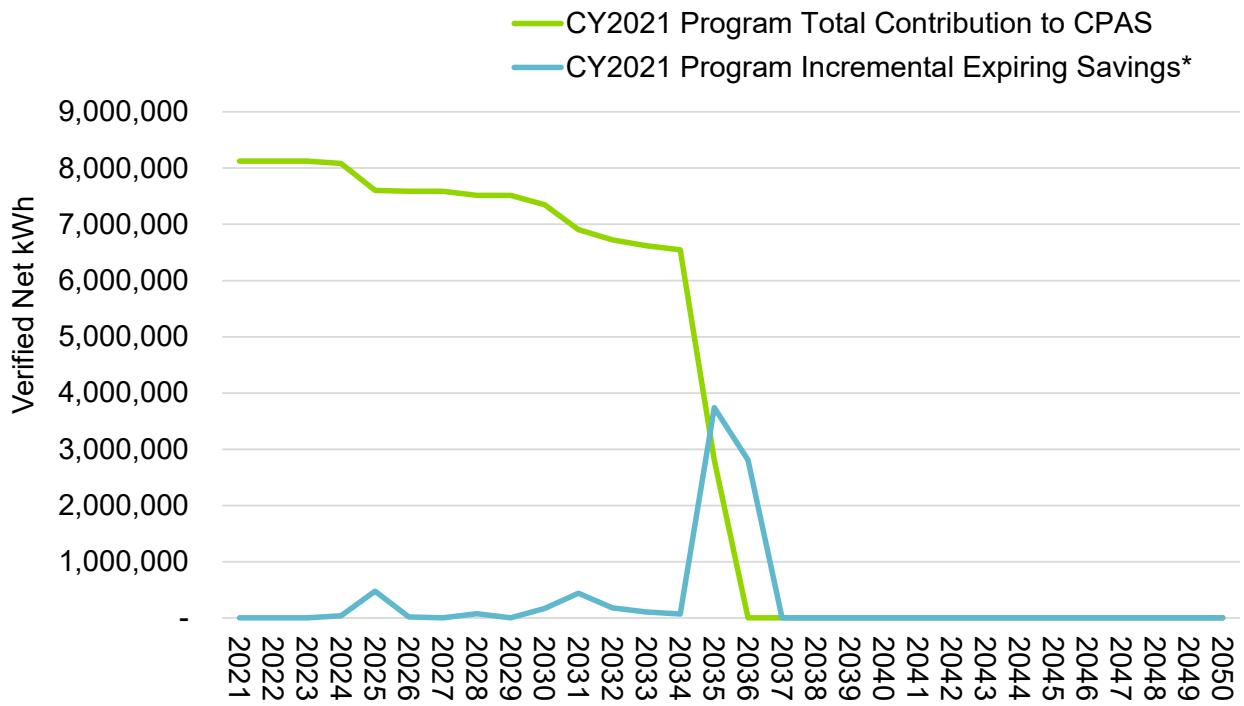
‡ Historic savings go back to CY2018.

§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

|| The EUL for this measure is a weighted average.

Source: Evaluation team analysis

Figure 4-1. Cumulative Persisting Annual Savings



* Expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

Source: Evaluation team analysis

5. Program Savings by Measure

This section provides evaluation results on savings by measure type. However, the precision at the measure level is not always sufficient to draw firm conclusions. The evaluation team analyzed savings for the Agriculture Program at a strata level using a stratified random sample based on project-level reported savings. The verified savings for each measure are summed by project, with strata-level realization rates extrapolated to determine the final program-level results.

Given that the program achieved 95.4% of program savings through the top five measures and these measures are well-represented in the sample, the team is confident in the statistical validity of the results for lighting fixtures and custom measures. The remaining measures, those that contribute 4.6% of measure impacts, have lower (minimal but non-zero) representation in the sample. Therefore, total program-level savings for these measures depends primarily on the realization rates of projects in their strata.

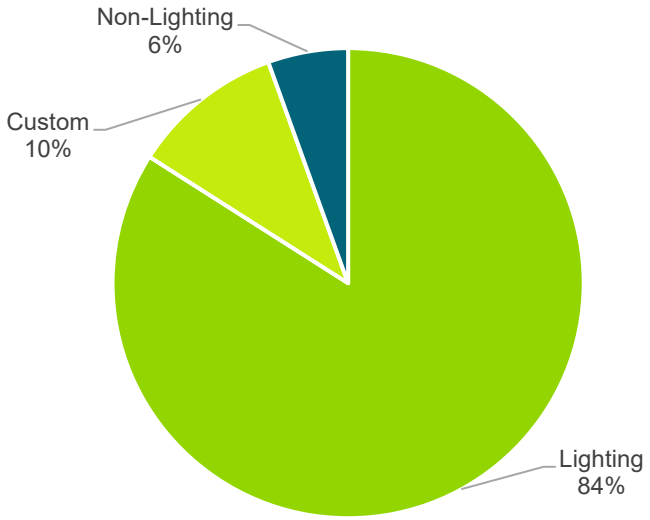
The program included the measures shown in Table 5-1 and Figure 5-1.

Table 5-1. Number of Measures by Type

End Use Type	Research Category	Quantity	Unit
Lighting	LED Fixtures and Retrofits	8,684	Fixtures
Custom	Custom (Lighting)	17	Unique Projects
Custom	Custom (Non-Lighting)	5	Unique Projects
Non-Lighting	Fan Thermostat Controller	2	Controllers
Lighting	Indoor LED Grow Lights	702	Fixtures
Lighting	Lighting Controls - Occupancy Sensors	3,887	Sensors
Lighting	Lighting Controls - Other	988	Sensors
Non-Lighting	Fans, High Speed	123	Fans
Non-Lighting	VSD Air Compressor less than 150 HP†	1	VSD
Non-Lighting	Insulated Livestock Waterer	6	Timers
Non-Lighting	VSD Milk Pump with Plate Cooler Heat Exchanger	1	VSD
Non-Lighting	No-Loss Condensate Drains	1	Drains
	Total	**14,418**	

Note: This is the same table as Table 2-2.
† The database tracks the quantity for VSDs in terms of horsepower. For consistency with other measures the quantity shown here is updated to reflect number of VSDs installed as opposed to the horsepower controlled.
Source: ComEd tracking data and evaluation team analysis

Figure 5-1. Verified Net Savings by End Use Type – Electric



Source: ComEd tracking data and evaluation team analysis

Measure-level energy and demand savings are provided in the following tables. None of the measures produced water savings so secondary energy savings from water reduction measures is zero.

Table 5-2. Energy Savings by Measure – Electric

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	EUL (years)
Lighting	LED Fixtures and Retrofits||	7,888,316	0.99	7,834,590	0.80	6,267,672	14.7
Custom	Custom (Lighting)	653,332	1.00	652,394	0.80	521,915	15.0
Custom	Custom (Non-Lighting)	411,222	1.00	410,741	0.80	328,593	15.0
Non-Lighting	Fan Thermostat Controller	364,108	1.00	364,096	0.80	291,277	15.0
Lighting	Indoor LED Grow Lights	649,857	0.65	420,542	0.80	336,433	9.5
Lighting	Lighting Controls - Occupancy Sensors	173,455	0.99	172,167	0.80	137,734	10.0
Lighting	Lighting Controls - Other	110,661	0.99	110,094	0.80	88,075	10.0
Non-Lighting	Fans, High Speed	92,937	1.00	92,790	0.80	74,232	7.0
Non-Lighting	VSD Air Compressor less than 150 HP	85,280	1.00	85,268	0.80	68,215	13.0
Non-Lighting	Insulated Livestock Waterer	9,557	0.98	9,351	0.80	7,481	10.0
Non-Lighting	VSD Milk Pump with Plate Cooler Heat Exchanger	4,119	0.98	4,030	0.80	3,224	15.0
Non-Lighting	No-Loss Condensate Drains	3,387	0.98	3,314	0.80	2,651	10.0
	Total	**10,446,231**	**0.97**	**10,159,378**		**8,127,502**	

* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021.**
|| The EUL for this measure is a weighted average.

Source: ComEd tracking data and evaluation team analysis

Table 5-3. Summer Peak Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Peak Demand Reduction (kW)	NTG*	Verified Net Peak Demand Reduction (kW)
Lighting	LED Fixtures and Retrofits	1,465	0.99	1,444	0.80	1,155
Custom	Custom (Lighting)	156	0.99	155	0.80	124
Custom	Custom (Non-Lighting)	99	1.00	99	0.80	79
Non-Lighting	Fan Thermostat Controller	0	N/A	0	0.80	0
Lighting	Indoor LED Grow Lights	164	0.47	77	0.80	62
Lighting	Lighting Controls - Occupancy Sensors	151	0.99	150	0.80	120
Lighting	Lighting Controls - Other	2	0.99	2	0.80	2
Non-Lighting	Fans, High Speed	29	0.98	29	0.80	23
Non-Lighting	VSD Air Compressor less than 150 HP	10	0.99	10	0.80	8
Non-Lighting	Insulated Livestock Waterer	0	N/A	0	0.80	0
Non-Lighting	VSD Milk Pump with Plate Cooler Heat Exchanger	0	N/A	0	0.80	0
Non-Lighting	No-Loss Condensate Drains	1	0.99	1	0.80	0
	Total	**2,078**	**0.95**	**1,966**		**1,573**

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).

* A deemed value. Source: Illinois SAG website**: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

Source: ComEd tracking data and evaluation team analysis

6. Impact Analysis Findings and Recommendations

The evaluation team developed several recommendations based on findings from the CY2021 evaluation.

6.1 Savings Adjustments

Finding 1. The program's database did not consistently specify the facility type for the measures installed. No facility type information was provided for 288 out of 1,648 (17.5%) measures installed, impacting all measure categories. For these measures, Guidehouse used values corresponding to the miscellaneous building type for the hours and lighting-heating, ventilation, and air conditioning (HVAC) integration factor for gas heating impacts parameters as per the Illinois Technical Reference Manual v9.0 (IL-TRM),[1] Section 4.5.4.

> **Recommendation 1.** Record and provide the facility type information for all measures in the program database.

6.2 Project Detail Findings

Finding 2. Ex ante analysis for the indoor LED grow lights measure used methodologies that only partially align with the algorithms defined in the IL-TRM. The evaluation sample included projects AGRI-134 and AGRI-251 that installed this measure. AGRI-134 applied an approach using fixture photosynthetic photon efficacy to determine ex ante savings, whereas AGRI-251 used a wattage per fixture method. The evaluation team found that in both cases the analysis failed to balance output from the baseline lighting system versus the as-built condition. This system balancing step is similar to using the common Lumen Equivalency Method but with plant-specific fixture output rated in photosynthetic flux as opposed to lumens. This step is particularly important as photosynthetic flux can vary widely between various light sources and hence as-built fixture quantities rarely match the baseline on a one-to-one basis.

> **Recommendation 2.** Ensure projects that include LED grow lighting measures have total output from the baseline system that is on par with the total output from the LEDs that are installed.

6.3 Documentation Findings

Finding 3. The program's end of year (EOY) tracking database did not include fields for five key input parameters:

- Baseline fixtures to be replaced
- Baseline watts
- Baseline quantity
- Proposed watts
- Measure-level incentive

[1] In this report, unless stated otherwise, IL-TRM refers to version 9.0 (v9.0).

In the absence of information on baseline fixtures at the population level, the evaluation team could only identify the lighting measures replacing T-12 fixtures through a detailed file review conducted only for the sampled projects. For the midlife baseline adjustment, the team extrapolated the portion of sampled lights with a T-12 baseline to the remainder of the population.

> **Recommendation 3**. Include these five key fields in the program's database.

Finding 4. The EUL reported in the program's database was not always consistent with the approach defined in the IL-TRM. For instance, LED fixtures and retrofit measures were all reported to have the maximum EUL of 15 years. Instead, guidance described in the IL-TRM for LED lighting requires the EUL be calculated—by measure—based on the estimated life of the replacement fixture and the annual hours of use according to the facility type. The evaluation team also updated the EUL for lighting controls – other, high speed fans, and insulated livestock waterers.

> **Recommendation 4.** Ensure the EUL in the program's database for all measures is consistent with the IL-TRM.

6.4 Program Diversity Findings

Finding 5. Similar to CY2020, 90% of ex ante energy savings for this program came from lighting measures (LED fixtures, custom lighting, and lighting controls). Although the program did produce 9.5% of savings from custom non-lighting, fan, and VSD projects, there remains a significant opportunity to diversify the measure mix impacted by this program and increase the deployment of VSDs. A more diverse measure portfolio will help the program to continue to accrue substantial energy savings without such significant reliance on lighting-based measures.

> **Recommendation 5.** Coordinate between the implementer and utility for marketing efforts to ensure the broader agriculture customer base is receiving messaging from program staff, the implementer, trade allies, distributors, on-farm service providers, and local equipment retailers. This messaging should include economic-based justification for adopting energy efficient practices beyond lighting. Ensure all stakeholders have quality data on the energy benefits and reliability and non-energy benefits of the measures offered. Discuss other measures included in the Agriculture Program with the participant before, during, and after lighting projects. Seek feedback from participants regarding barriers to adoption of non-lighting measures and seek to address those barriers more broadly.

Appendix A. Impact Analysis Methodology

Guidehouse initiated the impact evaluation process by designing a stratified, random sample of the CY2021 Agriculture Program participants. This stratified approach is used to increase sampling efficiency while maintaining a high degree of confidence in the overall results and representation across the full range of project sizes and participants, with a distribution of measures that organically tracks with the overall representation in the overall program.

The team categorized measures by annual energy savings strata whereby each of the three primary stratum (Large, Medium, and Small) contains approximately one third of total program impacts. The exceptions include a fourth "Very Small" stratum that contains the smallest two percent (cumulative) of projects, which are excluded from the sample, and a fifth "Certainty" stratum to isolate LED Grow Lighting projects. These stratum divisions are defined as follows:

- **Certainty:** LED Grow Lighting Projects
- **Large:** 200,000+ kWh
- **Medium:** 60,001 kWh-200,000 kWh
- **Small:** 9,501 kWh-60,000 kWh
- **Very Small:** Less than 9,500 kWh (cumulatively, smallest 2%)

To achieve the 85% confidence interval and 15% maximum relative precision, the evaluation team selected 13 projects according to the following distribution:

- **Certainty:** 2
- **Large:** 2
- **Medium:** 4
- **Small:** 5
- **Very Small:** 0

Table A-1. Agriculture Program Sample Design

Strata	Population Quantity	Sample Quantity	Average Savings of Installed Measures (kWh)
Certainty - Grow Lighting	3	2	215,433
Large (200,000+ kWh)	10	2	304,049
Medium (60,001 - 200,000 kWh)	36	4	113,452
Small (9,501 - 60,000 kWh)	93	5	25,939
Very Small (0 kWh - 9,500 kWh)	92	0	2,556

Source: ComEd tracking data and evaluation team analysis

The evaluation team requested documentation associated with the sampled projects for review. The team determined project savings by measure-specific program calculators, which were

reviewed by the team during the program year prior to the evaluation. Site- and project-specific details were input to this semi-custom analysis process by the implementer.

The evaluation team determined verified gross savings for each project by:

1. Reviewing the savings algorithm inputs in the implementer's measure calculations for agreement with the IL-TRM.
2. Validating the savings algorithm was applied correctly.
3. Where savings reported in the database do not agree with the verified values in Guidehouse's calculations, cross-checking IL-TRM deemed inputs with the implementer's supporting calculations and other project files.
4. Verifying the reported measure quantity with invoices, as able.

The team used the following documents to verify the savings inputs for each sampled project:

- Final ComEd CY2021 tracking data: AGRI_CY2021_EOY_Data_Rev3_2022_02_01.xlsx.
- IL-TRM for deemed input parameters or secondary evaluation research to verify any custom inputs used in the ex ante calculations. For example, participant interviews to confirm hours of use.
- Implementer Savings Calculations, for example, [participant name] - 2021 Ag Lighting Tool v1.01.xlsx, and [participant name] - Ag Comp Air - No-Loss Cond Drain.xlsx.
- When available: Program applications, measure specifications, and project invoices.

Final verified values were determined through a detailed review of the sampled projects. The evaluation team developed realization rates for each strata based on the verified savings for the projects sampled in that strata. These strata-level realization rates were then extrapolated to the remainder of projects in each strata to determine the program realization rate. The final verified savings resulted in 90% confidence interval and 5.2% relative precision, which was better than original sample target.

Table A-2. Energy Savings by Strata

Sample Strata	Sample Size	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	% of Claimed Savings
Certainty - Grow Lighting	2	637,814	0.64	408,499	0.80	326,799	6%
Large	2	3,040,495	1.00	3,040,495	0.80	2,432,396	29%
Medium	4	4,120,481	1.00	4,119,915	0.80	3,295,932	39%
Small	5	2,412,307	0.98	2,360,413	0.80	1,888,330	23%
Very Small	0	235,134	0.98	230,057	0.80	184,046	2%
CY2021 Total	**13**	**10,446,231**	**0.97**	**10,159,378**	**0.80**	**8,127,502**	**100%**

* A deemed value. Source: Illinois SAG website**: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021.**

Source: ComEd tracking data and evaluation team analysis

Table A-3. Peak Demand Savings by Strata

Sample Strata	Sample Size	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Peak Demand Reduction (kW)	NTG*	Verified Net Peak Demand Reduction (kW)	% of Claimed Savings
Certainty - Grow Lighting	2	161	0.46	74	0.80	59	8%
Large	2	530	0.97	514	0.80	412	26%
Medium	4	815	1.00	809	0.80	648	39%
Small	5	535	0.99	531	0.80	425	26%
Very Small	0	36	0.99	36	0.80	29	2%
CY2021 Total	**13**	**2,078**	**0.95**	**1,966**	**0.80**	**1,573**	**100%**

* A deemed value. Source: Illinois SAG website**: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021.**

Source: ComEd tracking data and evaluation team analysis

Net savings are determined by multiplying the verified gross savings estimates by the program-specific net-to-gross (NTG) ratio as approved by the Illinois SAG.[2]

[2] Source: **https://ilsag.s3.amazonaws.com/ComEd-NTG-History-and-CY2021-Recs-2020-09-30-Final.xlsx**

Appendix B. Impact Parameter Estimates

The implementer developed Excel-based analysis templates specifically for this program. These program- and measure-specific analysis templates (calculators) calculate energy and demand savings and incentives. These ex ante savings are based on savings algorithms and deemed inputs (wattages, hours of use, HVAC interactive impacts, coincidence factors, and unit-level savings) defined by the IL-TRM.

In verifying variables not informed by the tracking data, the team relied on defaults from the IL-TRM. Otherwise, the evaluation team sourced key inputs to the savings analysis using program tracking data and supporting project documents (product spec sheets, invoices, application, ex ante analysis workbooks). These sources allowed the team to verify, on a site-by-site basis, the following details:

- Pre- and post-retrofit fixture wattage
- Pre- and post-retrofit fixture quantity
- Lighting control types
- Installed measure location (e.g., for faucet aerators)
- Custom measure inputs unique to the specific technology and application

The vast majority of program savings stemmed from lighting measures. The evaluation team estimated the annual energy savings for lighting equipment using Equation B-1, per the IL-TRM, Section 4.5.

Equation B-1. Lighting Measures Energy Savings Equation

$$\Delta kWh = ((Watts_{base} - Watts_{EE}) / 1{,}000) * Hours * WHF_e * ISR$$

Where:

$Watts_{base}$	Input wattage of the existing (for early replacement) or baseline system.
$Watts_{EE}$	Actual wattage of LED purchased and installed.
Hours	Annual hours of use.
WHF_e	Waste Heat Factor – Energy: coefficient that captures HVAC interactive impacts on annual energy savings.
ISR	In-service rate: fraction of lamps installed as opposed to stored.

The non-lighting, non-custom measures covered in the Agricultural Program had a very low impact on total program savings. In the rare situation where these measures were included in the evaluation sample, Guidehouse applied the deemed per-unit savings directly from the IL-TRM.

For custom non-lighting measures, the verified analysis is unique to the measure and application. It is not practical to capture each of these instances as a whole, so they are not covered in this section. Across the remaining prescriptive measures, the evaluation team used the project's supporting documents to validate any parameters not specified in the IL-TRM. Table B-1 details these inputs.

Table B-1. Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source*
Quantity	Varies	Each	Evaluated	Project documentation, typically invoices
NTG	Varies	Fraction	Deemed	Illinois SAG consensus
Measure Type and Eligibility	NA	NA	Evaluated	Program database and project specification sheets
Hours of Use	Varies	Hours/year	Evaluated and Deemed	Participant interviews and IL-TRM – Section 4.5
No-Loss Condensate Drains	1,090	kWh/each	Deemed	IL-TRM – Section 4.7.3
EUL	Varies	Years	Mixture	IL-TRM – Sections: 4.1.3, 4.5, and 4.7.3

* IL-TRM is the Illinois Technical Reference Manual version 9.0 from **http://www.ilsag.info/technical-reference-manual.html**. The NTG values can be found on the Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/**

Source: Evaluation team analysis

For most measures, the evaluation team estimated lifetime energy savings by multiplying the verified savings by the EUL for each measure. However, some measures (notably, T-12 lighting fixtures) require midlife adjustment to the baseline to accurately reflect lifetime impacts. The program's database did not include fields for the five key input parameters necessary for an accurate program-level midlife adjustment: baseline fixtures to be replaced, baseline watts, baseline quantity, proposed watts, and measure-level incentive.

Without this detailed information on baseline fixtures, the team was unable to definitively determine which lighting measures replaced T-12 fixtures for projects that were not part of the evaluation sample. Therefore, the midlife adjustment for these measures is based on an assumption that the representation of T-12 baseline fixtures in the sampled projects is a reasonable approximation of T-12 baselines in the broader population. Based on this assumption, the ratio of savings attributed to replacement of T-12s in the sample is extrapolated to the remainder of the lighting savings to determine a fraction of lighting savings subject to the T-12 midlife adjustment.

Appendix C. Total Resource Cost Detail

Table C-1 shows the TRC cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. This table does not include additional required cost data (e.g., measure costs, program-level incentives, and non-incentive costs). ComEd will provide this data to the evaluation team later.

Table C-1.Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Gross Electric Energy Savings (kWh)	Gross Peak Demand Reduction (kW)	Gross Gas Savings (Therms)	Gross Secondary Savings due to Water Reduction (kWh)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Net Electric Energy Savings (kWh)	Net Peak Demand Reduction (kW)	Net Gas Savings (Therms)	Net Secondary Savings due to Water Reduction (kWh)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
Lighting	LED Fixtures and Retrofits	Fixtures	8,684	14.7	YES	7,834,590	1,444	0	0	0	-103,441	0.80	0.80	0.80	6,267,672	1,155	0	0	0	-82,752
Custom	Custom (Lighting)	Unique Projects	17	15.0	NO	652,394	155	0	0	0	0	0.80	0.80	0.80	521,915	124	0	0	0	0
Custom	Custom (Non-Lighting)	Unique Projects	6	15.0	NO	410,741	99	0	0	0	0	0.80	0.80	0.80	328,593	79	0	0	0	0
Non-Lighting	Fan Thermostat Controller	Controllers	2	15.0	NO	364,096	0	0	0	0	0	0.80	0.80	0.80	291,277	0	0	0	0	0
Lighting	Indoor LED Grow Lights	Fixtures	702	9.5	NO	420,542	77	0	0	0	-4,928	0.80	0.80	0.80	336,433	62	0	0	0	-3,942
Lighting	Lighting Controls - Occupancy Sensors	Sensors	3,887	10.0	NO	172,167	150	0	0	0	-2,503	0.80	0.80	0.80	137,734	120	0	0	0	-2,002
Lighting	Lighting Controls - Other	Sensors	988	10.0	NO	110,094	2	0	0	0	-1,813	0.80	0.80	0.80	88,075	2	0	0	0	-1,450
Non-Lighting	Fans, High Speed	Fans	123	7.0	NO	92,790	29	0	0	0	0	0.80	0.80	0.80	74,232	23	0	0	0	0
Non-Lighting	VSD Air Compressor less than 150 HP	VSD	1	13.0	NO	85,268	10	0	0	0	0	0.80	0.80	0.80	68,215	8	0	0	0	0
Non-Lighting	Insulated Livestock Waterer	Timers	6	10.0	NO	9,351	0	0	0	0	0	0.80	0.80	0.80	7,481	0	0	0	0	0
Non-Lighting	VSD Milk Pump with Plate Cooler Heat Exchanger	VSD	1	15.0	NO	4,030	0	0	0	0	0	0.80	0.80	0.80	3,224	0	0	0	0	0
Non-Lighting	No-Loss Condensate Drains	Drains	1	10.0	NO	3,314	1	0	0	0	0	0.80	0.80	0.80	2,651	0	0	0	0	0
	Total			**14.3**		**10,159,378**	**1,966**	**0**	**0**	**0**	**-112,684**				**8,127,502**	**1,573**	**0**	**0**	**0**	**-90,147**

* The total of the EUL column is the weighted average measure life (WAML) and is calculated as the sum product of EUL and measure savings divided by total program savings.

† Early replacement (ER) measures are flagged as YES, otherwise a NO is indicated in the column.

‡ The EUL for this measure varies over time. See the CPAS table (Table 4-1).

Source: ComEd tracking data and evaluation team analysis