Codes and Standards Advancement Energy Savings and Market Evaluation Plan

Center for Energy and Environment

CONTENTS

BACKGROUND AND SUMMARY OF POTENTIAL

Minnesota Efficient Technology Accelerator

Minnesota's Efficient Technology Accelerator (ETA) is a statewide market transformation program to accelerate deployment and reduce the cost of emerging and innovative efficient technologies, bringing lower energy bills and environmental benefits to Minnesotans. ETA is funded by the state's investor-owned utilities (IOUs),[1] administered by the Minnesota Department of Commerce, Division of Energy Resources (DER), and implemented by Center for Energy and Environment (CEE). Savings generated by the program will be claimed by the funding utilities to help meet state goals.

As a market transformation program, ETA will work to overcome market barriers, leading to greater market adoption of targeted technologies, and ultimately, energy savings. In the initial years of a market transformation program, energy savings can be small as it can take time to grow the market. In addition, the savings methodology for counting savings from market transformation initiatives (described further in this document) is more involved than what is typically the case for utility rebate programs. Therefore, a careful evaluation plan is a complementary endeavor to estimating savings from market transformation programs because it can provide additional evidence of the effectiveness of programmatic efforts to break down barriers and support the estimation and claiming of energy savings.

Within the overall ETA program, individual market transformation initiatives (a programmatic effort around a specific technology or approach) are developed. This Energy Savings and Market Evaluation Plan focuses on the Standards and Codes Advancement Initiative. We attempt to provide a thorough plan for both estimating savings and also measuring market progress in advance of launching our initiative in the market. As we learn more about the market through additional research and through our market engagement, we will continue to refine and update our approach.

Standards and Codes Advancement

This section contains a brief summary of our approach, including our theory of how we expect to transform the market for codes and standards advancement.

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

[1] Specifically, electric and natural gas IOUs with more than 30,000 customers as specified in Minnesota Statutes § 216B.241 subd. 14, which includes Xcel Energy, Minnesota Power, Otter Tail Power, CenterPoint Energy, and Minnesota Energy Resources.

technology and can result in a substantial acceleration of efficient technology adoption. Achieving a code or standard for a particular technology is the end 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 as a core aspect of its work.

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 are commercialized faster and eventually become 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) through accepting weakening amendments to the model code. This 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 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.

This stakeholder resistance to change is the single largest barrier for this initiative. Yet, there are currently few or no resources to address some of the specific concerns that are brought up by stakeholders. Thus, the easiest pathway currently is to adopt weakening amendments for any areas where concerns are raised, rather than attempting to address concerns.

Our strategy to overcome these barriers center two key activities: 1) engagement with market actors to understand (and therefore better address) market barriers and facilitate increased buy-in for code changes and 2) providing technical support for the adoption of new model codes and strengthening amendments and avoiding/eliminating 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 it is unlikely to do so 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 also work closely with market actors (outlined in the Market Transformation Plan) to identify concerns with particular code changes and work to address those. We will also leverage recent federal funding opportunities for advancing energy codes.

Standards

The U.S. Department of Energy (DOE) is the agency that sets federal 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 particular expertise, where there is significant 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 engagement with stakeholders. 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 only work with standards at the federal level. If state standards become a viable option, we will assess if it makes sense to try and roll that 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 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.

Energy savings potential

In the following, we present our best estimate of future potential savings from a Codes and Standards Initiative. This is to provide an order of magnitude estimate for savings to justify the investment of ETA resources, but actual claimed savings will vary from what we present here. The Energy Savings Estimation section below provides more details on how we intend to estimate savings going forward, building on the methodology discussed in this section.

There are a few different ways to look at savings potential. For other ETA initiatives, we have presented the technical potential, which is the absolute maximum amount of savings possible with the technology, considering engineering constraints. It is typically a projection of savings that would occur if we were to change out all existing technology in our building stock with this technology, including projected new construction. The program potential is a smaller subset of the technical potential that considers both broader factors like turnover rates, workforce limitations, and other market barriers, as well as program implementation constraints. We assume that no program will reach the full technical potential, but estimating program potential is often more difficult and makes large assumptions.

For this initiative, however, technical potential for the full initiative is less relevant as the technologies included in code may differ from cycle to cycle. Instead of technical potential, we can provide a different subset of program potential as we have projected code amendments for the next code cycle with modeled savings. Provided below are the annual savings potential estimates, assuming projected code amendments for the next code cycle. Given code cycles change every three years or so, and new code amendments would be adopted, we anticipate the savings will change with new code cycles and amendments. Given this, we are only providing a single year estimate rather than the full program lifetime estimate.

In addition, program savings will be derated by a compliance factor. However, since we anticipate the compliance factor also changing yearly (as years go by, we anticipate code compliance will increase), we are providing the full gross projected annual savings, as well as the first year derated savings. More information about how actual savings will be calculated is provided in the Energy Savings Estimation section.

Savings potential overview

For this initiative, the savings potential is broken out into three different categories: commercial code, residential code, and standards. ETA worked with 2050 Partners to provide an estimated gross savings potential for the commercial code, using PNNL modeling and 2022 Dodge data new construction estimates. ETA estimated residential gross savings potential using U.S. Census Building Permits Survey data and Ekotrope modeling software.

Savings potential for standards is not included as it will vary widely based on the standards selected and political priorities of current administrations (there is the potential that there could be zero savings, for at least a period of time). Further, based on NEEA's experience, overall savings that utilities could claim from standards are typically smaller in scale compared to codes savings. Therefore, we focused our resources on only estimating the savings potential from codes. The resulting savings potential is provided in Table 1, with more detail on how this was calculated in subsequent sections.

As shown in the table, we estimate roughly 42,000 MWh and 270,000 Dth of annual savings that could be potentially claimed for utility savings attributable to this initiative, after accounting for a reduction in savings due to lack of compliance (using the compliance rates shown in Table 6 for year 1). These claimed savings would continue to accrue for up to 10 years after the start of the new code cycle. We view these values to be accurate as an order of magnitude estimate, but actual savings could vary considerably.[2]

[2] The largest potential sources of variance in the savings are in the actual percentage improvement achieved in each code cycle, and the volume of annual new construction that happens in the state (assuming no changes in the methodology for how savings are calculated). Based on historical values, this could increase or decrease the savings by 30–70 percent, very roughly. Also consider that additional code cycles will add to and stack on top of the annual savings presented here (which could increase savings by 50–250 percent, very roughly), if those code cycles are completed prior to the 10-year timeframe that the savings are claimed once the new code is adopted. All of this is to reinforce that these estimates are intended as an order of magnitude estimate, rather than an annual target that will be achieved.

Table 1 1: Statewide annual savings potential from codes advancement (first-year savings)

	Electric (MWh)	Gas (Dth)	Combined (Net MMBtu)
Commercial code advancement	33,593	224,672	339,292
Residential code advancement	32,050	182,600	291,963
Total codes annual gross savings (1st yr)	*65,643*	*407,272*	*631,255*
Total annual 1st savings (derated by compliance factor)	**42,745**	**266,830**	**412,682**

Commercial

CEE worked with 2050 Partners to determine the annual gross savings potential for the commercial sector, in conjunction with their work for the Minnesota Advanced Energy Code Partnership (MAECP). The team created a calculator and has laid out the methodology and key assumptions.

Minnesota Code Cycle 1 amendments

MAECP project team has identified the key amendments to ASHRAE 90.1-2022 Std to support Minnesota's Climate Action Framework, which sets a goal for the State's commercial energy code to reach net zero by 2036. In 2023, the legislature directed the State to achieve a majority (80%) of this goal through energy efficiency alone, measured against the 2004 baseline. Below are the amendments proposed to 2022 Code Cycle 1 to pursue an aggressive improvement of 20% when the State adopts the next commercial energy code in 2026, which will likely become effective in 2027.

1. Improved fenestration
2. Reduced air leakage
3. Daylighting controls
4. Improved energy recovery effectiveness
5. Expanding energy recovery ventilator applicability to building prototypes by adopting CZ 7 criteria to CZ 6
6. Add requirements for fan power limits to allow for more coverage of equipment
7. Increase efficiency of residential warm air furnace

Simulated Savings Potential

The MAECP project team has been collaborating with PNNL on the modeling assumptions for these key amendments since the initiation of the project. A total of 16 prototype buildings are being simulated to determine energy savings and cost-effectiveness for each of the amendments discussed. While this work is still ongoing, preliminary results for the energy savings analysis indicate that 90.1-2022, combined with these amendments, will achieve a 20 percent efficiency improvement over 90.1-2019 (about 12% is from the 90.1-2022 Standard

itself and 8.3% from the amendments). The project team used the annual energy end-uses for each building prototype in each climate zone to calculate simulated energy savings in terms of energy use intensity (EUI, in kBTU/sq. ft.). These EUI savings were normalized to the statewide construction weights provided by PNNL.

Minnesota Statewide Savings Potential

Statewide energy savings potential is calculated by multiplying the EUI savings (in kBTU/sq. ft., kWh/sq.ft., or Dth/sq. ft.) by the 2022 statewide construction area.[3] Table 2 summarizes the statewide energy savings potential.

Table 2: Cycle 1 Minnesota Statewide Annual Commercial Energy Savings Potential

Building Prototype	Total Statewide Energy Savings Potential (kBTU)	Electricity Savings Potential (kWh)	Natural Gas Savings Potential (Dth)
APARTMENT HIGHRISE	27,079,444	3,455,464	15,289
APARTMENT MIDRISE	152,664,894	16,759,076	95,483
HOSPITAL	10,082,667	2,031,899	3,150
HOTEL LARGE	5,848,248	428,588	4,386
HOTEL SMALL	2,506,767	300,543	1,481
OFFICE LARGE	2,641,846	496,200	949
OFFICE MEDIUM	9,850,981	1,279,781	5,484
OFFICE SMALL	2,152,328	489,198	483
OUTPATIENT HEALTHCARE	11,130,218	1,734,468	5,212
RESTAURANT FASTFOOD	2,746,036	160,027	2,200
RESTAURANT SITDOWN	7,243,844	483,180	5,595
RETAIL STANDALONE	33,739,263	2,124,816	26,489
RETAIL STRIPMALL	3,429,625	319,379	2,340
SCHOOL PRIMARY	6,037,365	294,643	5,032
SCHOOL SECONDARY	18,195,653	1,459,198	13,217
WAREHOUSE	43,942,949	1,776,898	37,880
Total	**339,292,129**	**33,593,359**	**224,672**
Total Savings Potential (kBTU)	339,292,129	114,620,540	224,671,589
Fuel Savings Distribution	N/A	33.8%	66.2%

[3] 2022 Dodge Data provided by PNNL

Residential

To estimate the potential energy savings for the residential portion of the codes initiative, we began by calculating the energy use for a home that complies with the 2021 International Energy Conservation Code (IECC). We used Ekotrope modeling software and the Department of Energy's estimates to compare the impact of upgrading from the 2012 IECC to the 2021 IECC. We anticipate that when this initiative begins, Minnesota's residential code will be aligned with the 2021 IECC.

Since we don't have specific estimates for the impact of the proposed code amendments, we used the 20% savings figure from the commercial sector as a placeholder. This figure was derived using the PNNL model referenced above. The savings were calculated in terms of MMBtu saved, then converted to electric and natural gas savings using the estimated savings split from the "midrise apartment" category from the PNNL model. The electric and natural gas split for the midrise apartment was used as the basis for the single-family sector split since it is the archetype that most closely resembles single-family homes.

Statewide savings were estimated by multiplying the average energy savings expected for each home by the average number of new homes built between 2014 and 2023, excluding 2021. The year 2021 was excluded because it was unusual for new construction due to the COVID-19 pandemic in 2020.

Table 3 below shows the values and sources used to calculate the statewide potential for the residential sector.

Table 3: Cycle 1 Minnesota Statewide Residential Energy Savings Potential

	Value		Source
a	Single-family 2012 IECC compliant home total energy use	126 MMBtu / home	Ekotrope model house type 3. Sum of electric and natural gas annual use.
b	Savings for a 2021 IECC compliant home vs. 2012 compliant home	9.9%	Department of Energy (DOE) state level analysis of 2021 IECC versus 2012 IECC[4]
c	Single-family 2021 IECC compliant home energy use (baseline)	114 MMBtu / home	Calculated: product of a and (1-b)
d	Energy savings from code cycle 1	20%	PNNL commercial model savings (see section above)
e	Percent total home savings due to electric measures	37.5%	Percentage of savings from electric for the PNNL apartment-midrise building prototype

[4] https://public.tableau.com/app/profile/doebecp/viz/BECPStatusofStateEnergyCodeAdoption/2021IECCStateCodeComparison

f	Percent total home savings due to natural gas measures	62.5%	Percentage of savings from electric for the PNNL apartment-midrise building prototype
g	Estimated number of new homes per year	12,823	US Census 10-year average new construction permit counts (2014–2023, excluding 2021)
	Electricity Savings Potential (kWh)	**32,052 MWh**	Calculated: product of c, d, e, and g. Converted from MMBtu to MWh.
	Natural Gas Savings Potential (Dth)	**182,612 Dth**	Calculated: product of c, d, f, and g. Converted from MMBtu to Dth.

Standards

At this time, we are not presenting an annual savings potential for standards as it will vary depending on the standard, and the standards considered for the initiative will vary depending on the political priorities of new administrations. Once we identify a priority standard to work on, we will develop savings estimates for that standard and submit them to the Evaluation Committee. Some potential standards that could be of interest in 2024 and beyond include:

- Clothes Washers
- Ceiling Fans
- Consumer Furnace Fans
- Dishwashers
- Direct Heating Equipment
- Portable Air Conditioners
- Showerheads

LOGIC MODEL

Market transformation programs are different than traditional energy efficiency programs (i.e., resource acquisition programs) in that savings do not occur necessarily at the same time as activities. Market transformation relies on removing barriers in the market to increase product adoption and eventually achieve savings, so it is important to document the theory of market progress that will lead to energy savings. The program theory is derived from carefully documenting market barriers and opportunities, identifying activities to leverage opportunities and overcome barriers, and describing intended outcomes in the market, which will ultimately lead to energy savings. This theory draws a through line of logic from the current market conditions to what we plan to do and how we think the market will change as a result. Given that the market will take time to develop and absorb these changes before energy savings are fully realized, ETA will rely on other market progress indicators (MPIs) to show intermediate progress.

To document the program theory and identify MPIs, ETA engaged in a logic modeling process with support from NEEA. The logic model is a visual flow chart representation of the program theory, showing the key barriers and opportunities; ETA's market support strategies; the

immediate results of ETA's market support strategies (outputs); and the short-, medium-, and long-term market outcomes that we anticipate being the market result from these support strategies. All these lead to the overarching, long-term change that we hope to make at the end of our market intervention work. MPIs are then derived from the outcomes indicated in the logic model, and outputs will also be tracked to document market support strategy implementation and tracking. For more details about market support strategies, please see the Market Transformation Plan.

The logic model serves as a guiding document for the program and is used as a check for specific market activities to ensure alignment with the intended plan. We anticipate reviewing the logic model periodically to ensure the program theory remains sound and to adjust for new barriers and opportunities that arise. The logic model and identified MPIs will also serve as a basis for market progress evaluation, benchmarking the progress the initiative has made toward its market outcomes and as outlined in the program logic model. Since codes and standards are related but have some different barriers and activities, we have separated the logic models such that Figure 1 displays the codes advancement logic model and Figure 2 displays the standards logic model.

Figure 1: Codes Advancement Logic Model

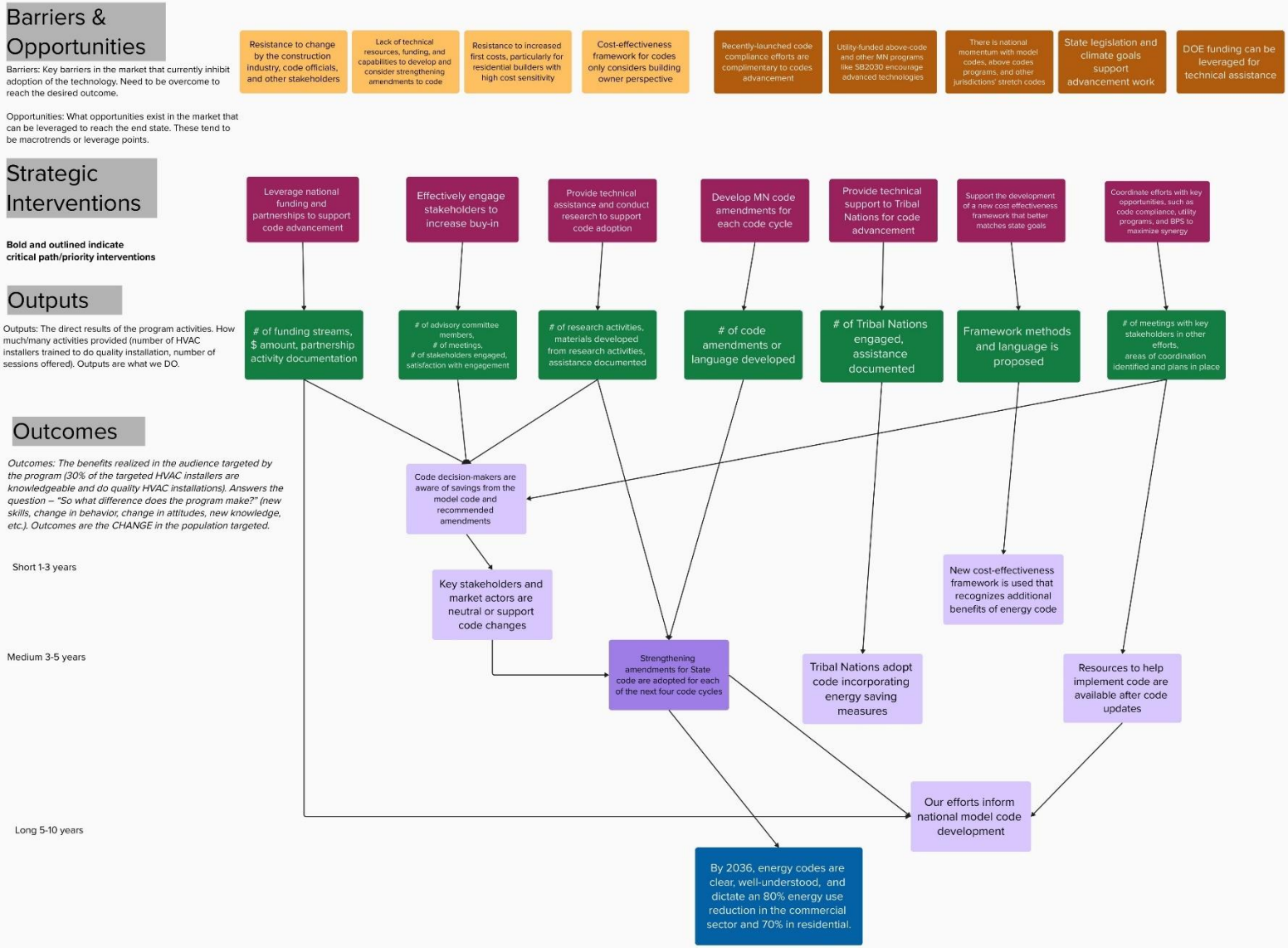
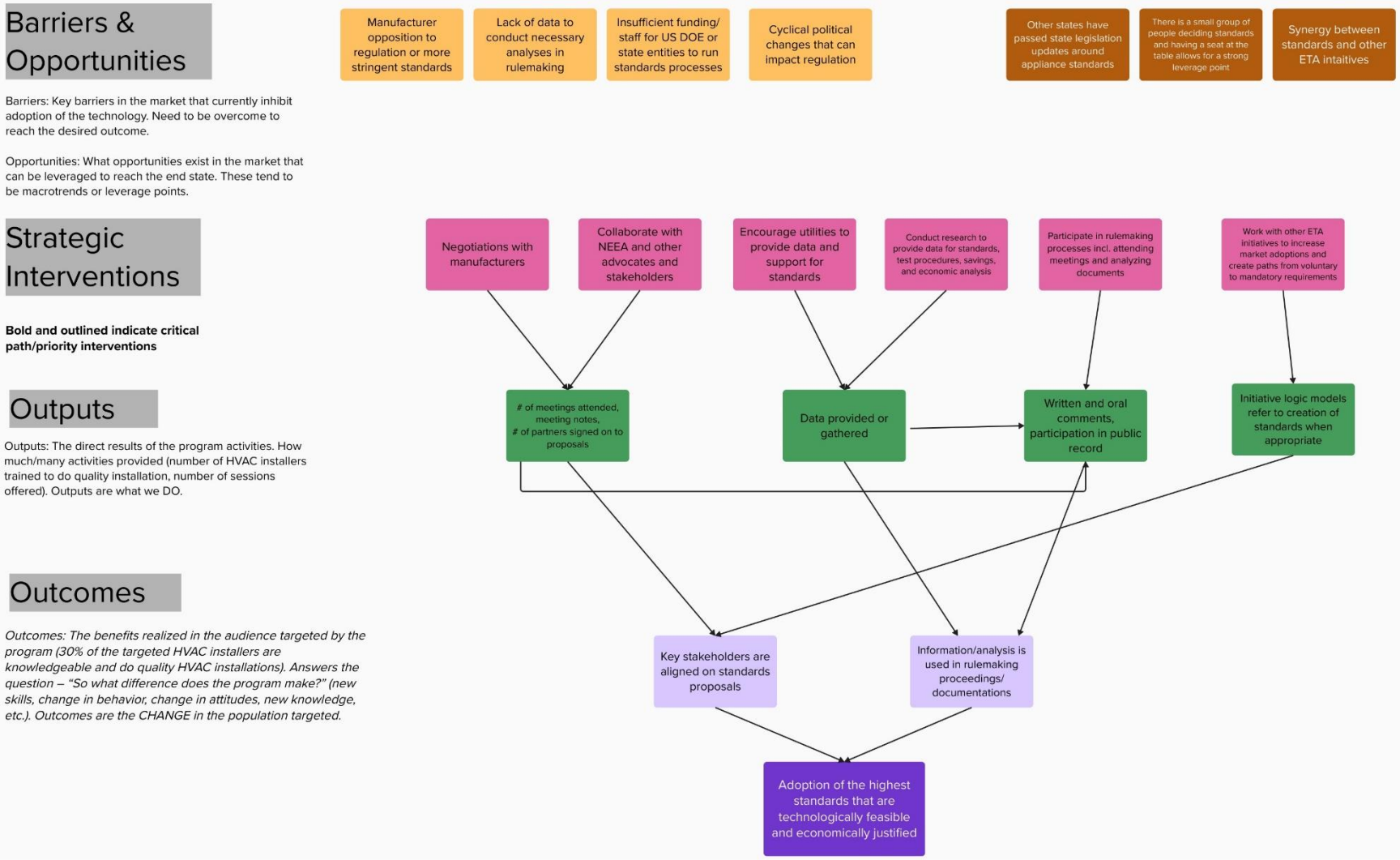


Figure 2: Standards Logic Model



Evaluation efforts

Various data, in addition to energy savings inputs, will need to be collected and tracked to understand the market and the initiative's progress. Output tracking will help show that we are implementing the outlined market support strategies, indicating implementation progress and completion of important milestones. Market progress indicators will show the state of the market and whether we are achieving or progressing toward the intended outcomes from our work. For more information about data sources and collection, see the **Error! Reference source not found.** section.

Outputs

Outputs are the direct result of ETA's actions and are therefore largely something we can measure and/or document internally or on a collective partner level depending on the market support strategy. The metrics used to assess outputs are essentially to show that the strategy is being implemented and the expected outputs and milestones are occurring, not that the market is changing, which is captured through outcomes and MPIs. Unlike with some market outcomes where the goal may be to achieve a year-over-year increase in a specific metric (MPI), outputs and associated metrics do not necessarily result in continued increases. Rather, they indicate how we anticipate reporting on our activities. For example, an output-based metric may be the number of trainings held. We may do four trainings one year and only two the next if we are focusing on other strategies. That difference is acceptable; we will simply plan on reporting the number of trainings held and qualitative details about the trainings each year.

At other times, we may want to focus our strategies and subsequent outputs on quality over quantity, though true quality tracking may require more resources and outside market actor perspectives to effectively gauge. We intend to focus resources and market actor time on MPI tracking rather than output tracking as MPIs are more critical for indicating market progress. When quality can be proxied via internally trackable metrics, we will denote those metrics. For example, we may include the number of individuals contacted and number of times we engaged with those individuals; we may only engage a small number of key market actors, but engage them deeply through numerous encounters, which is a proxy for quality engagement.

The market support strategy, output, and metric to measure the output are listed in the table below (Table 4). Outputs will be tracked and documented on an ongoing basis by program staff.

Table 4: Market support strategies and associated outputs and metrics

Strategy	Output	Metric
CODES ADVANCEMENT		
Leverage national funding and partnerships to support code advancement	Funding is secured and partnerships are documented	# of funding streams, $ amount, partnership activity documentation

Effectively engage stakeholders to increase buy-in through an advisory committee and other engagement efforts	Advisory committee meetings are held, meetings/communication with stakeholders occur	# of advisory committee members, # of meetings, # of stakeholders engaged
Provide technical assistance and conduct research to support code adoption	Research and technical assistance are documented	# of research activities, materials developed from research activities, assistance documented
Develop MN code amendments for each code cycle	Code amendment language is developed	# of code amendments or language developed, energy savings proposed through amendments
Provide technical support to Tribal Nations for code advancement	Technical assistance is documented	# of Tribal Nations engaged, assistance documented
Support the development of a new cost effectiveness framework that better matches state goals	Framework methods and language are proposed	Framework methods and language are proposed
Coordinate efforts with key opportunities, such as code compliance, utility programs, and BPS to maximize synergy	Meetings with key stakeholders in other efforts, areas of coordination identified, and plans created	# of meetings with key stakeholders in other efforts, areas of coordination identified, and plans created
STANDARDS		
Negotiations with manufacturers	Meetings with stakeholders, co-authored or supported proposals	# of meetings attended, meeting notes, # of partners signed on to proposals
Collaborate with NEEA and other advocates and stakeholders		
Encourage utilities to provide data and support for standards	Data provided or gathered	Data points provided or gathered
Conduct research to provide data for standards, test procedures, savings, and economic analysis		
Participate in rulemaking processes incl. attending meetings and analyzing documents	Written and oral comments, participation in public record, description of ETA's role	# of comments submitted, comments appear in public record, description of ETA role
Work with other ETA initiatives to increase market adoptions and create paths from voluntary to mandatory requirements	Initiative logic models refer to creation of standards when appropriate	ETA initiative logic models include standards

Market progress indicators

Outcomes are the anticipated *market change* that result from the market support strategy implementation. As they are a market change, their progress relies on market actors' behaviors and are not fully within ETA's control. Thus, they require evaluation of market progress indicators (MPIs), which are tracked via external data sources or primary data collection. The logic model outcomes, MPIs, associated metrics, and data sources are listed below. A single outcome may require measuring multiple MPIs to assess progress. Conversely, progress toward multiple outcomes might be tracked via the measurement of a single MPI. Table 4 lists all outcomes and their respective MPIs, so there may be duplicative MPIs listed. Similarly, multiple strategies can lead to the same outcome, or conversely, one strategy can lead to multiple outcomes, so strategies are not included in the table for simplicity. However, one can review the logic model to see the connection between strategies and associated outcomes. Table 4 also includes anticipated data sources to gather information about MPIs; these are discussed in more detail in the Data collection plan section.

As MPIs also relate to short-, medium-, and long-term outcomes, not all MPIs will be tracked initially or concurrently. We anticipate evaluating the time relevant MPIs every one to three years, depending on how quickly ETA can implement market support strategies and how frequently market insights are needed to guide strategies.

Codes and standards have fewer outcomes and MPIs than other initiatives as the work is a bit more direct and the primary outcome is a change in a code or standard. In other initiatives, the time horizons are much longer — there is a long lead time for getting something to a code or standard change — but for this initiative, the code cycle itself happens every three years, and standards changes tend to align with political cycles. While we may take an incremental approach for things that will play out over several code cycles, we are generally working on one cycle at a time and as such, the traditional medium- and longer-term outcomes of three or more years are less critical for this set of logic model outcomes.

Table 5: Logic model outcomes and associated MPIs

Logic Model Outcome	MPI	Data source
CODES ADVANCEMENT		
Key stakeholders and market actors are neutral or support code changes	More stakeholders approve of or are neutral toward code changes than oppose (# of stakeholders supporting code, # of stakeholders opposing code)	Votes of support during TAG meetings or other shows of support Tracking of stakeholder conversations with ETA staff
Code decision-makers are aware of savings from the model code and recommended amendments	Code decision-makers report awareness of savings	Key stakeholder survey

New cost-effectiveness framework is used that recognizes additional benefits of energy code	Cost-effectiveness framework is put in place	Cost-effectiveness framework
Strengthening amendments for State code are adopted for each of the next four code cycles	Strengthening amendments are adopted, anticipated energy savings	Code
Tribal Nations adopt code incorporating energy saving measures	Tribal Nation code includes energy savings measures	Code
Resources to help implement code are available after code updates	Training and code resources are coordinated with utilities, DLI, and other programs and are provided to market actors	Utility and other program documentation
Our efforts inform national model code development	Key stakeholders working on model code development report the influence of Minnesota code efforts	Key stakeholder interviews
STANDARDS		
Information/analysis is used in rulemaking proceedings/documentations	Rulemaking efforts include documentation of analysis provided	Rulemaking documentation
Key stakeholders are aligned on standard proposals	Joint letters submitted or comments in alignment	Rulemaking documentation
Adoption of the highest standards that are technologically feasible and economically justified	Standards are adopted	Standard

ENERGY SAVINGS ESTIMATION

Code energy savings methodology overview

While other initiatives have savings attributed based on units in the market, codes savings operate differently since there are not distinct units to count. For the codes savings methodology, energy savings will be measured using the following basic equation:

ETA claimed savings = [gross savings from code change] x [compliance factor]

Savings will be estimated based on savings from the code change multiplied by new construction square footage in that year. The compliance factor represents the fraction of buildings that meet or exceed code requirements. Savings will be claimed for 10 years after the code change. Each component of the energy savings calculation is described in more detail below.

When compared to other ETA initiatives, the savings:

1. Will still **count savings statewide.** Savings will still be generated at the state level, as code will be adopted at the state level. While some jurisdictions may vary in compliance, we will assume an average statewide compliance rate.
2. Will **NOT subtract utility rebates**, as rebates do not apply to code changes; however, will account for utility compliance program savings and avoid double counting.
3. Will **NOT calculate and adjust for a natural market baseline, but we will only claim code savings for 10 years.** For the codes initiative, we plan to follow NEEA's methodology (discussed in the subsequent sections) and claim savings for 10 years. This time horizon essentially acts as a natural market baseline and limitation on the amount of savings claimed by the program (given that the benefits of raising the code baseline will be reaped for decades and decades to come).
4. Will **NOT be counted until after a code change goes into effect**. Unlike other initiatives where we expect year-over-year market share increase from the start of the program, savings are only realizable after a code change.

Justification

The methodological approach of counting gross savings, adjusting for a compliance factor, and counting total savings for a 10-year period is based on the methodology successfully employed by NEEA for over a decade. The approach recognizes the inherent challenges of assigning attribution to utility influences on code advancement, particularly for utility above-code programs that have been in the market for over 30 years. Instead, a simplified approach is taken that assumes 100% attribution for a limited time. This is essentially a policy decision that a simplified approach is warranted and reasonable under the circumstances.

One of NEEA's justifications for this approach was their prolonged period of involvement in the new construction market — over 20 years. Minnesota utilities have similarly been involved in advancing efficiency in new construction for over 30 years for above-code measures (although they have never had an avenue to claim savings from their influence on easing the way for new codes). Thus, any assessment of market influence covering a span of more than three decades would be very imprecise at best.

We believe this approach is reasonable and warranted for Minnesota's situation because:

- ***The approach to counting gross savings aligns with Minnesota's policy approach for counting savings from ECO***. Minnesota's does not include a net-to-gross adjustment of savings, which aligns with counting gross savings from codes. For utility resource acquisition programs, only gross savings is counted (no net-to-gross adjustment is made), and we are proposing the same for this program, with the 10-year limit on savings.
- ***NEEA's experience and evaluation has shown the approach to be reasonable***. NEEA has been using this approach for many years and has had it approved by their stakeholders and evaluated by third-party evaluators. Their most recent Codes Market Progress Evaluation Report (Codes MPER #5, April 2024) states that "attribution of influence is difficult or impossible to determine," which provides context for their 10-year savings

policy decision. They have also had the 10-year savings duration evaluated and compared to other duration models, and evaluators agreed with their 10-year approach.

- ***The experience of Minnesota and nearby states indicates that a 10-year or more lag from model codes is typical.*** According to DOE analysis, the current residential energy code in effect for Minnesota, Wisconsin, and Iowa is equivalent to the 2009-IECC model code (when accounting for weakening amendments, which all these states have).[5] This lags behind the release of the most recent IECC model code (2024) by 15 years. The equivalent Commercial Energy code lags behind the most current model code (2022) by between 3 to 15 years for those same states (equivalent to ASHRAE 90.1-2007 in Iowa, 2010 in Wisconsin, and 2019 in Minnesota).[6] While the demonstrated disparity in adopting model codes is not the only justification for a 10-year savings claim, it provides a powerful indicator of the current baseline.
- ***The approach reduces risk in how savings will be calculated***. Establishing a simplified approach up-front removes some of the risk of a third-party evaluator assigning an attribution value after the initiative has been approved. This is particularly important for establishing utility support for the initiative.

We would also note that, while silent on the savings methodology employed, the codes initiative aligns with state statute. Minnesota Statutes Chapter 216B, Section 2401sets a goal to achieve 2.5 percent energy savings per year, through conservation programs, as well as "advancements in statewide energy codes" and other measures. This initiative will help achieve that objective, as well as provide a method to count the total savings from those efforts.

For each code change, a third party will confirm the use of 10 years is an appropriate timeframe given the circumstances around the change and confirm other key savings assumptions.

Detailed methodology

The basic approach to determine energy savings is to identify the savings from the code change versus the previous code using building modeling software and multiply that by the amount of new construction built per year.

Gross savings = [savings from code change] x [new construction volume]

Savings will be calculated separately by building type and totaled.

Gross savings is then multiplied by the compliance factor to determine ETA claimed savings.

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[5] Two other states adjoining Minnesota — North Dakota and South Dakota — do not have statewide building codes, so were left out of the analysis.

[6] See https://www.energycodes.gov/state-portal. Note that while Minnesota is listed on the DOE website as having a commercial code equivalent to ASHRAE 90.1-2019 (the standard upon which the current code is based), the Pacific Northwest National Lab estimates that Minnesota's weakening amendments will result in about a 5% reduction in energy savings compared to the model standard.

Step 1: Quantify code savings for each building type

The first step is to estimate the energy savings per square foot of new construction (commercial) or per building (residential) for different building types. To estimate savings from a code change, we will model energy consumption for different building types, comparing the previous code to the recently adopted one. Building categories for commercial and residential buildings are included in Table 6.

For commercial buildings, the savings will be determined by square footage for each building type. For residential buildings, this will be done on a per-unit basis by building type. Modeling for commercial savings will largely be done in partnership with Pacific Northwest National Laboratories (PNNL), and modeling for residential savings will likely be done by CEE or PNNL. Whether done by PNNL or CEE, the energy modeling will generally follow the standard protocols that PNNL has developed for conducting this modeling.[7]

[7] See: https://www.energycodes.gov/methodology

Table 6: Building types to be modeled for code savings

Commercial Building Types[8]	Approximate Proportion of Total Buildings in MN
Apartment – Highrise	6.2%
Apartment – Midrise	25.1%
Hospital	5.4%
Hotel – Large	3.9%
Hotel – Small	1.2%
Office – Large	4.7%
Office – Medium	4.2%
Office – Small	3.5%
Outpatient Health Care	4.9%
Primary School	4.4%
Restaurant – Fast Food	0.3%
Restaurant – Sit Down	0.7%
Retail – Stand Alone	12.1%
Retail – Strip Mall	1.8%
Secondary School	10.1%
Warehouse	11.5%
Residential building types[9]	
Single-family homes	96.8%
Duplexes	1.4%
3–4 Unit	1.8%

Step 2. Determine the number and type of new construction buildings

For both residential and commercial buildings, we will estimate the volume of new construction that occurs each year that the initiative claims savings. On a per building basis, only one year of savings will be claimed. As mentioned, the initiative will aim to speed up the adoption of codes

[8] 2022 Dodge Data provided by PNNL.

[9] https://www.census.gov/construction/bps/index.html. Values shown are each building type's percentage of total permits issued between 2014 and 2023 (excluding 2021, which had unusually high permit counts due to the onset of the COVID-19 pandemic in 2020).

and amendments by 10 years; therefore, the initiative will claim savings for 10 years of new construction after the code is in place.

To determine the number of residential new construction buildings, we plan on using the U.S. Census Building Permits Survey data, which are available at the state level. This will allow us to estimate the volume of new construction in Minnesota. As different measures have different impacts in the type of building in which they are added, the type of residential new construction buildings will also be determined. We will also evaluate other methods and data sources to estimate construction volume.

For commercial new construction, we will estimate the volume of new construction by building type. We plan on using data from Dodge Data & Analytics. The Dodge database includes new construction square footage and specifications for all commercial buildings that apply for a permit. We will also evaluate other data sources to estimate construction volume, such as Commercial Buildings Energy Consumption Survey (CBECS).

Step 3: Multiply and aggregate

After the new construction volume has been determined for each building type, they will be multiplied by the modeled energy savings for that building type to generate the total savings per building type. These will then be aggregated to determine an overall code or standard gross savings potential value.

Step 4: Apply compliance adjustment factor

We know that just because a code change is made, that does not mean the code achieves 100% compliance. Thus, a compliance adjustment will be applied to accommodate noncompliance in the market. The Minnesota Code Program Development Report[10] summarized past code compliance rate studies in Minnesota and looked at compliance rates in other states for certain circumstances to develop compliance rate assumptions. In Table 7 below, we have included the assumptions for the first three years after a code is adopted to accommodate one code change cycle.

[10] Minnesota Code Program Development report – TRC. 2022

Table 7: Preliminary compliance rate assumptions per the Minnesota Code Program Development Report

Program Year	Residential Compliance Rate	Commercial Compliance Rate	Assumptions
Year 1 after code change	60%	70%	New code effective, yielding a drop in compliance
Year 2	70%	80%	Compliance increases seen in other states where programs mature
Year 3	80%	90%	

Source: Taken from Minnesota Code Program Development Report, TRC. 2022.

At this point in time, we plan to derate all potential code savings by the compliance factor for the associated year as indicated in Table 6. Since we will not claim savings for 2024 or 2025, we will start with the compliance rates associated with Year 1 in 2026, or at least six months to a year after a new code is adopted.

However, our work through this program with other leveraged funding will aim to improve compliance, as will work initiated by Minnesota utilities and their programs. Due to this investment in compliance, if there is sufficient evidence to show compliance is increasing or different from our assumptions, we plan to adjust our compliance rates accordingly. Additionally, if there is better data available or a third-party evaluator determines another compliance rate is appropriate, we will adjust as needed.

Standards energy savings methodology overview

Savings claimed from standards that are beyond the scope of other ETA initiatives will follow a slightly different approach than that used for codes savings. The standards savings will not use a compliance factor but will instead use an influence factor determined by a third-party evaluator. Again, we follow NEEA's approach. The equation is as follows:

ETA claimed savings = [gross savings] x [influence factor]

With a new standard, any new equipment manufactured would be required to follow the standard, so a compliance rate is not as necessary. We recognize there may be some residual stock that could be installed after a standards change; however, we anticipate data sources that would be used to quantify savings for this initiative would indicate new product shipped or sold, not installed. Therefore, we do not plan to adjust for compliance.

Similar to codes, for the standards initiative, we:

1. Will still **count savings statewide.** Savings will still be generated at the state level, as standards will be adopted at the state or federal level.
2. Will **NOT subtract utility rebates**, as rebates do not apply to standard changes.
3. Will **NOT calculate and adjust for a standard natural market baseline, but we will apply an influence factor.** The purpose of a natural market baseline is to account for other market forces at play and to determine what would have happened without our activities. For a standards change, there will not be a market share baseline to subtract

like in other initiatives. However, we plan to use an influence factor to derate the savings claimed according to the amount of influence we had on the final standard, essentially accounting for the other market forces at play (see below for definition of "influence factor").

4. Will **NOT be counted until after a standard change goes into effect**. Unlike other initiatives where we expect year-over-year market share increase from the start of the program, savings are only realizable after a standards change.

Savings from a standard change that applies to a technology in another initiative will follow that initiative's savings calculation approach, rather than this approach.

Justification

This methodological approach also mirrors NEEA's approach and is similar to other entities. In addition, while influence is difficult to discern, it is important to create an influence factor especially when working at a federal level where there are many more players and Minnesota's market is only a fraction of the total U.S. market. While NEEA's influence factors or savings share estimates are often between 2–20%, that represents a large portion of savings and shows significant influence on the rule-making processes. We expect ETA influence factors to be in a range similar to NEEA's rates.

It is also important to note that derating by the influence factor only applies to products that fall outside of other current initiatives.

Detailed methodology

The gross savings will be counted like other ETA initiatives where:

Gross savings = [savings from standard] x [number of units sold]

The savings from a standard will be modeled, often through a federal process, and the number of units sold will be determined by market data. Market data sources could include manufacturer, distributor, third-party aggregator, and other sources depending on the standard equipment. When a standard is determined to pursue, appropriate data sources will be identified.

Influence factor

We recognize that other entities outside of ETA and its partners will be working toward standards changes, especially at a federal level. Given this, we need to determine the portion of savings that we have been able to influence that should be credited directly to ETA and its partners.

To determine the influence factor, we plan to emulate NEEA's approach by using a third-party evaluator. They will assess our influence by considering factors like the importance of barriers, the effectiveness of our activities to overcome those barriers, and our role in the process. For an example of NEEA's process, please see their Non-Weatherized and Mobile Home Gas Furnaces Standard Evaluation.

Interaction with other ETA initiatives

We recognize that other ETA initiatives aim to influence codes and standards for their specific technology, as this is often the ultimate play for market change. We may develop a plan, initiative by initiative, to determine how savings should be allocated. However, we anticipate primarily claiming savings achieved through a code change through this initiative rather than the individual initiative, as code changes will largely look at full building savings, rather than tease out individual measure savings. Standards changes for technologies within our ETA portfolio will be counted under the individual initiative.

Utility savings

Utility program and other leveraged funding interactions

Earlier in 2024, the utilities funding ETA launched an ECO program to increase code compliance. While this program may be working on different sections or versions of the code, we recognize there may be some overlap where the utility programs may help lay the groundwork for and increase adoption of a new code. We also know that the work through the ETA may increase code compliance. Since both efforts are ultimately funded by the utilities and savings will go back to the utilities, we generally anticipate that savings created from new code adoption will be attributed to ETA and savings related to code compliance will be attributed to the utility programs. Consideration will be given to adjust these parameters if there are particularly large or costly efforts through either program that would warrant ETA claiming some savings for compliance or for the compliance utility programs to claim some savings from code adoption. We will work with the utilities to ensure a coordinated approach and avoid double counting. A third-party evaluator would be involved in final consideration of utility compliance and ETA savings approaches.

In addition, ETA plans to claim savings from leveraged funding (including DOE grants), that would not have been possible without ETA funding or support.

Utility savings allocation

The allocation of statewide savings to individual utilities is based on their level of funding. Under this approach, statewide savings are allocated based on an individual utility's total fuel-specific funding as a percentage of total initiative funding. For codes and standards, electric and gas savings will be determined separately, and the breakdown of each will correspond to the percent of funding each of the utilities contribute.

The resulting 2024 through 2026 funding allocations are listed in Table 8 below. Funding percentages will be reviewed on an annual basis for adjustments in funding (e.g., additional utilities voluntarily contributing).

Table 8: Funding and savings percentages for codes and standards electric and natural gas savings

Utility	Electric EE (kWh)	Natural Gas EE (Dth)
Xcel Energy	88.4%	29.8%
CenterPoint Energy	--	55.5%
Minnesota Energy Resources	--	14.7%
Minnesota Power	8.2%	--
Otter Tail Power	3.4%	--
Electric total	**100.0%**	**100.0%**

NET BENEFITS

Calculation and allocation of net benefits

In addition to energy savings, we will calculate net benefits, which are the total benefits of an efficiency measure minus the total costs over its lifetime. They are used to assess the cost-effectiveness of programs and as inputs to calculate the financial incentive mechanism for the IOUs. All net benefits will be allocated to utilities based on funding level, following the same formula for attributing energy savings.

The inputs needed to calculate net benefits can be divided into measure-level inputs, utility inputs, and DER-specified inputs, and vary based on fuel type. In general, DER-specified inputs are set by the DER and publicly available, and we will work with utilities to gather utility input data including confidential trade secret data. For the initiative, we anticipate the following measure-level values and data sources (Table 8). Because code measures would typically represent a bundle of measures, rather than a single measure, measure-level values (other than the energy savings) would be calculated as the savings-weighted average for the bundle of measures that were included in the new code. For example, if the new code required continuous exterior insulation (with, say, a savings of 10 Dth per unit and lifetime of 20 years), and a more-efficient energy recovery ventilator (with, say, a savings of 4 Dth and lifetime of 15 years), the weighted average lifetime of the measure bundle would be 18.5 years.

Table 9: Measure-level input values and sources

ELECTRIC INPUTS	
Measure-level Inputs	**Measure-level Inputs**
Utility project costs (program costs)	ETA program
Incremental cost	Estimated based on code measures adopted (use TRM values when available)
Project life	Estimated based on the code measures that are adopted (use TRM values when available)
Total energy savings	Estimated using building energy model, as described above
Capacity savings/unit	Estimated based on code measures adopted (use TRM values when available)
Load shape	NREL or similar
GAS INPUTS	
Measure-level Inputs	**Measure-level Inputs**
Utility project costs (program costs)	ETA program
Incremental costs	Estimated based on code measures adopted (use TRM values when available)
Project life	Estimated based on code measures that are adopted (use TRM values when available)
Total energy savings	Estimated using building energy model, as described above

MARKET PROGRESS REPORTING

To monitor progress, we will create an annual status report, referred to in the filing as the Energy Savings and Market Progress Reports.

The content of each of these reports will include:

1. Output tracking and MPI progress
2. Total savings and net benefits
3. Savings and net benefit allocations to individual utilities

Some outputs and MPIs may not be appropriate to track initially or annually based on when we focus on particular market support strategies and whether the outcome is intended to be a short-, medium-, or long-term outcome. Thus, every report will include an update of outputs. However, the metrics reported will be tailored to include only those that are most appropriate at that time.

For the codes and standards initiative, savings will not be counted until after a code or standard change, which is not expected in the early years of the program. Thus, savings and net benefits for this initiative will not be included until after the code or standard change has taken place. However relevant outputs and MPIs will be included. The reports will fully document the final methodology and data sources used to calculate energy savings and net benefits.

These reports will continue throughout the Market Development and Long-term Monitoring and Tracking stages. When the initiative switches into Long-Term Monitoring and Tracking, the Energy Savings Report will include the same contents listed in 1–3 and will periodically assess the need for market re-entry (i.e., additional Market Development work). Re-entry to the market may be justified if market indicators show that progress and increased market share, or diffusion, are not proceeding as anticipated.

We will periodically assess the right time to sunset long-term monitoring and tracking.

DATA COLLECTION PLAN

There are many different data types and sources discussed throughout this document. These are compiled in Table 9 to provide a comprehensive view of how we plan to collect or access data for this initiative. We also acknowledge that this data landscape represents our current understanding of potential data availability, which may change in the future as other data sources are discovered or become available. We also plan to work with third-party evaluators to collect supplemental data and review approaches and assumptions as necessary.

Table 10: Evaluation data purpose, type, and sources

Purpose	Data type	Data source
Market support outputs tracking	Output tracking	Internal data documents: ■ Meeting records and documented communication ■ Activity records ■ Code amendment language, proposals, supporting documentation ■ Additional documents as relevant
MPI measurement – secondary data sources	Dichotomous outcome confirmation	Code language, program and rulemaking documentation
MPI measurement – primary data collection	Primary survey/interview data for appropriate MPIs	Key stakeholder interviews
Energy savings	New construction buildings and square footage	New Residential Construction Permits Census data, CBECs, Dodge data
	Code/standard savings	Models to be developed
Net benefits	DER inputs	DER guidance
	Utility data	Utility data transfers, IRPs, filings
	Measure-level inputs (see **Error! Reference source not found.**)	TRM, NREL, PNNL model, utilities

Output tracking – Internal data documents

Most logic model outputs, or results of our market support activities, will be tracked through internal sources. This may include activity records, participant lists, meeting notes, and materials created. We plan to utilize an adapted version of SalesForce to track market engagement and will have documents saved on our internal systems to share with future evaluators. Specific tracking processes for each output will be developed as the market support activities are rolled out.

MPI secondary data sources

Dichotomous outcome confirmation

There are several dichotomous MPIs that rely on proof that something happened or is in existence. It either happens or it doesn't. These include outcomes like code amendment

adoption. These outcomes are relatively easy to track as most documentation is publicly available, and proof of achievement is only needed once.

MPI primary data collection

Often, MPIs will need to be measured using primary data collection. In general, this will be done via surveys, interviews, focus groups, or other data collection options. This may involve a third-party evaluator — however, in areas where ETA has extensive knowledge and skillsets, ETA may undertake research in-house. We anticipate minimal primary data collection for this initiative compared to other initiatives as there are fewer MPIs and many MPIs are tracked via process or code/standard documentation. We will, however, plan on doing stakeholder surveys or interviews as appropriate.

Energy savings

For energy savings calculations, new construction volume and energy savings modelling will be critical for determining actual energy savings. Currently, we anticipate getting new construction commercial square footage estimates from CBECs or Dodge Data and residential building count from the New Residential Construction Permits Census data. Savings modeling will be based on modelling from PNNL, Ekotrope, 2050 Partners, or other modeling partners and software.

THIRD-PARTY EVALUATORS

This initiative indicates a greater use of third-party evaluators in its methodology than other initiatives. Third-party evaluators will be selected by ETA via an RFP, RFQ, or other appropriate methodology. For cases where there is a need for a particular skillset, or overlap with other efforts (e.g., utility compliance programs or DOE-funded components), there may be an opportunity to leverage efforts and select an evaluator via sole source.

The third-party evaluations will not go through a committee process for approval; however, the evaluation documentation will be given to the state's ETA third-party evaluator (currently Micheal's Energy) for confirmation of appropriate methodology and analysis.

As described in previous sections, we anticipate a third-party evaluator to be used in the following ways.

Savings estimations

- Review 10-year claimed savings approach and other key savings assumptions.
- Review or determine compliance factor for code savings.
- Determine influence factor for standards savings.
- Consider utility compliance program overlap and savings claimed.

Market progress tracking

- Conduct primary research as needed to determine market progress.
- Review additional documentation of market progress activities or data sources used as needed.