LUMINAIRE LEVEL LIGHTING CONTROLS MARKET TRANSFORMATION INITIATIVE BUSINESS PLAN SUMMARY

SAG MARKET TRANSFORMATION WORKING GROUP

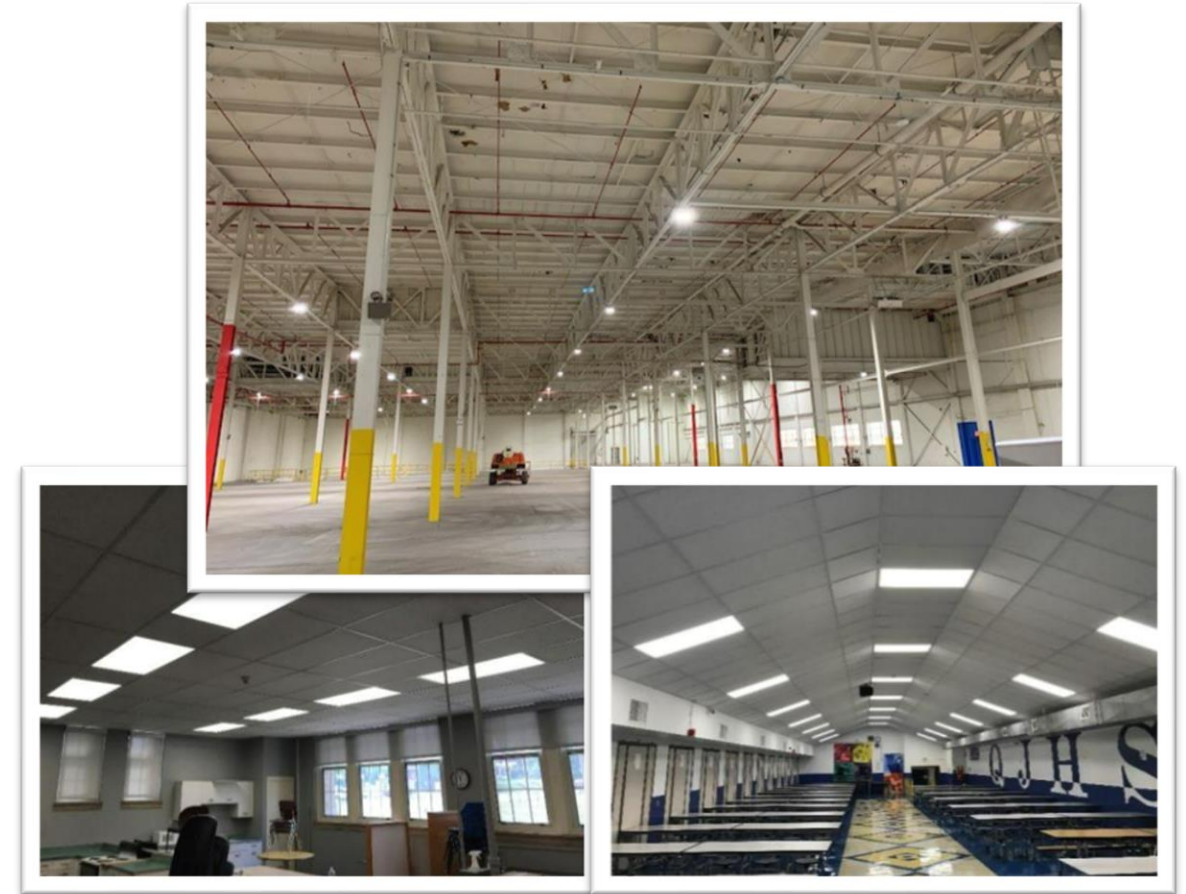OCTOBER 25, 2023

AmerenIllinoisSavings.com

Agenda

LLLC MTI Business Plan Summary
- **Market Transformation Initiative**
- **Target Market**
- **Program Theory of Change**
- **Energy Savings Framework**
- **Evaluation Plan**
- **Ameren IL Market Engagement**
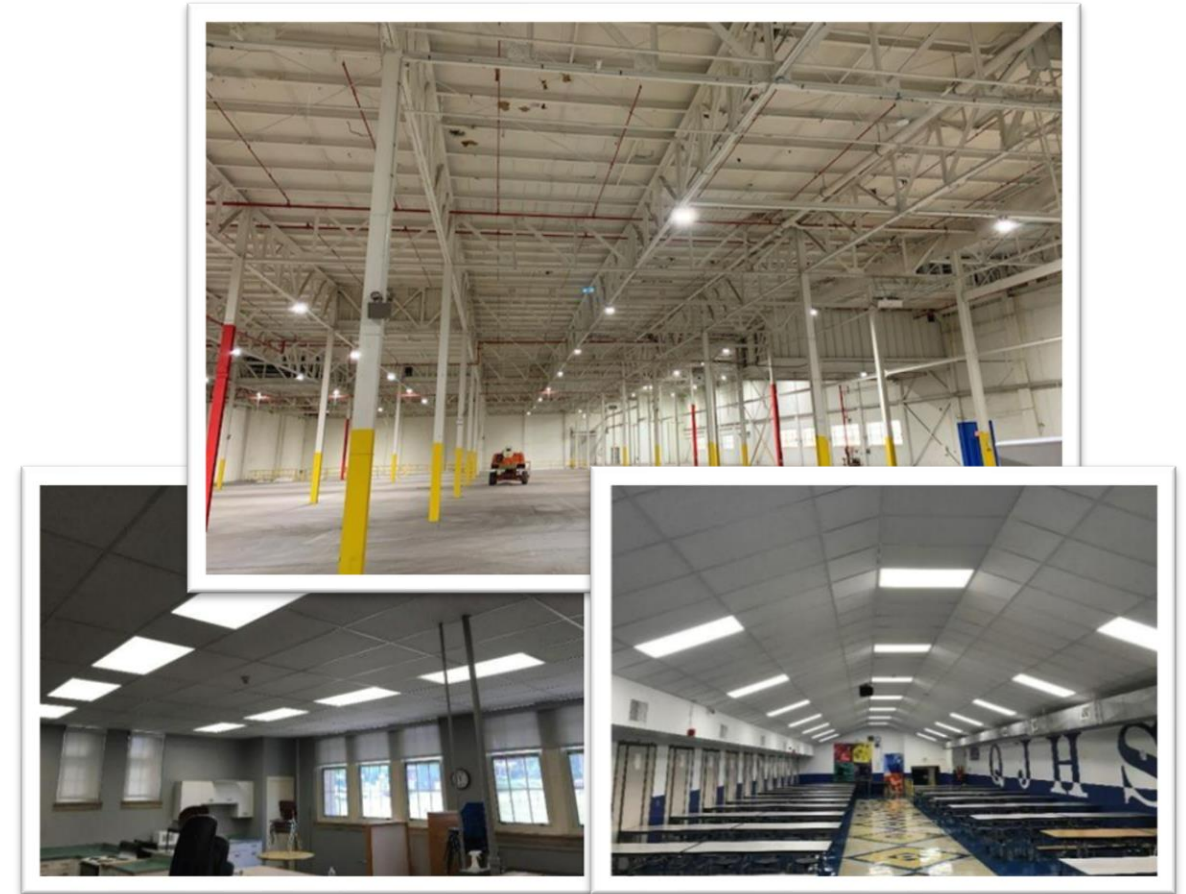
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Market Transformation Initiative

Illinois TRM – Version 12.0 Attachment C:

Market Transformation Definition

Market Transformation is the strategic process of intervening in a market to create lasting change that results in the accelerated adoption of energy efficient products, services and practices.

Market Transformation Initiative (MTI) Business Plan

The MTI Business Plan is intended to document the strategy, data, and assumptions about the initiative at the time of launch.

MTI Target Market

To qualify as an MT initiative, there needs to be a clearly delineated target market, as well as a documented theory of change in this market (or MT hypothesis) that is embedded in a defensible logic model.

Market Transformation Initiative

Illinois TRM – Version 12.0 Attachment C: Program Supporting Documents

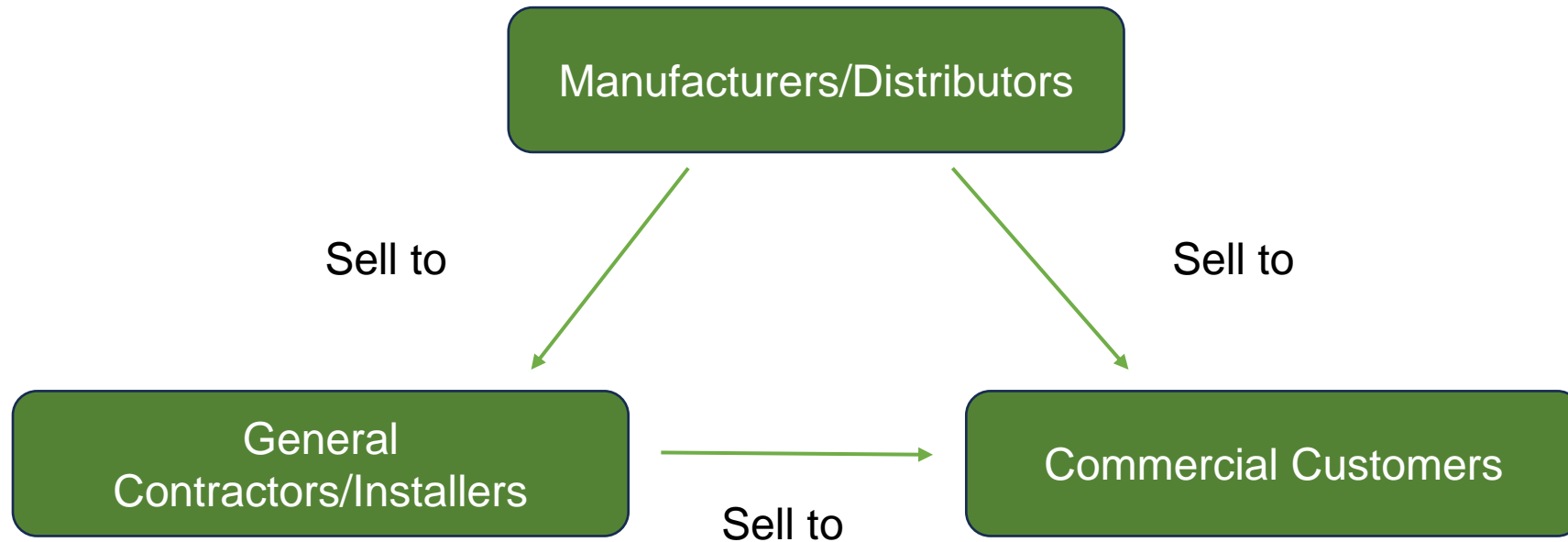| Document	Energy Savings Framework	Program Plan/Logic Model	Evaluation Plan
Summary of Document	*Market Characterization (Historical trends; market projection with NMB; unit sales & energy savings)*	*Program actions & intent; expected short-term and long-term outcomes; MPI's & measurement*	*Proposed evaluation research methods and plan – MPI's & ESF*
Document Developer	*Program Administrator (utility) with Implementation Contractor*	*Program Administrator (utility) with Implementation Contractor*	*Program Evaluator*
Review	*Program Evaluator (especially NMB); SAG*	*Program Evaluator; SAG*	*Program Administrator (utility) with Implementation Contractor; SAG*
Updating Process	*Evaluator assesses on-going adequacy of ESF; Change Recommendation reviewed by Program Administrator (utility) with Implementation Contractor and SAG*	*As needed by Program Administrator (utility) with Implementation Contractor with Recommendations by Evaluator*	*Updated annually by Evaluator; reviewed by Program Administrator (utility) and SAG*

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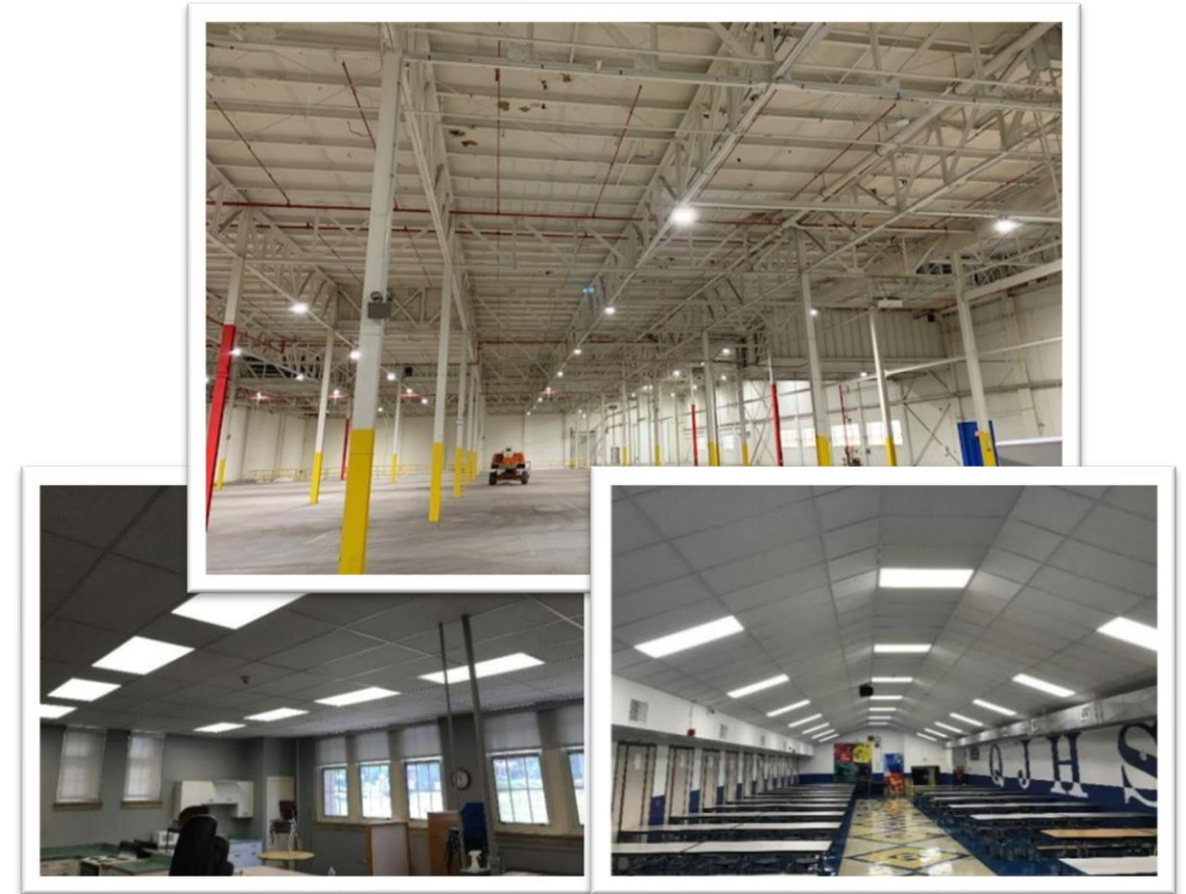
Target Market

The TRM defines Target Market as "an actual or nominal place where forces of demand and supply operate, and where buyers and sellers interact (directly or through intermediaries) to trade goods, services or contracts or instruments, for money or barter." This definition was used to define the LLLC MTI Target Market below.

```
                    ┌──────────────────────────┐
                    │ Manufacturers/Distributors │
                    └──────────────────────────┘
                     Sell to              Sell to

┌────────────────────┐               ┌────────────────────┐
│     General         │   Sell to     │ Commercial Customers │
│ Contractors/Installers │ ─────────> │                     │
└────────────────────┘               └────────────────────┘
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Agenda

LLLC MTI Business Plan Summary
- Market Transformation Initiative
- Target Market
- **Program Theory of Change**
  - **Barriers to Adoption**
  - **Market Outcomes**
  - **Logic Model**
  - **Market Progress Indicators**
- Energy Savings Framework
- Evaluation Plan
- Ameren IL Market Engagement
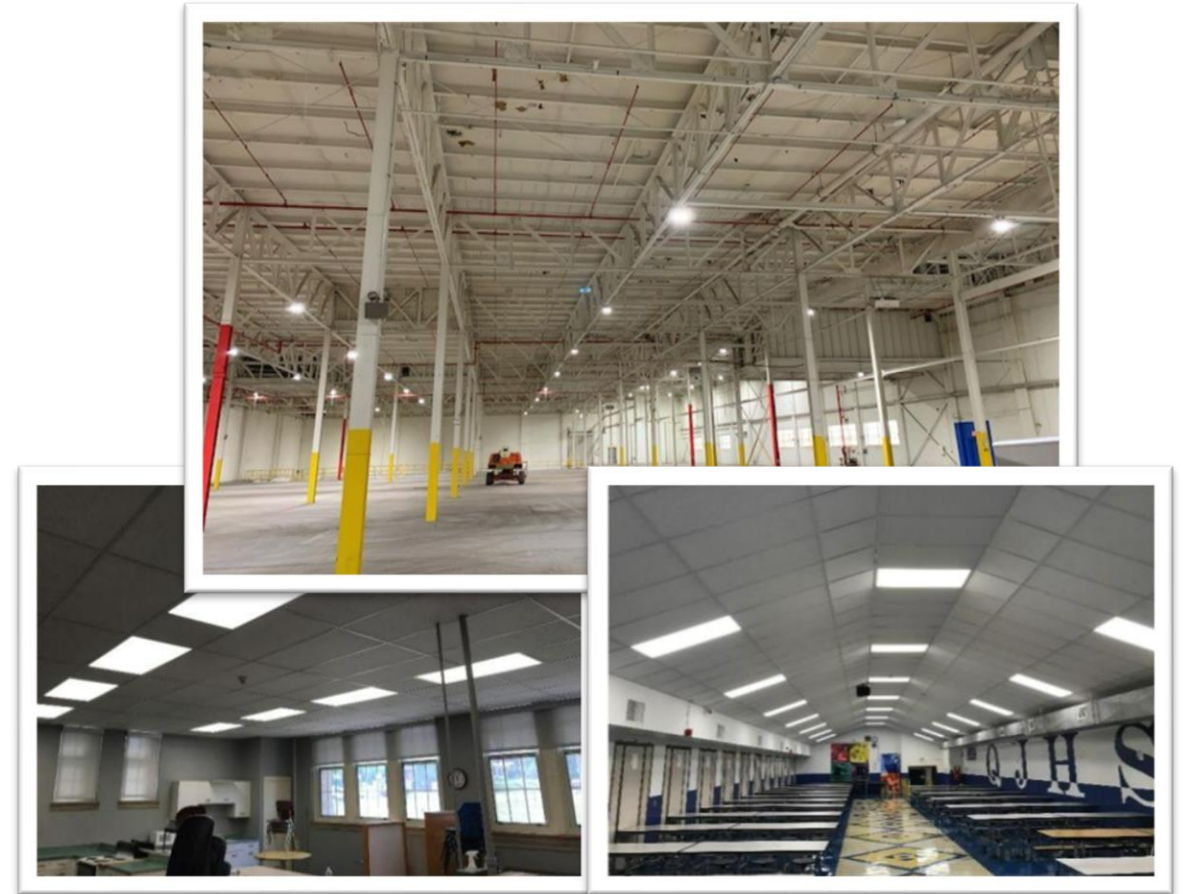
Program Theory of Change: Barriers to Adoption

The LLLC Market Transformation Initiative (MTI) seeks to accelerate the adoption of the technology by removing three key market barriers:

1. **Lack of value proposition**: Low awareness and familiarity with the technology among the target market.[1]
2. **Lack of skilled contractors and installers:** Low volume of skilled contractors and installers that are comfortable bidding, installing, and commissioning LLLC equipment.[1]
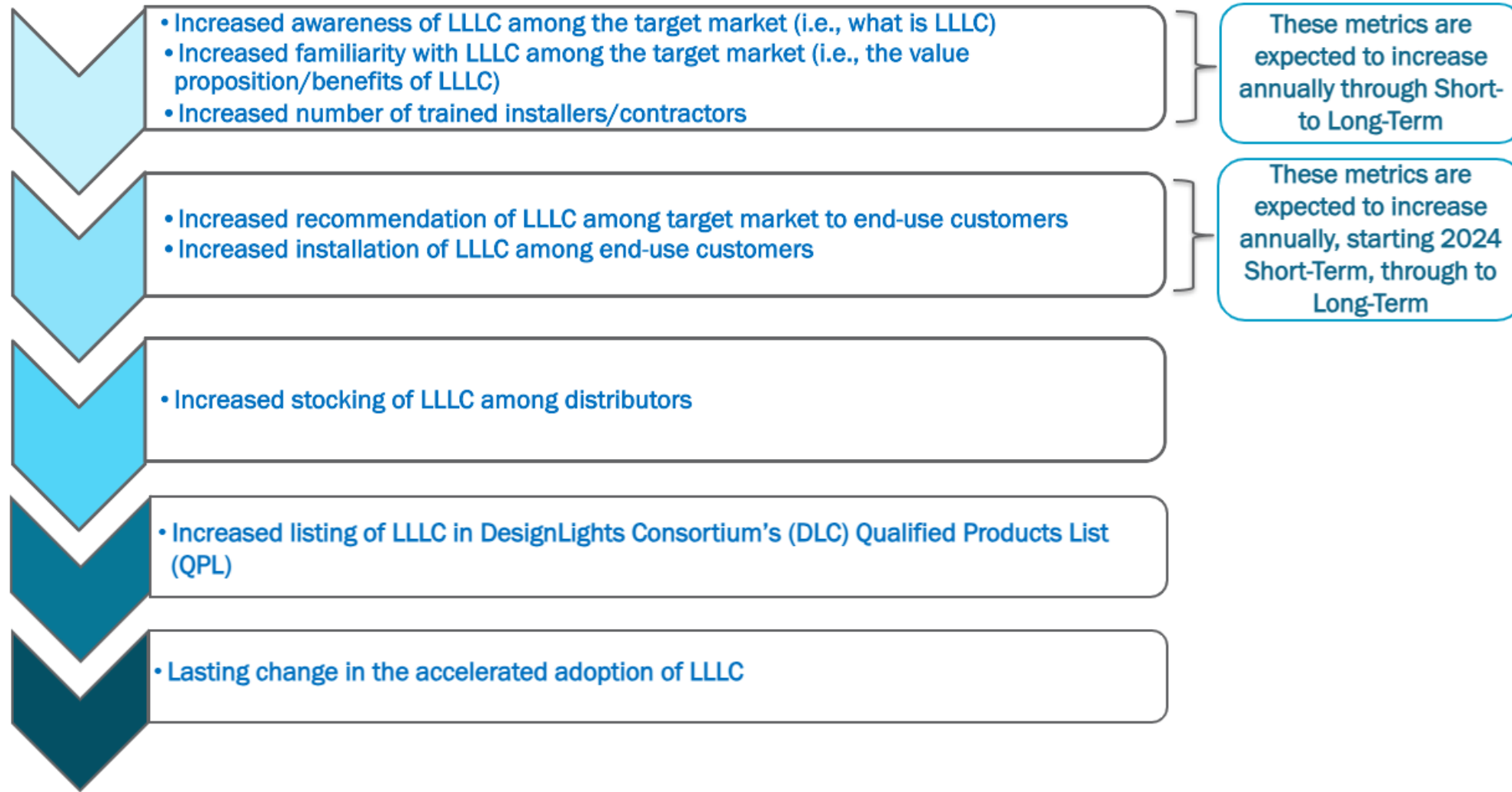3. **High upfront costs**: Per fixture cost of LLLC was $149 vs. $100 for standard LED fixture without controls.[2]

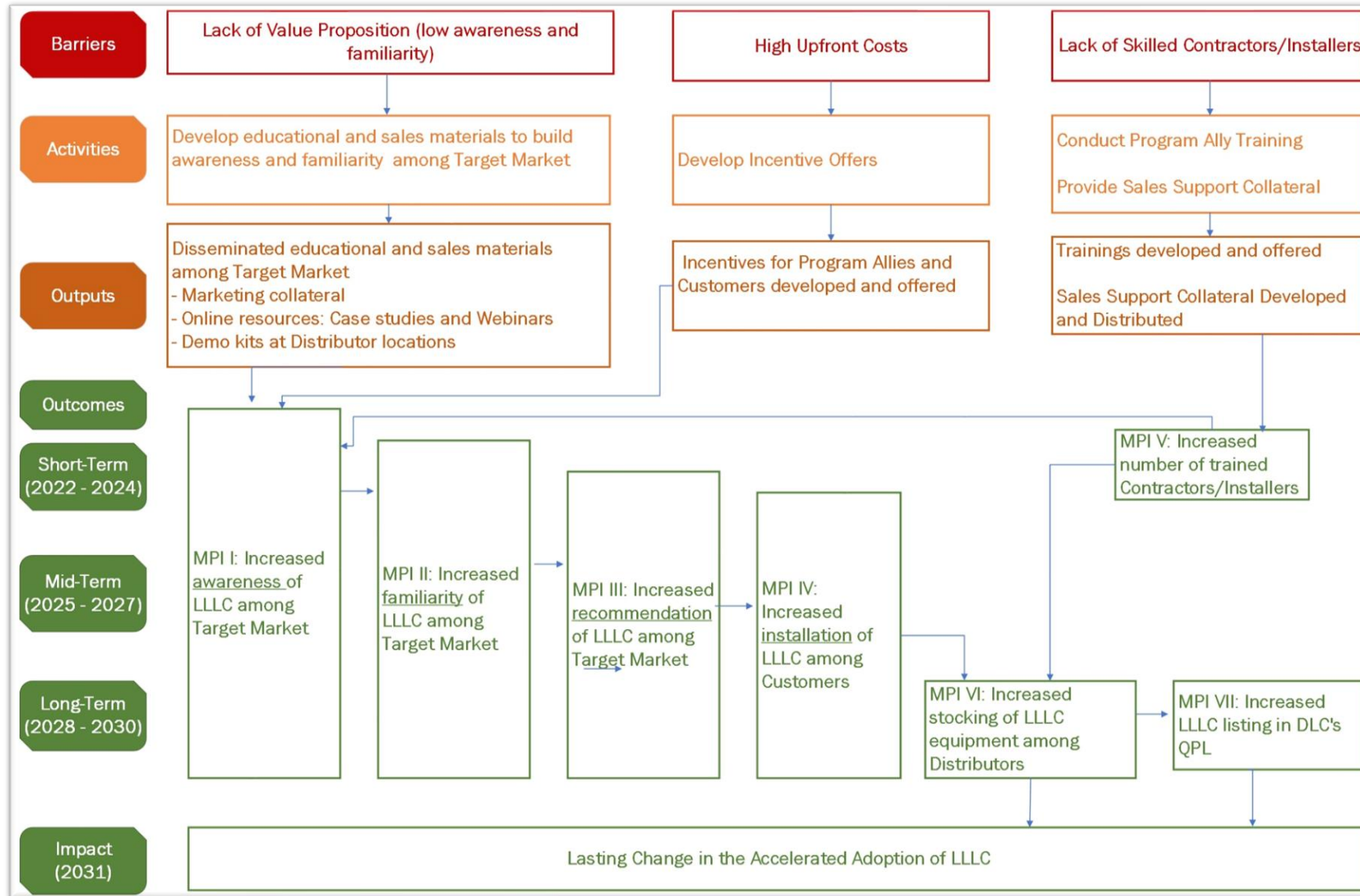| Barriers	Activities
Lack of value proposition: low awareness and familiarity	Educational and sales collateral; webinars
Lack of skilled contractors and installers	Training
High upfront costs	Incentives

[1] AIC interviews with Program Allies.
[2] NEEA 2021, 2020 Luminaire Level Lighting Controls Incremental Cost Study.

Program Theory of Change: Market Outcomes

- Increased awareness of LLLC among the target market (i.e., what is LLLC)
- Increased familiarity with LLLC among the target market (i.e., the value proposition/benefits of LLLC)
- Increased number of trained installers/contractors

> These metrics are expected to increase annually through Short- to Long-Term

- Increased recommendation of LLLC among target market to end-use customers
- Increased installation of LLLC among end-use customers

> These metrics are expected to increase annually, starting 2024 Short-Term, through to Long-Term

- Increased stocking of LLLC among distributors

- Increased listing of LLLC in DesignLights Consortium's (DLC) Qualified Products List (QPL)

- Lasting change in the accelerated adoption of LLLC

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Program Theory of Change: Logic Model

Program Theory of Change: Market Progress Indicators

MPI #	Outcome	Market Progress Indicator	Data Source	Goals
I & II	Increased awareness and familiarity with LLLC among Target Market	Awareness is determined by the percentage of Target Market who have never heard of LLLC. Familiarity refers to the knowledge that the Target Market has about the features of LLLC.	Surveys among Target Market	Awareness by 2027: 50% Customer awareness 95% Installer by 2027 Familiarity by 2027: 3.5/5 across Target Market
III	Increased recommendation of LLLC among Target Market	Target Market recommends LLLC when recommending lighting equipment including; Manufacturer recommendations to Distributors, Distributor recommendations to Contractors/Installers, and Contractor/Installer recommendations to End-Use Customers.	Surveys among Target Market	65% of Surveyed applicable Target Market recommends LLLCs by 2027
I & II	Increased awareness and familiarity with LLLC among Target Market	Awareness is determined by the percentage of Target Market who have never heard of LLLC. Familiarity refers to the knowledge that the Target Market has about the features of LLLC.	Surveys among Target Market	Awareness by 2027: 50% Customer awareness 95% Installer by 2027 Familiarity by 2027: 3.5/5 across Target Market
III	Increased recommendation of LLLC among Target Market	Target Market recommends LLLC when recommending lighting equipment including; Manufacturer recommendations to Distributors, Distributor recommendations to Contractors/Installers, and Contractor/Installer recommendations to End-Use Customers.	Surveys among Target Market	65% of Surveyed applicable Target Market recommends LLLCs by 2027

MPI #	Outcome	Market Progress Indicator	Data Source	Goals
VI	Increased stocking of LLLC equipment among Distributors	Distributors stock more LLLC equipment	Surveys among Distributors Sales data from Distributors	At a minimum, three key distributors stock LLLCs as a business practice by 2027
VII	Increased LLLC Listings in the DesignLights Consortium (DLC) Qualified Products List (QPL)	Manufacturers list their LLLC equipment on the DLC QPL	Number of Manufacturers listed in the DLC LLLC QPL	Five additional manufacturers list their product on the DLC QPL by 2027
Impact	Lasting Change in the Accelerated Adoption of LLLC	Consistent recommendation and installation of LLLCs among Target Market	Surveys among Target Market Dodge Data	Market share of LLLC reached a level where a significant portion of the Early Majority have adopted LLLC

LLLC MTI Business Plan Summary
- Market Transformation Initiative
- Target Market
- Program Theory of Change
- **Energy Savings Framework**
  - **Unit Energy Savings**
  - **Natural Market Baseline**
  - **Applying NMB Market Share**
- Evaluation Plan
- Ameren IL Market Engagement

Energy Savings Framework: Unit Energy Savings (UES)

The Energy Savings for LLLC are defined by the TRM[3] with the following formula:

$$\Delta kWh = kW_{Controlled} * Hours * (ESF_{EE} - ESF_{Base}) * WHF_e$$

Each part of the equation was weighted, where applicable, to derive a Territory Unit Energy Savings (UES) that is most representative of the luminaires and LLLCs in AIC's service territory.

The primary source of weighting used was based on the prevalence of different building types as laid out in the 2020 Ameren Illinois Market Potential Study[4]:

Building Type	Floor Area (Million Sqft)	Building Prevalence
Education	134.7	12%
Office	169.2	15%
Retail	168.9	15%
Warehouse	352.8	31%
Health	75.6	7%
Unknown	223.7	20%
		100%

[3] 2024 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 12.0. Volume 2: Commercial and Industrial Measures. IL-TRM_Effective_010124_v12.0_Vol_2_C_and_I_09222023_FINAL_clean.pdf (ilsag.info)
[4] AIC Illinois Market Potential Study Preliminary Potential Estimates. https://www.ilsag.info/wp-content/uploads/AIC-MPS_Prelim.-Electricity-Potential-for-SAG_09-02-2020.pdf

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Energy Savings Framework: Unit Energy Savings (UES)

kW Controlled

Through building level analysis, it was determined that across all building types, an average of 75% of fixtures were <10,000 lm and 25% of fixtures were ≥10,000 lm.
This was then weighted twice:

1. By prevalence of each building type, where it was found 62% were <10,000 lm and 38% of fixtures were ≥10,000 lm across Ameren territory.
2. By kW controlled. The 62% and 38% were applied to determine the weighted kW controlled.

Control Type	kW Controlled	Fixture Prevalence[5]	Weighted kW Controlled
< 10,000 lm	0.031	62%	0.1922
≥ 10,000 lm	0.118	38%	0.04484
			0.06406

Waste Heat Factor

The TRM[6] prescribes Waste Heat Factor (WHF) by building type in the large table in section 4.5 (Lighting End Use). As with the other parts of the equation, these values were weighted by the prevalence of each building type in AIC territory.

Building Type	WHF	Building Prevalence	Weighted WHF
Education	1.10	12%	0.13
Office	1.12	15%	0.17
Retail	1.08	15%	0.16
Warehouse	1.02	31%	0.32
Health	1.15	7%	0.08
Unknown	1.08	20%	0.22
			1.07

Hours

The TRM[6] prescribes lighting hours of operating by building type. Four building types (Education, Office, Retail, Warehouse) have operating hours found in section 4.5.10 (Lighting Controls). Two building types (Health, Unknown) have operating hours found in the large table in section 4.5 (Lighting End Use).

Weighted hours were then calculated based on building type prevalence:

Building Type	Hours	Building Prevalence	Weighted Hours
Education	4231	12%	508
Office	4453	15%	668
Retail	6936	15%	1040
Warehouse	5116	31%	1586
Health	7036	7%	493
Unknown	3379	20%	676
			4970

Energy Savings Factor

The TRM[4] prescribes the Energy Savings Factor (ESF) of "Interior Networked Luminaire-Level Lighting Controls as 61%. It also notes that the ESF of the baseline should be 0 if there are no lighting controls or "prior existence of lighting controls [are] unknown."

Therefore, the Energy Savings Factor is determined as 00.61-0 = **0.61**.

Unit Energy Savings

Using the weighted values, the TRM-prescribed calculation for LLLC energy savings was produced:

$$kWh = 0.06406 * 4970 * 0.61 * 1.07$$

Therefore, the average annual energy savings from a single LLLC installed in AIC service territory is **207.8 kWh**.

[5] AIC Illinois Market Potential Study Preliminary Potential Estimates. https://www.ilsag.info/wp-content/uploads/AIC-MPS_Prelim.-Electricity-Potential-for-SAG_09-02-2020.pdf
[6] 2024 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 12.0. Volume 2: Commercial and Industrial Measures. IL-TRM_Effective_010124_v12.0_Vol_2_C_and_I_09222023_FINAL_clean.pdf (ilsag.info)

Energy Savings Framework: Natural Market Baseline

1. Adoption Curve Shape
2. Year Product Enters Market
3. Forecast Start Year
4. Initial Market Share
5. Start of Hypergrowth*
6. Ramp Period*
7. Takeover Point
8. Takeover Period
9. Maximum Market Share*
10. Factor—*shape* between 5 and 7*

Theoretical Natural Market Baseline
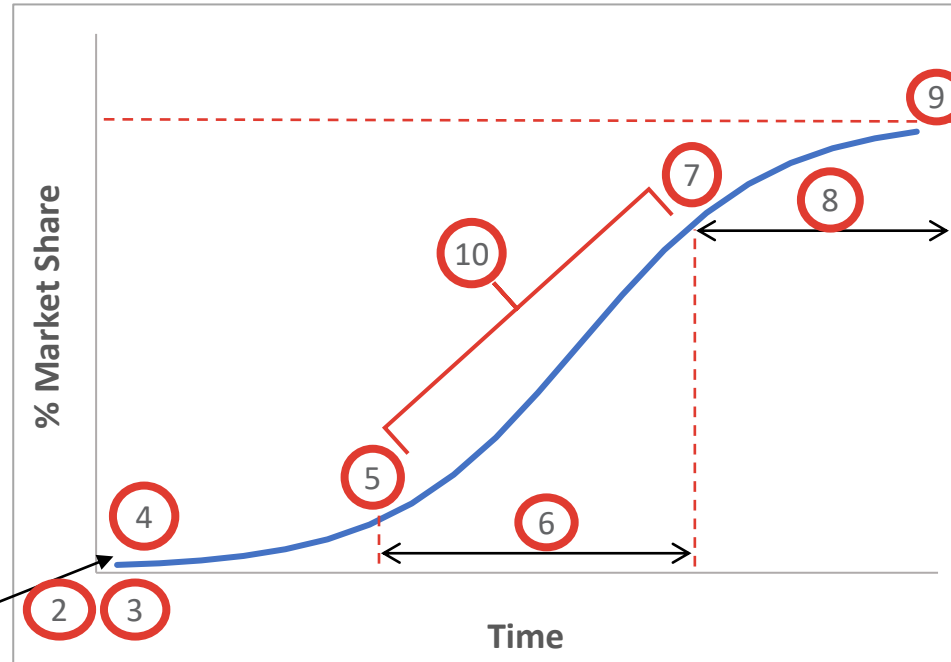
* Key input variable in NMB equation

For the LLLC NMB curve, the y-axis shows the percentage of total commercial luminaires sold that include LLLCs in time *t*, as defined by the following equation:

$$\frac{\%\ all\ luminaires\ sold\ with\ LLLCs(t)}{\%\ all\ luminaires\ sold\ (t)}$$

$$Market\ Penetration(t) = \frac{Maximum\ Market\ Share}{1 + Factor \wedge \left(\frac{Start\ of\ Hypergrowth + \left(\frac{RampPeriod}{2}\right) - Current\ Year(t)}{Ramp\ Period}\right)}$$

Energy Savings Framework: Natural Market Baseline

NMB Component	Selected Value	Rationale/Methodology
Year Product Enters Market	2016	NEEA research and IL Building Codes
Forecast Start Year	2021	AIC began its LLLC MTI
Initial Market Share	0.25%	Result of 2019 Dodge Data analysis
Start of Hypergrowth	2030	IECC 2027 may go into effect in 2029 or 2030
Ramp Period	14 years	Based on secondary research[7]
Takeover Point	2044	Calculated by adding Start of Hypergrowth and Ramp Period
Takeover Period	6 years	Based on deducting Takeover Point of 2044 from forecast end-date of 2050
Maximum Market Share	40%	Based on a derivative approach using data from various sources

[7]Research Into Action and Energy 350. Luminaire Level Lighting Controls (LLLC) Market Characterization and Baseline Report. Prepared for Northwest Energy Efficiency Alliance. December 14, 2016.

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Energy Savings Framework: LLLC Natural Market Baseline

Year	Market Share
2021	0.26%
2022	0.36%
2023	0.49%
2024	0.66%
2025	0.90%
2026	1.23%
2027	1.66%
2028	2.24%
2029	3.00%
2030	4.00%
2031	5.28%
2032	6.89%
2033	8.87%
2034	11.22%
2035	13.92%

Year	Market Share
2036	16.89%
2037	20.00%
2038	23.11%
2039	26.08%
2040	28.78%
2041	31.13%
2042	33.11%
2043	34.72%
2044	36.00%
2045	37.00%
2046	37.76%
2047	38.34%
2048	38.77%
2049	39.10%
2050	39.34%

LLLC Natural Market Baseline Adoption Curve
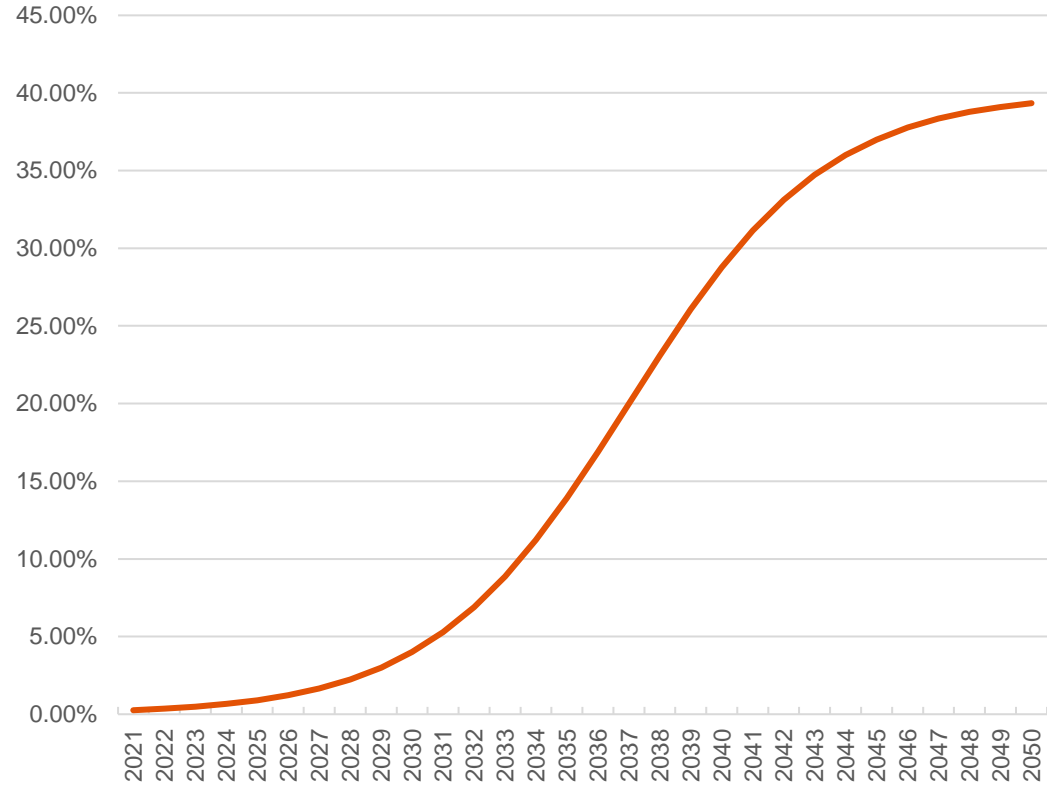
Energy Savings Framework: Applying NMB Market Share

NMB market share defined as:

$$\frac{\%\ all\ luminaires\ sold\ with\ LLLCs}{\%\ all\ luminaires\ sold}$$

The total number of LLLCs sold within the territory can be found by:

$$Number\ of\ LLLCs = LLLC\ Market\ Share(\%) * Total\ luminaire\ sales$$

Four steps were used to determine the total amount of LLLC sales per year:

1. Identify the total commercial square footage in AIC territory for each year of the forecast

2. Analyze the commercial and new construction and renovation/replacement luminaire installation rates

3. Develop an average sqft per luminaire

4. Calculate the total number of fixtures sold and installed in each year

The 4-step analysis was corroborated through comparative analysis with similar unit sales LLLC penetration study research performed by Bonneville Power Authority.

Energy Savings Framework: Applying NMB Market Share

(1) Total commercial square footage in AIC territory for each year of the forecast

AIC's non-residential market is characterized in the 2020 AIC Potential Study.[8] The study found that AIC's total commercial floor space in 2020 was **1,124,900,000** sqft. This value was used as a starting point, with estimated growth throughout the forecast period.

The Commercial Buildings Energy Consumption Survey (CBECS)[9] from the US Energy Information Administration (EIA) shows national trends in commercial space over the last 40 years. Using this data, a linear forecast from 1979 to 2050 (the end of the NMB range) was created where an average annual growth rate of 0.86% was found.

This annual growth rate was applied to AIC's known square footage to create a square footage forecast through 2030:

Year	Total Sqft
2022	1,144,331,478
2023	1,154,172,728
2024	1,164,098,614
2025	1,174,109,862
2026	1,184,207,207
2027	1,194,391,389
2028	1,204,663,155
2029	1,215,023,258
2030	1,225,472,458

(2) Commercial and new construction and renovation/replacement rates

The number of LLLC luminaires per year is contingent on the annual square footage of commercial new construction and the annual square footage of commercial space undergoing renovation/replacement.

New construction square footage in each year was estimated as the difference in commercial square footage from the prior year.
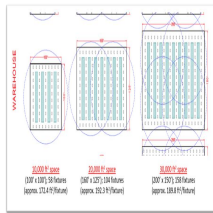
Renovation/replacement square footage in each year was estimated as total commercial square footage divided by 13, where 13 is the average deemed useful life of commercial luminaires.[10]

Year	New Construction (Sqft)	Renovation/Replacement (Sqft)
2022	9,757,338	85,048,840
2023	9,841,251	85,786,605
2024	9,925,885	86,530,769
2025	10,011,248	87,274,934
2026	10,097,345	88,025,498
2027	10,184,182	88,782,518
2028	10,271,766	89,546,047
2029	10,360,103	90,316,143
2030	10,449,200	91,092,862

(3) Average sqft per luminaire

Steve Mesh (Principal, Lighting Education and Design) created sample lighting designs for multiple building types, and developed small (10,000 sqft), medium (20,000 sqft), and large (30,000 sqft) designs for each building type. When sqft/fixture differed between sizes, the values were averaged across the building type.

Two building types—Retail and Unknown—did not have sample lighting designs, estimated values were used based on subject matter expertise.

All values were then weighted by building type prevalence in AIC service territory.

Building Type	Sqft/fixture	Building Prevalence	Weighted Sqft/fixture
Education	113	12%	13.6
Office	83	15%	12.5
Retail	120	15%	18.0
Warehouse	185	31%	57.4
Health	73	7%	5.1
Unknown	150	20%	30.0
			136

(4) Total number of fixtures sold in each year

With the total square footage for both new construction and renovation/replacement determined, as well as the average sqft/luminaire, the total number of luminaires sold in AIC's service area in each forecast year can be calculated:

$$Total\ luminaire\ sales = New\ construction\ luminaire\ sales + Renovation\ \&\ Replacement\ luminaire\ sales$$

Year	# of Luminaires Sold
2022	718,991
2023	725,175
2024	731,411
2025	737,701
2026	744,046
2027	750,444
2028	756,898
2029	763,408
2030	769,973

[8] AIC Illinois Market Potential Study Preliminary Potential Estimates. https://www.ilsag.info/wp-content/uploads/AIC-MPS_Prelim.-Electricity-Potential-for-SAG_09-02-2020.pdf

[9] 2018 Commercial Buildings Energy Consumption Survey. Building Characteristics Highlights. https://www.eia.gov/consumption/commercial/data/2018/pdf/CBECS_2018_Building_Characteristics_Flipbook.pdf
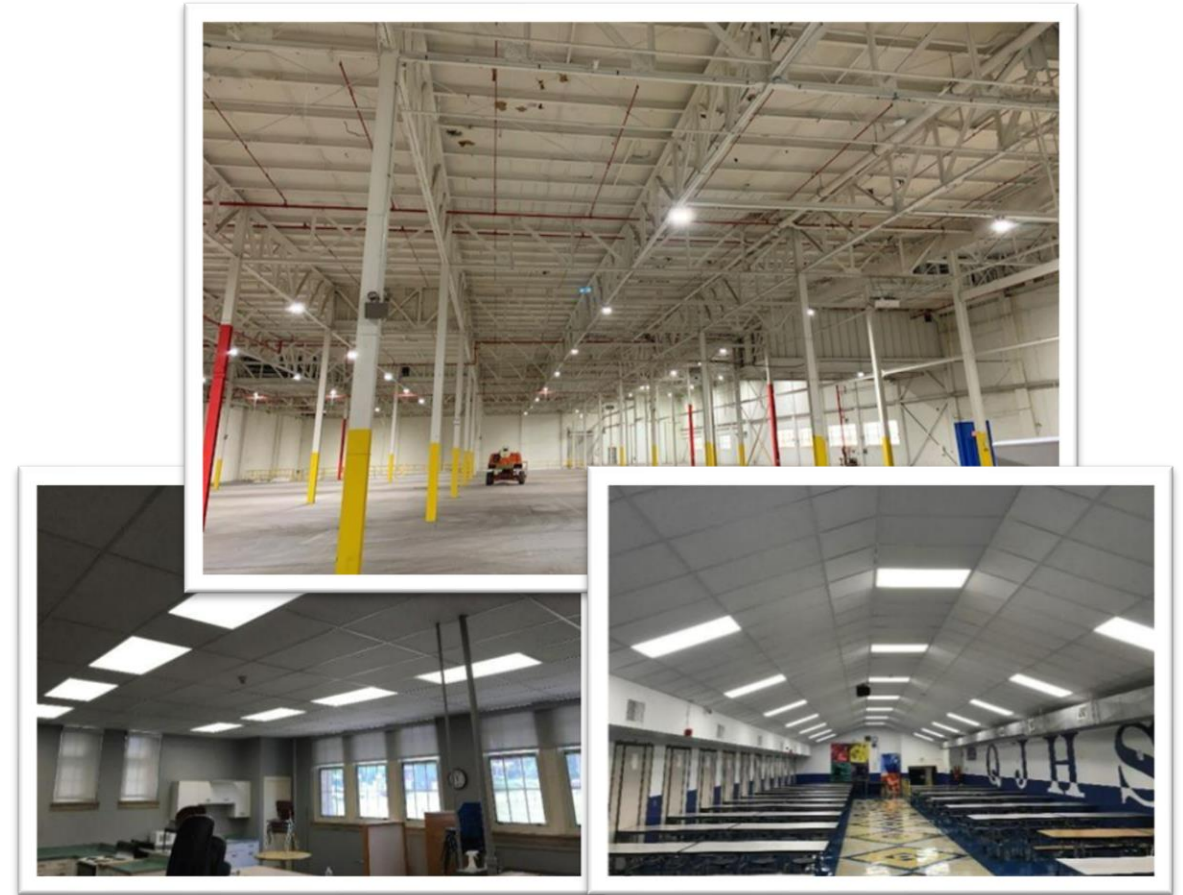
[10] 2024 Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 12.0, Volume 2: Commercial and Industrial Measures, Final. September 22, 2023. Effective January 1, 2024. Nonresidential luminaires have deemed lives depend on operating hours and generally range from 12 to 15 years.

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- **Evaluation Plan**
  - **Evaluation Objectives**
  - **Evaluation Activity Timeline**
  - **Calculating Savings**
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Evaluation Plan: Evaluation Objectives

- Describe how the pilot was implemented.

- Explore areas for pilot improvement, including increasing its overall effectiveness and ease of implementation.

- Measure Market Progress Indicators such as; the amount of knowledge gained from the LLLC training and determine if an increase in recommendations of LLLCs to clients occurred and assessing annual levels of awareness and understanding of LLLCs among the Target Market.

- Measure how the market share of LLLCs shifted over the evaluation period.

- Estimate energy savings associated with the LLLC market transformation initiative.

Evaluation Plan: Evaluation Activity Timeline

Activity	2024	2025	2026
Pilot Materials Review	✓	✓	✓
Pre- and Post-Training Assessments with Trade Allies	✓	✓	✓
Market Actor Surveys (Market-Level Measurement)	✓	✓	✓
MPI Assessments	✓	✓	✓
Monitor Lighting Market	✓	✓	✓
Revisit NMB and Assumptions		✓	
NLC and LLLC Sales Data Analysis	✓	✓	✓
Estimation of Market Transformation Savings	✓	✓	✓

The cadence of evaluation activities from 2024 – 2026 will repeat throughout the implementation of the LLLC MTI

Evaluation Plan: Calculating Savings

Using secondary data, the evaluation team will analyze lighting market sales data to calculate the total market units of LLLCs in Illinois.[11] The team will also use the IL-TRM to determine LLLC Unit Energy Savings (UES). The equations below provide the current IL-TRM algorithms for LLLCs[12]

IL-TRM V12.0 LLLC Electric Energy Savings Algorithm

$$\Delta kWh = KW_{Controlled} * Hours * (ESF_{EE} - ESF_{Base}) * WHF_e$$

IL-TRM V12.0 LLLC Summer Coincident Peak Demand Savings Algorithm

$$\Delta kW = KW_{Controlled} * WHF_d * (CF_{baseline} - CF_{LC})$$

Total Savings from LLLCs

$$LLLC\ EnergySavings_{Total} = UES\ x\ Number\ of\ MT\ Units$$

[11] Advance Market Analytics. United States Commercial Lighting Market Data Set.
[12] The IL-TRM is updated as part of a yearly process; each version of the IL-TRM corresponds to a specific program year. Evaluation will use the IL-TRM algorithm specific to each program year being evaluated throughout the course of our evaluation in alignment with Illinois requirements.

Evaluation Plan: Calculating Savings

Further evaluation is needed to calculate savings that occur from LLLCs as a result of Market Transformation efforts.

Total energy savings will be reduced by the Natural Market Baseline savings to determine the volume of savings resulting from Market Transformation and Resource Acquisition Program efforts.

$$MT\ Energy\ Savings_{including\ RA} = LLLC\ Energy\ Savings_{Total} - MT\ Energy\ Savings_{NMB}$$

Utility MT Savings will be further reduced by RA Savings to avoid double counting of project savings.

$$MT\ Energy\ Savings_{MT\ only} = MT\ Energy\ Savings_{including\ RA} - RA\ Incentive\ Savings$$

Where:
MT Energy Savings MT only = The total attributable savings from the LLLC MTI to the Ameren Illinois Energy Efficiency Portfolio
RA Incentive Savings = Energy Efficiency Resource Acquisition savings from participants of AIC EE who received an incentive, plus savings from LLLCs installed as spillover, and less savings from free riders.

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  - **Forecasting Savings**
  - **Market Activities**
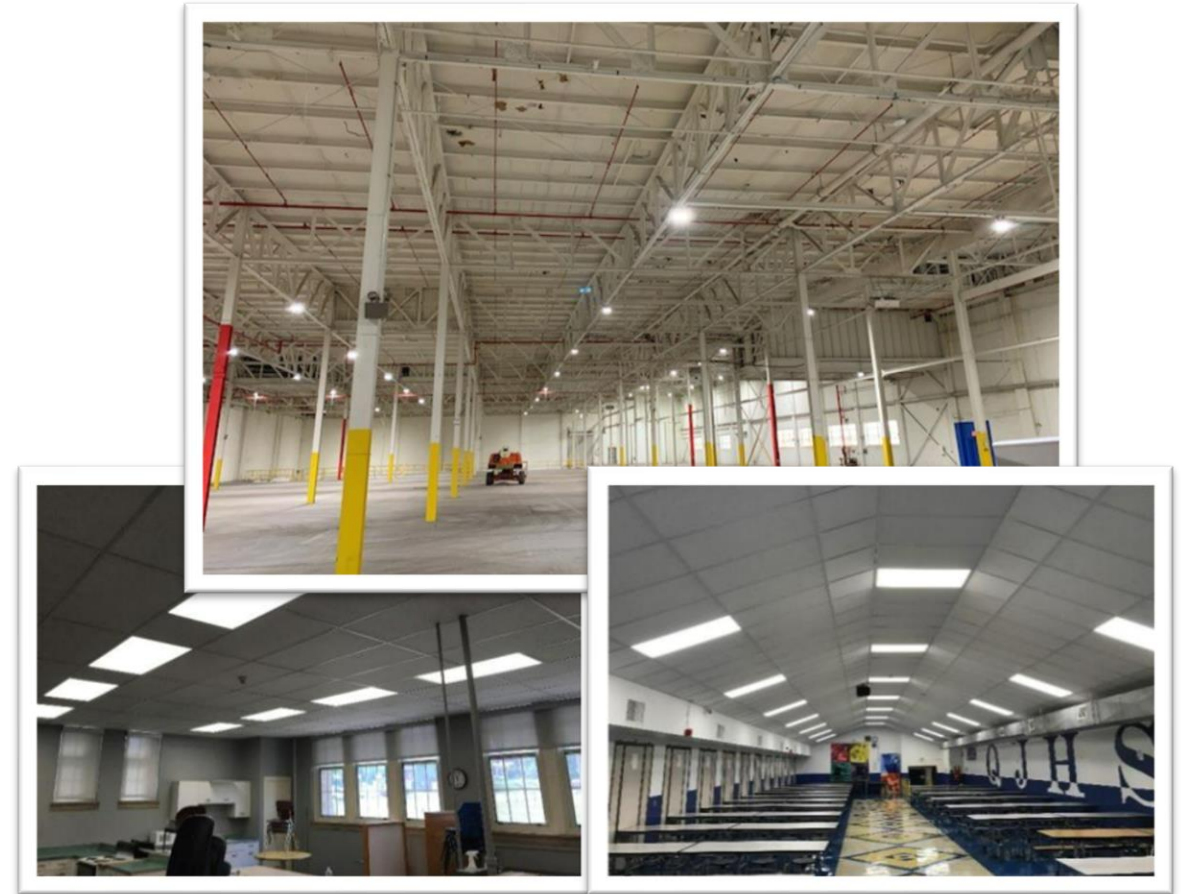
Ameren IL Market Engagement: Forecasting Savings

The number of LLLC attributable to MT was estimated by multiplying the total number of luminaires sold in each year by the estimated "uplift" attributable to Ameren Illinois' MT activities.

$$Number\ of\ MT\ LLLCs(t) = MT\ Uplift\ \%(t) * Total\ luminaire\ sales(t)$$

The "market uplift" attributable to MT activities was estimated using a combination of findings from AIC's 2023 LLLC baseline survey, lighting distributor and installer participation at AIC-sponsored LLLC training events in 2022 and 2023, diffusion, and other industry sources.[13] The MT market uplift calculations relied on these variables:

- % of trade allies who are familiar with LLLCs (A)

- Of trade allies who are familiar with LLLCs, percent of additional projects where they will recommend LLLCs to customers as the result of AIC-sponsored LLLC training and other outreach and educational activities (B)

- % of customers who would be willing to buy/install LLLCs. (C)

The calculated uplift attributable to MT is:

$$MT\ Uplift = A * B * C$$

[13] Opinion Dynamics. "2023 Luminaire Level Lighting Controls Pilot, Customer and Trade Ally Baseline Survey Findings." Prepared for Ameren Illinois Company. September 7, 2023.

Ameren IL Market Engagement: Forecasting Savings

- Based on a combination of secondary research findings, Ameren Illinois's baseline surveys and post-trade ally training findings, and factoring in anticipated MT barrier-removal activities, the team:

  - Assume just over 4% of trade allies are familiar with LLLCs

  - Escalated the initial trade ally familiarity percentage by 2.5% to 5.0% per year

  - Estimated 12% of trade allies will be very familiar with LLLCs by 2030

  - Estimated that trade allies recommend LLLCs to customers 21% more often than they did before training

  - Assumed that 40% of lighting trade allies will be recommending LLLCs by 2027[14]

  - Straight-lined the percentage of trained trade allies who will recommend LLLCs between 2022 and 2027

  - Used an Excel forecasting function to estimate the appropriate percentage of trained trade allies for 2028 and 2030 (resulting in just over 51% of trained trade allies in 2030)

  - Used Diffusion Theory's 2.5% of Innovators and 13.5% of Early Adopters 9total of 16%) would be willing to install LLLCs by 2030

  - Used a straight-line approach to estimate the percentage of customers willing to install LLLCs between 2022 and 2030

[14]Northwest Energy Efficiency Alliance. *Northwest Heat Pump Water Heater Initiative Market Progress Evaluation Report #5.* Prepared by NMR Group. November 4, 2019.
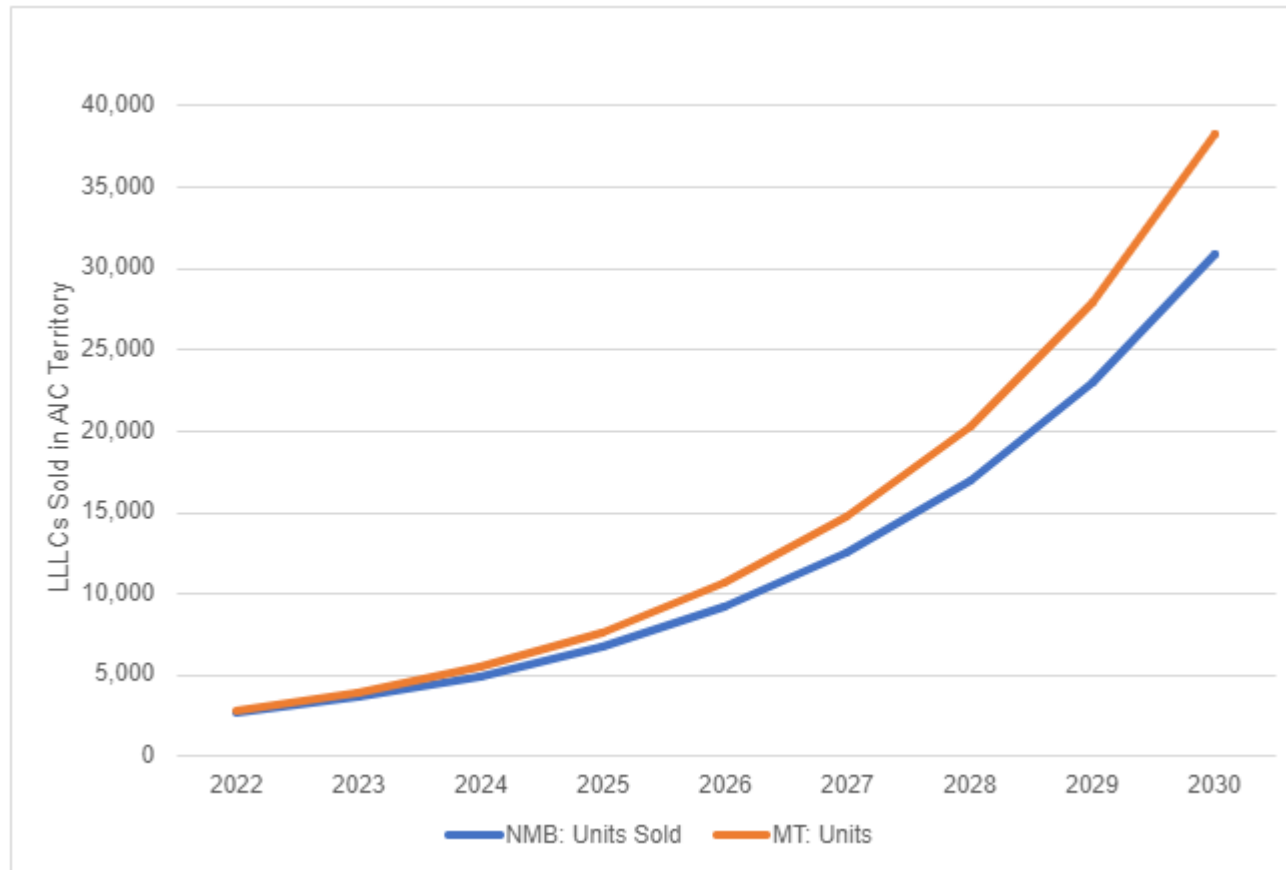
Ameren IL Market Engagement: Forecasting Savings

Year	% Market Uplift	# LLLCs	kWh Savings
2022	0.02%	159	33,041
2023	0.05%	332	68,991
2024	0.08%	583	121,151
2025	0.13%	943	195,961
2026	0.20%	1,461	303,604
2027	0.30%	2,215	460,289
2028	0.44%	3,317	689,291
2029	0.65%	4,948	1,028,221
2030	0.96%	7,379	1,533,396

Ameren IL Market Engagement: Forecasted Units

Ameren IL Market Engagement: Forecasted Savings
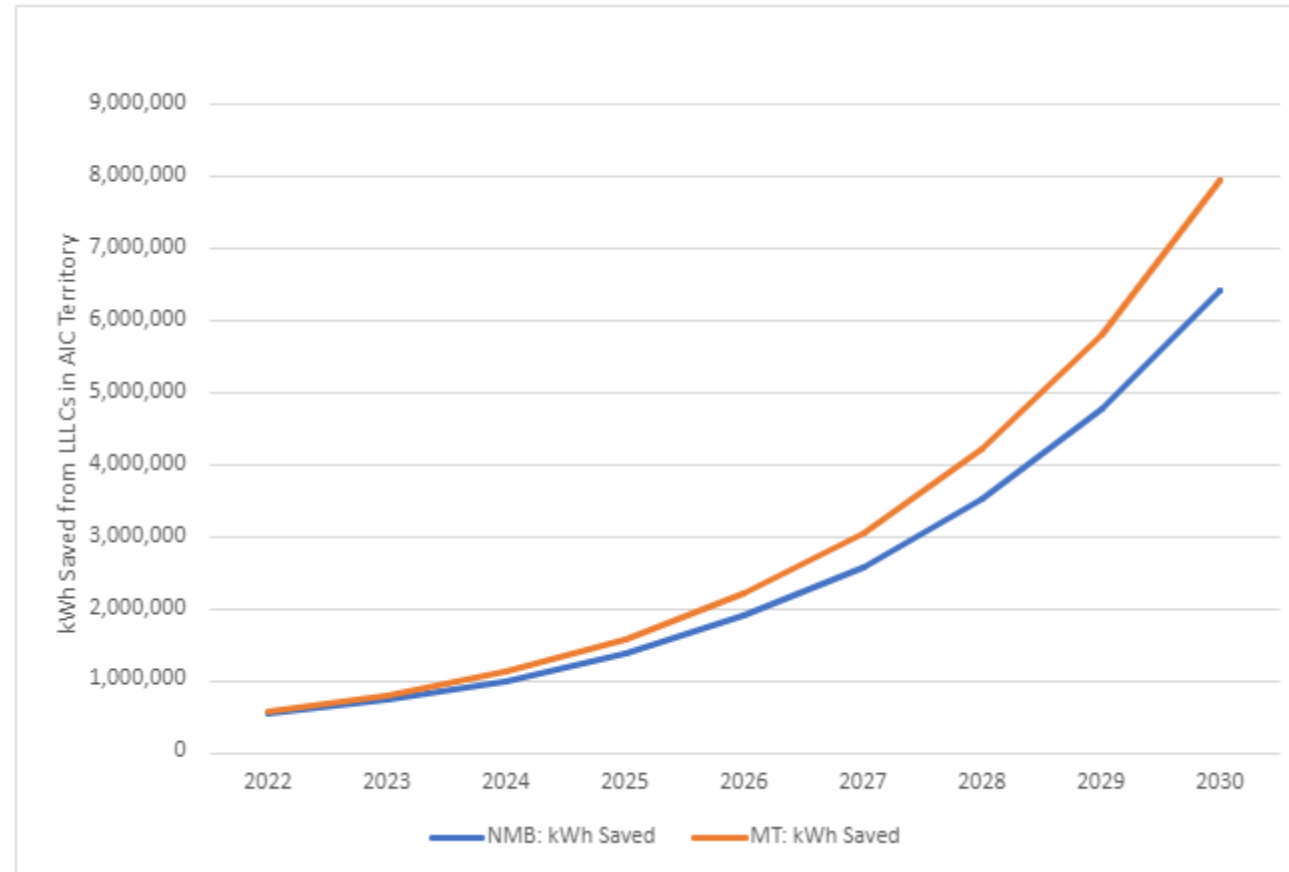
Ameren IL Market Engagement: Market Activities

Program Year	Incentives	Utility Activities	Supporting Materials	Market Progress Indicators		
2021	Standard and Installer Pilot*					
2022	Standard and Installer Pilot	• In-Person Training of Installers • Webinar for Customers, Installers, and Distributors				
2023	Standard and SBDI	• In-Person Training of Installers and Distributors • Webinars for Installers and Distributors	Facts of LLLCs, DLC QPL, and How to Bid LLLC Projects	Utility Personnel (Energy Advisor) and Distributor Expertise	General Contractor and Installer Expertise	Increased Awareness, Familiarity, Recommendations, and Installations made in the Target Market
2024		• In-Person Training of EE Personnel • Online and In-Person Training of Installers and Distributors • Webinars for Customers, Installers, and Distributors				
2025		• In-Person Training of EE Personnel • Online and In-Person Training of Installers and Distributors • Webinars for Customers, Installers, and Distributors	Facts of LLLCs, DLC QPL, How to Bid LLLC Projects, Where to Install LLLCs, and DLC LLLC Online Tool			
2026		• Online and In-Person Training of Installers and Distributors • Webinars for Customers, Installers, and Distributors				
2027		• Online and In-Person Training and Webinars for Customers, Installers, and Distributors				
2028		• Online and In-Person Support for Customers, Installers, and Distributors				
2029		• Online and In-Person Support for Customers, Installers, and Distributors				
2030		• Program Personnel Support Available				

Preliminary information for SAG discussion purposes only; subject to Section 3.1 of EE Policy Manual

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LLLC MTI Business Plan Summary
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- Ameren IL Market Engagement
- **Next Steps**

Next Steps

Pending any further questions, we will end the summary presentation Ameren Illinois Luminaire Level Lighting Controls Market Transformation Initiative

The Business Plan for the Ameren Illinois Luminaire Level Lighting Controls Market Transformation Initiative will be made available for review for a two-week period following distribution of the Business Plan.

Questions and comments submitted for the Business Plan will be addressed to finalize the AIC LLLC MTI

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Appendix

The slides in the Appendix at the end of this slide deck contain information referenced throughout the AIC LLLC MTI Summary presentation.
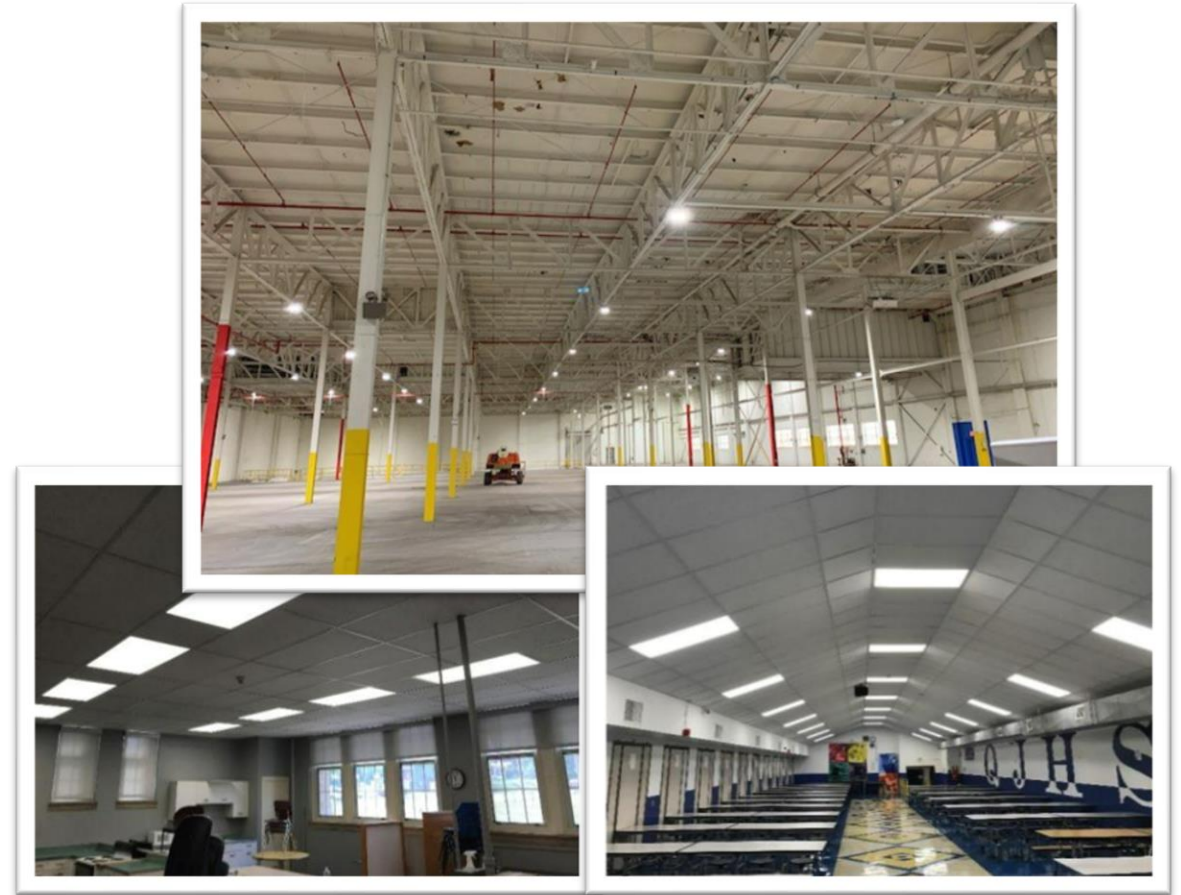
For access to more full detail and calculations, interested parties should reference the AIC LLLC MTI Business Plan that will be available on the SAG website.

Appendix

LLLC MTI Business Plan Summary
- Market Transformation Initiative
- Target Market
- Program Theory of Change
  - Barriers to Adoption
  - Logic Model
  - Market Outcomes
  - **Market Performance Indicators**
- Energy Savings Framework
- Evaluation Plan
- Ameren IL Market Engagement

Program Theory of Change: Market Progress Indicators

MPI #	Outcome	Market Progress Indicator	Data Source	Goals
I & II	Increased awareness and familiarity with LLLC among Target Market	Awareness is determined by the percentage of Target Market who have never heard of LLLC. Familiarity refers to the knowledge that the Target Market has about the features of LLLC.	Surveys among Target Market	Awareness by 2027: 50% Customer awareness 95% Installer by 2027 Familiarity by 2027: 3.5/5 across Target Market
III	Increased recommendation of LLLC among Target Market	Target Market recommends LLLC when recommending lighting equipment including; Manufacturer recommendations to Distributors, Distributor recommendations to Contractors/Installers, and Contractor/Installer recommendations to End-Use Customers.	Surveys among Target Market	65% of Surveyed applicable Target Market recommends LLLCs by 2027

Program Theory of Change: Market Progress Indicators

MPI #	Outcome	Market Progress Indicator	Data Source	Goals
IV	Increased installation of LLLC among End-Use Customers	End-users ask for LLLC for lighting retrofits End-users agree with recommendations from Target Market	Surveys among Target Market Dodge Data	65% of Customers install LLLCs when recommended by Contractors/Installers
V	Increase in trained Program Allies	Trained Program Allies can explain, describe and sell LLLC	Utility data of Program Allies who participate in AIC LLLC training Post-training evaluation surveys	25% of Program Allies and can explain, describe and sell LLLCs by 2027

Program Theory of Change: Market Progress Indicators

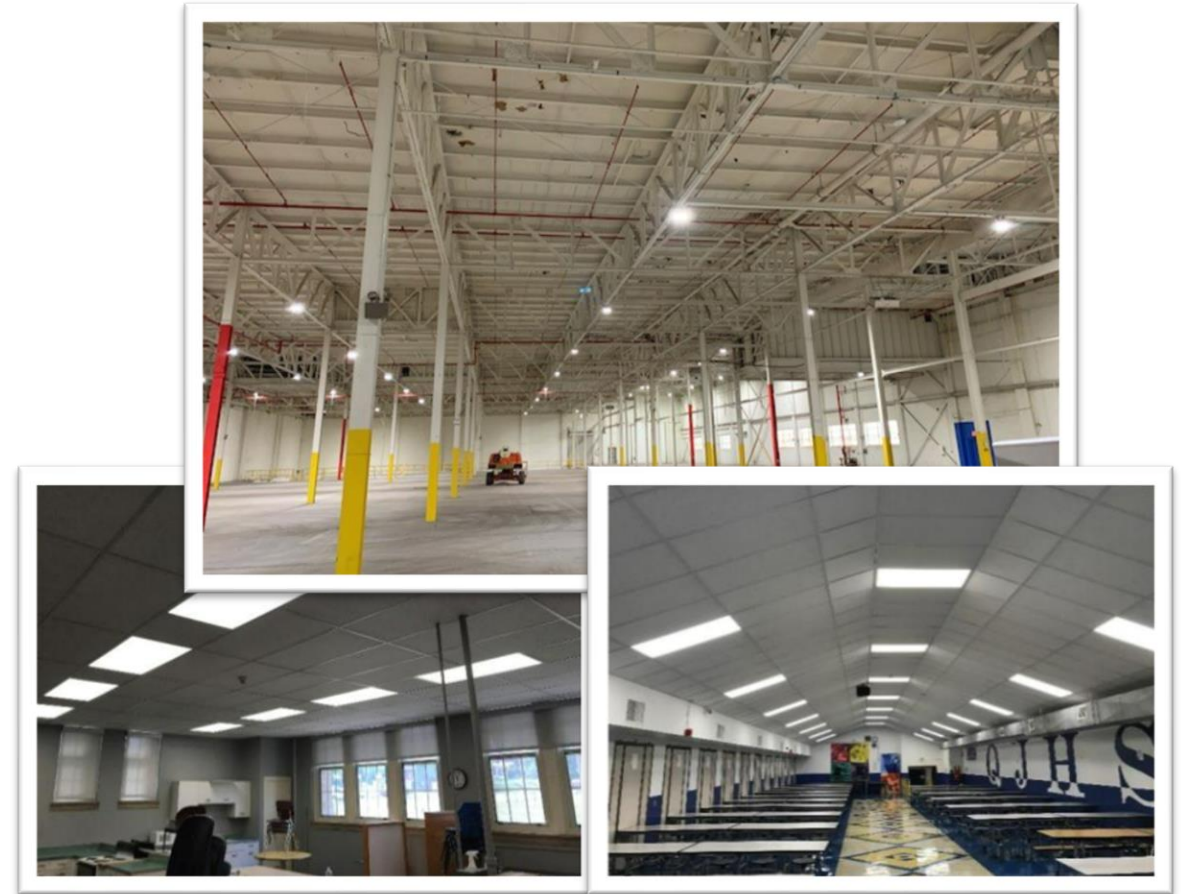| MPI #	Outcome	Market Progress Indicator	Data Source	Goals
VI	Increased stocking of LLLC equipment among Distributors	Distributors stock more LLLC equipment	Surveys among Distributors Sales data from Distributors	At a minimum, three key distributors stock LLLCs as a business practice by 2027
VII	Increased LLLC Listings in the DesignLights Consortium (DLC) Qualified Products List (QPL)	Manufacturers list their LLLC equipment on the DLC QPL	Number of Manufacturers listed in the DLC LLLC QPL	Five additional manufacturers list their product on the DLC QPL by 2027
Impact	Lasting Change in the Accelerated Adoption of LLLC	Consistent recommendation and installation of LLLCs among Target Market	Surveys among Target Market Dodge Data	Market share of LLLC reached a level where a significant portion of the Early Majority have adopted LLLC

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Energy Savings Framework: Unit Energy Savings (UES)

kW Controlled

Through building level analysis, it was determined that across all building types, an average of 75% of fixtures were <10,000 lm and 25% of fixtures were ≥10,000 lm.

This was then weighted twice:

1. By prevalence of each building type, where it was found 62% were <10,000 lm and 38% of fixtures were ≥10,000 lm across Ameren territory.

2. By kW controlled. The 62% and 38% were applied to determine the weighted kW controlled.

Control Type	kW Controlled	Fixture Prevalence[15]	Weighted kW Controlled
< 10,000 lm	0.031	62%	0.1922
≥ 10,000 lm	0.118	38%	0.04484
			0.06406

Hours

The TRM[16] prescribes lighting hours of operating by building type. Four building types (Education, Office, Retail, Warehouse) have operating hours found in section 4.5.10 (Lighting Controls). Two building types (Health, Unknown) have operating hours found in the large table in section 4.5 (Lighting End Use).

Weighted hours were then calculated based on building type prevalence:

Building Type	Hours	Building Prevalence	Weighted Hours
Education	4231	12%	508
Office	4453	15%	668
Retail	6936	15%	1040
Warehouse	5116	31%	1586
Health	7036	7%	493
Unknown	3379	20%	676
			4970

[15] AIC Illinois Market Potential Study Preliminary Potential Estimates. https://www.ilsag.info/wp-content/uploads/AIC-MPS_Prelim.-Electricity-Potential-for-SAG_09-02-2020.pdf
[16] 2024 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 12.0. Volume 2: Commercial and Industrial Measures. IL-TRM_Effective_010124_v12.0_Vol_2_C_and_I_09222023_FINAL_clean.pdf (ilsag.info)

Energy Savings Framework: Unit Energy Savings (UES)

Energy Savings Factor

The TRM[17] prescribes the Energy Savings Factor (ESF) of "Interior Networked Luminaire-Level Lighting Controls as 61%. It also notes that the ESF of the baseline should be 0 if there are no lighting controls or "prior existence of lighting controls [are] unknown."

Therefore, the Energy Savings Factor is determined as 00.61-0 = **0.61**.

Waste Heat Factor

The TRM[15] prescribes Waste Heat Factor (WHF) by building type in the large table in section 4.5 (Lighting End Use). As with the other parts of the equation, these values were weighted by the prevalence of each building type in AIC territory.

Building Type	WHF	Building Prevalence	Weighted WHF
Education	1.10	12%	0.13
Office	1.12	15%	0.17
Retail	1.08	15%	0.16
Warehouse	1.02	31%	0.32
Health	1.15	7%	0.08
Unknown	1.08	20%	0.22
			1.07

[17]2024 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 12.0. Volume 2: Commercial and Industrial Measures. IL-TRM_Effective_010124_v12.0_Vol_2_C_and_I_09222023_FINAL_clean.pdf (ilsag.info)

Using the weighted values, the TRM-prescribed calculation for LLLC energy savings was produced:

$$kWh = 0.06406 * 4970 * 0.61 * 1.07$$

Therefore, the average annual energy savings from a single LLLC installed in AIC service territory is **207.8 kWh**.

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Energy Savings Framework: Natural Market Baseline
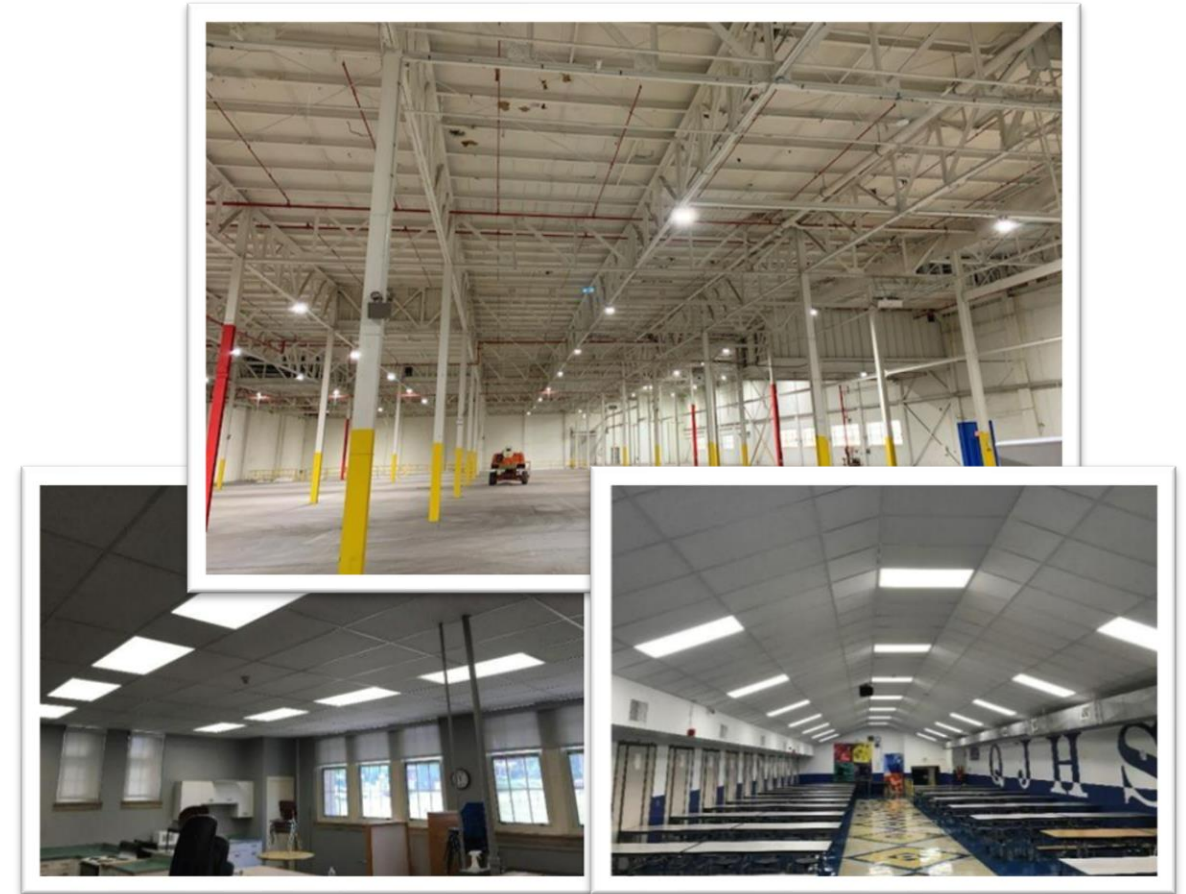
Theoretical Natural Market Baseline

1. Adoption Curve Shape
2. Year Product Enters Market
3. Forecast Start Year
4. Initial Market Share
5. Start of Hypergrowth*
6. Ramp Period*
7. Takeover Point
8. Takeover Period
9. Maximum Market Share*
10. Factor—*shape* between 5 and 7*

* Key input variable in NMB equation
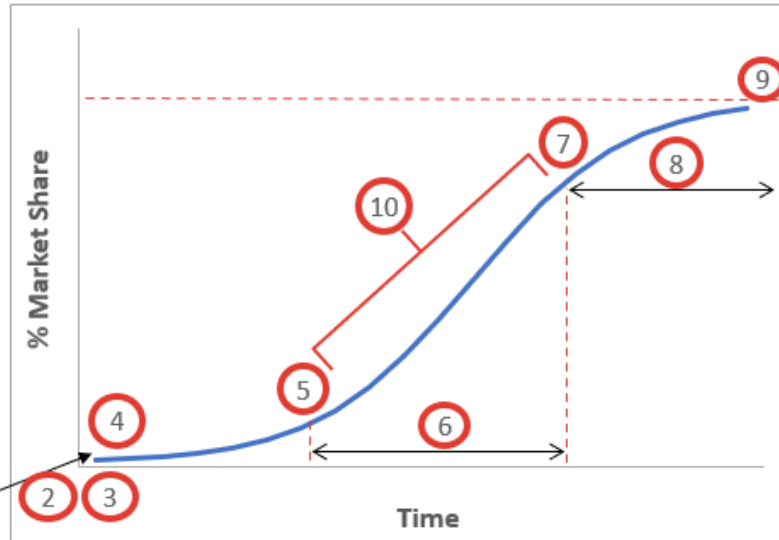
For the LLLC NMB curve, the y-axis shows the percentage of total commercial luminaires sold that include LLLCs in time *t*, as defined by the following equation:

$$\frac{\%\ all\ luminaires\ sold\ with\ LLLCs(t)}{\%\ all\ luminaires\ sold\ (t)}$$

$$Market\ Penetration(t) = \frac{Maximum\ Market\ Share}{1 + Factor \wedge \left(\frac{Start\ of\ Hypergrowth + \left(\frac{RampPeriod}{2}\right) - Current\ Year(t)}{Ramp\ Period}\right)}$$

Energy Savings Framework: Natural Market Baseline

Year Product Enters Market:

Value: 2016

- Based on NEEA's report LLLCs were introduced to Oregon and Washington in 2012-2013; Idaho and Montana in 2015-2016 (due to lag in building codes)[18]. Illinois timing of IECC building codes align with Idaho and Montana

- Puget Sound Energy initially piloted LLLCs in 2015[19]

- Design Lights Consortium (DLC) issued its first specifications for Networked Lighting Controls (NLC) in May 2016

Forecast Start Year:

Value: 2021

- 2021 is the year AIC began its LLLC MTI engagement with the Target Market

[18]Research Into Action and Energy 350. Luminaire Level Lighting Controls (LLLC) Market Characterization and Baseline Report. Prepared for Northwest Energy Efficiency Alliance. December 14, 2016.
[19]Puget Sound Energy. "The Future of Lighting is Here: PSE Achieves 72 Percent Energy Savings with Luminaire Level Lighting Controls."

Energy Savings Framework: Natural Market Baseline

Initial Market Share:

Value: 0.25%

Using the formula below, analysis of 2019 Dodge Construction Data sample (with a 90/10 confidence interval) for projects within Ameren Illinois' service territory yielded an estimated Initial Market Share of 0.25%

$$\frac{Project\ area\ covered\ by\ LLLCs\ (sqft)}{Total\ Area\ of\ all\ projects\ (sqft)}$$

- Estimated Initial Market Share of 0.25% is corroborated by the Bonneville Power Administration's (BPA) distributor sales data for 2019, which showed that LLLCs were 0.44% of non-residential lighting sales.[20]

- Since LLLCs had been supported by the NEEA MTI for several years prior to 2019, whereas LLLCs had not garnered utility support in Illinois prior to 2019, the 2019 market share of LLLCs in AIC's service area is more likely to be 0.25%.

[20]Bonneville Power Administration. *Northwest Distributor Nonresidential Lighting Sales Data Collection, Aggregated Sales Data Spreadsheet.* July 29, 2022.
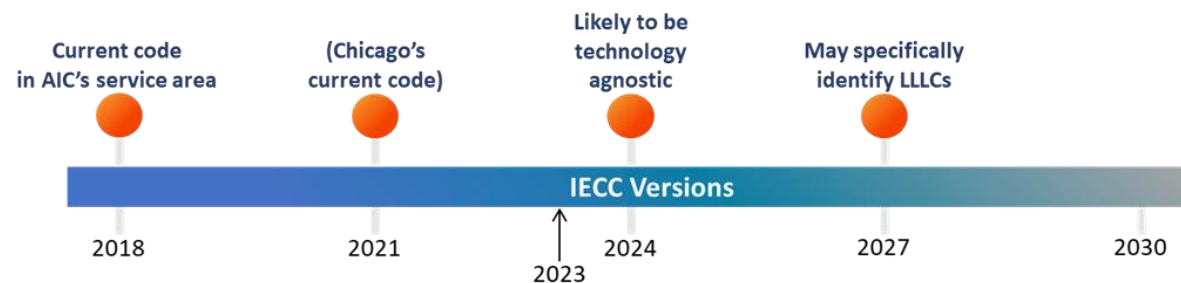
Energy Savings Framework: Natural Market Baseline

Start of Hypergrowth

Value: 2030

- Research shows that LLLC adoption is most likely in areas where: 1) energy code explicitly identifies LLLCs as a compliance path, and 2) utility incentives are available.[21]

- IECC is updated every three years, though most Illinois communities have historically not adopted the latest IECC until several years after a new code has taken effect.

- IECC 2027 may go into effect in 2029 or 2030 and may explicitly mention LLLCs; therefore, LLLC 2027 could have a large effect on LLLC adoption starting around 2030.

Figure 5. IECC Code Version Timeline

[21]The Cadmus Group and TRC Companies, Inc. *Luminaire Level Lighting Controls -- Market Progress Evaluation Report #1.* Report #E21-431. Prepared for Northwest Energy Efficiency Alliance. November 29, 2021.

Ramp Period:

Value: 14 years

- Earlier research into LLLC adoption estimated an LLLC Ramp Period of 14 years. This analysis was based on an adoption curve for DALI lighting systems with photocells and occupancy sensors, which is a similar technology[22]

Takeover Point:

Value: 2044

- The Takeover Point is defined as:

$$Takeover\ Point = Start\ of\ Hypergrowth + Ramp\ Period$$

- Using the values for Start of Hypergrowth (#5) and Ramp Period (#6) from above, the Takeover Point is calculated to be:

$$Takeover\ Period = 2050 - 2044 = 6\ years$$

[22]Research Into Action and Energy 350. Luminaire Level Lighting Controls (LLLC) Market Characterization and Baseline Report. Prepared for Northwest Energy Efficiency Alliance. December 14, 2016.

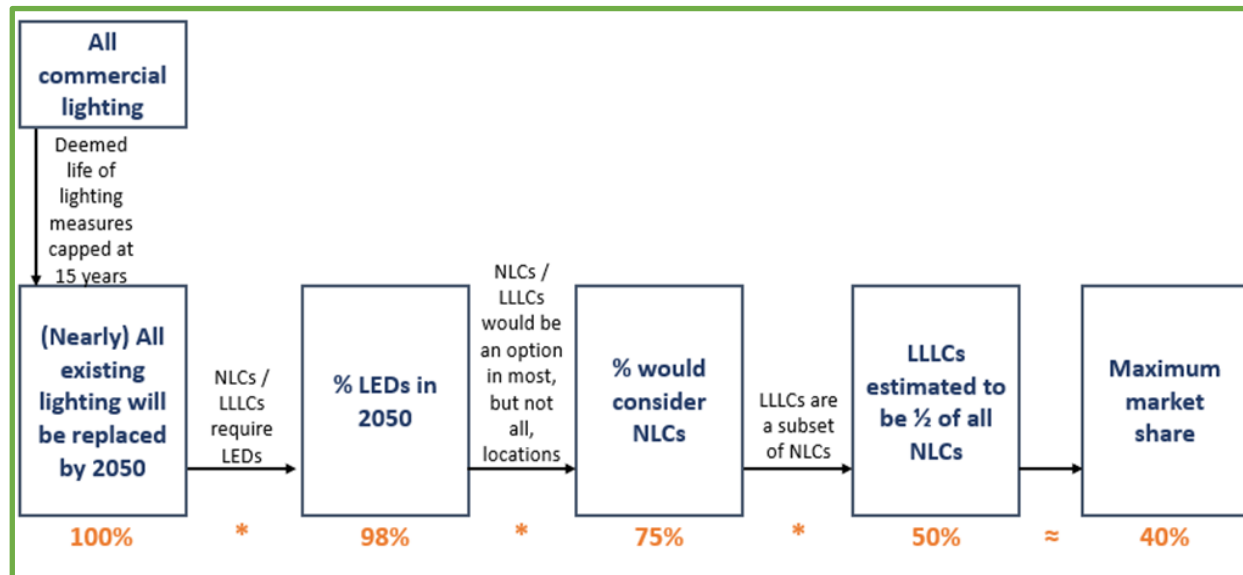# Energy Savings Framework: Natural Market Baseline

Takeover Period:

Value: 6 years

- Using a forecast end date of 2050, the RI team observes a Takeover Period of 6 years using the following equation:

$$Takeover\ Period = 2050 - 2044 = 6\ years$$

Figure 6. Derivation of Maximum Market Share


Maximum Market Share:

Selected Value: 40%

Figure 6 depicts RI team's approach to estimating the maximum market share of LLLCs.

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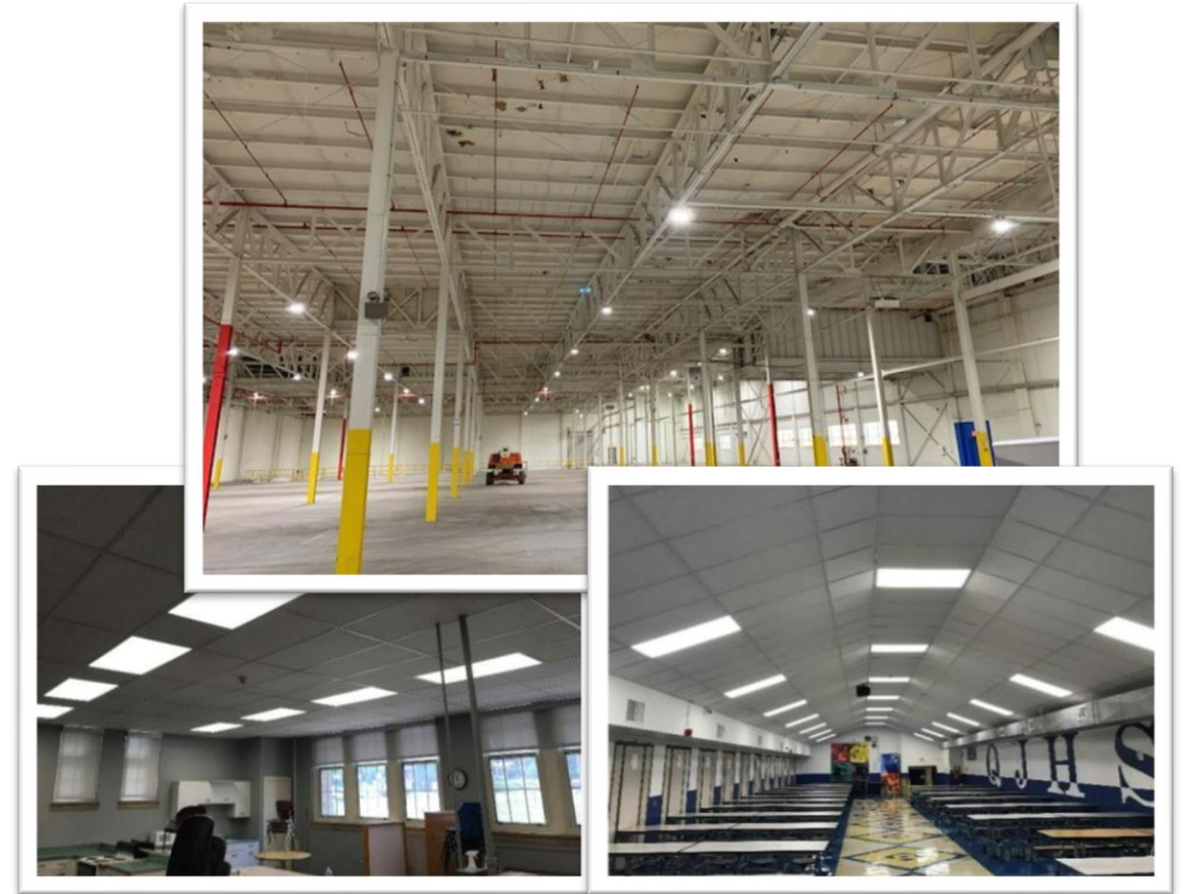
Energy Savings Framework: Applying NMB Market Share

Total commercial square footage in AIC territory for each year of the forecast

AIC's non-residential market is characterized in the 2020 AIC Potential Study[23]. The study found that AIC's total commercial floor space in 2020 was **1,124,900,000** sqft. This value was used as a starting point, with estimated growth throughout the forecast period.

The Commercial Buildings Energy Consumption Survey (CBECS)[24] from the US Energy Information Administration (EIA) shows national trends in commercial space over the last 40 years. Using this data, a linear forecast from 1979 to 2050 (the end of the NMB range) was created where an average annual growth rate of 0.86% was found.

This annual growth rate was applied to AIC's known square footage to create a square footage forecast through 2030:

Year	Total Sqft
2022	1,144,331,478
2023	1,154,172,728
2024	1,164,098,614
2025	1,174,109,862
2026	1,184,207,207
2027	1,194,391,389
2028	1,204,663,155
2029	1,215,023,258
2030	1,225,472,458

[23] AIC Illinois Market Potential Study Preliminary Potential Estimates. https://www.ilsag.info/wp-content/uploads/AIC-MPS_Prelim.-Electricity-Potential-for-SAG_09-02-2020.pdf
[24] 2018 Commercial Buildings Energy Consumption Survey. Building Characteristics Highlights.
https://www.eia.gov/consumption/commercial/data/2018/pdf/CBECS_2018_Building_Characteristics_Flipbook.pdf

Energy Savings Framework: Applying NMB Market Share

Commercial and new construction and renovation/replacement rates

The number of LLLC luminaires per year is contingent on the annual square footage of commercial new construction and the annual square footage of commercial space undergoing renovation/replacement.

New construction square footage in each year was estimated as the difference in commercial square footage from the prior year.

Renovation/replacement square footage in each year was estimated as total commercial square footage divided by 13, where 13 is the average deemed useful life of commercial luminaires.[25]

Year	New Construction (Sqft)	Renovation/Replacement (Sqft)
2022	9,757,338	85,048,840
2023	9,841,251	85,786,605
2024	9,925,885	86,530,769
2025	10,011,248	87,274,934
2026	10,097,345	88,025,498
2027	10,184,182	88,782,518
2028	10,271,766	89,546,047
2029	10,360,103	90,316,143
2030	10,449,200	91,092,862

[25] 2024 Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 12.0, Volume 2: Commercial and Industrial Measures, Final. September 22, 2023. Effective January 1, 2024. Nonresidential luminaires have deemed lives depend on operating hours and generally range from 12 to 15 years.
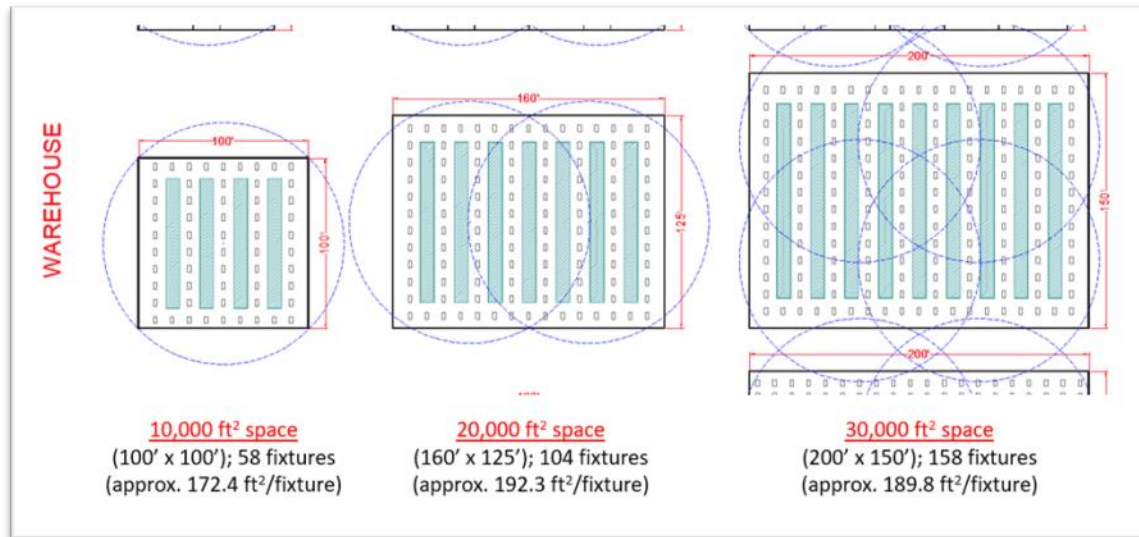
Energy Savings Framework: Applying NMB Market Share

Average sqft per luminaire

Steve Mesh (Principal, Lighting Education and Design) created sample lighting designs for multiple building types, and developed small (10,000 sqft), medium (20,000 sqft), and large (30,000 sqft) designs for each building type. When sqft/fixture differed between sizes, the values were averaged across the building type.

Two building types—Retail and Unknown—did not have sample lighting designs, estimated values were used based on subject matter expertise.

All values were then weighted by building type prevalence in AIC service territory.

10,000 ft² space
(100' x 100'); 58 fixtures
(approx. 172.4 ft²/fixture)

20,000 ft² space
(160' x 125'); 104 fixtures
(approx. 192.3 ft²/fixture)

30,000 ft² space
(200' x 150'); 158 fixtures
(approx. 189.8 ft²/fixture)

Example Warehouse Lighting Design Developed by Steve Mesh

Building Type	Sqft/fixture	Building Prevalence	Weighted Sqft/fixture
Education	113	12%	13.6
Office	83	15%	12.5
Retail	120	15%	18.0
Warehouse	185	31%	57.4
Health	73	7%	5.1
Unknown	150	20%	30.0
			136

Energy Savings Framework: Applying NMB Market Share

Total number of fixtures sold in each year

With the total square footage for both new construction and renovation/replacement determined, as well as the average sqft/luminaire, the total number of luminaires sold in AIC's service area in each forecast year can be calculated:

$$Total\ luminare\ sales(t) = New\ construction\ luminaire\ sales\ (t) + Renovation\ and\ Replacement\ luminaire\ sales\ (t)$$

| Year	# of Luminaires Sold
2022	718,991
2023	725,175
2024	731,411
2025	737,701
2026	744,046
2027	750,444
2028	756,898
2029	763,408
2030	769,973

Energy Savings Framework: Applying NMB Market Share

To corroborate the methodology, additional data was reviewed from the Bonneville Power Administration in the Pacific Northwest. BPA collected non-residential sales data from lighting distributors in the region from 2013-2021[26].

Because this data shows actual sales trends that include exogenous economic realities such as supply chain shortages caused by the COVID-19 global pandemic – and a theoretical luminaire sales forecast should not include such highly unusual influences on expected sales – a smoothed forecast was created for 2013-2030.

As AIC's service territory is considerably smaller than the entire PNW (that BPA's data covered), it needed to be scaled down. It was scaled down to 8% of the BPA figures as AIC's electricity sales (in MWh) is approximately 8% of the area in the study.

When compared to the primary methodology, estimates differed by only 1%-11% (increasing as time went on, likely due to general forecasting uncertainties). This "gut check" confirmed initial findings.
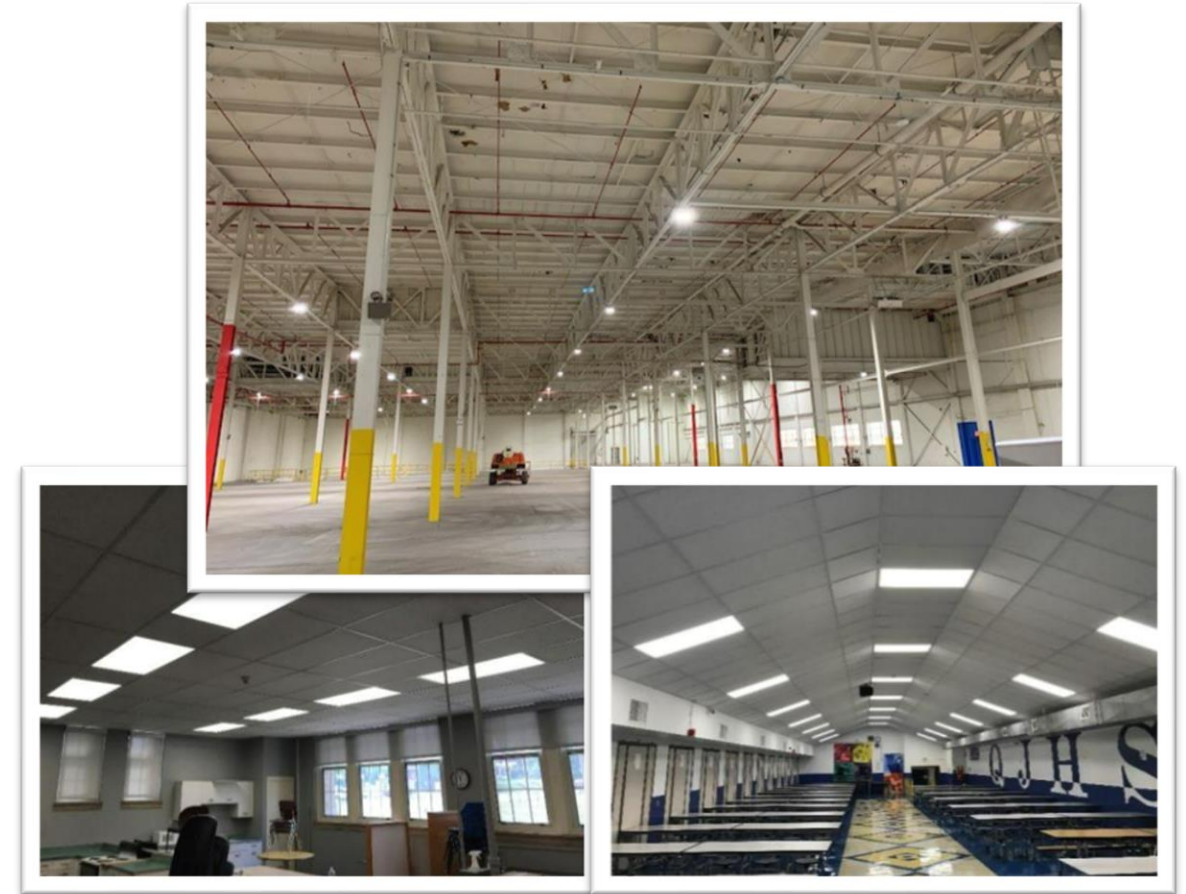

Smoothed Forecast + Reduction
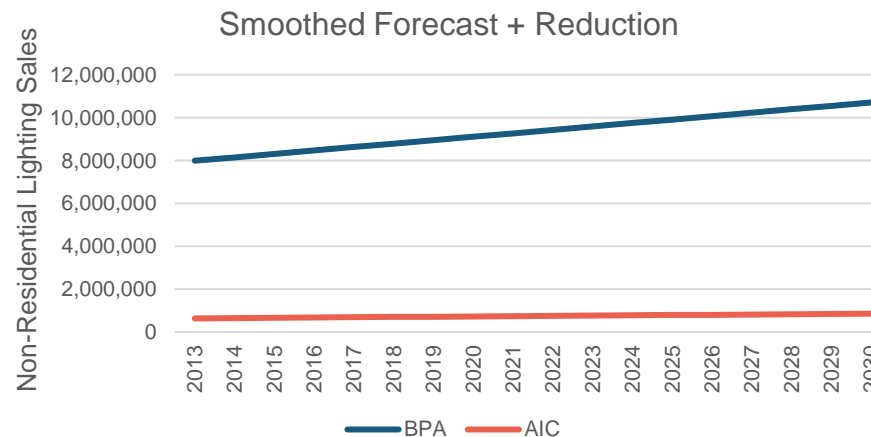
[26]BPA. Lighting Market Research. https://www.bpa.gov/energy-and-services/efficiency/market-research-and-momentum-savings/lighting-market-research

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  - Evaluation Activity Timeline
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Where:

$KW_{controlled}$ = Total lighting load connected to the control in kilowatts.

$Hours$ = Total operating hours of the controlled lighting circuit before the lighting controls are installed.

ESF_{EE} = Energy Savings Factor (represents the percentage reduction to the operating Hours from the non-controlled lighting system) from the new lighting controls installed.

ESF_{Base} = Energy Savings Factor of the lighting controls that existed before the new lighting controls were installed.

WHF_e = Waste heat factor for energy to account for cooling energy savings from efficient lighting.

WHF_d = Waste heat factor for demand to account for cooling energy savings from efficient lighting in cooled buildings.

$CF_{baseline}$ = Baseline Summer Peak Coincidence Factor for the lighting system without lighting controls installed.

CF_{LC} = Retrofit Summer Peak Coincidence Factor the lighting system with lighting controls installed is 0.15 regardless of building type.

The evaluation team will conduct secondary research to develop estimations of total connected load per control, total operating hours of the controlled lighting, and the ESF of the lighting controls that existed before the new lighting controls were installed.

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