High-Performance Windows (HPW)

Logic Model (LM) + Market Progress Indicators (MPI) Updates

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Agenda

1. Market Transformation Initiative Overview
2. Logic Model
3. Market Progress Indicators
4. Conclusion/Next Steps

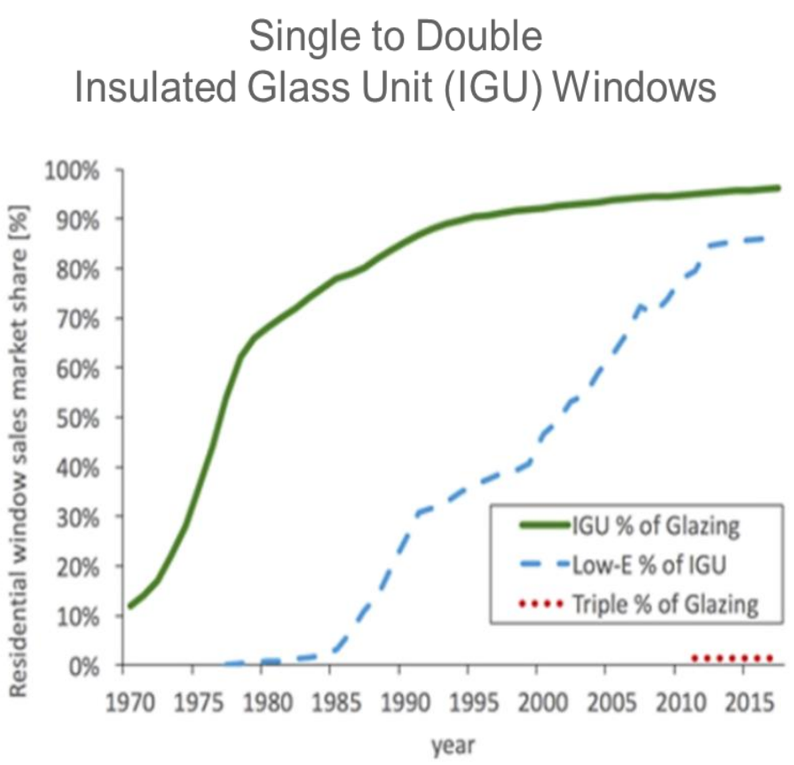
High-Performance Window (HPW) Design

- HPWs meet the ENERGY STAR® v7 performance specifications
- Examples can include double pane, triple pane, thin triple and quad pane windows
- New designs are drop-in replacement with lower energy costs, double the performance and minimal weight
- Energy efficiency requirements—Products shall have NFRC-certified U-factor and, where applicable, solar heat gain coefficient (SHGC) ratings at levels which meet or exceed the minimum criteria specified below:

Climate Zone	U-Factor	SHGC
Northern	≤ 0.22	≥ 0.17
North-Central	≤ 0.25	≤ 0.40
South-Central	≤ 0.28	≤ 0.23
Southern	≤ 0.32	≤ 0.23

Why Focus on High-Performance Windows Now?

- In most homes, windows are the weakest part of the building envelope resulting in increased energy costs, greenhouse gas (GHG) emissions and poor overall building performance
  - Windows account for 10% of the building envelope, yet account for 30 – 40% of heat loss in winter and add to cooling peaks and discomfort in summer
- Code compliant or ENERGY STAR® certified windows commonly used in the Midwest are ~R-3 (U-factor – 0.33) double-glazed—that has not changed significantly for the past two decades
- Market barriers with conventional high-performance windows are available but have a low rate of adoption due to the increased size, weight, and expense of the product and installation
- Currently low market penetration; ~2% market is HPW



Manufacturers

Products are currently available from following manufacturers:

ALPEN
CLEAR PERFORMANCE

Ply Gem®

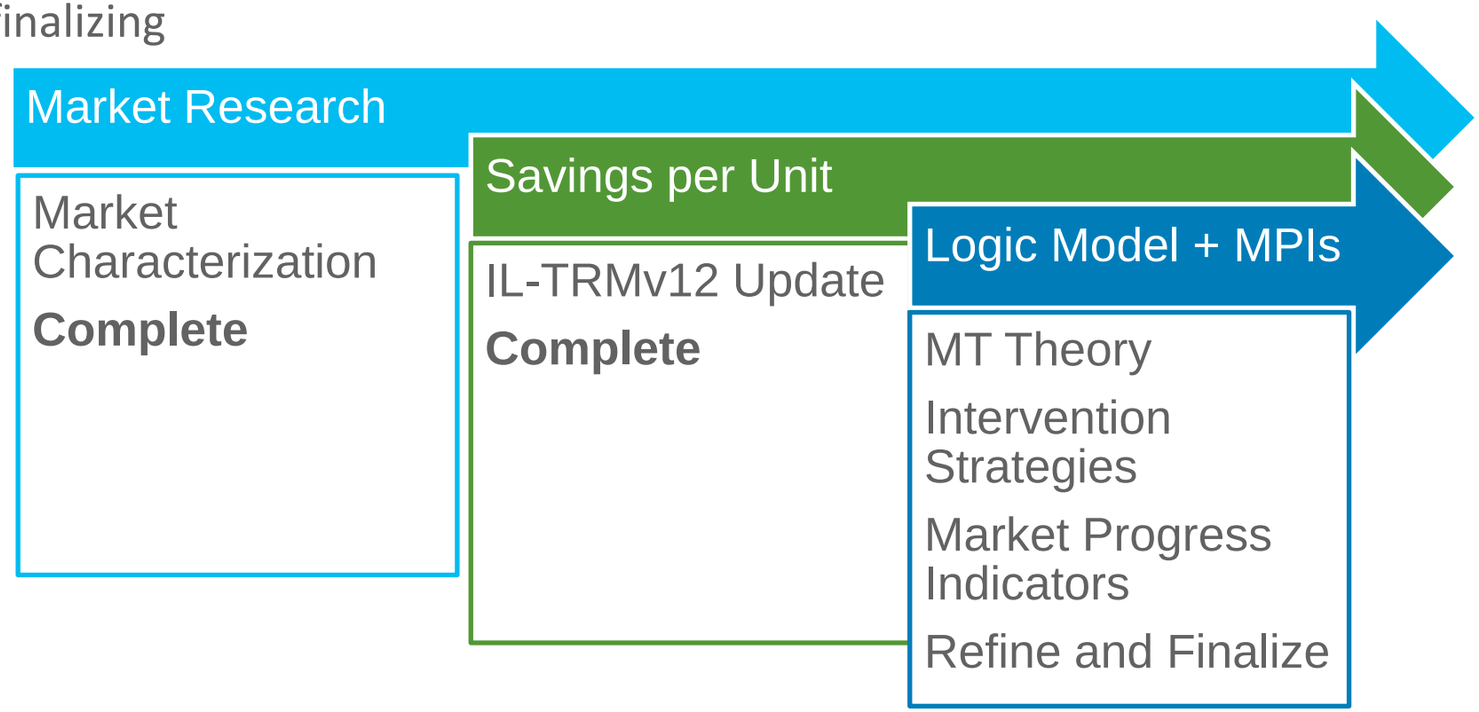
RENEWAL by ANDERSEN
FULL-SERVICE WINDOW & DOOR REPLACEMENT

JW
JELD-WEN
WINDOWS & DOORS

MT Savings Protocols Process

Per the Market Transformation Savings Protocol Process Recommendation, creating the logic model includes:

1. Conducting market research
2. Drafting the MT theory
3. Drafting the intervention strategies
4. Developing market progress indicators
5. Refining and finalizing



5.6.8 High-Performance Workpaper Update in the IL TRM v12

Primary Updates:

1. Changing terminology from "*Thin Triple Windows*" to broader "*High-Performance Windows*"
2. Update performance values/savings in line with ENERGY STAR® v7
3. Update savings (kWh/therm per ft^2)
4. Update incremental costs

Partners:

- Energy Modeling from Lawrence Berkeley National Laboratory (LBNL)

Illinois Baseline Conditions (U-Value):

- New Construction/Time of Sale: 0.30*
- Early Replacement – Double Pane: 0.55
- Early Replacement – Single Pane: 1.0

Gas and Electric Savings per square foot of window

- Approximately 40% more energy efficient compared to typical double pane window
- More savings for single pane windows and early replacement

Table 12: Gas heating savings per window area by climate zone and baseline window condition (therm/ft^2) [1625]

IL Degree-Day Zone	NC or TOS	EREP: Double Pane	EREP: Single Pane
1 – Rockford	0.12	0.22	1.27
2 – Chicago	0.12	0.21	1.12
3 – Springfield	0.16	0.17	0.91
4 – Belleville	0.17	0.16	0.93
5 – Marion	0.14	0.16	0.76

Table 9: Air Conditioner with Gas Furnace – cooling only electric savings per window area (kWh/ft^2) [1622]

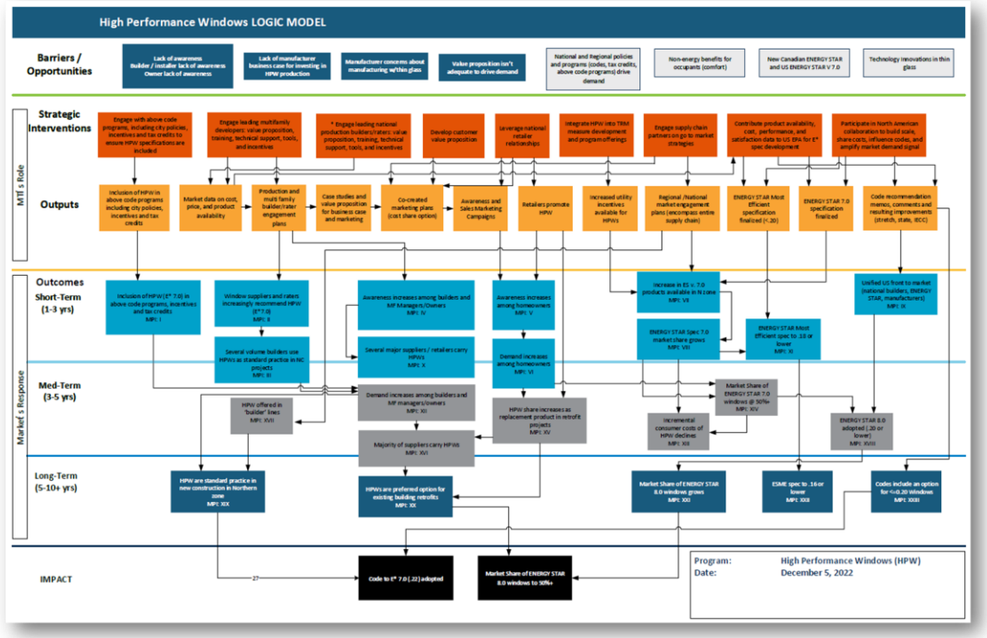
IL Degree-Day Zone	NC or TOS	EREP: Double Pane	EREP: Single Pane
1 – Rockford	0.35	0.60	1.24
2 – Chicago	0.36	0.53	1.13
3 – Springfield	0.39	0.61	1.37
4 – Belleville	0.40	0.60	1.38
5 – Marion	0.46	0.48	1.27

** 0.30 in ENERGY STAR Northern Climate Zone; 0.32 in North-Central*

High-Performance Window – Logic Model

Logic model started in 2021 was developed through a collaborative process with NEEA, Guidehouse and other Illinois utilities

- Continued refinements after
  - IL Market Characterization Report (with ComEd and Ameren Illinois) – Q1 2022
  - NEEA's NW Regional Market Characterization – Q2 2022
- Market Progress Indicators developed with NEEA in 2022-2023 and additional comments and edits based on Guidehouse feedback
- Target markets: Residential New Construction and Retrofit



** 0.22 in ENERGY STAR Northern Climate Zone; 0.25 in North-Central*

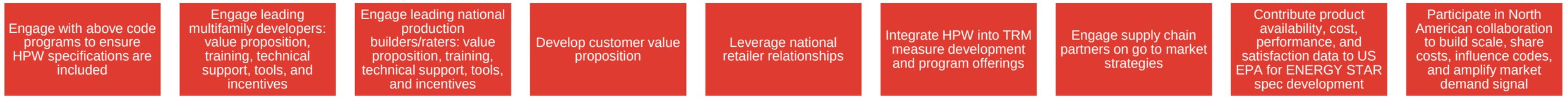
Logic Model: Barriers

Builder/installer lack of awareness Owner lack of awareness	Lack of manufacturer business case for investing in HPW production	Manufacturer concerns about manufacturing with thin glass	Value proposition isn't adequate to drive demand

As is common with Market Transformation Initiatives (MTI), the main barrier is not just an incremental cost that can be easily bought down. Additional factors are:

1. **Lack of awareness**
   - Affects both upstream and downstream participants
2. **Manufacturer investment**
   - No "spark" to prompt investment in HPW product lines
3. **Manufacturer concerns**
   - Hesitancy to produce some types of HPW (particularly thin triple windows)
4. **Inadequate value proposition**
   - Worsens in high retrofit markets

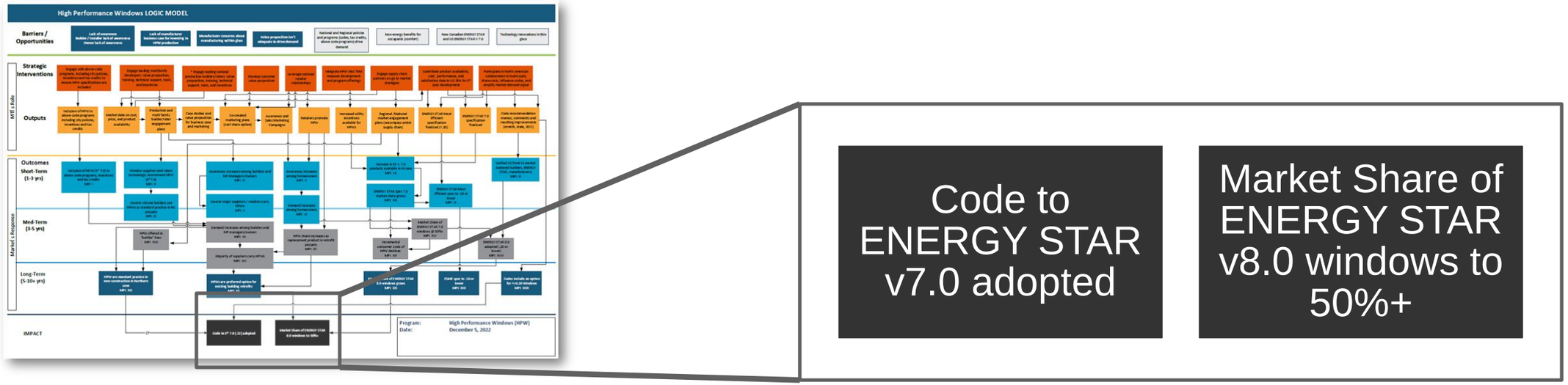
Logic Model: Strategic Interventions



Strategic interventions require action in different parts of the market to be effective. These actions may include:

1. **Supporting and engaging the homebuilder supply chain to increase product and awareness**
   - Including developers, builders, raters, suppliers, retailers, etc.
2. **Engaging Illinois energy efficiency infrastructure to keep HPW top of mind**
   - Above code programs, IL TRM (*already started!*), etc.
3. **Rewriting the value proposition**
   - Can’t sell based on energy efficiency alone
4. **Supporting ENERGY STAR® developments**
   - Helping inform the program to keep product specifications aggressive
5. **Collaborating broadly across the industry**
   - Using PAWS to amplify the overall market demand signal

Logic Model: Impact



Impacts are tied to ENERGY STAR® residential windows, doors, and skylights specifications:

1. **ENERGY STAR v7.0 adopted to code**
   - U-factor: ≤ 0.22*
2. **Market share of future ENERGY STAR specifications**
   - Version 7 had largest increase in performance in the last decade
   - The market is expected to be less saturated with ENERGY STAR certified products in the near term

Market Progress Indicators

- **23 total MPIs**
  - Connects each Logic Model outcome with a MPI, metric, and data source
- **Metric examples:**
  - # of installations
  - Recommendation rate
  - Awareness rate
  - Product cost

- **Data source examples:**
  - Surveys
    - Builder
    - Consumer
    - Supplier
  - ENERGY STAR® shipment data report
  - ENERGY STAR specifications
  - Literature review

High Performance Windows MPI Table

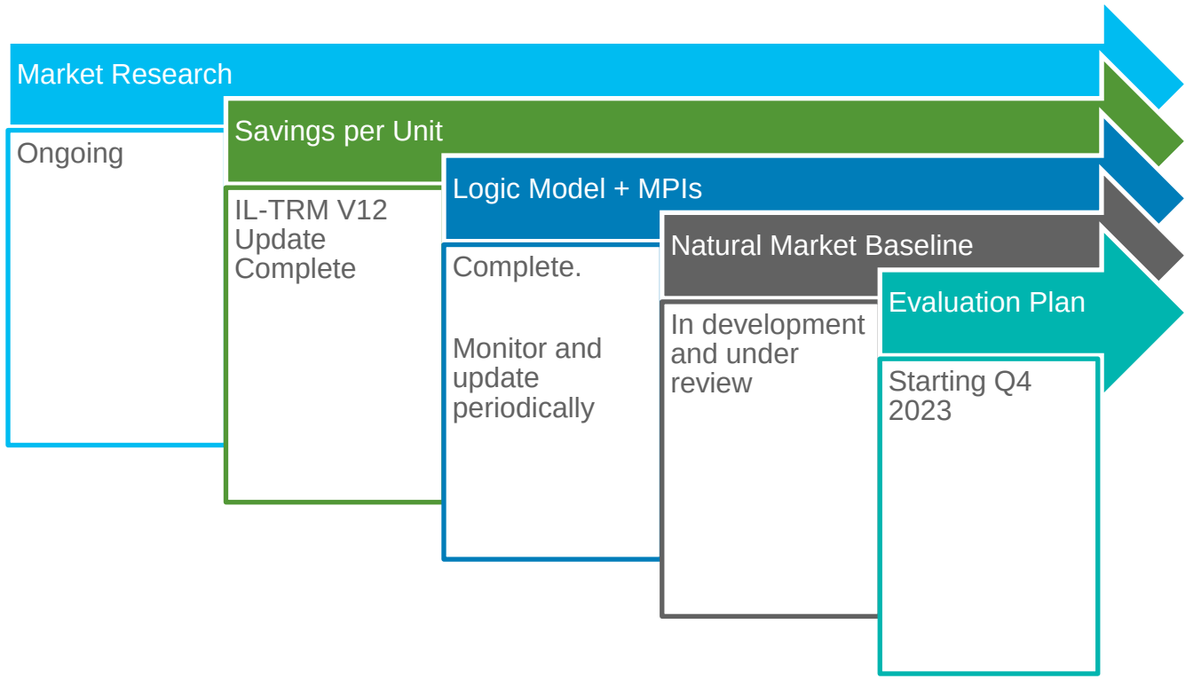
MPI#	Term	Logic Model Outcome	Market Progress Indicator	Metric	Data Source
I	Short	Inclusion of HPW (E* 7.0) in above code programs, incentives and tax credits	a. Inclusion of HPW in above code programs, with incentives b. Inclusion of HPW in tax credits	a. Number of programs b. Inclusion in tax credits	a. Literature review
II	Short	Window suppliers and raters increasingly recommend HPW (E*7.0)	a. Suppliers' year-over-year sales of HPW qualified products increase. b. Raters' recommendation of HPW qualified products increases year-over-year c. Year-over-year increase in the share of HPW installed new homes.	a. Number of installations b. Rate of recommendation	a. Rater survey b. Supplier survey
III	Short	Several volume builders use HPWs as standard practice in NC projects	a. Year-over-year count of builders installing HPW as standard increases.	a. Number of builders	a. Builder survey
IV	Short	Awareness increases among builders and MF Managers/Owners	a. Year-over-year builder awareness increase b. Year-over-year MF Manager/Owner awareness increase	a. Rate of awareness increases	a. Builder survey b. Building manager/owner survey
V	Short	Awareness increases among homeowners	a. Year-over-year homeowner awareness increase	a. Rate of awareness increases	a. Consumer survey

Conclusion + Next Steps

- Open to any comments from the Illinois SAG MT working groups on the completed LM and MPI components
- Revisions and updates will be made as needed as work continues

Coming down the pipeline:

- Evaluator/SAG MT working group review of natural market baseline
  - Estimated for Q1 2023 meeting
- Develop evaluation methodology
  - Use MPIs to guide
  - In collaboration with Guidehouse
- Implementation planning
  - Bringing strategic interventions into practice



Questions?

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