Energy Code Compliance Improvement Program

Draft Illinois Market Transformation Implementation Plan

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1 Purpose and Background of this Implementation Plan

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. For the Energy Code Compliance Improvement Program, the step of creating a business plan was bypassed because codes compliance is seen as a necessary support activity that makes existing and new energy codes, as well as other building based MT initiatives, more effective (rather than as an MT initiative itself). Many parts of the MT Business Plan are helpful in designing a strong program, and much of what would have been included in a business plan is outlined in the Energy Code Compliance Baseline Study report and this implementation plan. This implementation plan discusses the MT logic model, but does not make arguments about "leverage" or "lastingness" of the activities once utility/state involvement recedes because, by its nature, a supporting activity needs to be ongoing. Even with these concessions the energy savings generated from this MT Implementation Plan should be treated as MT savings since the changes will have a lifetime benefit on the building. This implementation plan describes the strategies, activities, schedules, and estimated savings to improve statewide energy code compliance levels in the residential and commercial sectors. This MT Implementation Plan is a working document and intended to be revised as needed based on feedback from implementation operations and evaluation efforts. This plan was developed by the Midwest Energy Efficiency Alliance, with consultation and assistance from Resource Innovations.

This Energy Code Compliance Improvement Program is intended to improve compliance with the baseline residential and commercial Illinois state energy codes in effect. This is not an advocacy program intended to improve the efficiency of or update the Illinois state energy code[1], but is intended to improve areas of non-compliance with the current baseline code in order to achieve full energy savings. This Implementation Plan uses the Illinois Energy Conservation Code (amended 2018 IECC) which is currently in effect as of July 1, 2019. The state energy code is updated every three years and will change in 2022. The changes to the next code are unknown.

Commented [AR1]: A clearer statement upfront would be helpful for the reader – e.g. "This implementation plan describes the strategies/activities/schedule/etc. to improve statewide energy code compliance levels in the residential and commercial sectors."

Commented [AL-M2R1]: Thank you.

Commented [AL-M3R1]:

[1] Such a program should be considered separately.

2 Opportunity Background

While many utility new construction programs claim savings with the energy code as their savings baseline, numerous compliance field studies[2] have shown that full compliance with energy codes is rarely achieved. With some level of non-compliance being the norm, the available potential energy savings are not being fully realized. Code compliance studies establish the baseline levels of non-compliance by major measure category and by building sector, and can inform a program design and identify missed savings. A residential and commercial code compliance study was completed in Illinois in 2019 and the results present the opportunity for a statewide energy code compliance improvement program in Illinois.

Interest in energy code compliance has been on the rise, with both utilities and local and state governments seeing energy codes as a necessary component in meeting energy or climate goals. Utilities in Rhode Island, California, and Massachusetts all implement claimed savings programs related to energy codes. Some utilities in the Midwest are also interested and are either already implementing codes compliance programs[3] or are exploring the possibility[4].

MEEA is deeply involved in the energy code compliance work in the Midwest. In addition to leading the Illinois residential and commercial baseline studies, MEEA led one of the original DOE-funded residential energy code baseline studies in Kentucky. This study included a statewide baseline study, the development and implementation of a custom two-year intervention, and a post-study to determine the impact of the intervention. That study found that the intervention improved compliance to a level that would reduce energy use in new single-family construction by 25% in the 18 months the program was operational.

MEEA also led the state-funded residential compliance program in Missouri. This study found substantial savings potential in improved compliance and resulted in a major utility in the state, Ameren Missouri, to propose and implement an Energy Code Support Program for new homes. MEEA leads the 3-year program, which started in March 2019. MEEA also has assisted the Michigan residential baseline study, and the commercial and residential baseline studies in Nebraska.

In addition, MEEA is a founding member and facilitator of the Nebraska Energy Code Compliance Collaborative – the oldest energy code compliance collaborative in the Midwest. MEEA also facilitates the Illinois Energy Code Compliance Collaborative and participates in, and in some cases helped create, four other energy code compliance collaboratives in the Midwest. Lastly, MEEA is contracted with the Minnesota

Commented [JH4]: The barriers, opportunities and other issues differ considerably between commercial and residential. Throughout this report, it is not clear if you are addressing commercial or residential codes or programs. Please specify, in each section, whether you are speaking to commercial, residential or both.

Commented [AL-M5R4]: Will do. Thanks.

Commented [JH6]: Is that lifetime savings, or first year savings?

Commented [AL-M7R6]: 25% in 18 months.

[2] Many states have conducted energy code compliance field studies, and have shown measures of noncompliance. The most well-discussed compliance studies were funded by US DOE Building Technologies Office (or use their recommended methodology), the description of which can be found here: https://www.energycodes.gov/compliance/energy-code-field-studies

[3] Ameren Missouri

[4] Xcel Energy

Department of Commerce to provide technical assistance for an Energy Codes and Standards Roadmap recommendations report to be published by the end of 2020. MEEA's vast energy code experience in the Midwest will be leveraged in support of a code compliance improvement program in Illinois.

3 Energy Code Compliance in Utility Programs

While energy codes increase in stringency, utilities may have concerns about what happens to the claimed savings potential of their existing programs as the baseline moves. This has led to interest in energy code compliance programs with utility support. Utilities in Rhode Island, California[5], and Massachusetts have all been implementing claimed savings programs related to energy codes. These programs have different methodologies for estimating and claiming savings.

Salt River Project and Ameren Missouri operate energy code compliance programs without claiming savings. While energy savings potential existed, Ameren Missouri chose to implement their residential energy code compliance program without claiming savings. This was in part because of the short timeline of the process and no approved savings methodology at that time. The program was chosen for implementation due to many comments demanding its need during the utility filing process; overall it provides an opportunity for Ameren Missouri to engage in a new manner with, and provide a requested service for, their customers.

Energy code compliance programs generally have a different structure from typical new construction programs. A building science-based Codes Compliance Program needs to focus on **buildings as a whole system** – utilizing training, education and engagement - rather than focusing on individual widgets. For example, incentivizing insulation without addressing proper air sealing can lead to moisture issues. A Codes Compliance Program can be viewed as an essential support mechanism for other building- related resource acquisition programs, especially MT initiatives, that solely focus on deploying widgets or new technologies (see Energy Code Compliance as Support for Market Transformation Initiatives, section 4). It can even be a tool to support other code initiatives such as Energy Code Advancement or Stretch Code Support programs (even if not considered MT). In addition, code compliance programs operate with the full range of key touchpoints in the building code enforcement industry, and this is not often the case in typical resource acquisition building related new construction programs.

In addition to generating energy and demand savings, Energy Codes Compliance Programs improve the resilience[6] of new buildings as well as providing a more comfortable, healthier environment for both building occupants and the larger community. Codes Compliance Programs also tend to expand the group of engaged

[5] California does not claim savings for the codes compliance portion of their program, but recognizes the importance of compliance to achieving the other code aspects they do claim savings for, such as adoption.

[6] https://www.iccsafe.org/advocacy/safety-toolkits/resiliency/

stakeholders to include code officials, builders, design professionals, manufacturers, retailers, realtors, lenders, and aspiring homeowners. When thoughtfully coordinated, these programs can be used as a stepping stone for customer engagement with other utility programs or as leverage for other utility offered energy efficiency incentive programs. More details on these opportunities are provided in the Planned Implementation Activities (section 12) of this report.

4 Energy Code Compliance as Support for Market Transformation Initiatives

Market transformation initiatives are intended to make changes in the market over time with the ultimate goal of lasting market change. One of the long-term goals can be for the initiative or measure to be placed into code language or to be seen as meeting code, thus ensuring it will penetrate the entire market, ie. "lasting change." But if the code is not achieving 100% compliance, that lasting market change may not be as lasting or as penetrating as hoped. Thus, energy code compliance programs play an essential role in Market Transformation initiatives. (Adoption of more efficient energy codes is often an essential part of the "lasting" nature of market transformation. These efforts can work simultaneously, but should be considered as separate programs/initiatives.)

Codes compliance programs make energy code changes and their included market transformation pieces meaningful. If code compliance rates are low, there's little gain in updating the code to new efficiency levels or including more efficient technologies. But if enhanced compliance activities create an environment where compliance is high and continues to create support for MT measures included in new codes, then the drive to change code combined with compliance improvement can generate an increased amount of savings overall.

While the energy savings, demand reduction, and other benefits from improved compliance are important, perhaps even more significant is the infrastructure a code support program provides. Any MT initiative related to getting new measures adopted into new codes could have some of the same components as a code support program - a collaborative or technical advisory committee; outreach to code officials, builders, designers and energy raters; highly developed program marketing channels; connections to manufacturers and distributors; and a mechanism for training on the selected technology - all of which are provided through a code support program. If there are MT initiatives that are moving new measures into new codes, the benefits of having an ongoing, centralized program that maintains these connections with the building industry, as opposed to starting from scratch with each initiative, is clear - both in terms of efficacy and cost.

Designing an energy code compliance program as support to Market Transformation initiatives amplifies and better secures the savings from those MT initiatives, be they product or policy-based initiatives. By lifting the floor of energy efficiency, these initiatives are most successful when achieving full compliance. A utility support program

can accelerate and enhance this beneficial compliance. In addition, energy codes touch all stakeholders of the building industry, and thus a program can be used as a support framework for future utility market transformation efforts that can capture savings through support of policy changes that build upon energy codes, such as energy code adoption, stretch codes, or other codified improvements in building efficiency.

5 Target Market

The target market is divided into two main groups: the design and construction industry (TM1) and the enforcement industry (TM2); each is described and defined below.

Target Market 1 (TM1): Design and construction industry (residential and commercial): Builders, subcontractors, material supply houses, site superintendents, energy modelers, HERS raters, building scientists, architects, engineers, and designers that design and build residential and commercial buildings. While self-selected individuals in the construction industry may be familiar with utility above-code programs, the target market for this program is all construction industry actors – everyone has a stake in code compliance. This significantly larger target market can be reached through involvement with the Collaborative and leveraged through direct outreach to priority organizations such as local and state chapters of Homebuilder Associations (HBA), American Institute of Architects (AIA), Residential Energy Services Network (RESNET), ASHRAE, International Code Council (ICC), Illinois Plumbing and Heating Association, and Illinois Green Alliance (former US Green Building Council chapter). Additional outreach could also be conducted to the Association of Licensed Architects, Illuminating Engineering Society, Lighting Controls Association, International Association of Lighting Designers, Building Performance Institute (BPI), Associated General Contractors of America, and others. Out of these players, the ICC, the Home Builders Associations, and contractors associations likely have the most influence on residential energy code compliance. In the commercial industry, ASHRAE, the ICC, AIA, and the lighting and mechanical subcontractors associations likely have the most influence.

Target Market 2 (TM2): Enforcement industry (residential and commercial): Local building departments, code officials, and jurisdictional employees that review, permit, and inspect energy code requirements. This target market has an outsized influence over the construction of new buildings relative to their small numbers (they approve the permit to begin construction and have the authority to stop a project at any stage prior to occupancy). Naturally they play a significant role in compliance with the energy code. Enforcement industry stakeholders in Illinois may not have direct contact with utility programs and thus represent a new opportunity for utility customer outreach. This target market can be reached through involvement with the Collaborative and leveraged through priority organizations like local and state chapters of the International Code Council (ICC), ASHRAE, Illinois Council of Mayors, Metropolitan Mayors Caucus, Illinois Capital Development Board, and the numerous state and local code official associations in Illinois.

Commented [AR8]: Need to consider how COVID and economic impacts affects key actors – cost, motivations, availability, etc.

Commented [AL-M9R8]: We have been considering some of this. Will ask the utilities if they'd like us to get more specific.

Commented [AR10]: This is important – would help to see some discussion of which actors are most influential on the specific areas of noncompliance.

Commented [AL-M11R10]: Thanks.

Commented [AR12]: Their role is verifying and ensuring compliance. Do we know whether noncompliance issues are due to issues or poor plan checks vs. poor construction checks?

Commented [AL-M13R12]: It can be both. It can also be lack of will to do either (not believing the energy code is as important as other codes).

Commented [JH14]: This varies from service territory to service territory and is not universally true.

Commented [JH15]: As well as national associations

6 . Energy Code Compliance Improvement Program

The Energy Code Compliance Improvement Program (Code Compliance Program) will improve energy code compliance in new residential and commercial building construction through an integrated, three-part approach: Direct Technical Support, Targeted Training and Education, and an Energy Codes Compliance Collaborative. The three pieces work together to form a cohesive program that supports all necessary areas of improving energy code compliance. Additional details of program elements can be found in the Planned Implementation Activities for the Implementation Plan Period (section 12).

6.1 Improving Areas of Non-Compliance

The Illinois Studies identified residential and commercial areas of non-compliance with some of the most energy-impactful items. More information can be found in the Illinois Studies in Appendix I - 2018-2019 Illinois Energy Code Compliance Studies. Reasons for non-compliance are discussed in section 10, Barriers and Opportunities. The Project Team recommends that a support program focus on improvement of these specific measures:

6.1.1 Residential Areas of Improvement: mostly in construction and installation:

- Above-grade wall insulation R-value and quality
- Ceiling insulation R-value
- Foundation insulation R-value and quality (heated basement wall insulation only)
- Duct leakage
- Envelope air leakage (ACH50) – blower door testing
- Mechanical ventilation

6.1.2 Commercial Areas of Improvement: both in plan review and construction review:

- Daylighting and interior lighting controls
- Exterior lighting
- Various HVAC controls and functional requirements
- Envelope insulation

6.2 Basic Program Elements

Direct Technical Support consists of direct support to the full range of construction industry stakeholders, including builders and contractors, design professionals, and code officials. The main source of direct support comes in the form of a traveling Circuit Rider(s) who performs tailored, individual/small group outreach with stakeholders to educate and answer questions about the energy code. Additional support, such as jurisdictional assistance, online code books, checklists, online resources, a Quick Answers system (phone, email, or text), and a dedicated website will bolster this technical assistance effort. Support materials will be different for residential and commercial elements, as well as by target market.

Targeted Training and Education provides support to the code officials, builders, and designers, as well as construction-adjacent groups like material supply houses. While the

Commented [JH16]: Res, com or both?

Commented [JS17]: It may benefit the reader to put this or a similar statement towards the beginning of this document, so they know the program is not a code update program.

Also, does it make sense to indicate which code is currently in effect, and if the code cycle is the same across the program years. E.g. there is not overlap in versions of code and the yeas the workforce education outreach and training are being proposed for?

Commented [AR18]: Might be helpful to reference the reasons for non-compliance from the 2019 compliance baseline study

Commented [AR19]: Where the compliance issues related to design/plan specifications or actual construction/installation?

Commented [AL-M20R19]: We didn't find many for residential.

Commented [JS21]: These are all likely issues with construction. E.g., in California, 3rd Party HERS raters can and should capture construction deficiencies and/or deviances from plans. This ties into the need identified earlier about a fourth inspection to capture quality insulation.

Commented [AL-M22R21]: I agree.

Commented [JH23]: I think the educational needs of contractors is different than the educational needs of code officials. This plan combines training for contractors and code officials which is offered by the same individual (the circuit rider). Will there be different resources available to these different types of stakeholders?

Commented [AL-M24R23]: Absolutely, and yes. They will be broken down by residential and commercial elements, as well as by target market.

core of the message remains the same (improved compliance is a win/win situation), the content and framing of the trainings are modified for the specific audience. Within the context of buildings as a system, the trainings focus on the areas of largest noncompliance and largest potential energy savings identified in the IL Energy Code Compliance Studies. The trainings are both in-person (classroom and on-site) and web-based, providing stakeholders with multiple avenues for engagement. Stakeholder specific continuing education credits will be provided where applicable. The program will coordinate with the outreach and education work to the real estate sector that is currently being conducted by MEEA. This program educates real estate agents and brokers on energy efficiency and how to properly market energy efficiency features. To better move building efficiency forward, the real estate program could be expanded but would require additional investment.

The Energy Codes Compliance Collaborative is a stakeholder engagement mechanism that is focused on improving energy code compliance through dialogue and communication between stakeholders in a neutral setting. Stakeholders rarely interact across groups outside of the pressure of a project. The collaborative allows space for the discussion of obstacles, a better understanding of other viewpoints and the opportunity for collective action. It also provides a vehicle to disseminate program information and serves as a program feedback mechanism for future program improvements. The Collaborative has already been established in Illinois through the baseline study and will typically meet on a quarterly basis. The Collaborative discusses residential and commercial items collectively as well as separately.

7 Motivating Factors for Program Participation

There are many motivating factors for individuals participating in residential and commercial energy code compliance activities. The motivations can be broken down into three main categories. The first are builders, subcontractors, design professionals, and code officials who are looking to improve their understanding of energy code requirements in order to perform their jobs correctly, improve customer satisfaction (fewer callbacks), expedite plan approval, and reduce liability. The second are individuals within the building industry that are interested in receiving continuing education credits to improve their own credentials. The third are builders that are looking for an edge to set them apart from competitors in the industry by having knowledge about the value of energy efficiency and how to properly market energy efficiency features within a home or building.

Commented [AR25]: ALSO - Reduce costs and shorten design/plan/approval/construction timeframes. Want to have their submitted plans approved as quickly as possible. Getting through plan checks is painful and expensive.

Commented [AL-M26R25]: True! Thank you.

8 Logic Model Activity

Logic models are used to link the activities planned to the outcomes desired. The purpose of the logic model is to clarify the hypothesis of how the planned market intervention will result in the desired market changes. A combined logic model was created for the two target markets described above: code officials and jurisdiction employees that manage and approve energy code compliance (TM2), and the

building industry which includes builders, subcontractors, architects, engineers, and designers that design and build residential and commercial buildings (TM1) (Figure 1)

9 Logic Model

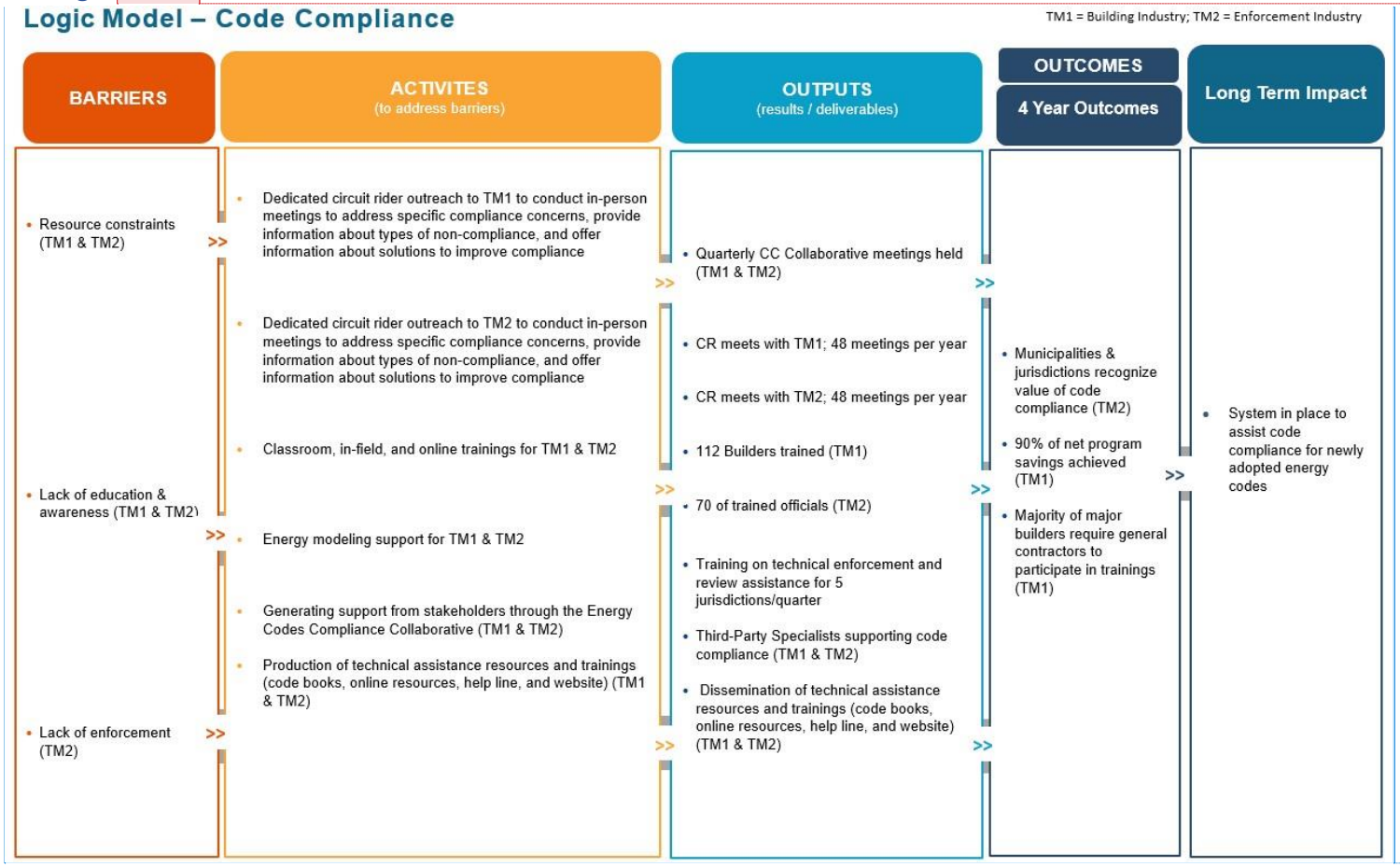


Figure 1. Logic Model for Energy Codes Compliance Program

Commented [AR27]: Outcomes – why not also set goal around municipalities and jurisdictions (TM2) participation in education/trainings? These are the actors we need for enforcement.

Commented [AR28]: Are there assumptions about the relative contributions of program activities on the outcomes?

Commented [AL-M29]: Add quarterly small group circuit rider meetings, and change 112 Builders to 112 Building Industry participants trained

10 Barriers and Opportunities

There are many reasons for non-compliance with the energy code, from philosophical opposition to the code, to lack of understanding of the compliance details of a specific code measure. The reasons vary by builder, designer and jurisdiction. Sometimes non-compliance is accidental, but at other times it can appear intentional. Many Illinois-specific barriers for non-compliance were identified in the baseline studies and a majority of these barriers for non-compliance can be addressed. The barriers fall into one or more categories: Lack of education and awareness, lack of enforcement, and/or resource constraints. The following outlines the details of these barriers and opportunities to address them.

Barrier 1: Lack of education and awareness
Description: Contractor/code official lack understanding of energy code requirements
Opportunity: Providing training and education to address lack of knowledge about code requirements. The project team has demonstrated that information presented by, preferably local, industry experts with past field experience is one of the best ways to encourage improvements with energy code compliance. One-on-one and in-person meetings often alleviate reluctance to seek out training or ask questions. The participants in the Collaborative verified that this is also true in Illinois. The hiring of a qualified traveling circuit rider to provide direct outreach combined with targeted classroom, in-field, and online training will address this opportunity.

Barrier 2: Lack of education and awareness
Description: Existing code training is great, but not enough to boost compliance
Opportunity: Offer new types of trainings and education opportunities and provide continuing education credits. The 2018-2019 Illinois Energy Code Compliance Studies identified the specific areas of non-compliance for residential and commercial new construction. Focusing technical assistance directly on these items (which were already identified to have the most energy impact), within the building as a system concept, will help to increase compliance. Use the Collaborative as a mechanism for disseminating multiple types of support at once.

Barrier 3: Lack of enforcement
Description: Jurisdictions are not enforcing current state energy code. Incorrect assumptions regarding local code adoption, or assumptions that enforcing the energy code is not required by jurisdictions. Some surveyed jurisdictions were found to be permitting and enforcing to previous out of date energy codes even though, at the time of the survey, the 2015 IECC was the mandatory statewide code in Illinois.
Opportunity: Educate jurisdictions about the benefits of updated codes, the correct energy code to enforce, and the role of planning and code staff in enforcement. The delivery method and messaging of the education and training is extremely important. Tailoring the training in ways that allow different stakeholders to hear the information in ways that allow them to receive, retain, and then apply the knowledge in the field. This can be done both through the Collaborative and by engaging specific stakeholder groups - code official associations, design and engineering organizations, and homebuilder and general contractor associations.

Commented [JH30]: Why are there 2 descriptions of the same barrier? These 2 should be combined

Commented [AL-M31R30]: The two have different causes, and thus two different solutions.

Commented [AR32]: Focus also on the areas with the most energy impact.

Commented [AR33]: And role of the plan/code check staff to enforce.

Commented [AL-M34R33]: YES. Thanks.

Barrier 4: Lack of awareness and lack of enforcement
Description: Energy codes are not a high priority because they are not really a "life/safety code."
Opportunity: Correct false assumptions about the energy code not impacting life/safety by demonstrating the numerous ways the energy code impacts life/safety. MEEA has already created fact sheets detailing why energy codes are life/safety codes which have been well-received amongst code officials and builders. Complement the fact sheets with training and education that discusses the full range of energy code benefits in a building science/building as a system framework. This may include occupant comfort due to comfortable heating/cooling, proper ventilation, and adequate light levels. Utilize the Collaborative as a way to boost broad social acceptance of full energy code compliance.

Barrier 5: Resource constraints
Description: Jurisdictions don't have capacity or resources to fully understand and enforce energy codes
Opportunity: Assist in permitting and inspections with trainings or direct technical assistance by a circuit rider. Increase plan review or inspection capacity with third-party assistance. Provide a traveling circuit rider and trainings in different areas or virtually to aid with individual assistance and ease travel burdens. Host Collaborative meetings in multiple locations or virtually.

Barrier 6: Resource constraints
Description: Perceived high cost of testing and/or meeting energy code
Opportunity: Provide education to enforcement officials and align them with other code officials through the Collaborative to build confidence to uniformly enforce the code. For builders, provide education to correct false assumptions about the "high cost" of energy efficiency. Develop guides and targeted trainings showing how full compliance can be met at little or no cost. Utilize feedback from Collaborative members in the industry to credibly verify this information directly.

11 Prior Actions/Key Learnings

11.1 2018-2019 Illinois Energy Code Compliance Studies

In August 2018, MEEA was contracted by ComEd, Ameren Illinois, Nicor Gas, North Shore Gas and Peoples Gas to collect and analyze data as part of a statewide study ("Studies") of code compliance and energy use in newly constructed buildings. This information included in-field data collection to study both residential and commercial energy code compliance, and for the convening of a stakeholder group (the Illinois Energy Code Compliance Collaborative) to build relationships with the local construction industry and gain insight into the reasons for non-compliance. The goal of the Studies was to establish a baseline of energy code compliance and identify missed energy savings due to noncompliance. The Studies included suggested recommendations for future utility programs that can improve energy code compliance. The Studies can be found in Appendix I - 2018-2019 Illinois Energy Code Compliance Studies.

Commented [JH35]: Barriers 1, 2, 3 and 4 are essentially the same. I think it would be cleaner/clearer if you present an individual barrier with several approaches to addressing it.

Commented [JS36]: Also remind that energy codes are required by law (whether statewide or by jurisdiction) Theoretically, aren't the laws being broken if energy code is not being enforced?

Commented [AL-M37R36]: There is debate amongst Illinois code officials on this, even though it is in fact law. This is addressed in Barrier 3.

Commented [AR38]: This may be more relevant with COVID-induced changes; e.g., related to ventilation system design/operation

Commented [JS39]: May want to also consider occupant comfort and how code compliance can assure occupants are comfortable thermally and with regards to adequate light levels and/or glare from daylighting (or over daylit spaces).

Commented [AR40]: This may also be a municipal/jurisdictional leadership issue; staff will focus on what they are told to focus on. Are there incentives/penalties for full compliance or noncompliance?

Commented [AL-M41R40]: There are not penalties and we couldn't afford incentives for this program. But maybe we could be creative.

Commented [AR42]: Resources will likely be even more constrained in the 1-2 years following COVID shutdowns.

Commented [AR43]: Good – need to make trainings low cost, short, and accessible.

Commented [JH44]: This is covered on page 5 under "opportunity background"

11.2 Illinois Energy Conservation Code

At the beginning of the Studies, the Illinois Energy Conservation Code in force was the 2015 International Energy Conservation Code (2015 IECC) with minor amendments. The energy code applies to newly constructed residential and commercial buildings, as well as most additions and rehabilitations, although the Studies only included new construction. Beginning July 2019, the Illinois Energy Conservation Code was updated to the 2018 version of the IECC. The differences between the 2015 IECC and 2018 IECC did not require any changes to the Studies' data collection effort. The code is mandatory statewide and is to be enforced in all jurisdictions. Jurisdictions are allowed to adopt a more efficient commercial code, but the residential code is a min/max code[7] with no weakening or strengthening amendments allowed with an exception for municipalities with a population of 1,000,000 or more. They are allowed to adopt an energy code or amendment that is equivalent to or more efficient than the Illinois Energy Conservation Code. The City of Chicago (the only municipality with a population over 1,000,000) has historically chosen to adopt the Illinois Energy Conservation Code with only slight modifications[8].

11.3 Multifamily Studies

High-rise[9] multi-family buildings were included in the commercial study; low-rise multifamily buildings were not included as part of the Studies. A low-rise multi-family building study that includes Illinois is currently being funded by DOE. The results of that study will be reviewed when completed, and, if appropriate, integrated as part of this implementation plan.

11.4 Permitting and Enforcement

While the requirements of the Illinois Energy Conservation Code are mandatory statewide, code enforcement happens at the local level and the stringency and structure of enforcement varies from jurisdiction to jurisdiction. Typically, a jurisdiction will permit and inspect for energy code compliance with their own personnel. In cases where a building is located outside of city limits, enforcement may fall to the county. In other cases, a jurisdiction may contract its permitting and/or inspections to a neighboring jurisdiction or another third-party.

Jurisdictions will review the permit application (drawings, calculations[10], other required information), and if necessary, require revisions prior to approving a plan and granting a construction permit. Actual construction is not allowed prior to permit acquisition, and

[7] A "min/max code" does not allow any jurisdiction to enforce as baseline a code that is more or less stringent than itself; it is the "minimum" and "maximum" that can be enforced.
[8] The City of Chicago has amended the city energy code to include a "Cool Roofs" provision for commercial buildings of a certain size and roof type.
[9] High-rise multi-family in the energy code is defined as over 3 stories in height, and falls under the commercial provisions of the energy code.
[10] Including but not limited to energy modeling, compliance software such as REMrate or Comcheck, lighting power density, Manual J, S and/or D, etc.)

Commented [JS45]: What does min/max code mean? Not entirely clear if munis w/pop greater then 1M can implement more stringent code. Pls elaborate/clarify.

Commented [JS46]: May want to clarify footnote to state "4 stories and higher" instead as "more than 3 stories".

Commented [AL-M47R46]: They mean different things. A building could be four stories, but have 1 story of commercial and 3 stories of residential. In that case, the 3 stories of residential would follow the residential energy code, and the 1 story would follow the commercial code. If there were four stories of residential, they would follow the commercial energy code. (This is only true for energy codes, which is why MF is often confusing .)

Commented [AR48]: Are there any measurements of compliance rates at the local level? Is there any enforcement/review mechanism for local jurisdictions enforcement of codes?

Will there be any targeting of jurisdictions with lower compliance levels or efforts to assess compliance by jurisdiction (to help future targeting)?

Commented [AL-M49R48]: Right now – no there is not jurisdiction level compliance rates that could be called statistically significant. But jurisdiction level outreach would be an initiative.

Commented [JS50]: Did previous studies indicate these situations as an area of noncompliance? Slipped through the cracks in a sense since responsibility may be unclear?

Commented [AL-M51R50]: Unsure about previous studies. We found them due to permits being pulled through them. Often these smaller entities hire outside or join forces with other jurisdictions for enforcement if they don't have their own available resources.

Commented [JS52]: What kind of calculations?

Does this submittal include the compliance documentation too? I assume so but not clearly state.

Can you provide examples of other required information?

Commented [AR53]: And delays in this process can be extremely costly to TM1 actors.

delays in this process can be extremely costly to TM1actors. Once construction starts, jurisdictions also require formal inspections in order to allow construction to proceed. In residential construction there are typically three inspections – foundation, framing, and final. However, for proper energy code enforcement there should be a fourth inspection at the insulation stage (between framing and final). If there are code failures at any of the inspections, the code official has the authority to require repairs or even stop construction until compliance is achieved. For commercial construction the overall process is similar, with additional critical plan reviews and inspections required for electrical and HVAC. However, the methods of permitting naturally also vary by jurisdiction and depending on building type and size. Activities designed around enforcement agencies will be particularly important to effectively increase compliance rates with the energy code.

11.5 IL Energy Codes Compliance Collaborative

An energy codes compliance collaborative is a group of industry stakeholders that meet on a regular basis to explore common interests and address obstacles related to energy code compliance. With the benefit of utility funding, the Illinois Energy Code Compliance Collaborative (Collaborative), began meeting in 2017 and has continued through 2019. Participants included code officials, architects, engineers, builders, subcontractors, energy raters, manufacturers, utilities, energy efficiency organizations, ASHRAE, ICC, and city, county, and state representatives. The Collaborative helped identify reasons for non-compliance as well as recommendations for future compliance assistance, which are included as part of this Implementation Plan.

11.6 Existing Compliance Assistance

By statute, the state of Illinois is required to provide some level of training when a new or updated code is adopted. This work is currently facilitated through the IL EPA Office of Energy, who has contracted with the Sustainable Energy Design Assistance Center (SEDAC) to provide trainings[11]. This statewide energy code training has been in place for many years and focuses on technical changes between code editions rather than direct issues of proven non-compliance with existing codes. This is a meaningful distinction. As an analogy, one approach is like telling everyone "this is the new speed limit" while the other approach explains why we need speed limits, the benefits of safe driving for car and driver, and specific ways to improve driving skills. The approaches are complementary, and both are necessary if the goal is to be achieved. Indeed, the baseline studies found that even though technical code change training has been provided for years, there was still significant non-compliance with measures that had been unchanged for multiple code cycles, such as duct sealing and insulation for residential buildings and lighting for commercial buildings. This implementation plan lays out the activities to increase code compliance. All activities included in the Code Compliance Program will be coordinated with SEDAC and IL EPA to complement and leverage their existing assistance. No other entities in Illinois have significant or sustained

[11] https://smartenergy.illinois.edu/energy-code

Commented [JH54]: As a former builder, this is not my experience. I have built homes in four states and some remote job sites and all had rebar inspections, framing inspections, plumbing rough, electrical rough, insulation, drywall, plumbing finish, electrical finish, HVAC, and overall finish inspections as well as leach field and water line inspections and sometimes others as well.

Commented [AL-M55R54]: It varies by jurisdiction in Illinois. Those three are minimum. I'm glad your experience has been different. I don't know if this matters, but there are less code officials now as many have been retiring.

Commented [AR56]: Is pursuing a 4th inspection any part of this Code Compliance Program?

Further down, the plan indicates insulation and duct sealing are the measures with most savings potential with compliance improvements. Are there any activities in this plan to consider this 4th inspection?

Commented [AL-M57R56]: Good point. Talking about this as a critical component was intended to be included, but I will make that explicit here.

Commented [AR58]: But the plan doesn't seem to weight activities toward this market. Equal number of trainings for TM1 and TM2, and training targets only 71 TM2 actors compared to 112 TM1 actors.

Commented [AL-M59R58]: They were weighted by the amount of builders and code officials we think we can reach; we think we can reach more people in the building/design/contracting industry as there are just more of them.

Commented [JH60]: This is already covered at the top of page 10

Commented [AL-M61R60]: It was suggested by someone else that this be included in this section as well, since this is a continuous of the previous work.

Commented [JS62]: Can you include these measures somewhere in the plan to help reader understand challenges?

energy code compliance improvement programs at this time, but if others are identified, the Code Compliance Program will coordinate with those organizations.

12 Planned Activities for the Implementation Plan Period

The implementation plan period is January 2021 through December 2024, with the intention for the program to continue on a six-year cycle[12] . The Implementation Plan period is based off the Illinois state energy code adoption cycle; the new energy code[13] will likely go into effect in early 2022 and the subsequent energy code three years later. For this reason, it is *very important* that the program begins as soon as possible to capture the maximum savings before the next code is in place; a later start will result in missing claimed savings. The program will revise the curriculum to reflect any new code changes in 2022, but the program elements and dissemination will likely not need to change except in the unlikely event that the energy code becomes less efficient (e.g., there will still be lighting requirements, and those that needed lighting compliance assistance will still need it even with a new code.) With any energy code update, the energy savings will need to be adjusted with any changes. Based on feedback from the Collaborative and data gathered in the field for both studies, the Project Team has outlined the following recommendations for the Code Compliance Program.

13 Program Activities

The Energy Code Compliance Improvement Program outlined below includes five activities for both the residential and commercial sectors – Collaborative, Circuit Rider, Targeted Training, Resources, and Jurisdiction Assistance. Their descriptions, deliverables, and budget allocation are summarized in this section. Optional enhanced program options are also described after the main program activities.

Table 1. Summary of Program Activities

Activity	Description
Collaborative	Stakeholder engagement, program dissemination and feedback
Circuit Rider	Enforcement industry and construction and design industry visits, participation in industry groups, phone and email support
Targeted Training	Classroom, in-field, webinar

Commented [AR63]: How will the program handle the upcoming energy code update – anticipated to go into effect in early 2022?

Commented [AR64]: Does the plan include any approach to assess/measure which of the activities were more/less effective in improving compliance?

Commented [AL-M65R64]: There will be evaluations and surveys used by program participants on effectiveness as one measure. When this happened in Kentucky, we found that the Circuit Rider had by far the biggest impact on improving compliance for residential. These surveys can be reviewed by the Delphi panel to determine and weight their effectiveness, if desired.

[12] Program elements will likely remain the same but the components may be adjusted based on the next study's results. See section 20, on Evaluation.

[13] Illinois will adopt the 2021 IECC as the next energy code. The 2021 IECC is roughly 10% more energy-efficient than the 2018 IECC (for both residential and commercial). The state often makes amendments during the adoption process so it is not certain to be adopted in full. The adoption process will begin in 2021 and go into effect within six months of its adoption. This six-month planning period would allow for curriculum development for the new code.

Resources	Website, checklists, field guides, FAQs, pocket guides, short videos
Jurisdiction Assistance	Plan review and software training, supporting use of third-party specialists in code compliance

13.1 Collaborative

The Energy Code Compliance Improvement Program will convene the Illinois Energy Codes Compliance Collaborative on a regular basis to provide stakeholder engagement, disseminate the training and education materials developed by the program, and solicit ongoing feedback to improve program offerings and effectiveness. Information provided to the Collaborative can also be used as an entry point for other utility programs. The Collaborative will meet quarterly, and meetings will be held across the state. Meetings will also be available via teleconference. Smaller meetings to address specific issues or topics may also be suggested and held. Periodic surveys will query effectiveness of the Collaborative, value of energy code compliance, and personal changes to energy code compliance practices.

Activity: Generating support from stakeholders through the Energy Codes Compliance Collaborative (TM1 & TM2)

Outcomes:

- Municipalities & jurisdictions recognize value of code compliance (TM2)
- 90% of net program savings achieved (TM1)
- Majority of major builders require general contractors to participate in trainings (TM1)

Deliverable: Minimum 4 Collaborative meetings a year

Budget: 15% of total

13.2 Circuit Rider

The program will hire one (1) full-time energy code expert OR two (2) half-time energy code experts to proactively engage builders, sub-contractors, building departments, designers, energy raters, supply houses, and others in the residential building industry. The circuit rider will travel to all parts of the state to meet with stakeholders in their place of business, or on the jobsite, to provide individualized assistance. The circuit rider will provide information about the types of non-compliance typically found, offer practical solutions to improving compliance, and discuss any specific issues or concerns the stakeholder may have about energy code compliance. The circuit rider can answer questions about specific projects or generally about the energy code. The circuit rider is typically someone with past building industry experience or with existing relationships in the building industry. The circuit rider will target approximately 4 in-person small group meetings with stakeholders per year, and 8 one-on-one meetings per month, resulting in 96 individual meetings per year and 4 additional small group meetings. Periodic surveys

Commented [AR66]: How is this measured?

Are you expecting participation of municipal officials/staff in the collaborative?

Commented [AL-M67R66]: If they start teaching their staff that energy codes need to be enforced. We will also have post-program surveys on the importance of energy code enforcement/compliance. And yes, we would expect different levels of jurisdictional staff to attend.

Commented [AR68]: How is this measured?

Commented [AL-M69R68]: Additional compliance study or it can be estimated with a Delphi panel or surveys as in the case with RI/MA between compliance studies.

Commented [AR70]: Is this person available "on call" for code support as well?

Commented [AL-M71R70]: Yes.

Commented [AR72]: 8/month x 12 months/year + 4/year = 100 meetings per year

Commented [AL-M73R72]: Thanks.

will query effectiveness of the Circuit Rider, their perceived value of energy code compliance, and personal changes to energy code compliance practices.

Each Circuit Rider will have five main duties.

- To provide individualized training and consultation to building departments, builders, design professionals and others involved in the construction industry
- To provide short (1-2 hour) trainings to small groups, particularly in rural areas
- To disseminate materials
- To generate interest in targeted trainings and other aspects of the program
- To collect and share information gathered from stakeholders about specific challenges with compliance – e.g. biggest knowledge gaps, cost concerns, material/resource issues, etc. to help inform and shape content, training, and compliance strategies

Activity:

- Dedicated circuit rider outreach to TM1 and TM2 to conduct in-person meetings to address specific compliance concerns, provide information about types of non-compliance, and offer information about solutions to improve compliance.

Outcomes:

- Municipalities & jurisdictions recognize value of Code Compliance Program (TM2)
- 90% of net program savings achieved (TM1)
- Majority of major builders require general contractors to participate in trainings (TM1)

Deliverable: Circuit rider(s) will conduct 4 in-person small group meetings with stakeholders per year, and 8 one-on-one meetings per month, resulting in 96 individual meetings per year (and 4 total quarterly small group meetings). Some meetings may become virtual if needed; with at least 48 meetings with TM1 and 48 meetings with TM2.

Budget: 39% of total

13.3 Targeted training

Targeted training and education through different delivery mechanisms, including classroom, in-field, and online training. Most participants stated they would prefer trainings of less than 4 hours and within a 100-mile drive of their location. Continuing education credits are important to many participants. The trainings will be developed as an initial step in the program in order to assure proper messaging and content. MEEA will develop the training curricula in association with the training partner, circuit rider and funding utilities to ensure a consistent focus and format, regardless of the trainer. Some trainings may become virtual if needed. Post-training surveys will query effectiveness of the targeted trainings, their estimated value of energy code compliance, and personal changes to energy code compliance practices. The trainings will also offer short quizzes at the end to test attendee understanding.

Commented [AR74]: Consider adding to this collecting and sharing information gathered from stakeholders about specific challenges with compliance – e.g. biggest knowledge gaps, cost concerns, material/resource issues, etc… to help inform and shape content, training, and compliance strategies

Commented [AL-M75R74]: Great idea. This IS what they do, but wasn't explicitly stated. Thanks.

Commented [AR76]: Is there any scheduling coordination with the SEDAC trainings organized by the state?

Commented [AL-M77R76]: Yes, all efforts will be coordinated with SEDAC.

Commented [AR78]: How is this measured?

Commented [AR79]: Logic model indicated 48 meetings each with TM1 and TM2 stakeholders

These trainings should be customized for different audiences and for the residential and commercial sectors. The following are examples of training topics in different target markets:

Code Officials and Jurisdictions: Measures of non-compliance (not just an overview of energy code requirements and changes); Building science training to improve understanding of potential health issues associated with improper ventilation; How to look for proper insulation and duct sealing techniques at the proper construction phase; Performance-pathway compliance; Manual J and Manual D requirements; Nuances of energy code requirements; and Statewide energy code permitting requirements.

The Design and Construction Industry: Measures of non-compliance(not just an overview of energy code requirements and changes); Building science training to improve understanding of potential hazards associated with improper ventilation; Proper insulation and duct sealing techniques; Performance-pathway compliance; Manual J and Manual D requirements; Hands-on duct sealing best practices; Statewide energy code permitting requirements; Actual costs versus the perceived costs of energy efficiency.

Activity:

- Classroom, in-field, and online trainings for TM1 & TM2

Outcomes:

- Municipalities & jurisdictions recognize value of code compliance (TM2)
- 90% of net program savings achieved (TM1)
- Majority of major builders require general contractors to participate in trainings (TM1)

Deliverables: Develop and administer 8 in-person trainings per year (4 commercial and 4 residential) across various target markets. These will be a combination of in-field and in-person trainings, with the option to make them virtual or record them for future use.

Budget: 27% of total

13.4 Resources

The program will include an interactive website with resources such as compliance checklists, field guides, FAQs, pocket guides, short videos on specific compliance measures, and links to code requirements. It will also include information about upcoming trainings, Collaborative meetings and minutes, and utility programs. These resources will be developed for specific target markets; some will be developed to address Illinois-specific non-compliant measures within a building-as-a-system framework. Periodic surveys will query effectiveness of the Resources, their perceived value of energy code compliance, and personal changes to energy code compliance practices.

Commented [JS80]: These outcomes are identical to those for the Circuit Rider trainings. Do you have an idea of anticipated contribution of each of these two trainings to overall outcomes/goals listed here?

What are the main differences in activities between the two? It appears to be delivery approach of one-on-one circuit and targeted classroom trainings. Activities appear very similar. Perhaps project specific assistance is offered in the circuit rider session since one-on-one?

Some thoughts for consideration:

It seems the document could use additional description of compliance issues. For example, is the compliance documentation being prepared accurately by the energy consultant and the projects meets code as-designed, but then the building is constructed differently than indicated in the compliance documentation/plans and this is not being caught in inspection?

Or is the compliance documentation preparation process in bad shape overall, with errors and oversights that are not being caught by the enforcement agencies?

Seems issues related to "designed to code" and "built to code" could be expanded upon in this document and used to develop the trainings.

Commented [AR81]: Are there measurable participation goals?

Commented [AR82]: Are there ALSO in-field and online trainings?

Commented [JS83]: Different site than https://smartenergy.illinois.edu/energy-code? Or will you create a new and expanded website?

Commented [AL-M84R83]: It will be new and different – focusing on specific elements of necessary compliance improvement. We will work with SEDAC to be included in their materials.

Activity: Production and dissemination of technical assistance resources and trainings (online resources, help line, and website) (TM1 & TM2)

Outcomes:

- 90% of net program savings achieved (TM1)
- Majority of major builders require general contractors to participate in trainings (TM1)

Deliverables: Set up and maintain interactive website. Develop residential and commercial compliance checklists, field guides, FAQs, pocket guides. Curate short videos on specific compliance measures.

Budget: 6% of total

13.5 Jurisdictional Assistance

The program will provide technical assistance to improve enforcement skills for jurisdictions. This could include training for how to conduct plan reviews efficiently and effectively, how to interpret and check required documentation (modeling report, Manual J calculation, third-party inspection report, etc.), learn critical aspects of field verification of energy code, and what documentation a jurisdiction should be requiring and why. To address the issue of lack of resources for a jurisdiction, this program will also support the use of third-party specialists in code compliance, potentially resulting in some attendees being able to provide support to multiple jurisdictions (this is the choice of the jurisdiction; many have expressed interest and or already allow it). Some assistance may happen virtually if needed. Periodic surveys will query effectiveness of the Jurisdictional Assistance, their perceived value of energy code compliance, and personal changes to energy code enforcement practices.

Activity:

- Classroom, in-field, and online trainings for TM2
- Energy modeling documentation and compliance report interpretation support for TM2

Outcomes: Municipalities & jurisdictions recognize value of code compliance (TM2)

Deliverable: Provide training on technical enforcement and review assistance for 20 jurisdictions a year

Budget: 13% of total

14 Education and Training Elements

14.1 Residential Elements

The Project Team recommends an integrated support program within a building-as-a-system framework. The program would focus on improvement of the specific non-compliant measures from the residential key items surveyed and addresses challenges identified through data collection and the Collaborative.

Commented [JS85]: To me, it seems that HERS field verification related training is critical component aspect of the Circuit and Targeted trainings that will improve the "Built to code" aspect of compliance. It inherently captures design aspects not incorporated into as-built too.

HERS raters are 3rd party people usually not affiliated with jurisdictions.

Commented [AL-M86R85]: Yes, we hope to involve HERS raters. However, according to our study, only 7% of projects are using HERS for compliance in Illinois.

Commented [JS87]: Specialists?

Commented [AR88]: If focus is on enforcement skills and resources, why is TM1 included here?

Include in this list the 3rd-party specialist support for jurisdictions

Commented [JS89]: See minor suggested edit in track changes.

Commented [AR90]: Why not include an outcome around compliance levels?

The residential data collection and analysis concluded that the following measures hold the most energy savings potential in the single-family residential new construction across Illinois if energy code compliance were improved. The Project Team recommends that a support program focus on improvement of these specific measures:

- Above-grade wall insulation R-value and quality
- Ceiling insulation R-value
- Foundation insulation R-value and quality (heated basement wall insulation only)
- Duct leakage
- Envelope air leakage (ACH50) – blower door testing
- Mechanical ventilation

14.2 Commercial Elements

The commercial data collection and analysis determined that the following measures hold the most energy savings potential in commercial new construction across Illinois if energy code compliance were improved. The Project Team recommends that a support program focus on improvement of these specific measures, both in plan review and in construction and installation :

- Daylighting and interior lighting controls
- Exterior lighting
- Various HVAC controls and functional requirements
- Envelope insulation

15 Key Market Progress Indicators

Outlined below are the Key Market Progress Indicators for the Codes Compliance Program for evaluating the success of the activities during the first year of the program period. These can be continued through following years, or updated as needed based on program feedback and success.

- Quarterly CC Collaborative meetings held (TM1 & TM2)
- Circuit Rider meets with TM1; 48 meetings per year
- Circuit Rider meets with TM2; 48 meetings per year
- 112 Builders and Designers trained (TM1)
- 70 officials trained (TM2)
- Training on technical enforcement and review assistance for 5 jurisdictions/quarter
- Third-Party Specialists supporting code compliance (TM1 & TM2)
- Dissemination of technical assistance resources and trainings (code books, online resources, help line, and website) (TM1 & TM2)
- Increased perception of value of energy code compliance based on surveys (TM1 and TM2)
- Improved compliance of energy code measures through changes made by TM1 and TM2 based on surveys from program participants

Commented [AR91]: Where the compliance issues related to design/plan specifications or actual construction/installation?

Commented [AL-M92R91]: We didn't find many for residential.

Commented [JS93]: These are all likely issues with construction. E.g., in California, 3rd Party HERS raters can and should capture construction deficiencies and/or deviances from plans. This ties into the need identified earlier about a fourth inspection to capture quality insulation.

Commented [AL-M94R93]: I agree.

Commented [AR95]: Were the compliance issues related to design/plan specifications or actual construction/installation?

Commented [AR96]: Could these include some more direct measurement of compliance? How do we know that these CCP activities are effecting change?

Commented [AR97]: Per year?

Commented [AR98]: Per year? What % of the enforcement community is this?

Commented [AR99]: What is the measure?

Commented [JH100]: What about actual code compliance levels?

Commented [AL-M101R100]: We won't be able to assess that until another compliance study is completed. Until then, we can use surveys to indicate progress.

16 Timeline

The timeline of this program may vary depending on the construction season and recent statewide energy code changes. For these reasons, it is suggested this program be started as soon as possible to capture the maximum available potential energy savings identified in the baseline studies and before the effective date of the next code change. Residential trainings typically have the most participation from the building industry and jurisdictions outside of peak construction season (May-September), whereas some commercial trainings can also be offered during that time. The timeline for this implementation plan budget is 4 years, beginning January 2021 through the end of December 2024. The new state energy codes will go into effect in January 2022 and January 2025. In order to achieve maximum savings, this program should continue through the first code update but the curriculum and savings potential will need to be adjusted for the code update. Overall program structure such as trainings, circuit rider deployment, and Collaborative could remain the same. The program could then continue to run on the same cycle of every six years. It is suggested that a new compliance field study be conducted along that same cycle (every six years) to determine potential energy savings and help inform compliance improvement.

Commented [AR102]: Trainings/technical support/etc occur throughout 2021… but new energy code goes into effect in Jan 2022. Will the trainings focus on or include aspects of the 2022 energy code?

Commented [AR103]: Was there any consideration of spot checks on compliance? Perhaps by one of the hired technical assistance personnel?

Commented [AL-M104R103]: Good idea. I don't think this program has the budget right now.

17 Gross Technical Potential Savings Analysis

The following technical potential energy savings are based off results from the 2018-2019 Illinois Energy Code Compliance Studies (Appendix I - 2018-2019 Illinois Energy Code Compliance Studies), broken down by residential and commercial potential.

17.1 Residential Energy Savings Potential for Illinois

Using methodology described in the Illinois Energy Code Compliance Studies Report (Appendix I), the statewide gross technical savings potential through improved code compliance is approximately 5.49 million kWh and 2.36 million therms for a single year of new construction starts (Table 2).

Table 2. First Year Gross Technical Residential Savings Potential for Illinois

Residential 1st Year Savings		
Gross Technical Potential	**Electricity (kWh)**	**Gas (therm)**
	5,487,539	**2,364,759**

17.2 Commercial Energy Savings Potential for Illinois

Using methodology described in the Illinois Energy Code Compliance Studies Report (Appendix I - 2018-2019 Illinois Energy Code Compliance Studies), the total estimated annual statewide technical savings potential through improved code compliance is approximately 7.9 million kWh and approximately 107,700 therms (Table 3).

Table 3. First Year Gross Technical Commercial Savings Potential for Illinois

Commercial 1st Year Savings

Gross Technical Potential	Electricity (kWh)	Gas (therm)
	7,894,134.90	107,734.91

18 Estimating Net Program Savings

At time of this writing, Illinois utilities have no accepted singular model for claiming and attributing savings from code programs, although utilizing the Delphi Panel Process is specified as one available option. Additionally, the Illinois SAG is in the process of determining how best to claim and attribute savings related to MT initiatives. Thus this Implementation Plan may not be able to determine exact potential achievable and attributable savings for the Code Compliance Program. However, a range of potential savings can be estimated by looking at processes of similar programs. In short, Net Program Savings typically equal the Achievable Savings of the Gross Technical Potential, multiplied by the Attribution caused by the impact of the utility program. In a multi-utility statewide program, Allocation amongst utilities also needs to be considered.

18.1 Achievable Savings of Energy Codes Programs

The first step to estimating the Net Achievable Savings is to determine if 100% compliance can be achieved, per measure and overall. Erring on the side of conservatism, we believe it is unlikely to achieve and/or be able to prove 100% overall compliance, but that something close might be achievable. Washington state, who administers a statewide energy code compliance improvement program, estimates that they have achieved 98% compliance overall over time. Although IL and WA are different states, we could hope that over time, a compliance improvement program in Illinois could achieve 98% compliance. We could then assume that 2% of the total energy savings would likely not be achievable, and would need to remove that amount of Gross Technical Potential for claimed savings.

18.2 Delphi Panels vs. Method Used in This Plan

The amount of improvement achieved is typically determined through data collected during the program implementation, including stakeholder surveys and even post-program compliance field studies similar to the Studies. When calculating *estimated* savings, a Delphi panel can help provide probable potential for improvement as deemed by industry stakeholders. For this exercise, the Studies provide the baseline from which to improve upon, similar to RI and MA baseline studies. Rhode Island and Massachusetts then both utilized a Delphi Panel process in order to estimate the highest achievable compliance for their region as part of understanding their Net Achievable Savings. MEEA did not have the resources to administer a full Delphi Panel for the purposes of this MT Implementation Plan, but instead conducted discussions internally with staff that have Illinois buildings and energy efficiency expertise to create estimations. We recognize that this method is not necessarily considered best practice (when compared to a full Delphi Panel Process) but with the timeline and resources that were available, it was the best option to provide information to an Implementation Plan. That said, MEEA chose conservative estimates when available in order to not overstate energy savings potential and minimize bias. These conservative estimates

Commented [JH105]: Would you include numbering for sections and sub-sections? It makes it much easier to reference.

Commented [AL-M106R105]: Absolutely. Done.

Commented [AR107]: Shouldn't all be "achievable" since compliance is technically required by law? What do we defined as not achievable?

Commented [AL-M108R107]: I agree with you, but others claim you will never be able to prove that 100% compliance has been achieved.

Commented [JH109]: Is the situation in WA similar enough to IL to support this assumption?

Commented [AL-M110R109]: We would hope that over time, Illinois will have a long-standing code compliance improvement program that runs as long as WA. We chose this number because it wasn't 100% - which we feel could not be justified.

Commented [JH111]: This is an accepted methodology. However, the baseline studies did not include current compliance levels.

Commented [JH112]: Incomplete sentence

may be one reason why other energy code compliance improvement programs may seem to be able to capture more energy savings. A full post-program evaluation process would determine the correct amount of claimable savings. We recommend that for the official post-program evaluation, "Delphi panelists should be made up of subject matter experts who have no stake in the outcome."

18.3 Comparison of Estimating Illinois Net Program Savings to Rhode Island Method

One method for estimating the Net Program Savings is the Rhode Island model. These estimated savings focus solely on compliance improvement. Net Program Savings are determined by multiplying the Attribution Score by the Gross Technical Potential, as demonstrated by Figure 2. Estimating net program savings for an IL Energy Code Compliance Improvement Program is slightly different than the Rhode Island model.

While the outline includes many important considerations, many items of the "Assess Attribution" column were approached differently in Illinois. "Determine Code Compliance Improvement" used estimates provided by MEEA staff rather than actual compliance improvement numbers or an actual Delphi Panel. "Assess measure categories relative importance" is already included in the methodology of Gross Technical Potential savings calculations of the Studies and does not need to be considered here. "Identify training focus and reported improvements" are again approximations provided by MEEA without concrete data as the program has not yet been implemented. The step of "Examining changes to the code estimate baseline in absence of the Program" is further explained in the Attribution of Energy Code Programs in Illinois section 18.5. NOMAD and Efforts of Other Organizations will also be assumed as having already quantified existing during the time of the Studies and we do not anticipate increased support from these sources; we will assume these factors as having minimal impact, or too complex to make an estimated change as defined by the Illinois SAG MT Workgroup and thus use a 1-2% declined savings credit every year like Rhode Island did (also further explained in the Attribution section 18.5).

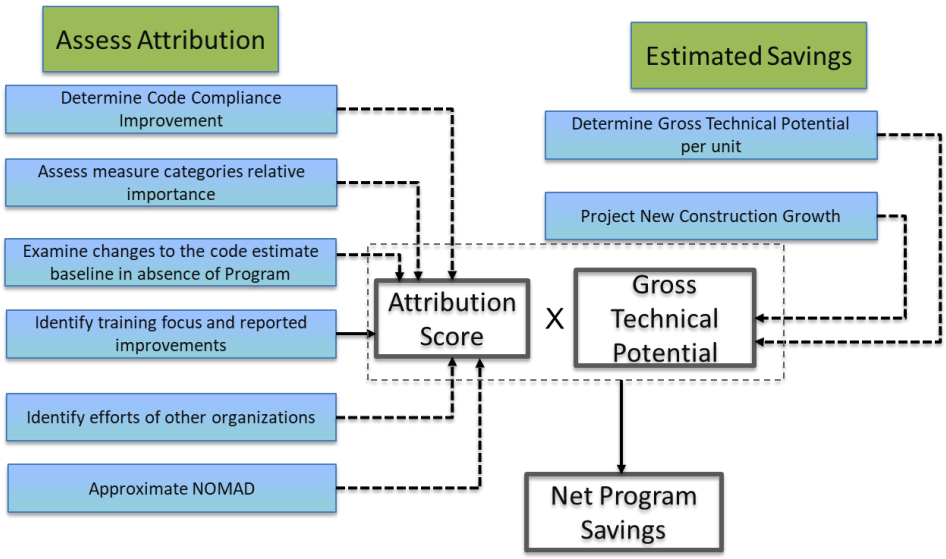
Figure 2. Rhode Island Program Attribution and Savings. Source: Rhode Island CCEI Attribution Study.

Commented [JH113]: RI does an attribution score. MEEA does not intend to do this

Commented [AL-M114R113]: No.

Commented [JH115]: You are saying there would not have been any natural market adoption? Compliance levels DO improve on their own over time.

Commented [JH116R115]: They are going to decrease the potential by 1-2%. This number comes from RI



Rhode Island CCEI Attribution and Saving Study

The "Estimated Savings" column of Figure 2 is very similar to work done by the Studies in Illinois. The Gross Technical Potential was calculated based on the amount of compliance from field study data for each measure (unit) and multiplied by annual projected new construction growth.

Commented [JH117]: Where is the explanation for how you got from gross technical potential to net program savings?

18.4 Illinois Achievable Savings

To estimate the Achievable Savings potential for this Implementation Plan, MEEA staff conducted an internal review (see Sections 18.1 and 18.2) of the likely increase in compliance for each measure. For residential, these estimates were based off the measures, data, and savings calculations of the residential US DOE PNNL studies. The measures, data, and savings calculations from Madison Engineering and Cadmus were used for the commercial provisions[14]. The compliance percentages are based on the number of compliant measures compared to the total number of data collected for that measure; these percentages were the starting point above which compliance improvements were then estimated. MEEA internally surveyed staff on the maximum potential compliance achievable from January 2021 through the end of 2024 for each measure. Much like the process used in a Delphi Panel (but not a true Delphi Panel), staff members individually rated each the likely increase in percentage for each measure. All results were tallied, shared with the team, discussed, and then adjusted if needed. One change to the initial survey results was to increase compliance gradually over time, rather than the steeper trend of the original responses. This information was

Commented [JH118]: Surveying staff to estimate the likely increase in compliance for each measure is not an industry best practice.

Commented [JH119]: Members of the Delphi panel should be subject matter experts with no conflict of interest in the outcome.

[14] Both the US DOE PNNL methodology and the methodology used by Cadmus and Madison Engineering weight the measures by amount of energy impact.

then again reviewed and discussed internally, compared to past studies in other states, compared against the likelihood of compliance improvement[15] for that measure, and considered against the ability of support mechanisms to impact compliance. The numbers were then adjusted to reflect conservative estimates. The numbers were readjusted further to decrease the overall savings potential each year by 1 percent to create a declining savings credit (see Section 18.5.2).

Some areas of residential compliance are believed to be more easily achievable than others; this includes improvements to the installation quality of wall, ceiling, and foundation/basement insulation, proper amount of insulation in the ceilings, and high-efficacy lighting. One area that may be more difficult or take longer to improve is achieving the proper prescriptive amount of wall insulation. Most builders were installing R-13 when the requirement is R-20; it would either take changing to a 2"x6" framed wall from the typical 2"x4" construction in Illinois or using a more expensive blown foam insulation to meet this requirement. Other nearby states have successfully moved to 2"x6" construction as the code progressed, but MEEA decided to estimate conservatively for this measure. Overall, the individual measure improvements estimated for the residential energy code ranged from improving by 3.7% to 41.3% through 2024. The average percentage of compliance improvement estimated through 2024 was 21.85%.

This number (21.9%) is even on the conservative end of compliance improvement seen in the first eight US DOE Residential Energy Code Compliance Improvement studies. These studies captured an average savings potential of 38.7% and a median savings potential of 25.4% across eight states. The studies conducted a baseline field study, implemented an improvement program for two years, and conducted another field study to measure these results. The proposed work outlined in this Implementation Plan is based on the items in that improvement program.

On the commercial side, the biggest potential compliance improvements were shown in measures with complex calculations or use of software. We believe with proper instruction and education that these areas could improve, and that the trend will follow the number of people trained and jurisdictional assistance received. For this reason, we also estimated conservative improvements over time. Overall, the individual measure improvements estimated for the commercial energy code ranged from improving by 0.5% to 17% through 2024. The average estimated total percentage of commercial compliance improvement likely to occur through 2024 was around 3.5%. (See Appendix VIII – Commercial Net Program Savings).

These estimated compliance improvements for each measure give a range of the amount of Gross Technical Potential that is achievable and available for a utility-sponsored program through the end of 2024. Based on the internal review and

Commented [AL-M120]: •

Commented [JH121]: Where did you get a number for this?

Commented [AR122]: Will there be any effort – even qualitative, e.g., through surveys of contractors – to track progress against these compliance estimates?

Commented [AL-M123R122]: Yes, they've been included elsewhere.

Commented [JH124]: ?

Commented [JH125]: ?

Commented [JH126]: Batts will never be installed well

Commented [AL-M127R126]: We were able to improve them substantially in KY

Commented [JH128]: This is a proven methodology. Is this what MEEA is proposing?

Commented [AL-M129R128]: Yes.

Commented [JH130]: How is this relevant?

Commented [JH131]: Where do these estimates come from?
In order for the savings to stand up to evaluation, all numbers must be defensible. And when sources are not firm, must err toward the conservative.

Commented [AL-M132R131]:

Commented [AR133]: Worth the cost?

[15] "Likelihood of compliance improvement" refers to internal discussion about how likely certain measures were to increase in compliance based on industry perception, cost, and ease of change. For example, a high cost change may result in a compliance number lowering after internal discussion about the likelihood of compliance improvement.

considering savings calculations, potential areas for improved compliance, and past studies, we concluded that 39-71% (average 55%) is a reasonable estimated achievable range across measures of the Gross Technical Potential of the Residential Savings, and that 20-58% (average 34%) is a reasonable estimated achievable range across measures of the Gross Technical Potential of the Commercial Savings (See Appendix VIII – Commercial Net Program Savings). In addition to these estimates, we decreased the available potential by 1% for a declining savings credit each year to provide a conservative estimate making up for NOMAD (See Section 18.5.2).

The Illinois Energy Conservation Code will be updated through the 3-year adoption cycle sometime in 2021, and go in effect in 2022. The model 2021 International Energy Conservation Code, which has not been officially finalized by the International Code Council, is currently estimated to be around 10% more energy efficient than the 2018 IECC. If adopted, some new measures may provide an opportunity for increased savings potential; others may have no change. However, Illinois currently has amended the residential 2018 IECC to be weaker than the model code. Based on previous Illinois adoption processes, it is unlikely the residential 2021 IECC will be adopted to its fullest efficiency. For this reason, MEEA has chosen to not speculate on changes to the upcoming code, and to give conservative estimates on potential likelihood of achievable savings. As mentioned earlier, a 1% declining savings credit has been included each year (See Section 18.5.2).

18.5 Attribution of Energy Code Programs in Illinois

The next step to estimating Net Program Savings is determining the amount of Achievable Savings that can be attributed to the intervention of a utility program. Determining the net portion of savings is conceptually different for codes compliance than for traditional utility programs. A codes program generates energy savings when a building enters the market or undergoes a major renovation. A traditional new construction utility program can claim savings from activities that improved efficiency above a determined baseline, usually the established energy code. A codes compliance improvement program will claim savings of increased compliance above a pre-established baseline and up to the enforced energy code, minus the other market influences (see Figure 3). In this case, the baseline was determined by the Studies and the enforced energy code is the Illinois Energy Conservation Code. Determining Attribution is done by separating these program effects from other market influences. The potential market influences and a method for identifying their influence are discussed below.

This implementation plan asserts that as long as no new non-utility energy code compliance support is introduced over what was already implemented during the Studies, the utilities should be able to attribute a high percentage of the Net Achievable Savings to the Codes Compliance Program. Items that should be considered when determining attribution to the utility program include the Natural Market Baseline, existing New Construction Utility programs (free ridership), and Other Outside Efforts.

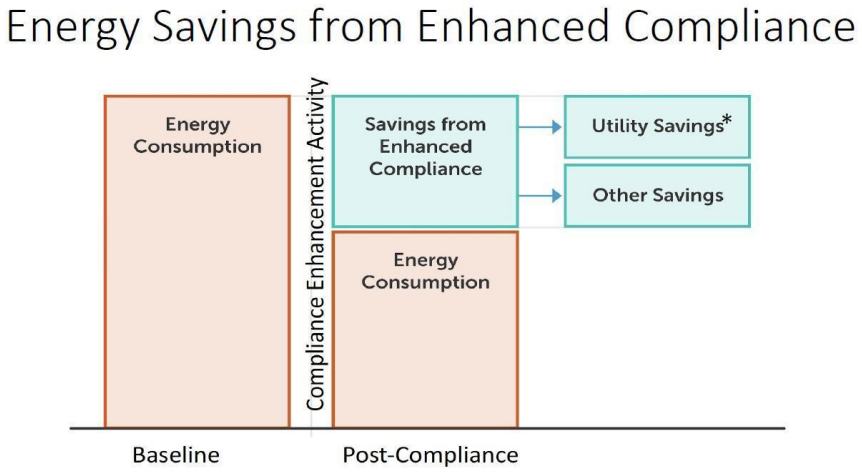
Commented [AR134]: So only ~11% achievable compliance improvement for Residential?

Commented [AR135]: So only ~1% of achievable compliance improvement for commercial?

Commented [AL-M136]:
- "Decreased the available potential by 1% for a declining savings credit each year" (pg. 25).
  - No reasoning was provided for this. Is this because the new code may be weaker than the model code?

Commented [AL-M137R136]: According to the IL SAG memo, when NOMAD cannot be predicted, a reasonable response is to apply a declining savings credit to offer a conservative estimate. This number (1%) was applied to potentially capture market adoption that might naturally increase compliance, which was shown in RI/MA. While this was used in RI/MA, it is important to note that the state of Illinois does not have the same code as RI/MA, and that certain measures may already be at top market compliance with no chance to move without intervention. This is why estimates are used, and it's not labeled "NOMAD."

Figure 3. Energy Savings from Enhanced Compliance.



*Note intersection with Attachment A of TRM Volume 4 Section 5.4 on NTG for code compliance

18.5.1 Free Ridership and New Construction Programs

According to the IL Draft MT Savings in the Technical Reference Manual section (below), New Construction Programs (free ridership) does not need to be calculated in the estimated Net Program Savings. This is even more clear in the case of a Codes Compliance Program which is aiming to capture savings below the typical baseline established for New Construction Programs.

18.5.2 Natural Market Baseline

According to the IL Draft MT Savings in the Technical Reference Manual section (below), the Natural Market Baselinemust be subtracted from the savings potential, and is determined by imagining how the market would change without a utility program. The natural market has been functioning without this utility support for decades in the codes compliance space in Illinois. It is difficult to speculate what percentage the market has already moved without utility assistance with compliance because the energy codes have changed every three years and compliance studies that have been conducted do not use the same methodology. However, we can look at a previous study using a similar methodology to ours, such as Rhode Island, and assume something similar for estimation purposes. Illinois does not currently have data on the annual market compliance rates, but using what Rhode Island used, we can assume a 1% decrease each year. This 1% declined savings credit has been included and subtracted in the Net Achievable Savings. We can also assume a conservative estimate

of attribution, as suggested by the TRM section 18.5.4 below; this has been estimated at 90% (see Section 18.5.4).

18.5.3 Other Outside Efforts

It is unlikely that any new additional energy code compliance assistance will begin during the Codes Compliance Program other than the IL EPA/SEDAC state energy code support that has already existed for some time, and was in place during the Studies. It is also difficult to speculate what impact any new outside efforts could provide with any certainty.

18.5.4 Illinois Draft MT Savings in the Technical Reference Manual

Excerpt of the Illinois Draft MT Savings in the Technical Reference Manual (2020 IL TRM v8.0 Vol. 4_June 20, 2019_DRAFT)[16]:

"The Natural Market Baseline is a forecast of the future in which no utility-funded energy efficiency programmatic intervention exists. Natural Market Baseline is removed from the Total Market Savings to ensure that the savings counted from ratepayer activities do not include savings that would have occurred without the utility funded programs. This is the MT version of "attribution" and no further adjustment for free riders is needed. As discussed earlier in the [TRM] paper, attribution can typically only be established qualitatively for MT initiatives, yet under the policy framework in place in Illinois, a net savings figure must be determined. Subtracting the Natural Market Baseline from Total Market Units is the mechanism by which this is accomplished. Once an initial forecast has been made, the focus of evaluation efforts turns to building a case over time as to whether sufficient evidence exists to establish a link between program activities and market effects that are consistent with that forecast. As discussed below, depending on the body of evidence that emerges over time, the initial forecast for both Total Market Units and the Natural Market Baseline may be revised periodically. In addition, quantitative adjustments may be made to allocate total net savings between sponsors or between MT and RA programs as discussed later. In principle, subtracting the Natural Market Baseline from total market units yields by definition an estimate of total net savings. However, depending on the specifics of the regional policy framework and the individual initiative, further adjustments could be called for. One example would be a situation in which policymakers or stakeholders simply wish to build some conservatism into MT savings claims to reflect the greater uncertainty surrounding attribution compared to RA programs. Another example would be a situation in which it appears that some other public intervention not directly connected to the MT initiative or reflected in the Natural Market Baseline, is likely to have contributed to the progress of the market. Such further adjustments for attribution could be either deemed up front, negotiated after the fact, or determined by an oversight agency such as a regulatory commission."

For the purposes of this Implementation Plan, it is proposed that most new energy code compliance improvement in Illinois could be attributable to a utility program because

[16] https://s3.amazonaws.com/ilsag/MT_Savings_Paper_Final_08-23-2019.pdf

there is likely currently little to discount for Natural Market Baseline, free ridership, and Other Outside Efforts, and there is no current data to calculate what is occurring naturally. This Implementation Plan will assume more conservative attributions than speculating the claimed savings will be equal to the total Achievable Savings. For this reason, we will use 90% of the Net Achievable Savings as the claimable Net Program Savings, with the understanding that this number should be revisited if the situation changes. The Gross Technical Potential totals attributable to the Codes Compliance Program are below.

Commented [JH138]: I don't follow how you arrive at the conclusion that there is no natural market adoption?

18.6 Illinois Residential Estimated Claimed Savings

MEEA estimated that the average overall maximum total compliance improvement could improve from around 60% to around 82%, with a total of 50-51% of the Gross Technical Potential to be achieved by the end of 2024 if calculated on an incremental annual basis for the four program years. See Appendix VII – Residential Net Achievable Savings. Table 4 demonstrates that these total net achievable savings are around 1,207,800 therms and 2,767,500 kWh. When multiplied by the Attribution discussed earlier, the total incremental Net Program Savings for four years is around 1,087,000 therms and 2,490,000 kWh (Table 5).

Commented [JH139]: Where did these numbers come from?

Commented [AR140]: How do these numbers compare to the estimates of achievable potential above?

Table 4. Yearly & Total Incremental Net Program Achievable Savings - Residential Code Compliance January 2021 through end of 2024

Units	GTP	2021	2022	2023	2024	Net Achievable
therms	2,364,458.04	219,329.79	364,485.81	360,681.52	263,332.98	1,207,830.10
kWh	5,487,539.40	566,313.11	805,082.10	815,116.77	581,001.12	2,767,513.10

Table 5. Yearly & Total Net Attributable Program Savings - Residential Code Compliance January 2021 through end of 2024

Units	GTP	2021	2022	2023	2024	Net Program
therms	2,364,458.04	197,396.81	328,037.23	324,613.37	236,999.68	1,087,047.09
kWh	5,487,539.40	509,681.80	724,573.89	733,605.10	522,901.01	2,490,761.79

18.7 Illinois Commercial Estimated Net Claimed Savings

MEEA estimates the average overall maximum total compliance improvement could improve from around 89-92% to around 95.75%, with a total average around 41% of the Gross Technical Potential possible to be achieved by the end of 2024. See Appendix VIII – Commercial Net Program Savings (Table 23, Table 24). Table 6 demonstrates that the total net achievable first year savings are around 46,600 therms and 3,882,000 kWh.

Table 7 shows the estimated Attributable Savings that the utilities could claim for the Codes Compliance Program for commercial savings; using first year savings only.

Table 6. Yearly & Total Net Achievable Savings - Commercial Code Compliance January 2021 to 2025

Units	GTP	2021	2022	2023	2024	Net Achievable
therms	107,734.91	10,444.85	13,138.87	12,496.62	10,564.86	46,645.20
kWh	7,894,134.90	806,667.75	1,152,613.39	1,063,159.44	859,383.99	3,881,824.57

Table 7. Yearly & Total Net Attributable Program Savings - Commercial Code Compliance January 2021 through end of 2024

Units	GTP	2021	2022	2023	2024	Net Program
therms	107,734.91	9,400.36	11,824.99	11,246.96	9,508.37	41,980.68
kWh	7,894,134.90	726,000.98	1,037,352.05	956,843.50	773,445.59	3,493,642.11

18.8 Implementation Plan Savings – Cumulative Persistent Savings

This Implementation Plan estimates that savings captured through the Codes Compliance Program should not only be counted cumulative and persistently, but also through the life of the measure as the market continues to be transformed through the increase of compliance. The length of each measure life was taken from the Illinois Technical Reference Manual (TRM), Volume 8.0; some assumptions had to be made for measures not present in the TRM. Please see Table 21 and Table 27 in the Appendices for more information on measure life used in these calculations. Table 8 demonstrates the total estimated Net Program Savings using a cumulative persistent calculation for the life of each measure through the program years at 90% Attribution.

Commented [JH141]: are you planning to count savings by measure, or by overall compliance level?

Commented [AL-M142R141]: By measure.

The total Net Program Savings for electricity using a cumulative persistent calculation for the life of each measure through the program years of January 2021-December 2024 and an Attribution rate of 90% is 78,608,668 kWh. This includes around 48 million kWh for residential savings (43 million kWh at 90% Attribution). Using the same savings calculation methodology for commercial electricity yields an additional 39,376,257 kWh of Net Achievable Savings (around 35.4 million kWh at 90% Attribution).

The total Net Program Savings for gas are estimated to be around 27,490,000 therms when calculated in the same manner as the net program electric savings. Residential gas savings are around 30 million therms of Net Achievable Savings, with around 27.4 million therms attributable to the utility program at 90% Attribution. Commercial gas savings add around 84,200 therms (75,788 therms at 90% Attribution).

Table 8. Total Estimated Net Program Savings - Cumulative Persistent Through Lifetime of Measures

	Electricity (kWh)		Gas (therms)	
	Residential	**Commercial**	**Residential**	**Commercial**
Total Cumulative Persistent 2021-2024 for Measure Life	**47,966,707.42**	**39,376,256.87**	**30,460,426.25**	**84,208.86**
90% Attribution	**43,170,036.68**	**35,438,631.19**	**27,414,383.62**	**75,787.97**
Total Net Program Savings	**78,608,668 kWh**		**27,490,172 therms**	

18.9 Allocation of IOUs in Illinois

The allocation of attributable Net Program Savings between the participating utilities will need to be determined by the utilities and the IL SAG. For code programs, allocation can be influenced by the number of new construction starts and/or the amount of money the program administrator is contributing to the overall program budget. There are five options for determining allocation for the MT SAG TRM paper[17]. The split that was used for the 2018-2019 field studies could be considered here (Table 4). These cost sharing percentages were determined by the utilities based on overall energy efficiency budget.

Commented [JH143]: The amount of $ paid in does not seem to be corelated with savings. Savings allocation should be by number of rate payers in the service territory, or as you point out, construction starts is even better.

Table 9. Budget Split for Previous IL Energy Code Compliance Studies Work

ComEd	Nicor	PG&NS	Ameren
0.6537	**0.0749**	**0.0587**	**0.2127**

19 Program Budget

Below is the estimated budget for the Code Compliance Program as outlined in this Implementation Plan. It includes both residential and commercial aspects of the program for one year, 18 months, and 4 years of the program. It does not include the cost of program evaluation, but does include the cost of creating and administering participant surveys that may assist with evaluation.

[17] https://s3.amazonaws.com/ilsag/SAG_MT_Policy_Issue_Recs_Memo_Final_for_MT_WG_with-stakeholder-comments-2.12.20.docx

Table 10. Budget Estimates for Various Program Lengths

Illinois Statewide Code Compliance Program Budget Estimate			
	12 months Jan-Dec 2021)	18 months (Jul 2020-Dec 2021)	48 months (Jan 2021-Dec 2024)
PROJECT TOTAL	**$ 417,755.40**	**$ 626,633.10**	**$ 1,671,021.60**

20 Program Evaluation

Although MEEA has developed initial estimates of the potential energy savings as indicated above, future evaluation is required to properly determine the true effect of the Code Compliance Program. This program will include an evaluation in collaboration with the evaluators of the utilities. Evaluation will occur every three years (the Delphi panel would happen every three years, and the in-field compliance assessment would happen every 6 years). The method of evaluation, measurement, and verification will ultimately be determined by the evaluators and the IL SAG. However, Illinois can learn from other utilities that have already established how to conduct these evaluations. Some methods to help with evaluation (such as surveys) have been included as part of the program work in this Implementation Plan.

Based on the processes implemented in California and Rhode Island, we suggested incorporating a Delphi panel process to the evaluation in order to include direct expertise from the design, construction, and enforcement fields into the measurement and verification process. A potential evaluation framework and special considerations for Illinois are also outlined below. The steps and information outlined above for Estimating Net Program Savings, should also be considered for evaluation.

20.1 Potential Evaluation Approach

A California evaluation[18] consisted of the following steps: For each measure, the evaluation team first estimated the technical *potential savings* that would result if all new homes met the code for that measure. Next, the team adjusted for compliance to determine *gross savings*. Next, the team determined the *net savings* by adjusting for naturally occurring market adoption (NOMAD) of energy-efficient units[19]. The NOMAD adjustment factor accounts for customers who would have built to the energy code absent the code compliance improvement program. Then to determine the *net program savings*, a panel of independent experts (Delphi panel) developed an attribution adjustment to account for the Codes Compliance Program's effect on compliance. Finally, the team allocated net savings to the IOUs based on one of the allocation methodologies presented above.

Commented [AR144]: Table 11 below suggests the Delphi panel (to determine attribution) would happen every three years, and the compliance assessment would happen every 6 years.

Commented [AR145]: Is the goal to measure overall compliance at these intervals and/or evaluate specific effects of the compliance program or program components? If the latter, evaluation should be planned w/ implementation.

Commented [HH146]: It would be helpful to include the study citation.

Commented [AR147]: This first step involves significant data collection and analysis to assess the total potential savings.

Commented [JH148]: This is a good summary

[18] https://pda.energydataweb.com/api/view/2279/Final%20Report%20CS%20Attribution%20Study%20July%205%202019.pdf

[19] This would be similar to accounting for "free ridership"

Table 11 outlines considerations for Illinois using the "Assess Attribution" method as outlined in Figure 2, the Rhode Island CCEI Attribution approach. When program evaluation is eventually conducted in Illinois, these items should be considered by the evaluation team.

Table 11. Attribution and Evaluation Considerations in Illinois

Steps	Residential	Commercial
Determine actual code compliance improvements	Baseline study approximately every 6 years; use Delphi panel every 3 years	Baseline study approximately every 6 years; use Delphi panel every 3 years
Assess measure categories' relative importance and assign weight	• REM/Rate Model • US DOE Field Studies • Illinois 2018-2019 Field Studies	• PNNL Checklist • US DOE Field Studies • Illinois 2018-2019 Field Studies
Examine changes to the code to estimate baseline compliance in the absence of the program	Depends upon energy code. Illinois update occurs every 3 years; next goes into effect in early 2022 but official changes won't be available until state adoption process is finished (2021)	Depends upon energy code. Illinois update occurs every 3 years; next goes into effect in early 2022 but official changes won't be available until state adoption process is finished (2021)
Identify Codes Compliance program impacts, such as training focus and areas where trainees reported improvements	• Hours of training provided • Surveys from participants • Interview of Code officials • Online trainings available	• Hours of training provided • Surveys from participants • Interview of Code officials • Online trainings available
Identify efforts of other organizations that may have contributed to improved compliance	• Existing resources by ICC, SEDAC and IL EPA • Only needed if existing efforts changed since field studies	• Existing resources by ICC, ASHRAE, SEDAC and IL EPA • Only needed if existing efforts changed since field studies
Approximate NOMAD	Depends upon energy code. Illinois update occurs every 3 years; next goes into effect in early 2022 but official changes won't be available until state adoption process is finished (2021)	Depends upon energy code. Illinois update occurs every 3 years; next goes into effect in early 2022 but official changes won't be available until state adoption process is finished (2021)

20.1.1 Delphi Panel Process

The project team recommends that evaluators set up a Delphi panel process to help inform improved compliance and calculate savings that can be attributed to the Code Compliance Program. A Delphi panel is a group of experts in the new construction and codes industry that reviews evidence and information and develops compliance numbers through a consensus-building process. A Delphi panel can be used to provide feedback on program success, compliance levels reached, and program attribution. This process has been used in Rhode Island, Massachusetts, and California. Depending on complexity, the Delphi process itself can take just a few days to reach consensus,

Commented [HH149]: Just so I'm clear, who is the evaluation team for this effort? Above it sounds like the utility's evaluation teams would be consulted, but I assume this is being conducted by a different entity?

Commented [AL-M150R149]: It could be either; that decision is not mine to make.

Commented [JH151]: What is the overall cost estimate for implementation including evaluation, Delphi panels and baseline studies?

Commented [AL-M152R151]: Evaluation cost would need to be determined by the evaluators and would depend on their process. This is merely a suggestion. The Delphi panel process and baseline studies would depend on that evaluation process.

Commented [HH153]: Seems like this should a subheading under Potential Evaluation Process as opposed to at the same level.

Commented [HH154]: Would help to be clearer on what type of "numbers" you're talking about here (i.e., specifically what are we estimating).

with two to three iterations being the norm. To avoid bias issues, members of the Delphi panel cannot be employees of the Program Administrators or the Program implementation contractor. There may also be separate panels for Residential and Commercial sectors. Below is an example of potential panel representation we suggest, based on the panel representation from Massachusetts.

Table 12. Potential Delphi Panelist Representation

Panelist Representation Category	Number of panelists
Building efficiency consultants working in IL	5
Building efficiency consultants working outside of IL	2
Code officials working in IL	3
Utility new construction program managers outside of IL	1
Evaluators working nationally	2
Other – mix of local and national efficiency experts	3
Total	15

Commented [JH155]: This applies to MEEA's staff estimates in this document as well.

Commented [AR156]: Consider whether there should be separate panels for Residential and Commercial.

Consider aligning panel expertise with the compliance areas that most effect energy savings.

Commented [AR157]: Do these represent TM1 actors?

Commented [AR158]: 20% of the panel – who are these folks?

20.2 Evaluation cost

The cost of evaluation will be determined by the evaluator based on the final evaluation scope. Costs could include the cost of the evaluation team's time and resources, and facilitation and coordination of the Delphi panel. The cost of compliance field studies should be included every six years; these costs may end up being lower than the initial baseline field studies because the methodology has now been created. The cost of the compliance field studies could also be shared with Energy Code Advancement Programs, as is conducted in Rhode Island and Massachusetts.

20.3 Cost-Effectiveness Considerations

The Illinois SAG MT TRM Working Group has drafted a few options for determining cost effectiveness in MT programs. This draft states:

In determining a utility's portfolio cost-effectiveness, Illinois's Total Resource Cost (TRC) Test will be applied to market transformation initiative costs and energy savings the same way it is applied to traditional resource acquisition or other current forms of energy efficiency programming. Traditionally, the utilities only count measures performed within the relevant 4-year energy efficiency cycle during which they occurred. In the case of MT initiatives, utilities will report two TRC evaluations to the ICC: 1) the total EE portfolio with MT initiatives included and 2) the total EE portfolio without MT initiatives both for the full four-year period.

a. *The utilities will individually calculate, track and report estimates of MT initiative performance to-date as well as future anticipated costs and savings.*

There are a few considerations when calculating cost-effectiveness for the Illinois Codes Compliance Program. The first is that the typical Incremental Costs included in the TRC calculation should not apply to a codes compliance program; i.e., the Incremental Costs should be zero. This is because a code is a law, and it applies to every builder and

building being constructed. Building to code should be included in the cost of any project and it should not incur any additional costs that are passed onto the occupant; theoretically every builder and designer is working from the same set of minimum requirements. If there is a point where Incremental Costs should be included with an energy code-related program, it might be at the point of adoption if an energy code is made more energy-efficient. Even this stage could arguably be zero because the floor is still being raised for the entire market; cost-effectiveness is also often a criteria already considered during the energy code development and adoption process.

The second consideration for a cost-effectiveness calculation is the measure life used. For the estimated cumulative claimed savings stated in this paper, the length of each measure life was taken from the IL TRM Version 8.0, with a few assumptions made for measures that are not currently in the TRM. That information can be found in Table 21 and Table 27 in the Appendices.

21 Appendix I - 2018-2019 Illinois Energy Code Compliance Studies

(This takes up a lot of space, and will be added in the final draft)

22 Appendix II - Illinois Comparison to Rhode Island and Massachusetts

Rhode Island and Massachusetts have been mentioned frequently in this report. The table below compares the population, new construction starts, and energy codes of Illinois to Rhode Island and Massachusetts.

Table 13. Illinois Comparison to Rhode Island and Massachusetts

		Rhode Island	Massachusetts	Illinois	Notes
Population	Statewide	1.057 million	6.902 million	12.74 million	
New Construction Comparisons	Residential (permits 2018)	936	7,169	10,041	https://www.census.gov/construction/bps/txt/tb2u2018.txt
	Commercial (January 2019)	$45,822	$766,377	$506,103	Most recent available data for one month of construction costs
	Commercial (New starts 2016)	32	333	483	CMD data 2016 - all new permits
	Commercial (sq.ft. 2016)	1,344,037	31,167,505	35,995,144	CMD data 2016 - total sq.ft. of all new permits
Code During Last Study	Residential	2012 IECC	2009 IECC, 2012 IECC	2015 IECC	2009 to 2012 = 20% EE increase; 2012 to 2015 = 8% EE increase; 2015 to 2018 = 1-2% EE increase
	Commercial	2012 IECC	2012 IECC	2015 IECC	
Current Code	Residential	2015 IECC	2018 IECC	2018 IECC	
	Commercial	2015 IECC	2018 IECC	2018 IECC	
Compliance Rate	Residential	83%	not calculated	62%	Compliance rates are calculated differently. IL is not weighted for each measure, for example.
	Commercial	70%	88-94%	88%	

Commented [AR159]: What units are these?

Non-compliant Measures	Residential	Ceiling insulation, mechanical ventilation, lighting, ducts	High-efficacy Lighting (19% compliance), Ducts (91% in unconditioned space with only 21% compliance), roof and basement r-values, all insulation quality	Envelope R-values and insulation quality, duct tightness, some lighting	
	Commercial	n/a	Daylighting controls, mechanical	Daylighting, lighting controls, mechanical controls, some envelope	
Projected Claimed Savings	Residential	Results estimate that the 2018-2020 residential new construction gross technical potential (GTP) savings will be 5,576 MWh for electric and 327,582 therms for gas. Using the residential attribution estimates, the estimated three-year net savings for electric and gas are projected to be 608 MWh and 35,812 therms, respectively.	3,988 MWh and 357,073 therms Gross Technical Potential for program year* with 0.96 to 1.10 NTG ratios for next 3 years	1 year 5,487 MWh and 2,364,759 therms Gross Technical Potential; claimed savings n/a	*Table 7 of "Residential New Construction and CCSI Attribution Assessment (TXC48)"
	Commercial	The projected 2018-2020 commercial new construction in GTP savings will be 2,338 MWh for electric and 28,955 therms for gas. Based on the commercial attribution estimates, the three-year electric and gas savings are estimated at 815 MWh and 10,099 therms, respectively.	Projected three year savings of 69,501 Mwh and (2,363) therms	1 year 7,894 MWh and 107,000 therms Gross Technical Potential; claimed savings n/a	There is negative therm savings because of increased lighting efficiency. See Table 19 of "Massachusetts TXC47 Non-Residential Code Compliance Support Initiative Attribution and Net Savings Assessment, 2018"

23 Appendix III - Comparison of Illinois, Massachusetts, and Rhode Island Commercial Energy Code Compliance Programs

Table 14. Comparison of Illinois, Massachusetts, and Rhode Island Commercial Energy Code Compliance Programs

Comparison of Illinois, Massachusetts, and Rhode Island Commercial Energy Code Compliance Programs				
Commercial Compliance Measures	**Illinois**		**Massachusetts**	**Rhode Island**
Envelope provisions	88% compliant with 2015 IECC	91% compliant with 2015 IECC	80-91% compliant with 2012 IECC	70% compliant with 2012 IECC
Mechanical provisions (MP), including HVAC equipment and system requirements		95% compliant with 2015 IECC	92-95% compliant with 2012 IECC	
Lighting, lighting controls, and electric provisions (LLC)		83% compliant with 2015 IECC	93-96% compliant with 2012 IECC	
Savings Attribution	n/a		GTP during 2017 and 2018 was 48% and 46% respectively. The estimated proportion of GTP savings projected to be achieved during 2019–2021 is between 42% and 45%. GTP is savings available from achieving 100% compliance.	As projected, the 2018-2020 commercial new construction in GTP savings will be 2,338 MWh for electric and 28,955 therms for gas. Based on the commercial attribution estimates, the three-year electric and gas savings are estimated at 815 MWh and 10,099 therms, respectively.
Commercial Savings Potential (GTP)	7,920 MWh and 103,000 therms (1 year)			2,338 MWh and 28,955 therms (3 years)
Savings Attributable to Program	n/a		Projected three year savings of 69,501 Mwh and (2,363) therms	815 MWh and 10,099 therms

Commented [AR160]: Helpful to reader to keep columns in the same order as previous table.

24 Appendix IV - Comparison of Illinois, Massachusetts, and Rhode Island Residential Energy Code Compliance

Table 15. Comparison of Illinois, Massachusetts, and Rhode Island Residential Energy Code Compliance

Comparison of Illinois, Massachusetts, and Rhode Island Residential Energy Code Compliance							
State	*Climate Zone (CZ)*	*Wall R Cavity*	*Wall Quality*	*Ceiling R*	*Ceiling Quality*	*Basement R Wall Cavity*	*Basement Quality*
Illinois	CZ4 and CZ5 (statewide)	6% R-20 cavity	27% met Grade I	18% met R-49	79% met Grade I	72% met R-13	36% met Grade I
Massachusetts	CZ5	72% (R-20 cavity or R-13+5; only 2 homes used continuous)	8% met Grade I; 90% are Grade II	27% met R-49	56% met Grade I	43% met R-15/19	7% met Grade I; 50% are Grade II
Rhode Island	CZ5	Most met the R-value requirement of R-20; only 5% used continuous	10% met Grade I; 74% are Grade II	Most don't meet; average is R-38	5% met Grade I; 44% Grade II; 50% Grade III	17% met R-15/19	No Grade I insulation
State	*Climate Zone (CZ)*	*DuctTightness Unconditioned*	*DuctTightness ALL*	*ACH (50)*	*Lighting*	*Window U*	*Construction Practices*
Illinois	CZ4 and CZ5 (statewide)	Only 4 homes in the sample had ducts in unconditioned space. 80% of those complied with 4 cfm requirement.	5% of total homes (conditioned and unconditioned) met 4 cfm	90% met 4ACH(50)	72% met 75 percent high-efficacy	Average: 0.30	2x4 construction with walk-out basements is most common
Massachusetts	CZ5	91% had some or all ducts in unconditioned space. 21% of those complied.	n/a	58% met 3ACH(50)	19% met 75 percent high-efficacy	Average: 0.30	2x6 construction is common (97%); 36% had no basement insulation. Furnaces are natural gas (64%) or propane (34%) or fuel oil (2%)
Rhode Island	CZ5	only 10% complied with the requirement of 8 cfm	n/a	n/a (no ACH requirement) Should be 3; average is 5.4; only 8% would comply	58% met 75 percent high-efficacy	All meet	2x6 framing with studs spaced 16 inches apart is common (87%)

25 Appendix VII – Residential Net Achievable Savings

Table 16. Residential Achievable Savings Estimates January 2021 through December 2024 Based on Code Compliance Improvement

A	B	C	D	E	F	G	H	I	J	K	L	M
Jan 2021 to 2025	Gross Technical Potential		Estimates for Residential Compliance Improvement								Net Achievable Savings	
Measure	Total kWh	Total therms	Average Compliance in 2018-2019	Through 2021	Through 2022	Through 2023	Through 2024	Average Percentage Improvement		% of GTP	Total kWh	Total therms
Exterior Wall Insulation	2,263,515.84	923,344.92	16.32%	24.00%	35.00%	47.00%	57.63%	41.30%	83.68%	48.57 %	1,099,292.87	448,429.15
Duct Leakage	1,704,768.12	532,030.68	80.49%	82.00%	85.00%	87.50%	89.50%	9.01%	19.51%	45.47 %	775,232.15	241,937.47
Ceiling Insulation	1,678,754.16	477,491.76	49%	56.00%	66.00%	76.00%	81.50%	32.78%	51.28%	63.02 %	1,058,008.06	300,931.57
Heated Basement Insulation	-858,159.36	396,738.00	54.05%	57.00%	65.00%	73.00%	78.38%	24.32%	45.95%	52.07 %	-446,831.05	206,575.68
Blower Door Test	668,327.76	46,403.28	90.48%	91.00%	92.00%	93.50%	94.25%	3.77%	9.52%	38.97 %	260,465.24	18,084.60
High Efficacy Lighting	30,332.88	-11,550.60	72.09%	78.00%	83.00%	88.00%	92.00%	19.91%	27.91%	70.37 %	21,345.83	-8,128.38
Total	5,487,539.40	2,364,458.04	60.36%	64.67%	71.00%	77.50%	82.21%	21.85%	39.64%	50.43 %	**2,767,513.10**	**1,207,830.10**

Table 17. Estimated Net Achievable Residential Electric Savings January 2021 through December 2024

Jan 2021 to 2025	Gross Technical Potential	Annual Electric Savings (kWh) Based on Residential Code Compliance Improvements						Achievable Savings	
Measure	Total kWh	Average Compliance in 2018-2019	Through 2021	Through 2022	Through 2023	Through 2024	Average Percentage Improvement	% of GTP	Total kWh
Exterior Wall Insulation	2,263,515.84	16.00%	207,701.84	294,576.51	318,142.63	278,871.90	41.30%	48.57%	1,099,292.87
Duct Leakage	1,704,768.12	80.00%	132,119.53	259,487.02	214,076.79	169,548.82	9.01%	45.47%	775,232.15
Ceiling Insulation	1,678,754.16	49.00%	238,383.09	324,083.49	320,842.66	174,698.83	32.78%	63.02%	1,058,008.06
Heated Basement Insulation	-858,159.36	54.00%	-55,069.84	-147,917.88	-146,438.70	-97,404.62	24.32%	52.07%	-446,831.05
Blower Door Test	668,327.76	90.00%	36,758.03	69,472.67	103,166.92	51,067.62	3.77%	38.97%	260,465.24
High Efficacy Lighting	30,332.88	72.00%	6,420.46	5,380.29	5,326.49	4,218.58	19.91%	70.37%	21,345.83
Total	5,487,539.40	60.17%	**566,313.11**	**805,082.10**	**815,116.77**	**581,001.12**	21.85%	50.43%	**2,767,513.10**
									90% Attribution
Attributable Total			509,681.80	724,573.89	733,605.10	522,901.01			2,490,761.79

Table 18. Estimated Net Achievable Residential Gas Savings January 2021 through December 2024

Jan 2021 to 2025	Gross Technical Potential	Annual Gas Savings (Therms) Based on Residential Code Compliance Improvements						Achievable Savings	
Measure	Total therms	Average Compliance in 2018-2019	Through 2021	Through 2022	Through 2023	Through 2024	Average Percentage Improvement	% of GTP	Total therms
Exterior Wall Insulation	923,344.92	16.00%	84,726.79	120,165.15	129,778.36	113,758.85	41.30%	48.57%	448,429.15
Duct Leakage	532,030.68	80.00%	41,232.38	80,981.72	66,809.92	52,913.46	9.01%	45.47%	241,937.47
Ceiling Insulation	477,491.76	49.00%	67,803.83	92,179.78	91,257.99	49,689.97	32.78%	63.02%	300,931.57
Heated Basement Insulation	396,738.00	54.00%	25,459.49	68,384.32	67,700.48	45,031.40	24.32%	52.07%	206,575.68
Blower Door Test	46,403.28	90.00%	2,552.18	4,823.62	7,163.08	3,545.72	3.77%	38.97%	18,084.60
High Efficacy Lighting	-11,550.60	72.00%	-2,444.88	-2,048.79	-2,028.30	-1,606.41	19.91%	70.37%	-8,128.38
Total	2,364,458.04	60.17%	**219,329.79**	**364,485.81**	**360,681.52**	**263,332.98**	21.85%	51.08%	**1,207,830.10**
									90% Attribution
Attributable Total			197,396.81	328,037.23	324,613.37	236,999.68			1,087,047.09

Table 19. Estimated Cumulative Net Residential Electric Savings January 2021 through December 2024

Measure	Through 2021	Through 2022	Through 2023	Through 2024	Cumulative Savings through Measure Lifetime
Exterior Wall Insulation	207701.8399	294576.5061	318142.6266	278871.8961	19,210,460.92
Duct Leakage	132119.5293	259487.0175	214076.7894	169548.8172	13,526,340.85
Ceiling Insulation	238383.0907	324083.4906	320842.6557	174698.826	18,400,279.00
Heated Basement Insulation	-55069.83936	-147917.8838	-146438.705	-97404.61985	-7814625.45
Blower Door Test	36758.0268	69472.67065	103166.9159	51067.62338	4,555,999.91
High Efficacy Lighting	6420.4596	5380.29459	5326.491644	4218.581382	88,252.18
Total	**566,313.11**	**805,082.10**	**815,116.77**	**581,001.12**	**47,966,707.42**
					90% Attribution
					43,170,036.68

Table 20. Estimated Cumulative Net Residential Gas Savings January 2021 through December 2024

Measure	Through 2021	Through 2022	Through 2023	Through 2024	Cumulative Savings through Measure Lifetime
Exterior Wall Insulation	84726.7933	120165.15	129778.362	113758.8454	7,818,369.06
Duct Leakage	41232.3777	80981.71988	66809.9189	52913.45577	13,526,340.85
Ceiling Insulation	67803.82992	92179.78427	91257.98643	49689.97361	5,233,632.03
Heated Basement Insulation	25459.488	68384.32128	67700.47807	45031.39611	3,612,800.86
Blower Door Test	2552.1804	4823.620956	7163.07712	3545.723174	316,331.82
High Efficacy Lighting	-2444.877	-2048.787675	-2028.299798	-1606.41344	-47048.37
Total	**219,329.79**	**364,485.81**	**360,681.52**	**263,332.98**	**30,460,426.25**
					90% Attribution
					27,414,383.62

Table 21. Measure Life of Residential Measures used in Cumulative Savings Analysis

Measure	Measure Life (years)
Exterior Wall Insulation	20
Duct Leakage	20
Ceiling Insulation	20
Heated Basement Insulation	20
Blower Door Test	20
High Efficacy Lighting	5

26 Appendix VIII – Commercial Net Program Savings

Table 22. Commercial Achievable Savings Estimates January 2021 through December 2024 Based on Code Compliance Improvement

A	B	C	D	E	F	G	H	I	J	K	L	M
Key Item Description	Electricity (kWh)	Gas (therms)	Average Compliance 2018 - 2019	Delphi Average 2021	Estimated Average 2022	Estimated Average 2023	Delphi Average 2024	Average Percentage Improvement	Percentage of GTP Available	% of GTP	Electricity (kWh)	Gas (therms)
Roof U-Factor	115,411.53	9,525.90	90.00%	91.00%	92.00%	93.25%	94.50%	4.50%	10.00%	45.00%	51,104.21	4,218.07
Wall U-Factor	17,032.04	1,217.44	85.00%	86.00%	88.00%	90.25%	92.50%	7.50%	15.00%	50.00%	8,366.59	598.04
Slab F-Factor	-40,326.38	630.35	92.50%	93.50%	94.25%	94.75%	95.00%	2.50%	7.50%	33.33%	-13,308.38	208.03
Vertical Glazing U-Factor	3,397.74	82.00	97.50%	97.80%	98.00%	98.30%	98.50%	1.00%	2.50%	40.00%	1,346.93	32.51
Vertical Glazing SHGC Non-North	374.38	-63.63	97.50%	97.80%	98.00%	98.30%	98.50%	1.00%	2.50%	40.00%	148.41	-25.22
Interior Lighting Power Density (LPD)	131,369.30	-836.12	95.00%	95.25%	95.35%	95.50%	96.00%	1.00%	5.00%	20.00%	25,765.84	-163.99
Lighting Shut Off Controls	510,841.57	-2,332.39	67.50%	70.00%	74.00%	79.00%	84.75%	17.25%	32.50%	53.08%	266,261.93	-1,215.69
Daylight Responsive Lighting Controls	3,905,054.68	-5,604.13	75.00%	77.00%	82.00%	86.00%	89.50%	14.50%	25.00%	58.00%	2,228,450.15	-3,198.04
Exterior Lighting Power Density (LPD)	2,703,967.01	0.00	77.50%	79.00%	82.25%	85.00%	86.50%	9.00%	22.50%	40.00%	1,066,952.15	0.00
Exterior Lighting Controls	445,084.30	0.00	97.50%	97.75%	97.90%	98.10%	98.25%	0.75%	2.50%	30.00%	132,728.58	0.00
HVAC Shutoff Controls	273,690.93	16,354.84	92.50%	93.00%	93.75%	94.75%	95.75%	3.25%	7.50%	43.33%	116,788.44	6,978.88
HVAC Outside Air (OA) Controls	18,433.98	597.12	90.00%	91.00%	92.50%	93.75%	94.75%	4.75%	10.00%	47.50%	8,627.88	279.48
HVAC Heat Recovery	-298,612.88	94,440.47	90.00%	91.00%	92.50%	93.75%	94.75%	4.75%	10.00%	47.50%	-139,763.49	44,202.15
HVAC Multiple Zone Supply Air Temperature Reset	412,254.23	-18,394.31	95.00%	95.25%	95.50%	96.00%	96.50%	1.50%	5.00%	30.00%	122,241.60	-5,454.28
HVAC Equipment Cooling Efficiency	8,576.08	0.00	95.00%	95.25%	95.50%	96.25%	97.00%	2.00%	5.00%	40.00%	3,362.34	0.00
HVAC Equipment Heating Efficiency	6,909.35	465.30	97.50%	98.25%	98.35%	98.45%	98.50%	1.00%	2.50%	40.00%	2,751.37	185.29

	7,894,134.90	107,734.91	92.28%	94.39%	95.10%	95.84%	95.76%	3.48%	7.72%	33.81%	**3,881,824.57**	**46,645.20**

Table 23. Estimated Net Achievable Commercial Electric Savings January 2021 through December 2024

Commercial Compliance - Illinois		Gross Technical Potential	Net Achievable Potential				
Code Item Category	Key Item Description	Electricity (kWh)	To 2022	To 2023	To 2024	To 2025	Electricity (kWh)
Envelope	Roof U-Factor	115,411.53	11,541.15	11,425.74	14,139.35	13,997.96	51,104.21
	Wall U-Factor	17,032.04	1,135.47	2,248.23	2,503.97	2,478.93	8,366.59
	Slab F-Factor	-40,326.38	-5,376.85	-3,992.31	-2,634.93	-1,304.29	-13,308.38
	Vertical Glazing U-Factor	3,397.74	679.55	269.10	266.41	131.87	1,346.93
	Vertical Glazing SHGC Non-North	374.38	74.88	29.65	29.35	14.53	148.41
Interior Lighting	Interior Lighting Power Density (LPD)	131,369.30	5,254.77	3,901.67	3,862.65	12,746.75	25,765.84
	Lighting Shut Off Controls	510,841.57	39,295.51	62,244.08	77,027.05	87,695.30	266,261.93
	Daylight Responsive Lighting Controls	3,905,054.68	312,404.37	773,200.83	612,375.05	530,469.89	2,228,450.15
Exterior Lighting	Exterior Lighting Power Density (LPD)	2,703,967.01	300,440.78	267,692.73	323,908.21	174,910.43	1,066,952.15
	Exterior Lighting Controls	445,084.30	89,016.86	17,625.34	17,449.08	8,637.30	132,728.58
Mechanical System	HVAC Shutoff Controls	273,690.93	36,492.12	18,063.60	26,824.45	35,408.27	116,788.44
	HVAC Outside Air (OA) Controls	18,433.98	1,843.40	2,737.45	2,258.39	1,788.65	8,627.88
	HVAC Heat Recovery	-298,612.88	-29,861.29	-44,344.01	-36,583.81	-28,974.38	-139,763.49
	HVAC Multi Zone Supply Air Temperature Reset	412,254.23	41,225.42	40,813.17	20,202.52	20,000.49	122,241.60
	HVAC Equipment Cooling Efficiency	8,576.08	428.80	424.52	1,260.81	1,248.20	3,362.34
	HVAC Equipment Heating Efficiency	6,909.35	2,072.81	273.61	270.87	134.08	2,751.37
First Year Achievable Savings		7,894,134.90					**3,881,824.57**
							90% Attribution
Attributable Savings at 90%			**726,000.98**	**1,037,352.05**	**956,843.50**	**773,445.59**	3,493,642.11

Table 24. Estimated Net Achievable Commercial Gas Savings January 2021 through 2024

Commercial Compliance - Illinois		Gross Technical Potential	Net Achievable Potential				
Code Category	Key Item Description	Gas (therms)	To 2022	To 2023	To 2024	To 2025	Gas (therms)
Envelope	Roof U-Factor	9,525.90	952.59	943.06	1,167.04	1,155.37	4,218.07
	Wall U-Factor	1,217.44	81.16	160.70	178.98	177.19	598.04
		630.35	84.05	62.40	41.19	20.39	208.03
	Vertical Glazing U-Factor	82.00	16.40	6.49	6.43	3.18	32.51
	Vertical Glazing SHGC Non-North	-63.63	-12.73	-5.04	-4.99	-2.47	-25.22
Interior Lighting	Interior Lighting Power Density (LPD)	-836.12	-33.44	-24.83	-24.58	-81.13	-163.99
	Lighting Shut Off Controls	-2,332.39	-179.41	-284.19	-351.69	-400.40	-1,215.69
	Daylight Responsive Lighting Controls	-5,604.13	-448.33	-1,109.62	-878.82	-761.28	-3,198.04
Mechanical System	HVAC Shutoff Controls	16,354.84	2,180.65	1,079.42	1,602.94	2,115.88	6,978.88
	HVAC Outside Air (OA) Controls	597.12	59.71	88.67	73.15	57.94	279.48
	HVAC Heat Recovery	94,440.47	9,444.05	14,024.41	11,570.14	9,163.55	44,202.15
	HVAC Multiple Zone Supply Air Temperature Reset	-18,394.31	-1,839.43	-1,821.04	-901.41	-892.40	-5,454.28
	HVAC Equipment Heating Efficiency	465.30	139.59	18.43	18.24	9.03	185.29

First Year Achievable Savings	107,734.91					**46,645.20**
						90% Attribution
Attributable Savings at 90%		9,400.36	11,824.99	11,246.96	9,508.37	41,980.68

Table 25. Estimated Cumulative Net Commercial Electric Savings January 2021 through December 2024

Commercial Compliance - Illinois		Annual Gross Technical Potential		Cumulative Over Measure Life 2021-2024
Code Item Category	Key Item Description	Electricity (kWh)		Electricity (kWh)
Envelope	Roof U-Factor	115,411.53		1,022,084.21
	Wall U-Factor	17,032.04		167,331.80
	Slab F-Factor	-40,326.38		-266,167.51
	Vertical Glazing U-Factor	3,397.74		13,469.31
	Vertical Glazing Solar Heat Gain Coefficient (SHGC) Non-North	374.38		1,484.13
Interior Lighting	Interior Lighting Power Density (LPD)	131,369.30		386,487.64
	Lighting Shut Off Controls	510,841.57		2,130,095.44
	Daylight Responsive Lighting Controls	3,905,054.68		17,827,601.18
Exterior Lighting	Exterior Lighting Power Density (LPD)	2,703,967.01		16,004,282.28
	Exterior Lighting Controls	445,084.30		1,061,828.64
Mechanical System	HVAC Shutoff Controls	273,690.93		1,521,967.15
	HVAC Outside Air (OA) Controls	18,433.98		104,165.32
	HVAC Heat Recovery	-298,612.88		-2,096,452.37
	HVAC Multiple Zone Supply Air Temperature Reset	412,254.23		1,422,420.95
	HVAC Equipment Cooling Efficiency	8,576.08		30,261.02
	HVAC Equipment Heating Efficiency	6,909.35		45,397.66
		7,894,134.90		39,376,256.87
				90% Attribution
				35,438,631.19

Table 26. Estimated Cumulative Net Commercial Gas Savings January 2021 through December 2024

Commercial Compliance - Illinois		Annual Gross Technical Potential		Cumulative Over Measure Life 2021-2024
Code Item Category	Key Item Description	Gas (therms)		Gas (therms)
Envelope	Roof U-Factor	9,525.90		84,361.35
	Wall U-Factor	1,217.44		11,960.81
	Slab F-Factor	630.35		4,160.53
	Vertical Glazing U-Factor	82.00		325.06
	Vertical Glazing Solar Heat Gain Coefficient (SHGC) Non-North	-63.63		-252.25
Interior Lighting	Interior Lighting Power Density (LPD)	-836.12		-2,459.87
	Lighting Shut Off Controls	-2,332.39		-9,725.53
	Daylight Responsive Lighting Controls	-5,604.13		-25,584.35
Exterior Lighting	Exterior Lighting Power Density (LPD)	0.00		0.00
	Exterior Lighting Controls	0.00		0.00
Mechanical System	HVAC Shutoff Controls	16,354.84		69,788.82
	HVAC Outside Air (OA) Controls	597.12		2,794.78
	HVAC Heat Recovery	94,440.47		325.06
	HVAC Multiple Zone Supply Air Temperature Reset	-18,394.31		-54,542.79
	HVAC Equipment Cooling Efficiency	0.00		0.00
	HVAC Equipment Heating Efficiency	465.30		3,057.23
		107,734.91		84,208.86
		9,525.90		90% Attribution
				75,787.97

Table 27. Measure Life of Commercial Measures used in Cumulative Savings Analysis

Commercial Compliance - Illinois				
Code Item Category	Key Item Description	Measure Life	TRM Location	Notes
Envelope	Roof U-Factor	20		
	Wall U-Factor	20	Res 5.6.4	(20 in residential)
	Vertical Glazing U-Factor	10		Does not exist - estimated
	Vertical Glazing Solar Heat Gain Coefficient (SHGC) Non-North	10		Does not exist - estimated
Interior Lighting	Interior Lighting Power Density (LPD)	15		
	Lighting Shut Off Controls	8		
	Daylight Responsive Lighting Controls	8		
Exterior Lighting	Exterior Lighting Power Density (LPD)	15		
	Exterior Lighting Controls	8		
Mechanical System	HVAC Shutoff Controls	10	4.4.41	
	HVAC Outside Air (OA) Controls	10	4.4.41	
	HVAC Heat Recovery	15	4.4.27	(ERVs are 15 years)
	HVAC Multiple Zone Supply Air Temperature Reset	10	4.4.41	
	HVAC Equipment Cooling Efficiency	9	4.4.7	(EnergyStar equipment)
	HVAC Equipment Heating Efficiency	16.5	4.4.11	

Commented [AR161]: Heating & cooling equipment values seem low for larger Commercial HVAC equipment.