ETA
EFFICIENT TECHNOLOGY ACCELERATOR

Codes and Standards Advancement Market Transformation Plan

Center for Energy and Environment

Fall 2024

Contents

INTRODUCTION

Minnesota Efficient Technology Accelerator

Minnesota's Efficient Technology Accelerator (ETA) is a statewide market transformation program that accelerates deployment and reduces the cost of emerging and innovative efficient technologies, bringing lower energy bills and environmental benefits to Minnesotans. ETA is a partnership funded by the state's investor-owned utilities (IOUs), administered by the Minnesota Department of Commerce, Division of Energy Resources (DER), and implemented by Center for Energy and Environment (CEE).[1]

The ETA program has set four overarching goals:

- Create a strategic process to accelerate market deployment of key technologies.
- Employ effective strategies to leverage market forces.
- Become a hub for collaboration among stakeholders.
- Achieve cost-effective energy savings and other benefits for utilities and Minnesotans.

The ETA program develops individual market transformation initiatives for a handful of targeted technologies and approaches, often starting at an early stage of development. The ETA approach involves working closely with market partners and other key stakeholders. Initiatives move through four stages of a life cycle that includes: 1) concept development; 2) program development; 3) market deployment; and 4) long-term monitoring and tracking. Most efforts and resources are spent on the market deployment stage, which is the implementation stage that involves intensive market engagement. Before moving from one stage to the next, an initiative must be vetted and approved by a coordinating committee consisting of the DER and the utilities funding the ETA.

Purpose of this plan

The Market Transformation Plan is the culmination of the program development stage, during which extensive research and planning is done to prepare the initiative for market launch. The purpose of this plan is to summarize key contextual information, lay out the basic program logic and desired end state that informs our market strategy, and present the fundamental market support activities necessary for success. This plan will then guide the development of specific activities each year during the market development phase. By being as transparent in our objectives and strategies as possible, we hope to better facilitate stakeholder engagement and alignment on strategy with key stakeholders, so we can be coordinated and successful in achieving common goals. Supporting and informing this plan are the Market Characterization Report and the Energy Savings and Evaluation Plan (Appendices A and B).

[1] Minnesota Statutes § 216B.241 subd. 14 created the framework for the ETA program, which is funded by Xcel Energy, CenterPoint Energy, Minnesota Energy Resources, Minnesota Power, and Otter Tail Power.

Summary of our approach

This section contains a summary of our approach, including our theory of how we expect to transform the market for codes and standards advancement. While the Plan will cover both energy code and federal appliance standards advancement work, the majority of the work expected to be done and savings to be had exist in the energy code space, so the plan will focus more heavily on code-related work.

Codes and standards set a minimum efficiency level, required by law, that must be met for new construction and renovation (and, in the case of standards, for any equipment replacement as well). Codes and standards advancement has been a core market transformation strategy for decades, as codes and standards enshrine in law the default market practice for a given technology and can result in a substantial acceleration of efficient technology adoption. Achieving a code or standard for a particular technology is the goal for a majority of ETA's current technology initiatives. Thus, there is great synergy between this initiative and other ETA initiatives, and a compelling value proposition for ETA to establish a leading role in energy code implementation in Minnesota.

This initiative will support the adoption of higher-efficiency Minnesota energy codes and federal standards and claim utility savings for the influence utility spending has had in advancing these codes or standards. This will be both through the activities outlined in this report, as well as the influence utilities have already had over the last 20+ years of supporting new technologies through their efficiency programs. These CIP (and now ECO) programs have helped achieve higher market adoption for efficient technologies. Over time, these efficient technologies become commercialized faster, and eventually establish the new baseline, adopted into codes or standards.

Codes

Energy codes in Minnesota are adapted from international model codes through a stakeholder process. In at least the past 15 years of Minnesota's adoption of the energy code, Minnesota has only adopted a weaker code than the model code (from an energy efficiency standpoint) by accepting weakening amendments to the model code. For example, the current Minnesota Residential Energy Code is based in the 2012 IECC but is almost 3% less efficient than the model code. Due to this difference, the DOE classifies Minnesota's current Residential Energy Code as equivalent to the 2009 IECC.[2] While not yet published, initial analysis by the Pacific Northwest National Laboratory (PNNL) for Minnesota's current amended Commercial Energy Code shows that it is less efficient than the ASHRAE 90.1 2019 model code. Minnesota's history of weakening energy codes is due to several perceived and real barriers. Stronger energy codes can lead to higher upfront costs as markets adapt. This is a particular challenge for residential homebuilders because that market is very price sensitive. In addition, the energy code is fairly

[2] Department of Energy, Office of Energy Efficiency & Renewable Energy Building Energy Codes Program, State Portal: https://www.energycodes.gov/state-portal

complex, particularly the commercial energy code. Stakeholders tend to resist advancements that may contribute to the complexity of the energy code, making compliance and enforcement more challenging. Similar challenges exist at the national level for the adoption of appliance standards and could be expected at the state level if a state appliance standards law were to pass.

This stakeholder resistance to change is the single largest barrier for the code advancement initiative. Yet, there are currently few or no resources to address some of the specific concerns that stakeholders cite. Thus, the easiest pathway currently is to adopt weakening amendments for any areas that concern stakeholders, rather than attempting to address those issues.

Our strategy to overcome these barriers centers around two key activities: 1) engage market actors to understand (therefore better address) market barriers and facilitate increased buy-in for code changes and 2) provide technical support for the adoption of new model codes and strengthening amendments and avoid/eliminate weakening amendments. This initiative will leverage recent legislative changes that set aggressive targets for increasing the efficiency of both the commercial and residential energy codes. Despite legislation being passed, the Department of Labor and Industry (the agency in charge of adopting building codes) has not been allocated additional resources to achieve these targets, so they are unlikely to achieve them without assistance. Thus, technical assistance to provide a pathway to achieve state targets is an essential role this initiative can play in advancing the energy code. We will work closely with market actors to identify concerns with particular code changes, and work to address those concerns. We will also leverage recent federal funding opportunities for advancing energy codes. Finally, we will leverage ETA work on building technologies where it makes sense. While code advancement efforts will not be limited to only these technologies, the market data gathered through these initiatives will be invaluable to identifying the right amendment proposals and gaining support for these amendments.

Standards

The U.S. Department of Energy (DOE) is the agency that sets appliance standards. The DOE has a stakeholder-driven process to set standards for a variety of appliances that Congress has given them authority to regulate. While we wouldn't participate in every federal standard process, we will select standards where we have expertise, where there is large energy savings potential, or where we feel we could have strategic influence (e.g., due to cold climate data or other market elements unique to MN that add value beyond typical actors). Like codes, we would influence the process through technical support and stakeholder engagement. Particularly valuable in this process is market data on the adoption of efficient appliances, and we would work with the market and utilities to gather Minnesota-specific data to inform the standards process.

In addition to federal standards, states can also set appliance standards for products not covered under the federal standards. Currently, Minnesota does not have a state appliance standard law allowing for this, but it is being discussed by policymakers. At this point in time, we plan to work only with standards at the federal level. If state standards become a viable option, we will assess whether it makes sense to try and roll this into this initiative; develop a

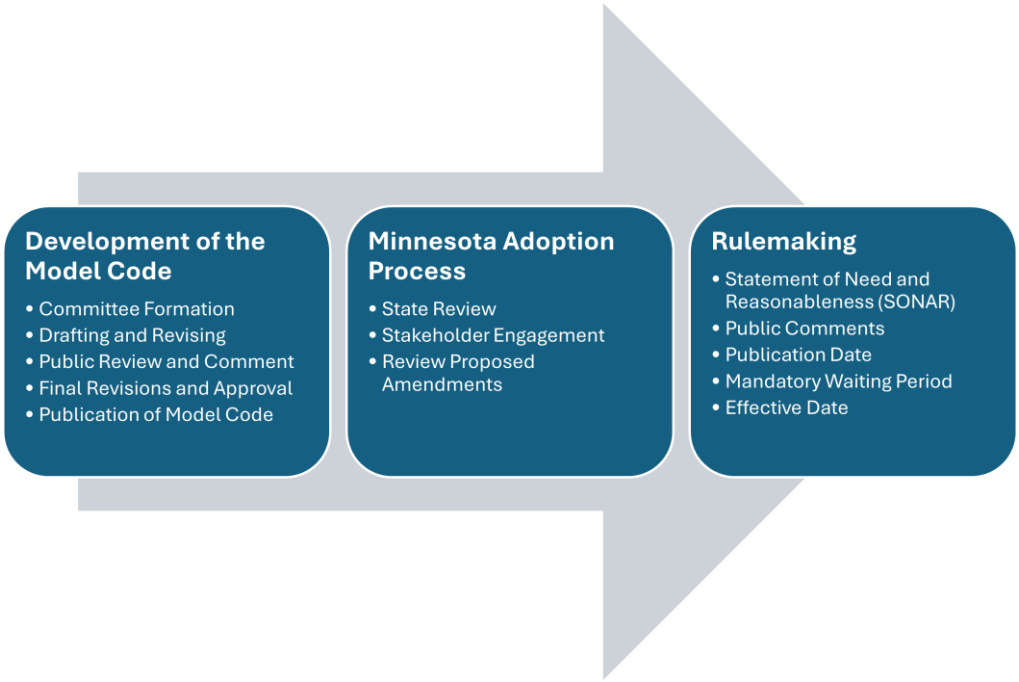
plan on what that would involve and how we'd claim savings; and engage our advisory committees and bring inclusion of state standards within this initiative to a vote.

The result of our efforts will be higher-efficiency codes and standards, bringing more substantial energy savings to nearly every building constructed in the state. Rather than losing utility savings when this baseline is increased (as typically happens to utility programs when the code is advanced), this initiative will enable at least a portion of these savings to be claimed by utilities.

CODES AND STANDARDS ADOPTION PROCESS

In this section, we provide context and background for how codes and standards are adopted at the state and federal levels. Our understanding of this process informed our Market Support Strategies. The high-level code development process is summarized in Figure 1 and discussed further below.

Figure 1: Code development process



Development of the model code

The code development process starts on a national/international level before filtering down to specific jurisdictions. While ETA work would not focus on influencing the model code development process, the model codes are the starting point for codes adoption but are often weakened in the process of state adoption. The following sections will outline how model codes are developed.

Various groups produce what are known as model codes. These include the International Code Council (ICC), whose model code Minnesota uses to inform the State's residential energy code, and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), whose 90.1 standard is used as the basis for the State's commercial energy code. For each group, a new model code is released every three years. Though each organization conducts the process slightly differently, discussed in the following sections, they both convene a group of stakeholders from across the buildings sector to formulate the model code. These stakeholders include utilities, state and local government officials, advocates, and industry professionals, including building technology manufacturers, homebuilders, and the gas industry. Changes to the model code can be proposed through a proposal submission process and a variety of viewpoints are then heard and considered. It is critical that this process includes open forums of debate and refinement to build safeguards into the process. These safeguards protect against conflicts of interest and prevent vested economic interests from determining the outcome of all code change proposals. While the model code development process is crucial, as the model codes serve as a starting point for adopted codes across the country, the codes that are ultimately adopted in each state are typically an amended version of the model code. Amendments can either strengthen or weaken the model code, but historically have been mostly weakening amendments.

Residential

The International Code Council (ICC) provides a series of building codes called the International Codes or I-Codes, including a model energy code. I-Codes are developed on three-year cycles through a process designed to incorporate the latest technology and innovation and allow new buildings to perform consistently at high levels. Each I-Code is developed through a consensus-based development process, which includes code officials, design professionals, code consultants, trade associations, builders, contractors, manufacturers, suppliers, government agencies, and other interested parties. Key aspects of the process include:

- Open public forums where anyone can submit code changes
- Transparency in decision-making at open hearings
- Balanced representation of interests with full disclosure of conflicts of interest
- A third of any code development committee's members are required to be regulators who are experts in the field
- Due process with equal time for rebuttals and all views are considered
- Consensus by a simple majority, with room for appeal
- An open appeals process

As part of a transparent, public process, all parties are welcome to submit a code change proposal, which is posted publicly for 30 days prior to being heard at a committee action hearing. Results of the committee action hearing are posted publicly online for no less than 60 days, during which time anyone can submit comments on these results. These comments are posted for public review for 30 days. This is followed by a public comment hearing, where eligible parties cast their vote on all code change proposals that have been presented during the

cycle. Finally, there is an Online Governmental Consensus Vote (OGCV). Throughout the process, remote participation is made available to increase participation and equity.

According to a PNNL report[3]:

> *Section 304(A) of the Energy Conservation and Production Act (ECPA), as amended, directs the U.S. Secretary of Energy to review the IECC and make a determination as to whether updated editions would improve energy efficiency in residential buildings. These results are reviewed by the U.S. Department of Energy (DOE) and published in the Federal Register. The DOE works in partnership with Pacific Northwest National Laboratory (PNNL) to conduct the technical analysis to determine the energy savings required for the official determination.*

Commercial

The Minnesota Commercial Energy Code is derived from ASHRAE 90.1, formally titled "Energy Standard for Buildings Except Low-Rise Residential Buildings." This standard is developed, similar to IECC, through a rigorous, consensus-based process with significant stakeholder engagement.

The ASHRAE 90.1 standard is revised by ASHRAE members, industry professionals, or other stakeholders. Each submission (an amendment to the standard) is reviewed by the standards committee, relevant subcommittees, and the ASHRAE Board of Directors to determine its feasibility and relevance. When a proposal is accepted, a project committee is formed to review the proposal in more depth. This committee includes experts from different sectors of the impacted industry, including engineers, architects, manufacturers, and government representatives. This committee is responsible for developing and writing the standard. Once a draft is prepared, it is made available for public review and comment for a minimum of 45 days. At this point, anyone can provide feedback or suggest changes to the draft. All comments are reviewed by the committee and action is taken as appropriate. Next, the final draft is submitted to the Standard Committee and the ASHRAE Board of Directors for approval. Depending on the change, additional approvals may be required from other organizations, such as the American National Standards Institute (ANSI). Approved changes can either be added as part of a new edition, which is published every three years, as an addendum, which is later incorporated into the new edition, or as a supplemental update, depending on the timing and characteristics of the change.

Similar to IECC, when a new edition of ASHRAE 90.1 is published, the DOE is required by law to issue a determination on whether the updated standard will improve energy efficiency in buildings compared to the previous version. DOE typically partners with PNNL to provide the Energy Impact Analysis portion of this determination. Following a positive determination, tools and resources are developed to support the implementation of the code in jurisdictions across the country.

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[3] Preliminary Energy Savings Analysis: 2021 IECC Residential Requirements (energycodes.gov)

Minnesota adoption process and rulemaking

Once a model energy code is released at the national level, the state-level process kicks off, although states vary considerably in how quickly model codes are adopted, with most lagging far behind the latest model codes. In Minnesota, the first step of the process is a review of the new code edition by the Department of Labor and Industry (DLI), which oversees building codes in Minnesota. During this review, DLI seeks to understand the changes, assess their impact on energy efficiency, and determine their suitability for Minnesota's climate and construction practices. Next, DLI names a Technical Advisory Group (TAG) for each building code, including a separate TAG for the energy code. This is a group of industry professionals selected by the governor-appointed Construction Code Advisory Council (CCAC).[4] The TAG is responsible for reviewing all changes between the previous Minnesota code and the new model code. They are also responsible for reviewing any code change proposals (CCPs) that are submitted. CCPs can be submitted by members of the TAG or by community members. All TAG meetings are open to the public and the times and locations are shared online. They are also available for remote attendees. Once the TAG has compiled their final recommendations, they are presented to the CCAC for review. The CCAC then passes their recommendation to the DLI Commissioner. This recommendation may match what was provided by the TAG or deviate from that, based on the evaluation of the CCAC members. The Commissioner is responsible for the final determination of what will become the new code. This often matches the recommendation made by the CCAC but is not required to. The new code initiates the rulemaking process, which involves drafting proposed amendments to the Minnesota State Energy Code to incorporate the new codes. The drafts are published and made available for a public comment period, which typically lasts 30 days. All public comments are then reviewed and considered by DLI. At this point, DLI finalizes the rule changes, and the final version of the updated building code is made available for review and approval by the relevant state authorities. From the release of a new model code to the implementation of a new Minnesota state code, the process takes approximately three years.

Recent legislation passed for the commercial energy codes in 2023, and for residential in 2024, set aggressive targets for the energy code.

For the residential energy code, Minnesota state statute 326B.106 dictates that:

> *Beginning in 2026, the commissioner shall act on the new model residential energy code by adopting each new published edition of the International Energy Conservation Code or a more efficient standard. The residential energy code in effect in 2038 and thereafter must achieve a 70 percent reduction in annual net energy consumption or greater, using the 2006 International Energy Conservation Code State Level Residential Codes Energy Use Index for Minnesota, as published by the United States Department of Energy's Building Energy Codes Program, as a baseline. The commissioner shall adopt residential energy*

[4] CCAC fact sheet, including statutory requirements: https://www.dli.mn.gov/sites/default/files/pdf/fs-ccac.pdf

codes from 2026 to 2038 that incrementally move toward achieving the 70 percent reduction in annual net energy consumption.

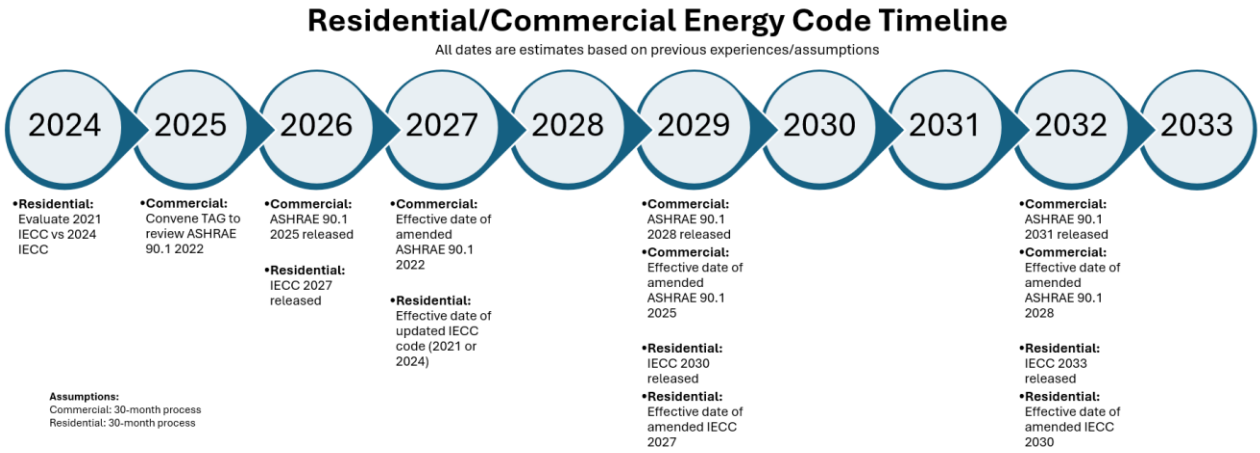
For the commercial energy code, Minnesota state statute 326B.106 dictates that, beginning in 2024:

> *The commissioner shall act on the new model commercial energy code by adopting each new published edition of ASHRAE 90.1 or a more efficient standard. The commercial energy code in effect in 2036 and thereafter must achieve an 80 percent reduction in annual net energy consumption or greater, using the ASHRAE 90.1-2004 as a baseline. The commissioner shall adopt commercial energy codes from 2024 to 2036 that incrementally move toward achieving the 80 percent reduction in annual net energy consumption.*

These statutes provide a significant leveraging opportunity for this initiative. DLI was not allocated any additional funding to achieve these targets and will need technical assistance to do so.

In Figure 2, an estimated timeline of key milestones in the Minnesota energy code adoption process are outlined. While these estimates are based on the stated assumptions and historical precedent, there is uncertainty about what this will look like going forward.

Figure 2: Estimated residential/commercial energy code timeline



National standards development process

National equipment and appliance standards are developed and regulated by the U.S. Department of Energy (DOE) to ensure products meet minimum energy performance standards.[5] Legislation that supports the ongoing development of standards includes the Energy Policy and Conservation Act (EPCA), which mandates the DOE to establish energy conservation standards for various appliances and equipment. New standards are developed on a rolling basis when the DOE identifies a need for new standards or updates to existing standards. Typically, products are evaluated every six years, but an evaluation by the DOE does not necessarily mean the standard will be updated. The DOE generally considers technological advancement, market changes, or legislative directives when determining if an update is in line for a product standard at the time of review. A rulemaking plan is then developed that outlines the schedule, scope, and objectives for developing the new or revised standards.

Like the code development process, stakeholder engagement is critical to the standards process. The DOE holds public meetings, webinars, and workshops to engage stakeholders in the process from the start. The stakeholders provide feedback and suggestions on initial concepts, data needs, and potential issues. These stakeholders include manufacturers, industry associations, consumer groups, and other interested parties. Also, part of the early stages of the process are technical analyses, conducted by DOE to assess the potential energy savings, technological feasibility, and economic impact of different standards levels. These results are made available for public review and comment.

Based on the early analysis and commentary, the DOE prepares a Notice of Proposed Rulemaking (NOPR) that outlines the proposed energy conservation standards, including detailed technical analyses and economic analyses. These are published to the Federal Register and made available for a public comment period, typically lasting 60 days or more. Stakeholders are asked to make public comments and participate in public hearings during this time. This feedback is reviewed by the DOE and may lead to revisions in the final draft. A second technical and economic analysis is done on the final rule to ensure all statutory requirements for energy savings, technological feasibility, and cost-effectiveness. The final rule is published to the Federal Register and specifies a compliance date. This process is completed on an ongoing, as-needed basis. Historically, the number of standards considered depends on the priorities of the current administration and has been highly variable across different administrations.

State appliance standards

Over a dozen states currently have established state appliance standards for products that are not covered by federal law. These products include home appliances such as air cleaners,

[5] DOE maintains a useful portal that further explains their role: https://www.energy.gov/eere/buildings/appliance-and-equipment-standards-program

residential ventilating fans, faucets, and more.[6] States adopting standards must take care to avoid federal preemption for appliances regulated by DOE. Currently, Minnesota does not have a state appliance standard law, but it is being discussed by policymakers.

While this initiative would not include any state-level standards work at its onset, the initiative would help inform any state effort if or when discussions occur. Should Minnesota adopt state appliance standards in the future, we could provide market support to ensure each adopted standard is practical and effective while also supporting compliance efforts. Before that work happens, we would develop an amendment to add state standards to this initiative, consult with stakeholders, and return to the ETA Coordinating Committee for a stage gate approval vote. This amendment to add state standards would include providing updated logic models and market support strategies to reflect the specific opportunity provided by the legislation. We would also develop an energy savings and evaluation methodology specific to the opportunity, to be reviewed by the ETA Evaluation Advisory Committee.

Market description

This section provides more information on the market relevant to codes (new construction). Standards apply to all appliances sold in both existing and new buildings, and their market dynamics are specific to the appliance, so are not discussed here. This market information informed the development of our Market Support Strategies. Additional information data sources and how the savings estimates were calculated for this initiative can be found in the Energy Savings and Evaluation Plan.

Target market

Sector (e.g., residential, commercial, industrial, etc.)	Commercial and residential
Existing buildings and/or new construction	Mostly new construction (codes), some existing buildings (standards)
Current market size, new construction	12,800 new single-family homes/year 38 million sq. ft. of commercial building space per year
Savings potential estimate	266,672 Dth per year (first-year savings) 42,745 MWh per year (first-year savings)

[6] The Appliance Standards Awareness Project (ASAP), an ACEEE program, maintains resources that detail what appliances each state has chosen to regulate. ASAP has developed model legislation, also available on their website, which has been the starting point for most states that have passed standards legislation, thus is likely to be a starting point for any legislation in Minnesota.

New construction market dynamics

During the building process, codes must be considered at every stage to ensure that the construction meets the required safety, health, and energy efficiency standards. From initial design through final inspections, building codes guide architects, engineers, and contractors in making decisions about materials, construction methods, and system installations. Adherence to these codes is essential not only to obtain necessary permits but also to pass inspections, ensuring that the structure is safe, functional, and compliant with local, state, and national regulations. Failure to comply with codes can lead to costly delays, legal issues, and even the need for significant modifications after construction.

Residential

Design Phase:

The key stakeholders in a residential design phase can vary, but often include architects and/or engineers and sometimes energy consultants. An architect creates the overall design and layout of the home, ensuring it meets aesthetic and functional requirements while complying with all relevant building codes. An architect may consider things like building orientation, window placement, insulation type, and more during this phase, which all impact the structure's energy performance. They are also often responsible for making material and system decisions, such as for windows or insulation levels. They can use energy modeling and simulations to assess the impact of these different design decisions.

During the design phase, engineers design and specify systems such as HVAC, plumbing, and electrical. Each of these systems are regulated by the energy code and often other building codes as well, so engineers are responsible for making sure they meet compliance requirements while also providing the necessary performance.

Energy consultants can be used during this phase to provide expertise on energy efficient design practices, perform energy modeling, or offer recommendations to meet energy code requirements, but this is not a standard practice within the residential construction industry and often only used in specialty builds.

Construction Phase:

During the construction phase, builders and contractors are responsible for executing the building based on the approved design plans, ensuring all materials and systems are installed according to specifications. At various points during this process, code officials or inspectors conduct inspections to verify that the building complies with all relevant requirements, including energy codes. This ensures that installations meet the required standards and that construction practices are followed correctly. These inspections are done at specific stages in the construction process to ensure the inspectors can see what they need to see.

Post Construction Phase:

After construction is substantially completed, the code inspector or official conducts a final inspection and testing to verify that the completed building meets all energy code requirements. If any compliance issues are identified, the builders or contractors are responsible for

addressing them as needed. The builders or contractors are also responsible for providing all the required documentation to the building inspector or official.

Commercial

Design Phase:

In commercial construction projects, a broader range of parties are involved at each phase in the process. In the design phase, architects are common. They are responsible for developing the building design and layout, as in the residential space, but often must consider significantly more complex requirements.

In commercial construction, a wide variety of engineers specializing in different parts of the building process are involved, including structural engineers, mechanical engineers, electrical engineers, and plumbing engineers. Each is responsible for designing their specific system to meet all relevant code requirements, including energy code.

Within the commercial space, it is much more common to work with energy consultants and/or sustainability consultants during the design phase of the process. These consultants can conduct energy modeling and provide recommendations for achieving energy efficiency targets. These models can be used to meet code requirements or identify areas where compliance is lacking.

Construction Phase:

While builders and/or contractors are still responsible for executing the construction plan according to the approved plans, in commercial construction there is often a project manager on site ensuring this is done properly. The project manager will oversee the construction process, manage schedules, and coordinate between different trades and stakeholders, including code officials/inspectors. All these stakeholders may have to work together to make adjustments as needed throughout the process, ensuring that they continue to meet code requirements.

Post-Construction Phase:

Similar to residential, a final inspection is required to ensure the building meets all relevant code requirements. In commercial construction this often also includes performance testing. This can involve an outside energy auditor who would conduct the building's energy performance testing. All documentation and instructions are passed to the facility manager or building owner to ensure the building is operated and maintained in accordance with the design and with code requirements.

PROGRAM LOGIC

This section presents the logic, informed by market data, that underlies our theory of change, and our strategies for overcoming market barriers and achieving our long-term vision. More information on the details of the logic model is provided in the Energy Savings and Evaluation Plan for this initiative. While we present the program logic and market support strategies here jointly for codes and standards for simplicity and because there are many areas of congruence,

they are addressed separately in the Energy Savings and Evaluation Plan. We also indicate below whether the barrier, opportunity, or market strategy applies to codes, standards, or both.

Long-term vision

Our technical support and market engagement will lead to setting energy codes in Minnesota that achieve goals set by Minnesota policymakers, dramatically improving the energy efficiency of energy codes, and resulting in significant energy savings. In addition, ETA engagement in federal appliance standards will influence the adoption of more efficient standards in the state.

Market barriers and opportunities

Multiple barriers inhibit the adoption of this initiative. However, Minnesota is well positioned to overcome the anticipated obstacles for several reasons. In this section of the market transformation plan, we have distilled the key and most pronounced barriers and opportunities to build a successful strategy that will take these market dynamics into account. Market support strategies will either be designed to overcome the most critical barriers listed or leverage the opportunities identified to help the market accelerate faster. Further detail on these barriers and opportunities can be found in the Energy Savings and Evaluation Plan.

Key barriers:

1. Resistance to change (codes and standards)

Resistance to change is expected from key stakeholders, including the construction industry, code officials, manufacturers, and others. The construction industry often views enhanced energy code as additional costs and complexities that could affect project budgets and timelines. Builders and developers may be concerned about increased construction expenses and the potential for delays as they adapt to new requirements. Code officials may have to invest additional time in updating their knowledge and training to enforce the revised code effectively. Finally, other stakeholders may resist change due to a general fear of the unknown, as they struggle to understand the impact new and evolving energy codes will have.

For standards, manufacturers are reluctant to spend additional resources developing new products to meet higher-efficiency standards.

2. Insufficient resources (codes and standards)

Significant resources, including technical expertise, funding, and the capabilities to develop and consider strengthening amendments, are required to overcome resistance to code adoption. Without adequate financial support and skilled personnel, the process of proposing, reviewing, and adopting more stringent codes can be impeded, leading to delays and resistance.

While the DOE typically conducts extensive analysis on proposed new standards, insufficient resources are also a barrier for standards, as stakeholders opposed to advancing higher standards (such as manufacturers) tend to spend more resources than do advocates for advancing higher standards. Good market data on current adoption of appliances meeting proposed standards is also frequently lacking in the standards process.

3. Upfront cost concerns (codes)

While energy efficiency improvements can often lead to long-term savings on energy bills, they can come with a higher upfront cost than less efficient products or construction methods. This can deter builders, developers, and property owners, who may be concerned about the immediate financial impact and the potential strain on project budgets. This concern about first cost can also apply to potential buyers that would have lower utility bills, who may not consider that lower cost in their buying decision.

4. Cost-effectiveness framework (codes)

When evaluating code amendments, cost-effectiveness does not currently play a prominent role in evaluating energy code chances in Minnesota but could in the future. At the national level, PNNL calculates state cost-effectiveness based on a national framework, considering cost-effectiveness from the perspective of a building owner financing the cost of a new building at today's costs.[7] However, this is not a complete economic picture. For one, it considers only the product costs today, which are often much higher than they will be in 5–10 years, as economies of scale lower costs after code adoption. Even by the time the code is implemented, a few years after cost-effectiveness is calculated, the upfront costs may be significantly different than at the time of the analysis. Additionally, it does not include non-energy benefits, which have been crucial in Minnesota's ECO framework for achieving aggressive energy efficiency goals. Overall, we conclude that energy efficiency is under-valued in the current approach.

This is less of a barrier for standards advancement, as DOE typically conducts rigorous cost-benefit analysis for the proposed standard.

Key opportunities:

1. Complementary code compliance efforts underway (codes)

Earlier in 2024, the utilities that fund ETA launched a robust code compliance program. The program funds circuit-riders, or energy code experts, who provide one-on-one assistance to local code-enforcing jurisdictions throughout Minnesota. In addition, the program conducts training and webinars and develops tools to support code compliance. Support for increasing compliance can smooth the way for ETA's code advancement activities.

2. Increased market readiness for new codes and standards due to above-code programs (codes and standards)

In Minnesota, utilities have run robust above-code programs for decades, priming the pump for more rapid code adoption. These programs provide technical and financial support for builders to adopt more efficient building technologies and practices. Other programs, such as SB2030

[7] See R. Hart and B. Liu, "Methodology for Evaluating Cost-Effectiveness of Commercial Energy Code Changes," Prepared by Pacific Northwest National Laboratory, August 2005.

(which specifies performance well above code for certain publicly funded buildings) or the voluntary green building standards, drive above-code construction as well.

These programs can help support code and standards advancement efforts in a variety of ways. First, they can accelerate the adoption of efficient technologies. The programs stimulate demand for more efficient but often more expensive technology. As these solutions become more commercialized due to this increased demand, costs come down and the technology is more readily adopted into code or standards. Second, above-code programs often involve detailed monitoring and reporting requirements, which generate valuable data on energy efficiency, cost-effectiveness, and occupant comfort. This data can be used to support advanced code changes and new standards. Additionally, programs requiring higher levels of energy performance in buildings can be an opportunity to train and educate architects, engineers, builders, and code officials. This increases current market readiness and makes it easier to adopt and implement more advanced codes and standards in the future. Finally, these programs create momentum as the stakeholders who are involved in them often become advocates for energy efficiency practices. Their successes and experiences can guide the state toward more efficient energy codes, and ready the state for higher standards.

3. State legislation and climate goals support code advancement (codes)

In 2022, Minnesota adopted a Climate Action Framework that envisions reaching carbon neutrality by 2050, and specifically calls for improvements in efficiency in new construction by advancing energy codes. To support that framework, legislation was passed around improving energy codes in the state (see “Local code development process” section). On the commercial side, the legislation mandates that the commercial energy code (an amended version of ASHRAE 90.1) achieves an 80% improvement in energy efficiency by 2036 over a 2004 baseline. On the residential side, the legislation mandates that the residential energy code (an amended version of IECC) achieves a 70% improvement in energy efficiency by 2038. These mandates provide a guidepost for the state and stakeholders to focus on, where the technical support of ETA will be valued and effective.

4. DOE funding available for code advancement (codes)

In recent years, a significant amount of federal DOE funding has become available for code advancement, largely through the Infrastructure Reduction Act (IRA) and the Bipartisan Infrastructure Law. The IRA dedicated about $1 billion for improving energy codes over the next 10 years. Overall, this funding is intended to ensure that more stringent building energy codes are widely adopted and properly implemented, contributing to long-term energy savings and reductions in greenhouse gas emissions.

Further federal investments have also been made through the Infrastructure Investment and Jobs Act (IIJA), otherwise known as the Bipartisan Infrastructure Law (BIL), with $225 million over five years dedicated to support the adoption and implementation of more energy efficient building codes. With these unprecedented funding opportunities for energy codes, there is the potential to increase capacity, fund the workforce, provide training and technical assistance,

and achieve advanced energy codes. ETA has been involved in helping incubate these efforts, including forming the Minnesota Advanced Energy Codes Partnership (with participation from the Minnesota Department of Commerce and Department of Labor and Industry) to capture some of these DOE funds. This is creating momentum around codes advancement and related efforts.

5. Strong point of leverage in standards process (standards)

Within standards work, the relatively small number of stakeholders actively involved in the rulemaking process presents a unique opportunity for those who do engage. Unlike other regulatory areas with broad participation, standards typically attract a specialized group of manufacturers, environmental organizations, and technical experts. This smaller pool of participants means that those who secure a seat at the table can wield significant influence over the outcomes. Engaging early in the process would allow us to shape the narrative, advocate for specific standards, and present technical support.

6. Synergy between existing ETA initiatives and codes and standards (codes and standards)

ETA has already developed key subject matter expertise for its existing initiatives (windows, air source heat pumps, rooftop units, and advanced lighting controls) that is broadly applicable to codes and standards development. For example, ETA's work on the high-performance window initiative includes coordinating with the national Partnership for Advanced Windows Solutions (PAWS), where we are connected with leading manufacturers and stakeholders that are applicable to our codes and standards work. We also have staff who are windows subject matter experts that can help develop, for example, specific code amendments to increase the U-value requirements for specific space types in the energy code.

Market support strategies

To leverage the opportunities that exist in the market and overcome known barriers, we've identified a comprehensive selection of key market support strategies, outlined in this section. Many are informed by CEE's previous efforts and current ETA initiatives. They were also informed by a literature review of other code programs and are consistent with national code program best practices.

As the team embarks on market support strategies, more intelligence about the market will be gained, the impact of the strategies will become better known, and the market itself may evolve or shift. To optimize impact of the initiative, the team will adapt and potentially shift market support strategies over time. These changes will be carefully considered, documented, and brought to the coordinating committee on an annual basis.

1. Effectively engage stakeholders to increase buy-in (codes and standards)

By working directly with stakeholders to engage them throughout the process, we can anticipate pushback and resolve conflicts from the start. Building trusting relationships and demonstrating

a willingness to work together enables the team to find solutions that advance codes. Statute prescribes that there must be an open process where stakeholders can participate and share their perspectives. Therefore, it can be highly impactful to engage stakeholders, including builders, architects, engineers, and the broader community, early and often, giving them a chance to share their motivations, concerns, and/or reactions to proposed approaches. In practice, this may look like:

- Meeting with stakeholders individually to share proposals or discuss concepts
- Sharing efforts broadly in forums such as advisory groups led by CEE or others
- Individual or small group follow-up discussions to topics covered in the forums
- Sharing prepared materials with stakeholders and asking for feedback

While this is not an exhaustive list, it sheds light on how we intend to work collaboratively to better understand a wide variety of perspectives. Expected outcomes of this engagement include:

- Identifying which code amendments have broad support, and which don't, to effectively research potential code changes
- Better understanding of knowledge gaps that need to be filled to inform educational and technical research
- Better understanding of market barriers, which can inform technical research and education to overcome these barriers

Furthermore, engagement helps build a sense of ownership and shared responsibility, making stakeholders more likely to support and advocate for the new standards. Finally, transparent communication and education around the benefits of more stringent energy codes can help dispel misconceptions, align interests, and create a unified front in the push for higher efficiency.

For standards, our stakeholder engagement will focus on participating in the standards development process and coordinating our formal comments with those of others participating for a stronger combined impact. Manufacturers are also a critical stakeholder we would engage for standards.

See the "Partners and roles" section for an overview of the key groups with which we expect to work most closely on this initiative.

2. Provide technical assistance and conduct research (codes and standards)

Technical assistance and research done throughout the code and standards evaluation process can ensure the advancements made are practical, effective, and market ready. This kind of support can include everything from energy modeling and simulations, cost-benefit analyses, workshops and focus groups, advisory committees, code drafting assistance, pilot programs, and demonstrations, all of which provide valuable insights that inform the development of new energy code language or market data to support standards advancement. Utility data on market adoption of targeted technologies will be particularly valuable for both codes and standards advancement. By conducting thorough research and offering targeted technical assistance,

stakeholders can make data-driven decisions, refine proposals, and address potential concerns early in the process. Ultimately, this approach creates more sufficiently vetted energy codes and standards that are more likely for policymakers to accept and adopt. Ensuring that future energy codes and standards are not only ambitious, but also feasible and beneficial in real-world scenarios is key to achieving successful adoption and long-term improvements in building energy efficiency.

3. Develop Minnesota code amendments for each code cycle (codes)

By identifying and proposing specific amendments each code cycle in line with the latest model code and existing Minnesota code, the group can provide specific direction on how to achieve an advanced code. This process starts with identifying key areas of opportunity in Minnesota. This happens in many ways. Some proposals will be inspired by work occurring in other parts of the country or in existing stretch codes. These will be evaluated on their overall fit with the construction practices and needs specific to Minnesota. Other amendments will be crafted out of an analysis of the work successfully being done in Minnesota or similar environments. From there, technical analysis will be done to evaluate the overall cost, benefit, and impact specific to Minnesota. Generally, the universe of possible code amendments will be prioritized based on our assessment of the savings impact they would have, and the likelihood they have of being adopted. From our market work so far, we expect some significant factors in this assessment to include product availability (are there products that are widely available to meet the new requirement), the incremental cost to comply (how much extra cost will there be from the amendment), and workforce readiness (are there any barriers for the existing labor force in meeting the new requirements). Minnesota stakeholders are engaged throughout the process to share any unique perspectives from the local market that may impact the decision going forward.

4. Coordinate with compliance and other related efforts (codes)

Without compliance, energy codes will not improve the energy efficiency of new buildings. Fortunately, other funding sources have launched activities that will provide much needed resources to improve compliance. This includes the Minnesota Utility Codes program funded by the same utilities that fund ETA (discussed above) and DOE funding.

The initiative will work to collaborate more broadly on codes-related areas, including regional and national partnerships, such as ACEEE's National Codes Collaborative and MEEA's code support team. See the following section on "Partners and Roles" for more discussion of these entities. We will also engage code-related efforts, such as a Building Performance Standard (BPS). While a BPS would apply to existing buildings, all new construction becomes existing building stock and owners have an interest in ensuring their buildings would meet a future BPS standard. This collaboration also helps provide consistent messaging, financial incentives, and training, which can increase stakeholder buy-in and facilitate smoother adoption of the new codes.

We recognize the critical importance of code readiness to our work to advance codes, thus we may devote some ETA resources to this function. Code readiness is related to compliance and

refers to how ready the market is to implement new codes, which can influence how readily stakeholders support new code changes. Contractors, for example, will be more supportive of code changes if there is training available to help them comply with existing and new code requirements. Code readiness activities could include education, training, tools, and other activities for code officials, contractors, and other key stakeholders to be better prepared for code changes. We would only do this to fill gaps in the market, if market research indicates need, and in coordination with the utility code compliance program. We will leverage DOE funding that we have received through the Minnesota Advanced Energy Code Partnership.

5. Support the development of a new cost-effectiveness framework (codes)

The current code process does not include a rigorous assessment of cost-effectiveness. However, we anticipate in future code cycles that it would be helpful to have a quantitative framework to analyze the choices available more objectively. Our ETA team has deep knowledge of how to develop and apply cost-effectiveness analysis to policy questions. We would leverage this knowledge to develop an appropriate framework for the codes process.

6. Provide technical support to Tribal Nations (codes)

Tribal Nations in Minnesota are sovereign entities, thus not covered by the Minnesota Building Code. They adopt and enforce their own codes separately from those of the state. We will engage each of the Tribal Nations in Minnesota to introduce this initiative and, if requested by the Tribal Nation, offer technical support to identify and implement effective code development and enforcement strategies. We will also leverage federal DOE funding for this purpose through the Minnesota Advanced Energy Codes Partnership.

7. Leverage national funding and partnerships (codes)

Through federal funding opportunities, we can form strategic alliances with other organizations to increase our capabilities and capacity while allowing for a more comprehensive and coordinated approach to policy development and implementation. National funding opportunities support efforts such as research, training, and monitoring of new technologies. Partnerships with national organizations and other stakeholders enable the sharing of best practices, technical expertise, and advocacy efforts, which can amplify the impact of local initiatives. Furthermore, by aligning our work with movements happening around the country, local efforts can more effectively overcome barriers, plan for high compliance, and achieve greater environmental and economic benefits.

8. Engage with the process for adopting new standards (standards)

ETA would participate in the DOE's process for adopting appliance standards, as described in the section above. This would primarily consist of developing written comments for formal submission to the DOE and other parties but can also include participating in meetings and discussions on the standard under consideration.

Partners and roles

For this work, CEE plans to build partnerships with local and national stakeholders to establish a trusted voice in the market and influence change.

Utility stakeholders

Minnesota utilities funding Minnesota's Efficient Technology Accelerator (ETA) are key stakeholders that serve on the ETA Coordinating Committee. Representatives of these utilities are also invited to serve on the Evaluation and Cost-Effectiveness Advisory Committee and the Market Strategy Advisory Committee. These utilities include:

- Xcel Energy
- Minnesota Power
- Otter Tail Power
- CenterPoint Energy
- Minnesota Energy Resources

Partnering with utilities is crucial for code advancement, as it allows for effective coordination around code compliance and utility-led programs, ensuring that new codes are not only promoted but also successfully enacted. Utilities can provide essential data that informs and supports changes to codes and standards, offering a robust foundation for decision-making and demonstrating the potential energy savings. Additionally, utilities' involvement increases buy-in and support from key stakeholders, leveraging their credibility and established relationships to build consensus around the importance of more stringent energy codes, ultimately leading to broader adoption and successful implementation.

NEEA

CEE partners with NEEA's Code and Standards program to support the development and adoption, training, and implementation of energy codes and standards. NEEA's program staff serve as technical experts during U.S. DOE rulemakings to encourage the adoption of federal appliance and equipment efficiency standards. Their engagement and expertise in this area is invaluable to supporting the work in Minnesota.

National Partnerships and Stakeholders

Achieving scale is crucial in the program's market transformation plan, and this scale extends beyond the Minnesota market. Therefore, coordinating with national partners is integral to the program's plan. Below is a summary of each group and CEE's involvement.

ACEEE National Energy Codes Collaborative is a nationwide network that seeks to empower states and jurisdictions to effectively and sustainably implement updated building energy codes. The Collaborative seeks to drive innovation and generate cross-functional resources through three core activities: collaboration, technical advisory and assistance, and capacity building. By participating in a variety of technical advisory groups, annual in-person meetings,

and other forums, workshops, and meetings, both in person and virtual, ETA is able to find additional support through resources and collaboration.

Midwest Energy Efficiency Alliance (MEEA) is a collaborative network, promoting energy efficiency to optimize energy generation, reduce consumption, create jobs, and decrease carbon emissions in all Midwest communities. MEEA partners with state and local energy code officials, building professionals, utilities and other code experts to increase accessibility to the latest code-related information and technologies, keep stakeholders briefed on the latest activities across the Midwest, and coordinate code-related activity from the regional to federal level.

ACEEE Appliance Standards Awareness Project (ASAP) is a program that advocates for appliance, equipment, and lighting standards. They help build coalitions of efficiency proponents and have a clearinghouse of information on their website including reports and analysis that they have conducted.[8] They provide analysis of the impacts of standards, including state-level appliance standards.

Manufacturers of efficient equipment play a crucial role, especially in standards development. While manufacturers as a group generally tend to oppose increased standards, this is not true for all manufacturers, such as those that specialize in efficient products. These manufacturers can benefit from tighter standards. ETA would engage with manufacturers that oppose new codes or standards to understand their concerns, and work to bring supportive manufacturers more deeply into the process of code/standard adoption.

Minnesota stakeholders

The initiative will work with the following a broad range of stakeholders, including:

- Construction Industry Stakeholders
- Low-Income Housing
- Multifamily Groups
- Code Officials
- Workforce Organizations
- Tribal Nations

SAVINGS POTENTIAL

This initiative has significant savings potential. Table 2 presents our estimate of statewide savings program potential from the next iteration of both the commercial and residential energy codes.

[8] See https://appliance-standards.org/

As shown in the table, we estimate roughly 42,000 MWh and 270,000 Dth of annual savings that could potentially be claimed for utility savings attributable to this initiative. These savings could be claimed for up to 10 years, as detailed in the Energy Savings and Evaluation Plan (Appendix B), along with all other assumptions used in calculating this estimate. Savings from standards advancement is not included in this and would add to this potential. Savings would be distributed among sponsoring utilities as detailed in the Energy Savings & Evaluation Plan.

Table 2. Codes initiative annual program potential savings

Total annual 1st savings (derated by compliance factor)	**42,745**	**266,830**	**412,682**

CODE AND STANDARD SELECTION PROCESS

For both the codes and standards processes, there are several technologies or amendments that could be pursued. Given how they change based on technology advancement, market readiness, political will, and other external factors, it is not prudent to suggest all potential code amendments or standards technologies this initiative will work toward. However, we also recognize there will be more technologies or amendments opportunities than we can pursue (e.g., there are over 60 standards), we suggest the following prioritization criteria.

For codes, we would prioritize based on:

1. Impact/energy savings
2. Cost-effectiveness
3. Product availability
4. Other market barriers

For standards, we would prioritize based on:

1. Impact/energy savings
2. Alignment with ETA expertise or active initiatives
3. An opportunity to contribute a unique perspective because of our data or analysis (e.g., due to cold climate data or other market elements unique to MN that add value beyond typical actors)

The building technologies within ETA's current technology initiatives will also be prioritized to take advantage of the market transformation work being done in these areas. The market data gathered through these initiatives will be invaluable to identifying the right amendment proposals and gaining support for these amendments. However, code advancement efforts will not be limited to only these technologies. Additionally, prioritization will also depend on where those technologies and the markets are in the market transformation process (e.g., we are not ready to push for code adoption of ASHPs for the next code cycle, though there will likely be a code play in the future).

Code amendments and standard appliances that we would like to work on based on the listed criteria will be presented to the Coordinating Committee for review.

Risk Mitigation Plan

Risks are inherent to any project. However, we have identified key anticipated risks and developed mitigation strategies.

"IF" this happens	"THEN" this will occur (impact)	Probability (H/M/L)	Impact(H/M/L)	Risk response: (Accept, avoid, mitigate, transfer)	Response plan
Developers and other stakeholders do not support aggressive energy codes and actively work against them.	We will decrease the savings we are able to achieve through new code adoption.	M	H	Mitigate	Extensive stakeholder engagement; Research/technical analysis to support code adoption
DOE does not bring up any standards for review.	Standards will not move forward.	H	H	Accept	Consider working toward state standard advancement
Insufficient or poor technical support is provided for advanced code development,	Amendments are not approved. Amendments are not feasible in the market and therefore achieve low compliance. Amendments are not feasible in the market and therefore cause significant conflict.	L	H	Avoid	Provide robust technical support and conduct market research well in advance of when TAG meetings occur

Transition Plan

The Codes and Standards initiative team will track metrics to monitor the progress of the initiative and re-evaluate strategic interventions as necessary. The Codes and Standards logic

model will be updated periodically during the Market Development phase, removing barriers and opportunities based on the evolution of the market. Interventions will be adjusted to ensure sustained acceleration of market adoption and impact.

It is expected that this initiative would continue until the targets set by Minnesota statute (2036 for commercial and 2038 for the residential code). At this time, we will evaluate the need for our continued involvement in the market, depending on:

- If DLI is sufficiently funded to continue effective code development without us
- The level of energy savings that would be expected from future cycles of the code
- Past performance and success of the Codes and Standards Initiative

However, we will evaluate transitioning the initiative earlier if other circumstances warrant it, such as insufficient energy savings being generated. This includes the initiative's ability to transition critical functions to the market and a move into the Long-Term Monitoring and Tracking (LTMT) phase where key metrics will be tracked and analyzed to measure savings, but market support activities are discontinued. Determining readiness for transition from market development, a resource intensive phase, to LTMT, a resource light phase, will require careful monitoring and assessment to determine optimal timing. The ETA coordinating committee will review and approve the transition to LTMT.

Appendix A. Market Characterization Report

See Codes and Standards Market Characterization Report

APPENDIX B. ENERGY SAVINGS AND MARKET EVALUATION

See Codes and Standards Energy Savings and Market Evaluation Plan (Includes complete logic model)