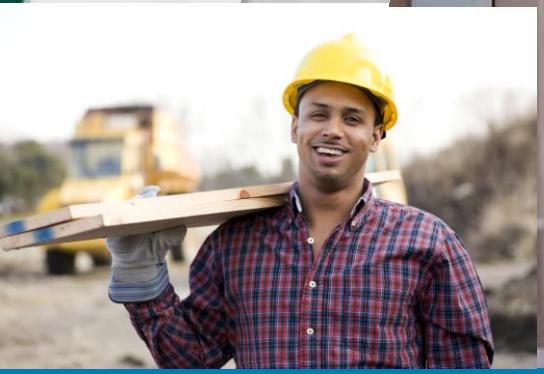

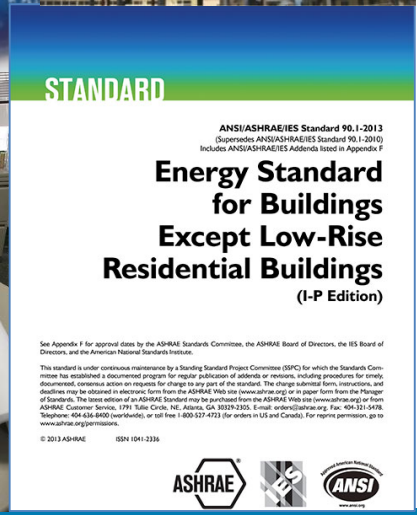

IL Energy Code Compliance

SAG MT Savings Update

November 20, 2019

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Ameren
ILLINOIS


ComEd
Energy Efficiency Program


Nicor Gas


PEOPLES GAS®
ENERGY EFFICIENCY PROGRAM


NORTH SHORE GAS®
ENERGY EFFICIENCY PROGRAM


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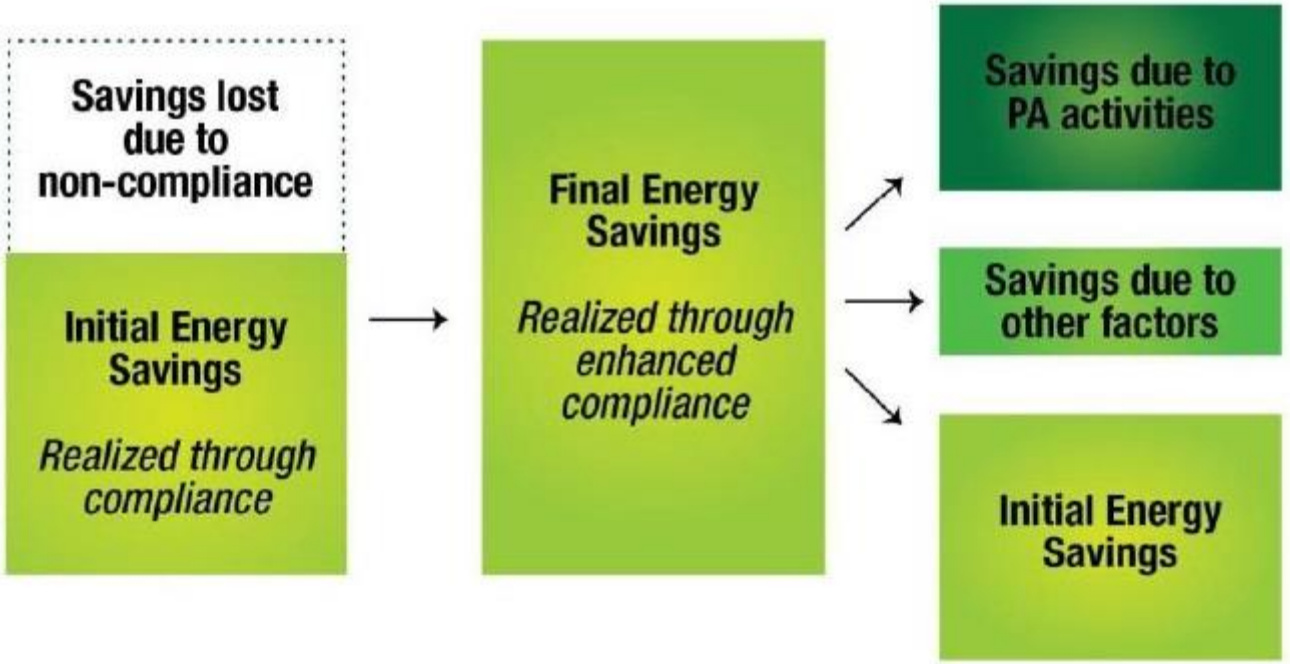
Opportunities for Claimed Savings

Energy Code Compliance



Source: Attributing Building Energy Code Savings to Energy Efficiency Programs (2013), Institute for Market Transformation, Institute for Electric Innovation, Northeast Energy Efficiency Partnerships

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Benefits

Why utilities are interested in energy codes

- **Short term**
  - Portfolio savings
  - Less low-hanging fruit
- **Long term**
  - Ever-accruing demand savings
  - Less stress on the grid
  - Better buildings
  - Opportunity to engage customers in a new way

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Non-Energy Impacts

Opportunities for Engagement

Building Industry Engagement

- Code Officials
- Home Builders
- Subcontractors
- Manufacturers
- Supply Houses
- Homeowners
- Real Estate Community
- Architects
- Engineers

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Energy Codes Utility Programs

Other States and Utilities

Rhode Island and Massachusetts

- National Grid

Arizona

- Salt River Project

Iowa

- Cedar Falls Utility

California

- Pacific Gas and Electric Company
- San Diego Gas and Electric
- Southern California Edison
- Southern California Gas

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Model Program Framework

Energy Code Compliance

1. Residential and Commercial Codes Field Study
   - Basis for measuring improvement
   - Identifies specific compliance improvement opportunities
2. Integrated Compliance Support Program
   - Develop a suite of programs targeted at identified compliance improvement opportunities
3. Post Program Study
   - Positive results from Kentucky

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What and Why

Understanding Energy Code Compliance

√	**What**		Why	**Residential Compliance Field Study**
√	**What**		Why	**Commercial Compliance Field Study**
	What	**√**	**Why**	**Illinois Energy Codes Compliance Collaborative**

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What and Why

Understanding Energy Code Compliance

√	**What**		Why	**Residential Compliance Field Study**
√	**What**		Why	**Commercial Compliance Field Study**
	What	**√**	**Why**	**Illinois Energy Codes Compliance Collaborative**

√ Who

√ How

√ How Much

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Residential Field Study

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Residential Study
Background

- In 2014 the US Department of Energy funded 3-year **residential energy code studies** in eight states
- Study goals
  - Establish compliance baseline, and **calculate potential savings**
  - Determine if **focused training & support** can improve compliance
- Collected data will be **anonymous**

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Residential Study
Data Collection Process

- DOE established a **data collection protocol**
  - Randomized Sampling Plan
  - Key Items Must be Observed
  - 63 Observations of Each Key Item
  - Single Visit to a Given Home
- Collaborative will **provide feedback and guide** the project

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Residential Study

US DOE Key Items

- **Envelope Tightness** (ACH50)
- **Window Solar Heat Gain Coefficient**
- **Window U-factor**
- **Wall Insulation** (R-value and Quality)
- **Ceiling Insulation** (R-value and Quality)

- **Foundation Insulation** (R-value and Quality)
- **High Efficacy Lighting**
- **Duct Leakage** (CFM25)

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Residential Survey
Progress To Date

- Recruitment delays due to weather, late project start and construction season timing, building industry irregularities, etc.
- Data collection completed in September 2019
- Anonymized data has been sent to PNNL.
- Results received October 30, 2019.

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Residential Study
PNNL Analysis

PNNL conducted these analyses of the collected data:

- ***Compliance Distribution Analysis***
  - Examination of the field data, and data distribution relative to compliance requirements
- ***Measure-Level Savings Analysis***
  - Projection of potential savings associated with improved compliance

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Residential Study
Measure-Level Analysis

- Measure-level analysis includes all key items having **non-compliant observations**

- The savings potential from each non-compliant value is **evaluated in isolation**

- An individual "as-built" model is created for **each non-compliant value**, with all other values remaining at code compliant levels

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Residential Study

Measure-Level Analysis

- An average **energy savings potential** for each key item is then calculated
- State-specific construction volumes and fuel prices are used to calculate the key item **savings potential of full compliance**
- **Share analysis** with stakeholders
- Design and start **support program!**

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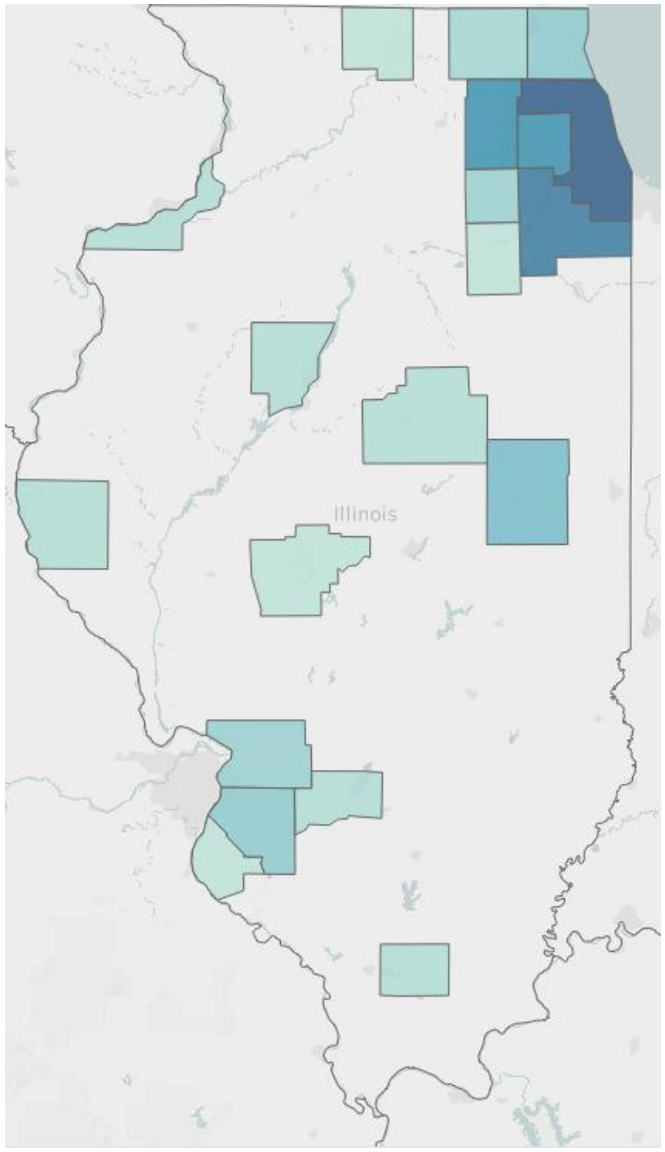
Residential Study

Data collection



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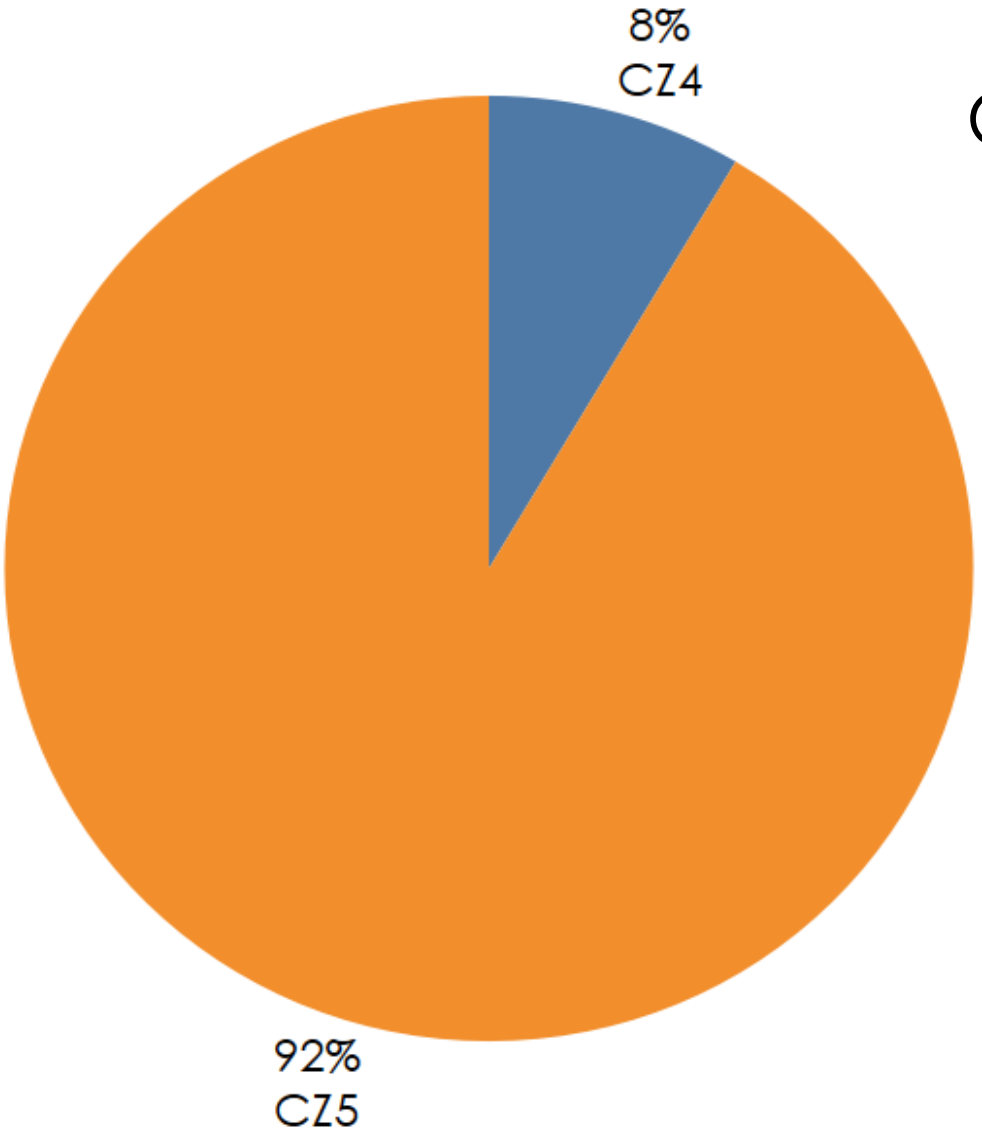
Residential Study

Trends based on available data



Climate Zone

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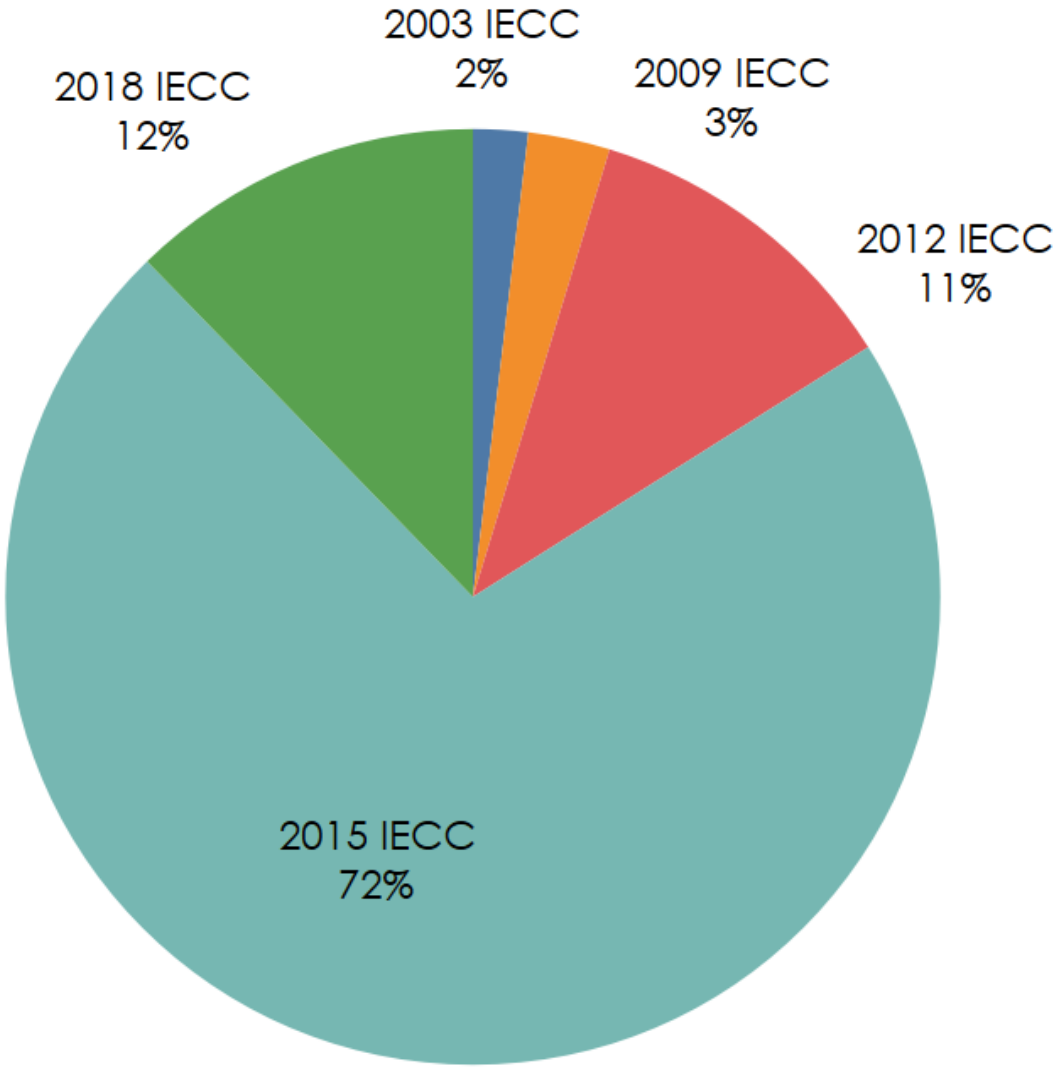
Residential Study

Trends based on available data



Permit Code

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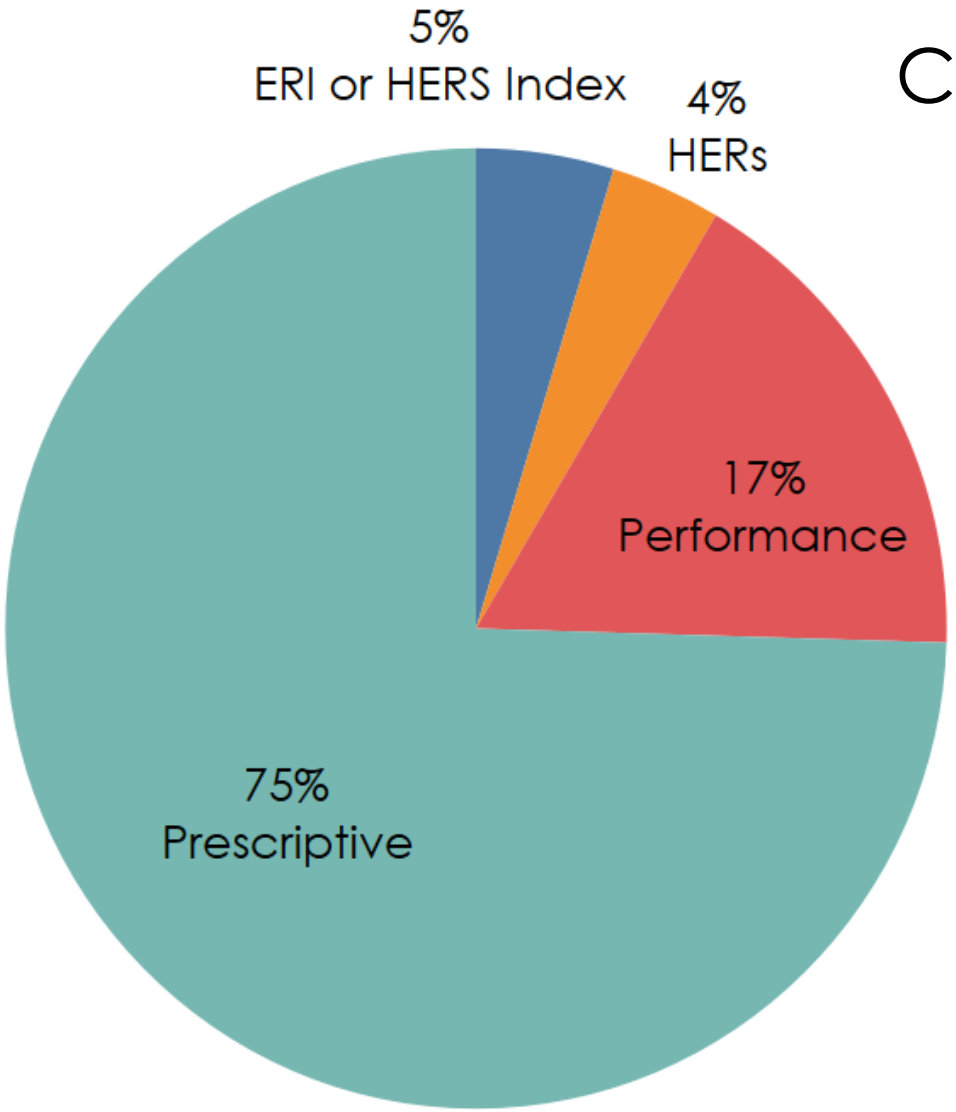
Residential Study

Trends based on available data



Compliance Path

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Summary of Residential Trends

- Blower door rates are compliant with 2015 and 2018 IECC – but are all builders testing?
- Lighting compliance is fairly good
- Ceiling, frame wall cavity insulation R-value high noncompliance
- Quality of insulation installation can improve
- Performance path utilized more than anticipated

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Summary of Residential Trends

- U-factor and SHGC is generally compliant
- Duct systems are leaky
- Heated basements are typically not insulated properly
- Some jurisdictions not enforcing the current state energy code

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Potential Residential Savings

PNNL Measure-Level Analysis

Rank by Potential Energy Savings by Measure (1= Most Potential)

Rank (MMBTU)	CZ 4 & CZ5
1	Exterior Wall Insulation*
2	Duct Leakage**
3	Ceiling Insulation*
4	Heated Basement Insulation*
5	Air Sealing
6	High Efficacy Lighting

*Includes R-Values and quality of insulation installation

** Duct leakage in unconditioned space

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Residential Study

PNNL Measure-Level Analysis Result

Table 1. Annual Measure Level Savings for Illinois

Measure	Total kWh Savings	Total Therms Savings	Total cost savings($)
Exterior Wall Insulation	2,263,516	923,345	1,024,882
Duct Leakage	1,704,768	532,031	638,534
Ceiling Insulation	1,678,754	477,492	590,877
Heated Basement Insulation	(858,159)*	396,738	218,042
Blower Door Test	668,328	46,403	70,690
High Efficacy Lighting	30,333	(11,551)**	41,515
Total Savings	**5,487,539**	**2,364,458**	**$2,584,541**

*basement insulation in climates with hot summers and cold winters, as uninsulated foundation components can be a benefit in hot weather (by providing "free cooling" from the cooler ground (basements) or cooler air (crawlspaces))

** Older light bulbs gets heated when kept on for period of time and hence reduces heating load in the building.

Corrected error from previous versions of slide. This is the accurate information.

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Commercial Field Study

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Commercial Survey
Overview

- Similar to the residential study, the commercial study will **survey high impact measures** and analyze the results
- The commercial survey is **not intended** to achieve the "statistical significance" label
  - **Too much variation** in use types and size to cost effectively survey
- Will survey 40 of the **most common** building use types
- Analysis is designed to identify **measure-level savings opportunities**

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Commercial Study
Data Collection

- Review Building Plans and Specs
  - Record values for 22 key items
- Identify Compliance Path
- Collect Field Data
  - Building Insulation and Fenestration
  - Mechanical System and Controls
  - Lighting and Controls

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Commercial Study
Process

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Commercial Study

Energy Impact Analysis

1. Rely on DOE code-compliant prototype building EnergyPlus models to manage level of effort
2. Simulate prototype building using as-built characteristics to estimate total energy impact
3. Simulate prototype building with each key measure as-built to estimate measure energy impact
4. Combine and weight building results to estimate population impacts

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Illinois Commercial Samples Collected

Data collection completed by Building Type

Building Type	Count
Education	5
Multifamily	2
Office	11
Retail	5
Warehouse	11
Other	6
Total	**40***

Data collection completed by Size

Building Size	Count	Sq. Ft.
Small	25	<25,000 sf
Medium	7	25,000 sf-60,000 sf
Large	8	>60,000 sf

*5 buildings were LEED certified buildings

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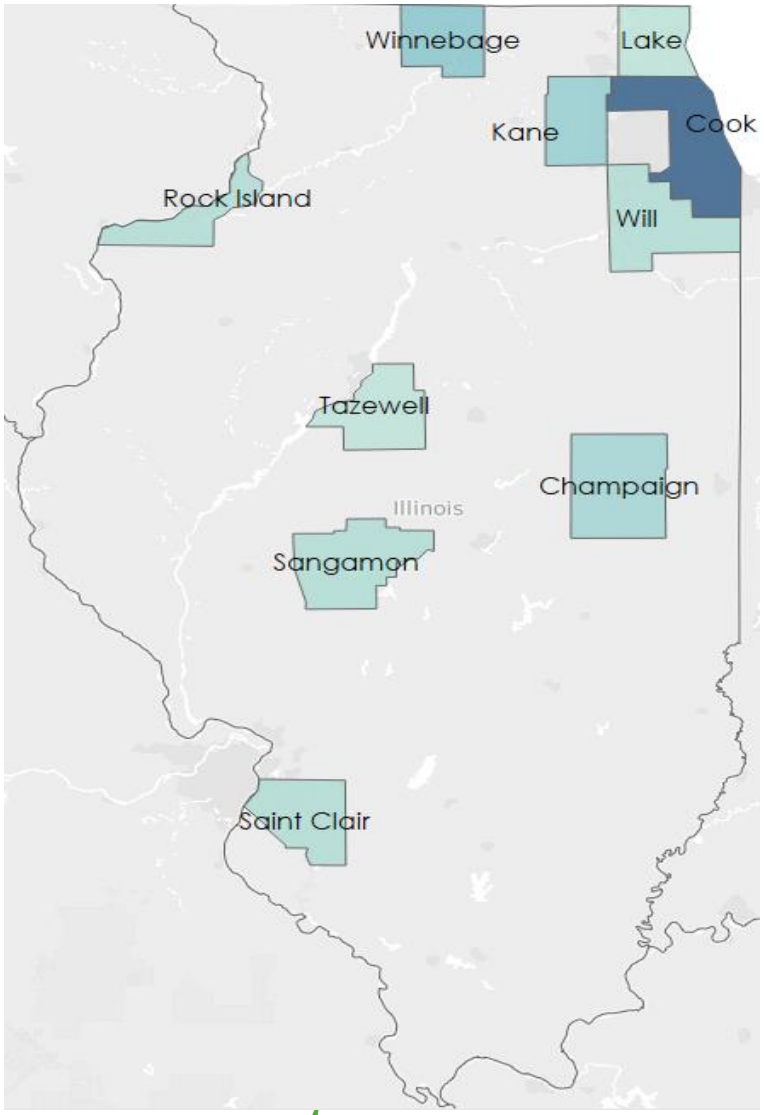
Illinois Commercial Samples

Sampling Plan Distribution

COUNTY	NUMBER OF SITE VISITS
Champaign	3
Cook	18
Kane	4
Lake	1
Rock Island	2
Saint Clair	2
Sangamon	2
Tazewell	1
Will	2
Winnebago	5
TOTAL	**40**



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Commercial Recruitment

Process and Summary

- Our team finalized the recruitment efforts and made at least a single call to reach out to about 400 projects.
- For each project that agreed to participate, our team made multiple calls to collect project data from project owner, contractor, architect and engineer.
- Some people were interested but did not have anything within project time frame or have declined participation.

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Commercial Study - Permits

Trends based on available data

Project Documentation

- All sites were permitted
- All sites have been able to provide construction drawings and/or as-builts either prior to or after the site visits
- Code path and compliance documentation (COMChecks, City of Chicago Commercial Compliance Statements) have not been readily available for most sites

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Commercial Study - Lighting

Trends based on available data

IECC 2015 Code Compliance

Initial findings from the plan reviews and on-site observations in the sample:

- Installed interior and exterior lighting systems are predominately LED
- Lighting systems mostly have code-compliant controls; however, there are a few compliance issues with daylighting and auto-shutoff controls

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Commercial Study - Envelope

Trends based on available data

IECC 2015 Code Compliance

Initial findings from the plan reviews and on-site observations in the sample:

- Building envelope components mostly look good; however, there are some issues with roof, floor and slab-on grade insulations
- Office and retail buildings with a higher vertical fenestration area in comparison to code maximum (30%) used daylight responsive controls and high-performance fenestration components as a trade-off

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Commercial Study - HVAC

Trends based on available data

IECC 2015 Code Compliance

Initial findings from the plan reviews and on-site observations in the sample:

- HVAC equipment performance typically meets IECC 2015 minimum requirements; some HVAC controls demonstrated non-compliance

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Estimated Commercial Savings Methodology

- Estimate total annual new construction by building type
  - CMD statewide data provides floor area by individual building
  - Categorize building types consistently
  - Sum floor area by building type
- Compile building energy use intensity (EUI) by building type
  - Use PNNL EnergyPlus EUI estimates for code-compliant building prototypes
- Estimate annual energy use of buildings constructed in one year
  - Multiply building type EUI*total floor area

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Savings Methodology (cont.)

- Perform EnergyPlus simulations for sampled buildings
  - Use PNNL prototypes and scale results to actual building
  - Model buildings as-built and to just meet code
  - Perform simulation for each key item that does not comply with code
  - Calculate ratio of each key item's as-built level to code-required level = compliance factor
- Compare as-built building energy use to code-compliant building use
- Calculated total new construction floor area
  - 55 million square feet total

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Preliminary Savings Estimates

Commercial Code Compliance

- Initial simulations completed on a subset of buildings
  - Many as-built buildings use less energy than code-compliant buildings
  - But bringing non-compliant items up to code would produce savings
  - Final savings numbers will be based on simulations from field data

Incremental Savings %	Incremental kWh Savings	Comment
0.5%	4,700,000	kWh savings comparable to residential
3.4%	31,700,000	Savings % in MA study
8%	74,516,701	Savings % comparable to residential

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Illinois Energy Codes Compliance Collaborative

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What and Why

Energy Codes Compliance Collaboratives

- **What**: A group of stakeholders that come together on a regular basis to explore common interests and address obstacles related to **energy code compliance**

- **Why**: To establish a forum for identifying and tackling obstacles to improving energy code compliance (eventual goal 100%)

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Collaborative Goals

- Inform stakeholders baseline studies for recruitment
- Gather feedback on noncompliance
- Identify next steps for the key areas of energy code noncompliance
- Gain commitment for future participation in programs

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Illinois
Collaborative Meetings

Final Collaborative updates will be in December.

Past Meetings:

- June 11, 2019 (Oak Park, IL)
- June 5, 2019 (East Peoria, IL)
- June 4, 2019 (O'Fallon, IL)
- Feb 28, 2019 - Commercial/Residential
- June 28, 2018 - Commercial
- June 26, 2018 - Residential
- May 18, 2018 (East Peoria)
- May 15, 2018 (O'Fallon)
- May 7, 2018 (Oak Park)

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Why?
Non-compliance

- Contractor/code official lack of understanding of energy codes
- Jurisdictions don't enforce energy code
  - Incorrect assumptions of adoption
  - Not high priority
- Jurisdictions don't have capacity for energy codes
- Not enough demand from homeowners
- Cost and/or perceived cost of testing and/or meeting energy code

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Potential Program Elements

Residential

- Collaborative
- Circuit rider
- Targeted In-person training
- Administrative assistance
- Energy Modeling/ Performance Assistance
- Equipment incentive
- Third party verification
- Manual J program
- Plan Review Support
- Incentives

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Potential Program Elements

- Basement insulation
- Ceiling insulation
- Wall insulation
- Duct leakage
- Insulation Quality
- Air leakage verification
- Ventilation
- Overall energy code assistance with city officials

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Targeted Trainings
Residential Elements

- AC sizing through ACCA Manual J calculations
- Duct sealing techniques and Manual D calculations
- The benefits and challenges of proper insulation installation
- The "why" (building science) behind code requirements
- How and why to comply with air leakage requirements
- The rationale for complying with or enforcing the statewide energy code
- How to utilize utility program assistance and incentives to meet the energy code
- Energy Modeling
- Homeowner training
- Appraiser/lender/real estate training

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Targeted Trainings
Preferred Types

- Classroom-style
  - at my place of employment or other meeting I normally attend (municipality or HBA)
  - within 20 miles
  - within 60 miles
- Hands-on training at a facility or job site
  - at my place of employment or other meeting I normally attend (municipality or HBA)
  - within 20 miles
  - within 60 miles
- Training that has continuing education credits.
  - ICC
- Web-based training.
  - 30-60 minutes; 2 hours
- 2-3 hours max at a time; combo of hands-on/classroom

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Administrative Assistance

Preferred Types

- Phone Line
- Email Queries
- Website with FAQs
- Compliance Checklists
- Web-based Compliance Support and Verification

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Direct Technical Assistance

Preferred Types

- Third-party Verification
- Plan Review Support
- Manual J Program
- Manual D Program
- Performance Path Assistance
- Energy Efficiency Certificate
- HERS Certificate
- Manual S
- Ventilation

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Incentive Ideas

Preferred Types

- Blower door test (50%)
- Duct blaster test (50%-75%)
- Equipment/Ventilation (50% or all)
  HRV/ERV
- Insulation Quality Inspection Cert ($25)
- Manual J Report ($50-200 or 50%)
- Manual D Report ($50-200 or 50%)
- HERS Cert ($300 or 50%) all included
- Plan Review Support
- Third Party Verification
- Ventilation

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Summary

- HERS Certificate would include blower door, duct blaster test, insulation quality inspection, plan review, and third-party verification
- Targeted training
- Ventilation concerns – incentives for HRVs & ERVs
- Performance path assistance
- Third-party compliance
- Manual J and D
- Homeowners, realtors, appraisers

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Potential Program Elements

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Market Transformation

- Proposed code compliance effort would be the first MT demonstration project.
- As MT project it will prove:
  - Without active code support compliance rates are less than they could be
  - There are generalized, repeatable code support activities that result in increased compliance rates
  - Increased compliance rates can result in measurable energy savings for any given set of code requirements
- Next steps:
  - Developing MT codes implementation plan starting in latter half of 2020 with claimable savings

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Program Framework

Energy Code Compliance

1. Residential and Commercial Field Study
   - Basis for measuring improvement
   - Identifies specific compliance improvement opportunities
2. Integrated Compliance Support Program
   - Develop a suite of programs targeted at identified compliance improvement opportunities
3. Evaluation – To Be Determined
   - Delphi panel*
   - Field Study can be conducted at pre-determined cycle (e.g., every six years)*
   - Utilize Collaborative for program feedback*

**Option for evaluation*

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New Construction Programs

How does codes compliance intersect?

- Compliance programs are a different structure than typical new construction programs
- Compliance programs focus on buildings-as-a-system rather than incenting individual widgets
- Compliance programs engage different stakeholders
- Compliance programs could be an entry point for other utility programs if desired

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Non-Energy Impacts

Opportunities for Engagement

Building Industry Engagement

- Code Officials
- Home Builders
- Subcontractors
- Manufacturers
- Supply Houses
- Homeowners
- Real Estate Community
- Architects
- Engineers

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Suggested Program Elements

Commercial & Residential

- Collaborative: Stakeholder engagement, program dissemination and feedback
- Circuit Rider: Building department visits, participation in industry groups, phone and email support
- Training: Classroom, in-field, webinar
- Resources: Website, checklists, field guides, FAQs, pocket guides, short videos, code books

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Suggested Program Elements

Commercial & Residential

- Incentives: Equipment incentives, HERS/blower door/duct blaster incentives, Manual J incentives
- Jurisdiction Assistance: Plan review, software training
- Third-party Compliance Support: Supporting use of third-party specialists in code compliance

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Technical Potential

Residential Claimed Savings

Residential 1st Year Savings			
	kWh	Therms	Dollars
Total Impact	5,487,539	2,364,759	$2,584,541

Cumulative Residential Savings			
	kWh*	Therms**	Dollars^
Total Impact	338,031,000	26,009,000	$63,646,000

*Electric: Persistent savings through 2030

**Natural Gas: 1st year savings through 2030

^ Based on EIA cost data for IL

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Preliminary Savings Estimates

Commercial Code Compliance

- Initial simulations completed on a subset of buildings
  - Many as-built buildings use less energy than code-compliant buildings
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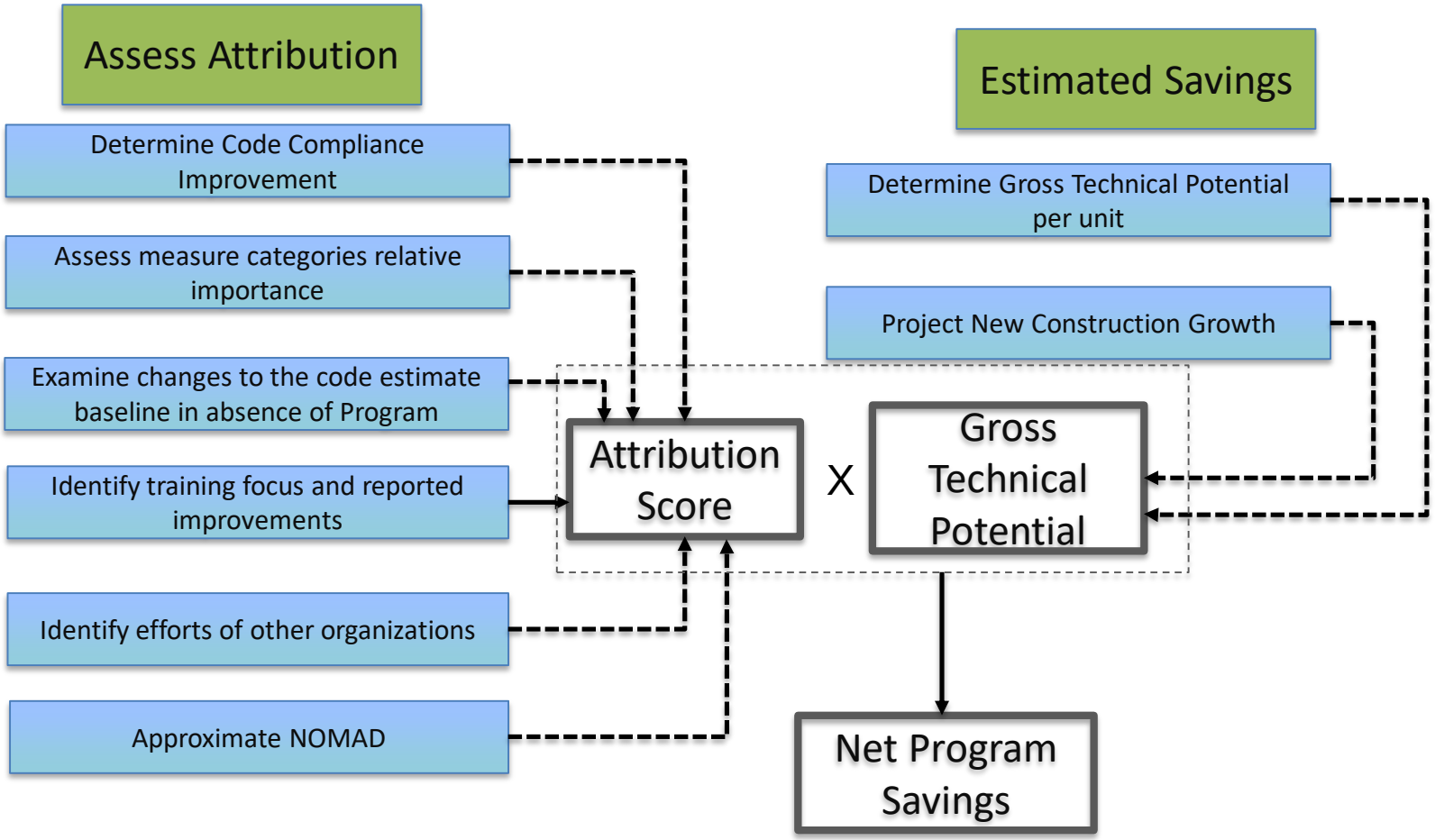
Attribution Study Approach 1



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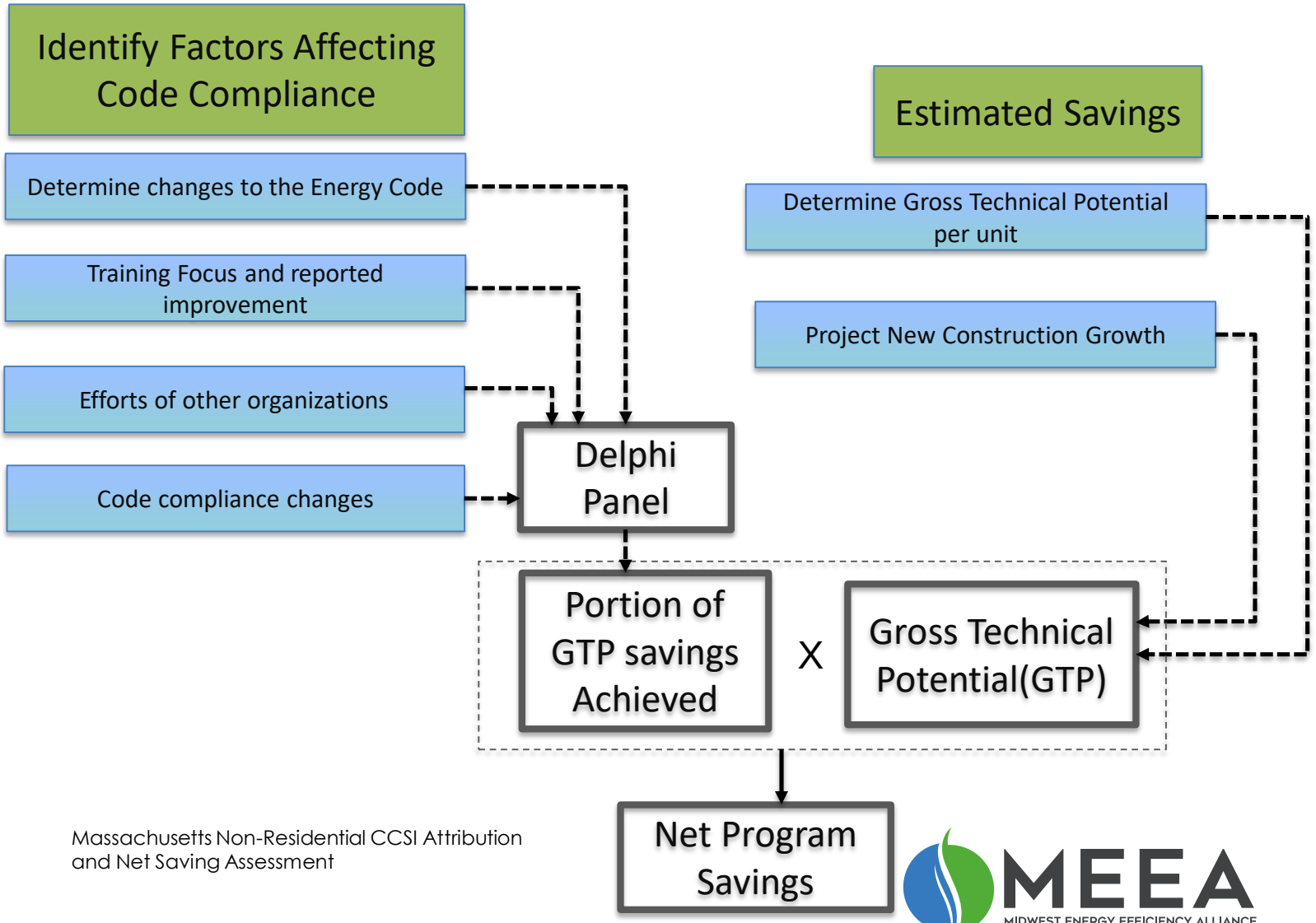
Attribution Study Approach 2



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Next Steps

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Market Transformation

Implementation Plan Outline

Purpose and Intent

A Market Transformation (MT) implementation plan is intended to document the primary tasks, timing and costs to implement the near-term (1-3 years) components of the MT Business Plan. The implementation plan links the MT hypothesis (e.g., theory of change) and logic model to specific activities. The initial version of the MT Implementation Plan is developed in advance of launching MT activities but is intended to be revised on a regular basis as needed based on feedback from operations and evaluation efforts.

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Market Transformation

Implementation Plan Outline

The Implementation Plan will include the following components:

Logic Model Activity (from the MT Business Plan). A brief description of the activity included in the MT Logic Model and its connection to the outputs and outcomes of the activity.

Barriers and Opportunities Addressed. Each activity will be linked to a corresponding MT barrier or opportunity with a brief rationale for how the activity will address/exploit them. The description will also contain a link to the overarching intervention strategy in the MT logic model.

Prior Actions/Key Learnings. As appropriate, each activity will have a brief description and link to prior activities and how learnings and prior outcomes have now been incorporated into the current set.

Planned Implementation Activities for the Implementation Plan Period. A brief description of the specific activities to be implemented during the timeframe covered by the Implementation plan; usually 1-3 years.

Timeline. A timeline of specific activities and associated outcomes/outputs

Key Market Progress Indicators. A list of the key market progress indicators to be used for evaluating the success of the activities during the planning period.

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Questions?

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