ASHP Energy Savings and Market Evaluation Plan

Center for Energy and Environment

Fall 2023

CONTENTS

Background and summary of potential 3
Minnesota Efficiency Technology Accelerator 3
Air Source Heat Pumps 3
Energy savings potential 5
Logic model 7
Evaluation efforts 9
Energy savings estimation 14
Energy savings methodology overview 14
Modification for simplified baseline approach 15
Inputs for savings calculations 16
Utility savings allocation 21
ETA savings attribution 22
Post code/standard adoption plan 22
Net benefits 23
Calculation and allocation of net benefits 23
Market progress reporting 25
Data collection plan 25
Sales data 27
Utility data 28
Output tracking – internal data documents 28
MPI secondary data sources 29
MPI primary data collection 29
Net benefits 29
Appendix A. Net benefits 30

BACKGROUND AND SUMMARY OF POTENTIAL

Minnesota Efficient Technology Accelerator

The 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. The 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 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 Evaluation and Savings Plan focuses on the air source heat pump (ASHP) initiative. We attempt here to provide a well-thought-out plan for both the estimation of savings, and for 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.

Air Source Heat Pumps

Summary

Space heating uses the greatest portion of energy in residential homes in Minnesota. Air source heat pumps (ASHPs) offer a more efficient and climate-friendly alternative to homes heated by electric resistance, propane, and traditional gas-fired furnaces paired with a central air conditioner (CAC) for residential space heating and cooling.[2] Currently, an estimated two thirds

[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.

[2] Center for Energy and Environment, "Heat Pumps for ACs" (2021–2022). Available here.

of Minnesota households heat their homes with gas furnaces and could instead meet a portion of their home heating needs by replacing their CAC with an ASHP. By moving heat instead of creating it, ASHPs heat homes more efficiently and contribute to reducing emissions in line with the transition to a carbon-free grid by 2040 in Minnesota.

Despite the energy and emissions savings potential, ducted ASHPs face many barriers including an undefined or weak value proposition for customers; lack of contractor and customer awareness and experience; potential for higher operational costs; and inconsistent incentive designs and product specifications across utility, state, and federal offerings. However, there are also several opportunities to increase the technology's prevalence such as increasing motivation to reduce greenhouse gas emissions by multiple actors (incl. customers; manufacturers; utilities; and federal, state and municipal entities), fuel flexibility and demand response that enables cost saving and resiliency opportunities for customers and utilities, and state and federal codes and standards.

ETA plans to lead several market support strategies to accelerate adoption of ASHPs. Anticipated market support strategies include the following.

1. Build contractor champions (through developing resources, training, and contractor differentiation)
2. Drive customer awareness through resources and collaboration
3. Facilitate alignment among financing and incentive programs
4. Work with distributors and manufacturers to encourage appropriate stocking and promotion
5. Collaborate with utilities and regulators on new rates and demand response programs
6. Support product development and utility program development to enable demand response programs
7. Influence state or federal code, policy, or appliance standard to encourage ASHPs in place of CACs

For more information about barriers, opportunities, and market support strategies, please see the Market Transformation Plan.

Product description

A heat pump is a heating and air conditioning system that uses the vapor compression cycle with refrigerant to heat or cool a home. Using this cycle, heat pumps work by transferring (or pumping) energy between the outdoors and the inside of the home. Unlike ACs, heat pumps can reverse the direction of the refrigerant flow. Given that a heat pump moves heat instead of creating it, and because the energy required to move the heat is less than the amount of heat that the refrigerant cycle delivers, this technology is over 100% efficient, reaching efficiency levels typically between 200% and 400% (heat output is between 2-4 times greater than the electric input to move refrigerant).

Application focus

While ASHPs can be deployed in a myriad of applications, we are focusing our initiative on centrally ducted homes with air conditioning and natural gas or propane furnaces. The goal is to replace central air conditioners with ASHPs and pair them with a furnace in a hybrid or dual-fuel manner, providing both heating and cooling. Our target market includes all single-family homes and 2–4 unit homes with central ductwork, and we are primarily focusing on the replacement market rather than new construction.

For this initiative, we are currently using a two-tiered system for our product definition. The purpose of these two tiers is to simultaneously raise the floor and the ceiling of the market, capturing both immediate and convenient applications while still advancing the technology and wider application types for our cold climate.

- **Tier 1** is composed of an ASHP chosen instead of an AC that will displace some furnace operation, typically sized for cooling and an entry level product.
- **Tier 2** is composed of a variable capacity ASHP that will be sized to cover most of the heating load and will have suitable efficiency and capacity maintenance for Minnesota's climate.

Energy savings potential

To understand a technology's savings potential, we can consider both the absolute maximum amount of savings possible with the technology (the technical potential) and, more realistically, the savings the program may expect to achieve (program potential).

Technical potential is the theoretical maximum amount of energy use (first-year savings) that could be displaced by the measure with consideration of engineering constraints. It is a snapshot in time, assuming immediate implementation of the technology across all buildings and applications where it is feasible. In other words, if we were to change out all existing technology in our building stock with this technology, including projected new construction, the savings of that transition would be our technical potential.

The technical potential is helpful to compare savings across initiatives and provide an order of magnitude of savings potential. Technical potential assumes that all possible retrofit opportunities and all new construction opportunities over a 20-year timeframe are fully captured.

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.

The technical potential estimates are described below. Program potential will be estimated over the next year as more data become available.

Technical potential

To project technical potential, we first identified per unit savings values using Appendix G[3] of the Minnesota TRM (version 4.0). We leveraged the default inputs included in Appendix G and modified the product specification inputs, outlined in the table below, to align with our product definitions (Table 1). As Appendix G is updated, we can consider updates, revisit inputs, and determine the most appropriate methodology. The listed product specifications were converted from M1 to M format for input into Appendix G,[4] and the climate-zone specific outputs were converted into one load-weighted average value based on the proportion of buildings in each climate zone. This resulted in a net ASHP per unit savings of 25 MMBtu for Tier 1 ASHPs and 43 MMBtu for tier 2 ASHPs.

Table 1: Product specification inputs for Appendix G

Tier	Spec aligns to:	Switchover (°F)	For homes with this fuel type:	HSPF2	SEER2 (HP)	SEER2 (AC)
1	Federal minimum	30	Natural gas	7.5	14.3	13.4
2	25C tax credit requirement	15	Propane	8.1	15.2	--

Note: More detail about chosen switchover temperatures is discussed in the Savings per unit section.

These per unit savings were then applied to existing building stock data from RECS2020[5,6] to estimate the technical potential. This includes all centrally ducted homes with CAC and natural gas heat (1,036,318 homes) and all centrally ducted homes with CAC and propane heat in Minnesota (141,080 homes), resulting in a technical potential of 31.4 million net MMBtu (Table 2). To calculate the technical potential, we assumed that Tier 1 products would go into natural gas-heated homes, and Tier 2 products would go into propane-heated homes as propane is more expensive and justifies a higher product cost. This is a conservative savings approach because we anticipate that some Tier 2 products will go into natural gas-heated homes.

---

[3] Mn Commerce Department. "Technical Reference Manual." Available here.

[4] Consortium for Energy Efficiency. "Program Resources." Available here. This was accomplished using the conversion method in the MN Technical Reference Manual 4.0, which differ from the recommendations from AHRI.

[5] U.S. Energy Information Administration, "2020 RECS Survey Data." Available here.

[6] A similar estimate was conducted for the Minnesota Energy Efficiency Potential Study published in 2018. The RECS data are newer than the data used in the potential study and have a larger sample size in this iteration allowing for state-by-state analysis.
Center for Energy and Environment, "Minnesota Energy Efficiency Potential Study: 2020–2029" (2018). Submitted to Minnesota Department of Commerce, Division of Energy Resources. Available here.

Table 2: ASHP technical potential

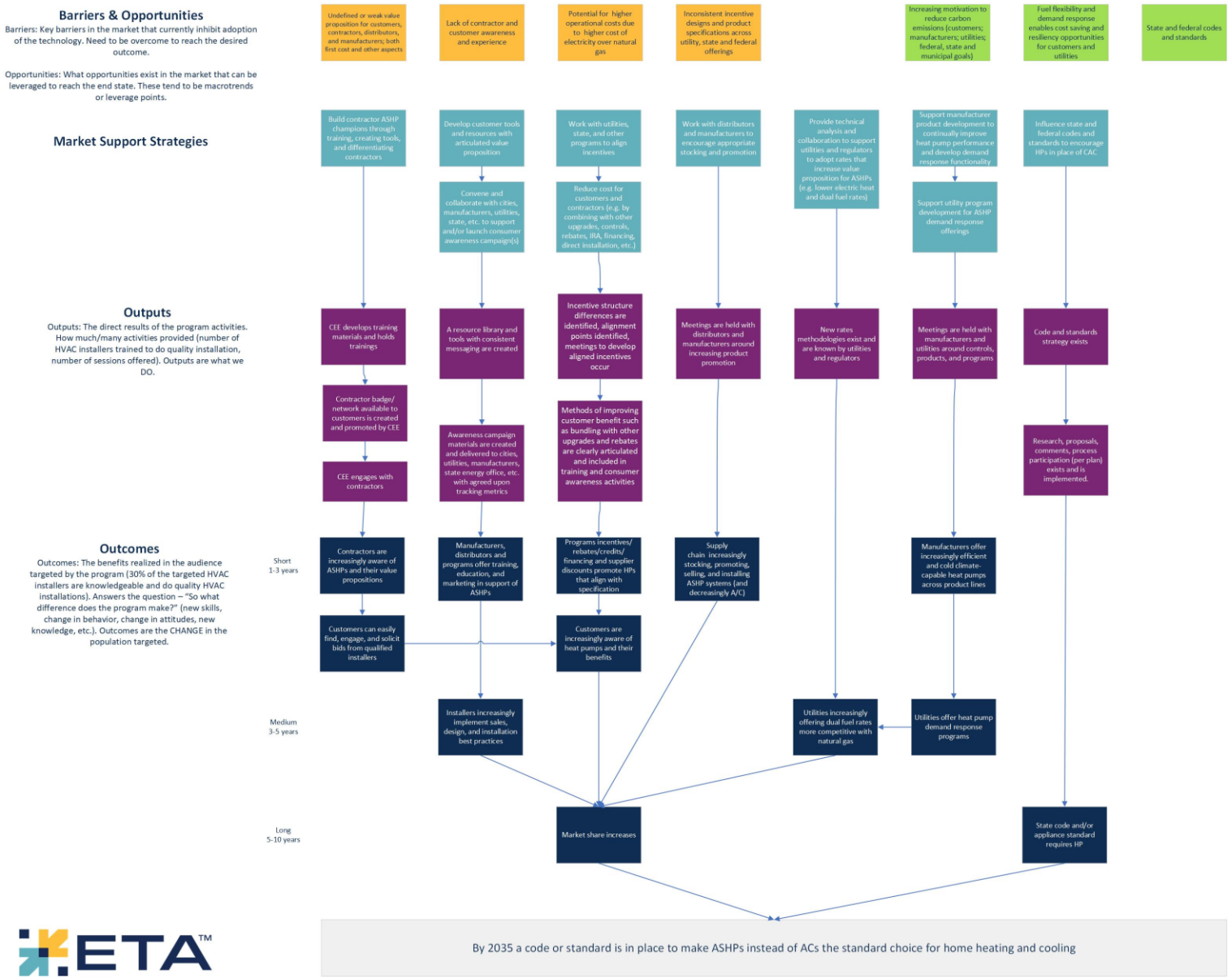
	Electric (MWh)	Gas (Dth)	Combined (Net MMBtu)
Statewide Technical Potential	**-4,170,000**	**45,600,000**	**31,400,000**
Gas Heated Homes	-3,300,000	36,600,000	25,400,000
Propane Heated Homes	-870,000	9,000,000	6,000,000

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 impact that we hope to make at the end of our market intervention work. Market progress indicators are then derived from the outcomes indicated in the logic model, and outputs will also be tracked to document that the market support strategies are implemented. 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 in the outlined program theory. The current logic model for the ASHP initiative is shown in Figure 1.

Figure 1: ASHP 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 the intended outcomes from our work. For more information about data sources and collection, see the Data collection plan 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 as 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.

In other times, we may want to focus our strategies and subsequent outputs on quality over quantity, though quality 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 to showing 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 with a small number of key market actors, but engage with 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 3). Outputs will be tracked and documented on an ongoing basis by program staff.

Table 3: Market support strategies and associated outputs and metrics

Strategy	Output	Metric
Build contractor ASHP champions through training, creating tools, and differentiating contractors (MSS 1)	O1. CEE develops training materials and holds trainings	Materials developed, # of trainings held by CEE, # of people trained, level of satisfaction with training

Strategy	Output	Metric
	O2. Contractor badge/network exists and is available to customers	PCN is available, # of contractors in network, # of website visitors
	O3. CEE engages with contractors	# of contractors engaged, # of times engaged with contractors
Develop customer tools and resources with articulated value prop (MSS 2)	O4. A resource library and tools with consistent messaging are created	messaging doc created, # of resources included, # of website visitors
Convene and collaborate with cities, manufacturers, utilities, state, etc. to support and/or launch consumer awareness campaign(s) (MSS 2)	O5. Awareness campaign materials are created and delivered to cities, utilities, manufacturers, state energy office, etc. with agreed upon tracking metrics	Materials exist, Materials delivered, # of partners, # of outreach channels
Work with utilities, state, and other programs to align incentives (MSS 3)	O6. Incentive structure differences are identified, alignment points identified, meetings to develop aligned incentives occur	Documentation of differences and alignment points, # of meetings with key partners, meeting notes and presentations
Reduce cost for customers and contractors (e.g., by combining with other upgrades, controls, rebates, IRA, financing, direct installation, etc.) (MSS 3)	O7. Methods of improving customer benefit such as bundling with other upgrades and rebates are clearly articulated and included in contractor training and consumer awareness activities	Methods identified, Messaging created, Materials created, Materials incorporated into contractor training/consumer awareness
Work with distributors and manufacturers to encourage appropriate stocking and promotion (MSS 4)	O8. Meetings are held with distributors and manufacturers around increasing stocking and product promotion	# of meetings held, # of contacts made, presentations/meeting notes
Provide technical analysis and collaboration to support utilities and regulators to adopt rates that increase value proposition for heat pumps (e.g., lower electric heat and dual fuel rates) (MSS 5)	O9. Technical analysis and rate options are developed and are known by utilities and regulators	Analyses created, # of meetings with utilities, meeting notes/presentations
Support manufacturer product development to continually improve heat pump performance and develop demand response functionality (MSS 6)	O10. Meetings are held with manufacturers and utilities around controls products and programs	# of meetings held, # of individual contacts made, presentations/meeting notes

Strategy	Output	Metric
Support utility program development for ASHP demand response offerings (MSS 6)		
Influence state or federal code or standard to encourage ASHPs in place of CAC (MSS 7)	O11. Research, proposals, comments, process participation (per plan) exists and is implemented.	# of research/other activities per plan implemented
	O12. Code and standard strategy exists	Plan document created

Market progress indicators

Outcomes are the anticipated *market* result of the market support strategy implementation. As they are a market result, they rely on market actors to come to fruition and are not fully within ETA's control. Thus, they require evaluation of 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.

Table 4: Logic model outcomes and associated MPIs

Logic Model Outcome	MPI	Data source
Contractors are increasingly aware of heat pumps and their value propositions	A. Increasing # of contractors reporting familiarity with heat pumps	Contractor survey
	B. Increasing # of contractors reporting agreement that heat pumps are appropriate for natural gas and propane heated homes, especially with CAC replacement (may include technical and financial suitability)	Contractor survey

Logic Model Outcome	MPI	Data source
	C. Increasing # of contractors can name at least two benefits of heat pumps for customers	Contractor survey
	D. Increasing # of contractors report that selling ASHPs are valuable to their business.	Contractor survey
Customers can easily find, engage, and solicit bids from qualified installers	E. Increasing # of contractors report they include ducted ASHPs in their bids for natural gas and propane heated homes (e.g., good, better, best model)	Contractor survey
	F. Increasing # of customers who report satisfaction with their bids and contractor search	Customer survey/homeowner survey
	G. Increasing # of programs and key partners promoting the preferred contractor network	Conversations with programs and partners, Partner websites
Manufacturers, distributors, and programs offer training, education, and marketing in support of heat pumps	H. Increasing # of manufacturers and distributors offering training on ASHP products	Manufacturer/distributor survey or conversations
	I. Increasing # of trainings and educational materials exist	Literature review, Manufacturer/distributor survey
Program incentives/rebates/credits/ financing/manufacturer discounts promote ASHPs that align with specification	J. ETA funding utilities offer ASHP programs that align with our recommended specifications	Utility conversations and rebate finder[7] (or dsireusa.org)
	K. Increasing # of programs offer ASHP rebates that align with our recommended specifications	Utility conversations and rebate finder
	L. Increasing # of programs offer ASHP financing that aligns with our recommended specifications	Utility conversations and online search
	M. Increasing # manufacturers offer discounts that promote ASHPs aligning with our recommended specifications	Manufacturer/distributor survey or conversations
	N. Increasing # of state rebates submissions	State administered rebate records

[7] MN ASHP Collaborative, "Incentives and Financing." Available here.

Logic Model Outcome	MPI	Data source
Customers are increasingly aware of heat pumps and their benefits	O. Increasing # of potential HVAC customers are aware of heat pumps	Homeowner survey, contractor survey
	P. Increasing # of potential HVAC customers can identify at least one benefit of ASHPs	Homeowner survey, contractor survey
Supply chain increasingly stocks, promotes, sells, and installs ASHP systems (and decreasingly A/C)	Q. Increasing % of contractors indicate that ASHPs are readily available with reduced lead times	Contractor survey
	R. Increasing % of distributors stock ASHPs that align with our recommended specifications	Distributor survey
	S. Increasing % of contractors install ASHPs that align with our recommended specifications	Contractor survey
	T. Increasing # of ASHPs sold that align with our recommended specifications	Sales data, contractor survey
Manufacturers offer increasingly efficient and cold climate-capable heat pumps across product lines	U. Increasing % of products that align with our recommended specifications	AHRI product directory
Installers increasingly implement sales, design, and installation best practices	V. Increasing # of installers reporting they are following best practices	Contractor survey, possible site survey
Utilities increasingly offer dual fuel rates more competitive with natural gas	W. Increasing # of utilities offer dual fuel rates	Utility rates data
	X. Gap between rates for dual fuel and natural gas costs narrows	Utility rate data
Utilities offer heat pump demand response programs	Y. Increasing # of utilities offer heat pump demand response pilots and/or programs	Utility conversations, web research, Regulatory filings
Market share increases	Z. Proportion of heat pump sales from all HVAC cooling sales increases	Sales data
State code and/or appliance standard requires ASHP	AA. State code or appliance standard requires ASHP instead of one-way AC	Code or standard

Energy savings methodology overview

As outlined in the ETA filing, ETA will apply an approach consistent with how savings are estimated for traditional CIP programs.

In its most basic form, energy savings are estimated using the following equation:

[market transformation savings] = [number of units] x [savings per unit]

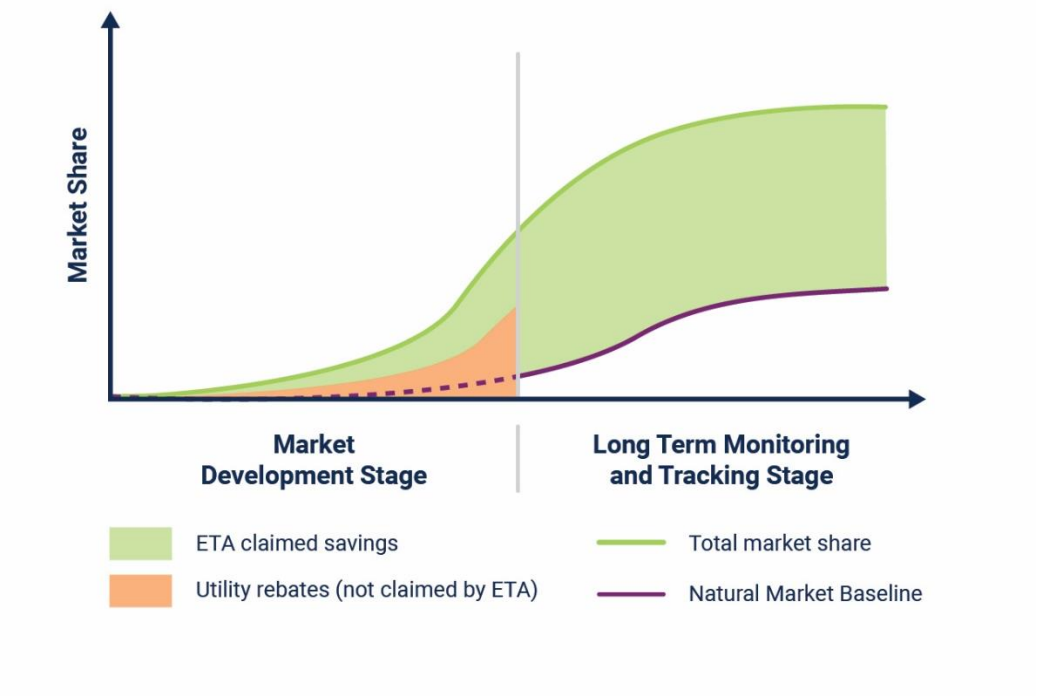
However, there are some key differences in approach and additional adjustments that are made to estimate market transformation savings, which were described in the filing and approved in the ETA final order. In summary, the approach involves three basic steps:

1. **Counting total statewide savings from market sales data.** For market transformation, the number of units is counted at the whole market level, rather than at the individual customer level. This is because the market support strategies influence the whole market, not just a single customer's decision. Thus, because the program will not be collecting site-level data for the whole state, the program will use an average statewide savings number across all applicable customer sites, and multiply that by data typically collected at the manufacturer, distributor, or retailer level.[8] In traditional CIP programs, savings accuracy depends on precisely capturing customer site information, while in market transformation it is more important to accurately characterize the whole market.
2. **Adjusting the total savings to account for utility rebates.** Frequently, at least a portion of a market transformation initiative's life cycle will overlap with rebates offered by a traditional CIP program, as entities work together to advance the adoption of energy efficient products and practices in the market. Savings from this type of joint program effort are referred to as co-created savings because both programs contribute to the total savings and to the market transformation effects. However, these savings should not be double counted in savings claimed through ETA. Therefore, when rebates are provided by a traditional CIP program during the course of a market transformation initiative, the savings claimed through these rebates will be subtracted from the total market transformation savings to avoid double counting.
3. **Adjusting for a natural market baseline during the Long-Term Monitoring and Tracking Stage.** The natural market baseline is a forecast of the future in which no utility-funded intervention exists (CIP or ETA). It is a counterfactual, hypothetical forecast that allows us to

[8] We note that distributors could provide product to contractors in Minnesota that may install them in other states. A similar situation can occur for retail products sold directly to customers. In this case, an adjustment to account for this leakage to adjacent states may be needed. NEEA has developed methodologies for accounting for this leakage, and we would follow best practices in making those adjustments.

recognize that there is some current market adoption, albeit very minimal, and that market adoption may change on its own. Minnesota, however, does not require the subtraction of the natural market baseline from the statewide savings data during the Market Development Stage, as it is a gross savings state (Figure 2). However, it is appropriate to adjust for the natural market baseline in the Long-Term Monitoring and Tracking Stage, per the filing (Figure 3).

Figure 2: Market Development and Long-term Monitoring and Tracking savings accounting



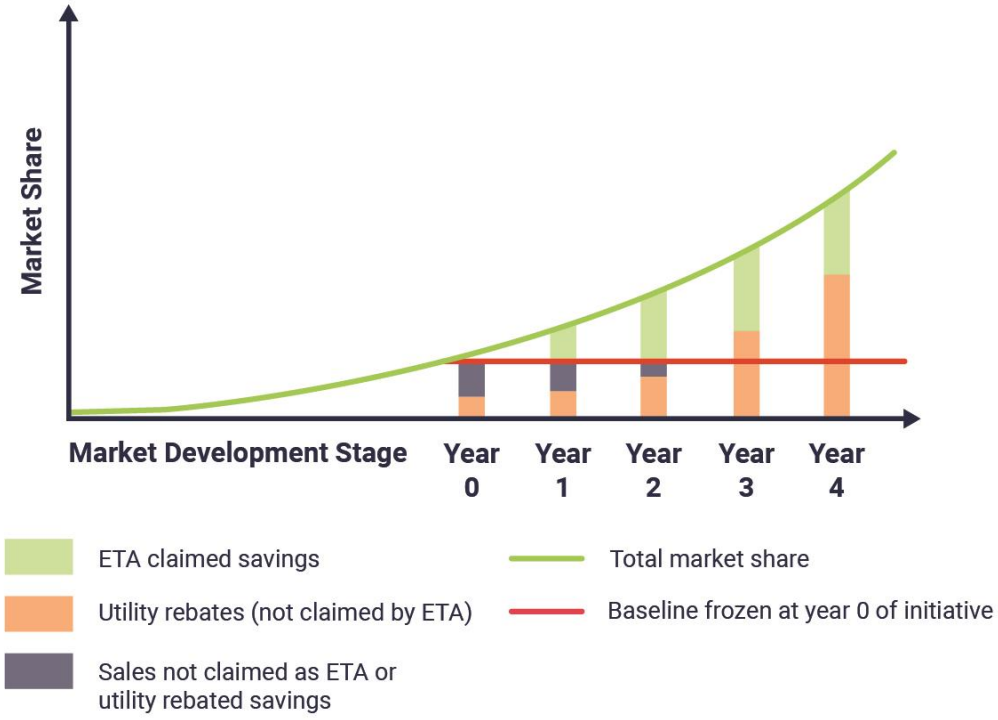
Modification for simplified baseline approach

While it is not a regulatory requirement to account for the natural market baseline (NMB) during the Market Development Stage, there are currently commercially available products that meet our product definition in the market with a small portion of sales prior to ETA strategy implementation. Therefore, we plan to modify the approach outlined in the filing and follow a more conservative, simplified baseline approach to adjust for some naturally occurring sales during the Market Development Stage. This will be accounted for by freezing a baseline at the total market share of the product in the year prior to the Market Development Stage (Figure 3). Trendlines or averages may also be considered if we believe the year before contained anomalies (e.g., supply chain shortages, COVID-19).

With this simplified baseline approach, ETA will only claim savings for sales above the initial frozen baseline. In early years, rebate participation may be below the simplified baseline (e.g., yr. 1 and 2). Therefore, there is no need to subtract the rebated savings from ETA savings since they are already accounted for within the simplified baseline. Once utility rebate amounts cross

the simplified baseline amount, we will simply subtract utility savings instead of the baseline. Utility rebate participation will likely grow over time, and while we anticipate having positive influence on volume of rebated sales, we plan to only count ETA savings above the rebated amount, so it is possible that ETA savings may temporarily shrink over time until reaching Long Term Monitoring and Tracking (e.g., yr. 3–4 in Figure 3).

Figure 3: Simplified baseline approach for savings calculations in market development stage



The simplified baseline approach is more conservative than claiming all gross savings, as is allowable in statute, and requires less evaluation spend than a full NMB. The NMB is also hypothetical and uncertain, and this approach relies on a more tangible sales figure. We will, however, still provide NMB projections and use the NMB in the Long-Term Monitoring and Tracking Stage.

For the ASHP initiative, we plan to freeze sales and market share based on the initial market condition estimates described by distributors (4%). Moving forward, we hope to utilize AHRI or direct distributor data, and may readjust our initial baseline if we identify differences from our original assumption. After five years, the program will review the baseline assumptions to account for unforeseen market disruptions or new data to inform the baseline adoption, and we may adjust the baseline accordingly.

Inputs for savings calculations

Each input used to calculate energy savings and complete the necessary adjustments is discussed in more detail below. As noted in the basic methodology above, we plan to estimate statewide sales and multiply it by the savings per unit. We will then subtract the simplified

baseline or the utility rebates (whichever is greater) when the initiative is in the Market Development Stage. Once the initiative moves to the Long-Term Monitoring and Tracking Stage, we will instead subtract the natural market baseline (assuming the natural market baseline is greater than any rebate activity that may still be occurring).

Savings per unit

Per unit savings estimates will be generated via the Minnesota TRM's Residential ASHP Fuel Switching Calculator (Appendix G), using TRM-specified inputs where possible. Product specifications inputs for Tier 1 and Tier 2 products will align with federal minimum requirements or Consortium for Energy Efficiency Tier 1[9] requirements, respectively (Table 5). Appendix G generates outputs specific to each climate zone; these will be converted into one load-weighted average value based on the proportion of buildings in each climate zone.

Table 5: Product specification inputs for Appendix G

Tier	Spec aligns to:	Switchover (°F)	For homes with this fuel type:	HSPF2	SEER2 (HP)	SEER2 (AC)
1	Federal minimum	30	Natural gas	7.5	14.3	13.4
2	25C tax credit requirement	15	Propane	8.1	15.2	--

For the Tier 1 product, 30°F was chosen as the switchover temperature primarily to be consistent with utility choices in recent ECO triennial plans.[10] This is also what we expect to see from the market, given that single-stage equipment has capacity constraints that make the equipment unable to deliver the required heat at lower temperatures and that equipment becomes noisier and much less efficient as the temperature drops.

For the Tier 2 product, the equipment can operate to lower temperatures, even down to 5°F — however, there are some challenges with sizing the equipment for those lower temperatures given ductwork limitations and cost constraints. Therefore, 15°F was chosen to balance reasonably sizing equipment with a goal of displacing as much propane as possible.[11] These temperature choices may be adapted as we gather more data.

[9] MN ASHP Collaborative, "Air Source Heat Pump Specification Summary." Available here.

[10] Xcel Energy and CenterPoint Energy, "Triennial Plan" dockets: 23-92 and 23-95. Available here and here.

[11] Northwest Energy Efficiency Alliance, "Variable Speed Heat Pump Product Assessment and Analysis" (2022). Available here.

We plan to collect data (including product specification) regularly throughout this program. Energy savings for each product will vary depending on whether the product meets the requirements for a Tier 1 or Tier 2 product, and we estimate net ASHP per unit savings to be 25 MMBtu for Tier 1 ASHPs and 43 MMBtu for Tier 2 ASHPs. Energy savings are not currently being ascribed based on fuel type as we will not know the fuel type for homes in which ASHPs are installed. However, natural gas and propane-heated homes have the same level of MMBtu savings per unit, so this is not imperative. As we receive data, we plan to monitor this approach's results and adjust our allocations and analysis as needed over time.

Statewide sales estimates

Currently, we have limited insight into ASHP sales data. In subsequent years, we will work on collecting distributor-level whole product category sales data (HVAC cooling market), including ASHP sales. This will only represent a portion of statewide sales, as it is unlikely every distributor will provide data. We will then extrapolate data to estimate statewide sales.

We hope to discern Tier 1 and Tier 2 products within the sales data or determine an approximate share of Tier 1 and Tier 2 products from market insights. If that is the case, we will apply the appropriate per unit savings to the sales in each tier. If tier information is unavailable, we will create a singular weighted per unit savings estimate to apply to all qualified product sales.

Utility rebate data

Most funding utilities have an existing ASHP rebate program, though the rebate amounts and specifications vary. We will work with these funding utilities to track ASHP rebates to subtract from the total savings if they rise above the simplified baseline.

Additionally, as consumer-owned utilities (COUs) have been funding the ASHP Collaborative since 2019, we will collaborate with our existing relationships as well as with DER and non-funding COUs to identify additional rebate programs and amounts.

Simplified baseline

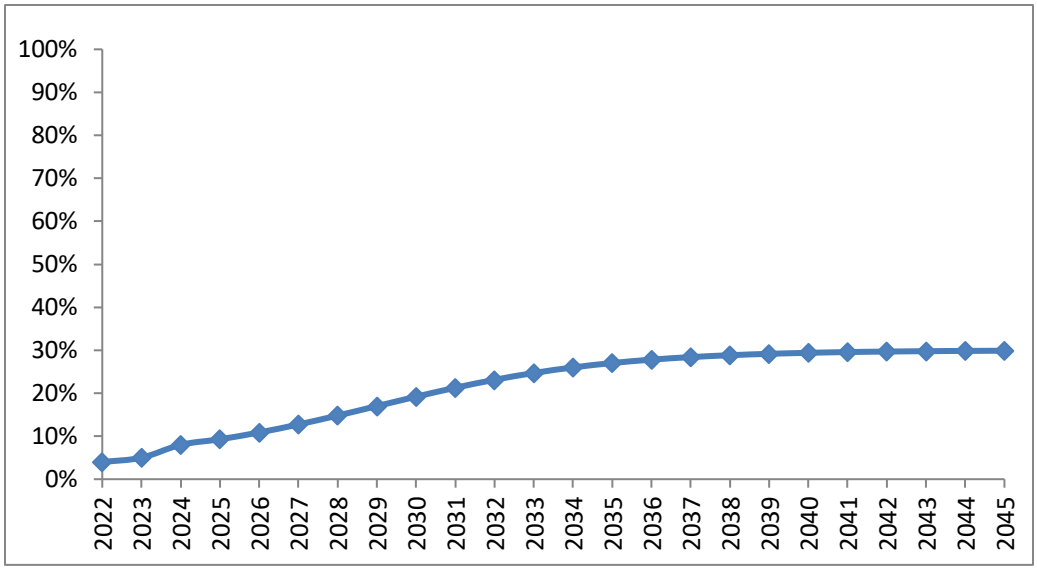
Based on current market intelligence from distributor conversations, we estimate ASHPs constituted roughly 4% of the HVAC cooling market (CACs and ducted ASHPs) in 2022. This 2022 data point will be confirmed and updated through the sales and market share data that we plan to gather directly from distributors (extrapolated to the full state). Our plan for this data collection is described in more detail in the Data collection plan.

Natural market baseline

The natural market baseline is initially created using a methodology developed by NEEA, and it results in an s-curve shaped model of the projected market adoption for ASHPs if the ETA did not intervene in the market. Since these are hypothetical models, a large amount of uncertainty around estimated figures exists. However, AHRI data and other data sources, market characterization, expert opinion on future projections, and current understandings of the market inform the NMB inputs. They will be refined over the next year as the program launches and will

be reviewed periodically to confirm the assumptions are still appropriate. Based on our current understanding of the market, we anticipate the natural baseline curve over the program lifetime of 20 years to be similar to that in Figure 4.

Figure 4: ASHP natural market baseline over the 20-year program life



Rationale

Initial condition

The initial condition for the ASHP NMB was determined based on conversations with distributors who indicated the share of ASHPs in the HVAC cooling market was about 4%.

Expected growth pattern of the technology

ASHP technology has a challenging value proposition for displacing centrally ducted air conditioners and offsetting natural gas furnaces. Customers who have central AC and gas furnaces report high levels of comfort[12] and these customers have relatively low heating and cooling costs.[13,14] This market would grow very slowly without intervention, because ASHPs installed in these applications have few non-energy benefits, higher operational costs, and a dynamic environment. However, there is strong social momentum toward emissions reduction, and this application is the best way for customers to reduce their space heating emissions if they primarily use natural gas to heat their homes.

[12] Center for Energy and Environment, "Heat Pumps for AC" (2021–2022). Available here.

[13] MN ASHP Collaborative, "Cost of Heat Comparison Resources." Available here.

[14] Center for Energy and Environment, "Developing Electric Rates for Hybrid Air Source Heat Pumps in the Midwest." Available here.

Federally funded rebates and tax incentives through the Inflation Reduction Act will help reduce upfront costs. However, due to the limited pool of funding and the incremental cost differences between qualifying ASHP products and air conditioners, cost parity will likely not be achieved. Moreover, consumer's willingness to pay more for energy saving or environmentally friendly products is mixed and has a wide variation in results.[15,16,17] Therefore, the addition of federal rebates and tax credits may have a more modest impact.

Modest growth is estimated to begin in 2024 with the rollout of IRA funds. Many customers are expected to carry out projects they may have been deferring in anticipation of the rollout of federally funded incentives. The expected trajectory of growth from 2024 onward was informed using historical growth rates from the Air-Conditioning, Heating, and Refrigeration Institute (AHRI). Looking at historical, national-level data from AHRI from 2018–2022, as a portion of the total, the market share for ASHPs compared to ACs grows about 1% each year.[18] National-level data includes the recent high-paced growth of ASHPs, mostly in milder climates in the southern US.[19] This growth figure is reasonable to apply to northern markets that will receive an influx of federal funding to counteract the challenges posed by the current value proposition. Similarly, the Energy Information Administration Annual Energy Outlook 2023 estimates the growth of electric heat pump stock for the purpose of cooling to grow at a rate of 1.5% each year through 2050.[20] While stock and sales are different concepts, these two data sources and trends illustrate that a modest growth estimate is a reasonable assumption.

Aside from unknowns surrounding state implementation and distribution of federal rebate dollars and how long these funds are expected to last, federal rebates in the IRA will be funded through FY 2031. The tax credit supporting ASHP installations will be available through December 31, 2032.[21] Therefore, it is reasonable to assume the growth rate will slow when these funds expire.

Saturation rate

To further explore the growth rates above, it is helpful to compare similar products that have gone through market transformation efforts. NEEA's ductless heat pump initiative provides a good example of a natural market baseline and actual market growth with market intervention

[15] Tyson Ang, Vivien Jancenelle, and Shuqin Wei, "Willingness to pay more for green products: The interplay of consumer characteristics and customer participation" (2018). Available here.

[16] Dalia Streimikiene et al, "A Review of Willingness to Pay Studies for Climate Change Mitigation in the Energy Sector" (2019). Available here.

[17] Jonas Scmidt and Tammo Bijmolt, "Accurately measuring willingness to pay for consumer goods: A meta-analysis of the hypothetical bias" (2019). Available here.

[18] AHRI, "Central Air Conditioners and Air Source Heat Pumps." Available here.

[19] U.S. Energy Information Administration, "2020 RECS Survey Data." Available here.

[20] U.S. Energy Information Administration, "Annual Energy Outlook 2023." Available here.

[21] ENERGY STAR, "Air Source Heat Pumps Tax Credit" (2022). Available here.

as a ceiling for comparison. This market targets ductless heat pumps to displace zonal electric heat (baseboard heating) used by customers. This technology has a high value proposition because it provides enhanced heating comfort, cooling to customers who don't have cooling, and a 50% reduction in electric heating costs. This technology has a higher natural market baseline, reaching saturation at around 65%, and has relatively high growth in the market.[22]

NEEA's heat pump water heater (HPWH) initiative provides an additional comparison setting a growth rate floor. HPWHs have a challenging value proposition: customers aren't compelled to think about innovation when it comes to water heating — they just want hot water. There are minimal non-energy benefits for HPWHs, and while they do save costs operationally, the annual amount is low compared to the upfront cost increase. Also, the supply chain barriers are steep. In this market, HPWH adoption has been slow and mostly code driven. The natural market baseline in the case of this technology projects a 25% saturation rate.[23]

Though the technology is more similar to ductless ASHPs, we anticipate the value proposition of ducted dual-fuel ASHPs as AC replacement to more closely align with HPWHs. There are similarly few non-energy benefits beyond cooling performance and displacing heating load. Additionally, depending on switchover temperature settings, fuel type, and rates, operational costs might be higher, lower, or comparable to baseline heating costs. However, there are some social and market tailwinds as it relates to urgency to reduce carbon emissions and momentum behind the product with current policies and rebates. We therefore believe that a saturation rate of 30% seems likely, which is slightly higher than the NMB saturation for HPWHs based on the ASHP product momentum. This is further corroborated by extrapolating national AHRI year-over-year growth rates of ASHP market share (comparing ASHPs to ASHPs and ACs combined) from 2010–2022 and applying the national trend rates to the Minnesota market share for 2045.

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. Funding and savings for this initiative is thus 34.1% by gas utilities and 65.9% from electric utilities. The 2023 funding allocations are listed in Table 6 below. Funding percentages will be reviewed on an annual basis for adjustments in funding (e.g., updated triennial plans, additional utilities voluntarily contributing).

[22] Northwest Energy Efficiency Alliance, "Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #4" (2015). Available here.

[23] NEEA. Aug. 15, 2023. Baseline Forecasting Assumptions: DHP and HPWH.

Table 6: Funding and savings percentages for the ASHP initiative

Utility	% of funding/savings
Electric utilities	
Xcel Energy (electric)	58.0%
MN Power	4.8%
Otter Tail Power	3.0%
Electric total	**65.9%**
Gas utilities	
CenterPoint Energy	18.7%
Xcel Energy (gas)	9.4%
MERC	6.1%
Gas total	**34.1%**
Total	**100.0%**

While not currently part of ETA funding, COUs have been funding the ASHP Collaborative since 2019. Given this involvement, some savings may be attributed to these utilities, proportionate to their level of funding outside the ETA. The ETA funding utility percentages will remain consistent within ETA savings unless a different arrangement brings COU funding into the ETA.

ETA savings attribution

While ETA plans to claim savings only above and beyond the simple baseline and utility rebates, we anticipate that ETA activities will increase product demand in a way that will benefit utility rebate programs, which should be partially attributed to ETA when the program is evaluated. When the state evaluates the program, we anticipate highlighting co-created savings, which is a mixture of utility rebated savings and ETA claimed savings, as an overall indicator of ETA's effectiveness. We will also work with the third-party evaluator to determine any additional adjustments necessary to account for these activities as they arise.

Post code/standard adoption plan

Energy codes or appliance standards are often the endpoint of market transformation efforts. A given market transformation initiative helps accelerate the technology's adoption into the code or standard, and savings can continue to accrue from the ETA initiatives after they have been adopted into a code or standard. The method to calculate savings post-code adoption is well

established nationally and involves adjusting the savings by an attribution rate[24] to account for the degree to which the market transformation effort influenced the code or standard. Thus, the basic savings equation for market transformation initiatives post code or standard adoption is as follows:

[market transformation savings] = [number of units] x [savings per unit] x [attribution rate]

The number of years after the code or standard is adopted that the program can claim savings must also be determined. NEEA generally claims savings from energy codes for 10 years, while savings claimed from appliance standards vary more based on the extent to which earlier standards were adopted due to market support activities. Therefore, we plan to claim savings for 10 years for energy codes, while standards changes will be based on an estimate by an independent evaluator of how much earlier the standard was adopted. The attribution rate will be determined based on an evaluation completed by an independent evaluator after the code or standard has been adopted.

For this initiative, we anticipate engaging with state energy code development to promote the inclusion of ASHP into Minnesota's Residential Energy Code and/or engaging with standard development. If a code change is achieved, we plan to continue to count savings for 10 years after code adoption.

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. For the ASHP initiative, both gas and electric inputs will be needed. All inputs are outlined in Appendix A. 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 ASHP initiative, we anticipate the following measure level values and data sources (Table 7).

[24] The attribution rate is initiative-specific and determined as an outcome of the evaluation. It is an estimate of the extent to which market transformation efforts influenced the savings (considering other factors) and is typically expressed as a percent.

Table 7: ASHP measure-level input values and sources

ELECTRIC INPUTS	
Measure-level Inputs	**Data source**
Utility project costs (program costs)	ETA program
Incremental cost	Xcel Energy Triennial Eco plan Tier 1: $4,072.21 Tier 2: $9,741.82
Project life	MN TRM v4.0 (18 years)
Energy savings/unit	Appendix G Tier 1: 7,170 kWh Tier 2: 12,495 kWh
Capacity savings/unit	Appendix G Tier 1: 0.14 KW Tier 2: 0.25 KW
Number of units	Annual sales data
Load shape	NREL or similar
GAS INPUTS	
Measure-level Inputs	**Data source**
Utility project costs (program costs)	ETA program
Incremental costs	Xcel Energy Triennial Eco plan Tier 1: $4,072.21 Tier 2: $9,741.82
Project life	MN TRM v4.0 (18 years)
Energy savings/unit	Appendix G Tier 1: 24 Dth Tier 2: 43 Dth
Number of units	Annual sales data

Note: For all inputs with Tier 1 and Tier 2 data, we will use tier-specific data if we are able to get sales data with that level of detail. If we are not able to distinguish between tiers, we will create a singular weighted figure to be applied to any product regardless of tier.

To monitor progress, we will create an annual status report, referred to 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 and MPIs, however, the particular metrics reported will be tailored to include only those that are most appropriate at that time. Savings and net benefits, as well as utility allocations, will be included in each annual Energy Savings and Market Progress Report. 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 the 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 of an initiative. For initiatives with an end goal that includes an energy code or standard, the initiative often continues to accrue savings for many years after the technology or practice is included in that code or standard. The methodology for calculating savings from the ETA initiatives after a technology is adopted into codes or efficiency standards is covered in the Post code/standard adoption plan.

There are many different data types and sources discussed throughout this document. These are compiled in Table 8 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 will also plan to work with third party evaluators to collect supplemental data and review approaches and assumptions as necessary.

Table 8: Evaluation data purpose, type, and sources

Purpose	Data type	Data source
Market support outputs tracking	Output tracking	Internal data documents: ■ Engagement plans ■ Meeting records ■ Activity records ■ Additional documents as relevant
MPI measurement – secondary data sources	Product data	AHRI product directory
	Rebate data	Utility data State rebate records Rebate finder
	Dichotomous outcome confirmation	Web searches/literature review Utility conversations and rate data
	Sales data	Distributor data/AHRI or other data sources
MPI measurement – primary data collection	Primary survey/interview data for appropriate MPIs	Contractor survey Customer survey General population survey Manufacturer/distributor survey Training surveys and records
Energy savings	Whole product category sales data (including ASHPs)	Distributor data
	Per unit savings	TRM Appendix G
	Utility rebate data	Utilities and DER database
Net benefits	DER inputs	DER guidance
	Utility data	Utility data transfers, IRPs, filings
	Measure level inputs (see Table 7)	TRM, NREL, utilities

Sales data

Sales data is used for both calculating energy savings and tracking MPIs and is thus critical to understand market impact over time. In 2024 and beyond, we will aim to collect distributor level sell-through data to estimate the statewide market. The ASHP Collaborative maintains many significant relationships with Minnesota ASHP distributors. The benefit of collecting data at the distributor level vs. the manufacturer level includes:

- Data will reflect zip code of units sold to contractors vs. number of units shipped to a particular zip code. This provides better accuracy and confidence that the product was sold and installed in MN vs. moved in inventory to other geographies.

The process of data collection will be as follows.

- Develop value proposition for distributors to share data (likely by providing anonymized local market insights back to distributors in exchange for sharing data).
- Establish data sharing agreements and secure file transfer process with distributors.
    - Targeted distributor partners include Auer Steel, Stevens Equipment Supply, Dakota Supply, Gustave A. Larson, Ferguson HVAC Supply, First Supply, Minnesota Air, RHI Supply, etc.
    - Additional distributor partners may be added to data sharing process as the program increases partnerships.
- Initiate the agreement and data sharing process with as many distributors as possible; will likely begin with 2 or 3 and ideally increase data sharing and coverage over time.
- Estimate the whole market based on available data.

Additional insights on this anticipated process are described in the following.

- Data transfer will occur and be analyzed semiannually.
- Initial data transfer will be requested for historic data beginning in 2019 through present and each subsequent data transfer will include data in six-month batches.
- Requested data fields may include:
    - Manufacturer
    - Model numbers
    - Zip code
    - Month sold
- Data sharing incentives can be offered if needed.
- If data sharing at the distributor level doesn't yield intended results, the ETA team will shift focus to the manufacturer level to receive ship-to data by ZIP code.

AHRI data and alternative data sources

AHRI collects and reports on manufacturer ship-to data nationally. They provide data insights and reporting back to manufacturers only and do not provide local-level data to third parties. AHRI does provide national sales data publicly and that can be leveraged to understand national macro trends. In 2024 and beyond, we will continue to engage with manufacturers and AHRI to explore ways to access AHRI data to improve market visibility with improved efficiency.

Additionally, the ETA team will continue to explore alternative and emerging methods of collecting whole market data to ensure that the largest portion of the market is represented, with the highest fidelity at the local level and requiring the most efficient cost as possible to acquire.

Utility data

Since the beginning of 2019, the MN ASHP Collaborative has collected, and will continue to collect, utility rebate participation data every six months from Xcel Energy, Otter Tail Power, Minnesota Power, Great River Energy (GRE), Missouri River Energy Services (MRES), and Southern Minnesota Municipal Power Agency (SMMPA). We will also work to collect rebate data from Minnkota Power Cooperative, Dairlyland Power Cooperative, East River Electric Power Cooperative, Connexus Energy, L&O Power Cooperative, and others as appropriate. Additionally, we will work to align rebate fields collected and improve data insights from utility aggregator data, which currently is high level.

Data from utilities will also be used for a variety of purposes including energy savings, net benefits calculations, and additional benefits tracking. We will continue to request a variety of data from funding utilities including:

- Utility rebate data (both ASHPs and CACs)
- Measure-level inputs for net benefits calculations (e.g., project costs, incentive amounts)
- Utility-level inputs for net benefits calculations (e.g., avoided energy costs, avoided emissions)

We will continue to work with existing points of contact to collect utility rebate data and will work with each funding utility to determine the appropriate person to collect inputs for net benefits calculations. We will also use existing documentation, such as Integrated Resource Plans and other filings to glean appropriate information.

We will also work with DER to utilize their Energy Savings Platform database to gather additional information entered by COUs.

Upon completion of the state rebate program, we will also work with the state to gain access to IRA rebate data to understand site level trends, quality control inspection findings, and cost data. We will also share market intelligence collected through the initiative with the state to inform their program efforts.

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 records of trainings, participant lists, meeting notes, engagement or strategy plans, 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

AHRI product directory

AHRI maintains a comprehensive product directory with unique reference numbers for equipment combinations and pairings. These reference numbers correspond to a variety of details about HVAC equipment, including metrics required to meet specifications. We anticipate purchasing a subscription for this directory and tracking new products that align with our specifications.

Rebate data

Currently, we have relationships with funding utilities and COUs to share rebate participation data. The state is currently working to develop and roll out a rebate program; while their system is not yet up and running, we anticipate being able to access state rebate records once the system is in place. Finally, there is an online rebate finder tool that we will use to identify additional rebate programs and opportunities for alignment.

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 ASHP specifications being adopted or codes being adopted. These outcomes have many data sources but are relatively easy to track as most are publicly available, and proof of achievement is only needed once.

MPI primary data collection

Many MPIs will need to be measured outside of sources that currently exist. In general, this will be done using survey, interviews, focus groups, or other data collection options. Most often, this will involve a third-party evaluator — however, in areas where ETA has extensive knowledge and skillsets, ETA may undertake research in-house. We anticipate the following groups will be important to engage with data collection.

- Contractors
- Distributors
- Homeowners (general population)
- HVAC Customers
- Manufacturers

Net benefits

For information about net benefits inputs and data sources, please see Appendix A. Net benefits memo.

TECHNICAL MEMORANDUM

Draft Methodology for Calculating ETA Net Benefits

September 13, 2023

Authors: Chidinma Emenike, Isaac Smith, Carl Nelson, Maddie Hansen-Connell

Purpose

ETA statute requires the calculation and allocation of net benefits as well as energy savings. This document lays out a draft methodology for calculating net benefits from ETA initiatives. This methodology will be included as part of the Market Transformation Plan documents to be approved by the ETA Coordinating Committee prior to launching ETA initiatives.

Net benefits are used for assessing program cost-effectiveness and as inputs for calculating utility financial incentives. As with other CIP programs, net benefits for ETA will be reported when there are savings from specific initiatives to be claimed. Once ETA initiatives are approved and launched, CEE will file annual ETA Energy Savings Reports (similar to an individual utility's Status Report) of total savings and net benefits for each participating utility.

Background

The ETA filing approved by DER provides some overall guidance on calculation of net benefits[25]. As described in the filing, ETA net benefits calculations differ from other CIP programs in several key respects, as outlined in Table 1 below.

Table 1: ETA net benefits calculations compared to traditional CIP program savings calculations

ETA net benefits	CIP program net benefits
Calculated on a statewide basis	Calculated by individual utility territory

[25] Center for Energy and Environment. "Minnesota Efficient Technology Accelerator Program Proposal" (2022). Submitted to Minnesota Department of Commerce, Division of Energy Resources. Docket No. E,G999/CIP-21-548. P. 21-34.

Allocated based on financial contribution to ETA (same as ETA savings)	Calculated based on each individual utilities' spending and savings

ETA net benefits will be calculated based on the primary approved cost-effectiveness test (Minnesota Test) and all other secondary approved cost-effectiveness tests (Societal, Utility, and Ratepayer Impact Tests). Consistent with the approved filing, we will not calculate participant net benefits[26]. Participant cost-effectiveness is a more impactful metric earlier in the program cycle (i.e., when considering program rebates, as opposed to reporting net benefits), and is already considered as part of the ETA initiative selection process.

Included impacts for calculating net benefits

Table 9 below shows a list of various impacts (benefits and costs). Per DER guidance, these impacts will be included in each of the four cost-effectiveness tests. Shaded cells indicate values that are currently not quantified and/or do not have an approved estimation methodology[27].

Table 9: DER-approved cost-benefit impacts (non-quantified impacts in grey)

Utility	Category	Impact	MN Test	Societal Test	Utility Test	RIM
Electric Utility	Generation	Energy Generation	X	X	X	X
		Capacity	X	X	X	X
		Environmental Compliance	X	X	X	X
		RPS Compliance	X	X	X	X
		Market Price Effects	X	X	X	X
		Ancillary Services	X	X	X	X
	Transmission	Transmission Capacity	X	X	X	X
		Transmission System Losses	X	X	X	X

[26] The participant test is designed to assess cost-effectiveness from a participant's perspective, considering rebates provided by the program. As described in the filing, this test is not as meaningful for ETA initiatives (which may intervene in the market prior to a technology being cost-effective, and do not provide rebates).
Center for Energy and Environment. "Minnesota Efficient Technology Accelerator Program Proposal" (2022). Submitted to Minnesota Department of Commerce, Division of Energy Resources. Docket No. E,G999/CIP-21-548.

[27] DER Decision. "In the Matter of 2024-2026 CIP Cost-Effectiveness Methodologies for Electric and Gas Investor-Owned Utilities" (March, 31, 2023). Docket No. E,G999/CIP-23-46.

Utility	Category	Impact	MN Test	Societal Test	Utility Test	RIM
	Distribution Costs	Distribution Costs	X	X	X	X
		Distribution System Losses	X	X	X	X
	General	Program Incentives[28]	X	X	X	X
		Program Administration Costs	X	X	X	X
		Utility Performance Incentives	X	X	X	X
		Utility Revenue Impacts				X
		Credit and Collection Costs	X	X	X	X
		Risk	X	X	X	X
		Reliability	X	X	X	X
		Resilience	X	X	X	X
Gas Utility	Commodity / Supply	Fuel and Variable O&M	X	X	X	X
		Capacity and Storage	X	X	X	X
		Environmental Compliance	X	X	X	X
		Market Price Effects	X	X	X	X
	Transportation	Transportation	X	X	X	X
	Delivery	Delivery	X	X	X	X
	General (same as Electric)	Program Incentives[28]	X	X	X	X
		Program Administration Costs	X	X	X	X
		Utility Performance Incentives	X	X	X	X
		Credit and Collection Costs	X	X	X	X
		Risk	X	X	X	X
		Reliability	X	X	X	X
		Resilience	X	X	X	X
Non-Utility System	Other Fuels	Other Fuels	X	X		
	Participant	Participant Costs		X		
		Participant Benefits		X		

[28] Note that ETA is not expected to have any costs in this category as ETA initiatives do not provide customer rebates.

Utility	Category	Impact	MN Test	Societal Test	Utility Test	RIM
Societal	Societal Impacts	GHG emissions	X	X		
		Criteria air emissions	X	X		
		Other environmental	X	X		
		Economic and Jobs (Macroeconomic)	X	X		
		Energy Security	X	X		
		Energy Equity	X	X		

Basic methodology – electric utilities

Below we outline the methodology plan to employ to calculate these impacts for the ETA. In general, this is very similar to calculating net benefits for an individual utility, with the exception of calculating the time value of avoided energy for electric utilities, as described below.

Step 1: Calculate total annual energy and capacity savings. This is based on energy savings calculation methodology, discussed in the Energy Savings and Evaluation plans (generally, it will be total units * energy savings/unit or capacity savings/unit). To the extent possible, savings will be consistent with the most recent TRM.

Step 1a (electric utilities only): DER guidance provides for calculating the benefits of avoided energy by each hour of the year (8760 hours) for each year of measure life, resulting in a high level of data granularity that is needed to calculate net benefits. It is reasonable to expect that we might be able to get this level of granularity of data from ETA-participating utilities; but data for the rest of the state will be challenging. Thus, a simplified method will be used for calculating the time value of efficiency, by breaking down the year into periods, and estimating the $/kWh value for each time period. Savings from measure-specific load shapes will also allocated to these discrete time periods.

For illustrative purposes, Table 10 shows the time periods used for calculating energy savings in the 2018 Minnesota Potential Study. We will base the actual time periods and percentage allocations used for ETA net benefits calculations according to what makes the most sense based on the data that is received.

Table 10: Potential Study energy time periods, for calculating time value of electric energy savings

Period	Period definition	% of year
Summer on-peak	Jun-Aug: weekdays 9 a.m. – 10 p.m.	10%
Summer off-peak	Jun-Aug: weekdays 10 p.m. – 9 a.m.	8%
Winter on-peak	Nov-Mar: weekdays 8 a.m. – 10 p.m.	17%

Period	Period definition	% of year
Winter off-peak	Nov-Mar: weekdays 10 p.m. – 8 a.m.	12%
Shoulder on-peak	Apr-May & Sep-Oct: Weekdays 7 a.m. – 11 p.m. + All weekend days 9 a.m. – 11 p.m.	33%
Shoulder off-peak	Apr-May & Sep-Oct: Weekdays 11 p.m. – 7 a.m. + All weekend days 11 p.m. – 9 a.m.	20%

Step 2: Multiply energy and capacity savings by the appropriate values. Energy savings will be multiplied by each relevant $/kWh value (value of avoided energy, value of avoided emissions, etc.), for each period shown in Table 10. Capacity savings will be multiplied by each relevant $/KW value (value of avoided capacity, value of avoided T&D, etc.) per year of measure life. Calculate total benefits by adding together all resulting dollar amounts for each value.

Step 3: Discount benefits in future years by the appropriate discount rate. The ETA would use the discount rates provided by DER guidance, with some extrapolation needed to calculate statewide values for the utility test, as described in a below section.

Step 4: Calculate total net costs, in keeping with current DER methodology. If available, these inputs will be sourced from the most recent TRM. If costs occur beyond year one (e.g., O&M costs), they will be subtracted from the benefits in the year in which they occur.

Step 5: Calculate net benefits (total benefits minus total costs).

Electric inputs

Table 11 shows the inputs needed to calculate net benefits for electric utilities (Table 4). These inputs are divided into three categories:

1) *Measure-level inputs.* These will be different for each ETA initiative. The method for estimating these inputs will be defined in the Energy Savings Plan for each initiative.
2) *Utility-specific inputs.* These are inputs that are specific to each utility; as described in the "calculating statewide inputs" section below, load-weighted statewide averages will be calculated for these values. Some utility-specific inputs utilize DER-specified values for individual utilities – refer to the footnotes for more information about these values. The statewide average will be based on DER-specified inputs where possible (not available for all utilities).
3) *Global inputs*. These are inputs that apply statewide and are provided by DER.

Utility-specific inputs and global inputs are largely derived from Triennial Plan filings and associated decisions. See the Relevant Filings section for specific filing references.

Table 11: Benefit-cost inputs for electric-saving measures

Measure-level Inputs	Utility-specific Inputs	Global Inputs
Utility Project Costs	Avoided Energy Costs	Participant Discount Rate (residential customers)
Project Life	Avoided Emissions	Societal Discount Rate
Energy Savings/Unit	Avoided T&D[29]	Environmental Compliance
Capacity Savings/Unit	CIP Utility Discount Rate[30]	Non-gas Fuel Cost
Number of Units	Participant Discount Rate (non-residential customers)[31]	Non-gas Environmental Damage Factor
Load Shape		Non-Gas Fuel Loss Factor
Incremental Costs		Avoided Capacity Costs
Electric Non-Energy Benefits		
Variable O&M		

Basic methodology - gas utilities

The gas utility methodology follows DER guidance.

Step 1: Calculate total annual energy savings. This is based on energy savings calculation methodology, discussed elsewhere (generally, it will be total units * energy savings/unit). To the extent possible, savings will be consistent with the most recent TRM.

Step 2: Multiply energy savings by the appropriate values. Energy savings will be multiplied by each relevant $/Dth value (value of avoided energy, value of avoided emissions, etc.). Calculate total benefits by adding together all resulting dollar amounts for each value.

Step 3: Discount benefits in future years by the appropriate discount rate, as provided by DER.

Step 4: Calculate the total net costs, in keeping with DER methodology. If available, these inputs will be sourced from the most recent TRM.

Step 5: Calculate net benefits (total benefits minus total costs).

Gas inputs

Table 12 shows the gas inputs that will be used to calculate net benefits, divided into the categories described above in the electric section.

[29] DER-approved annual values per utility.

[30] Specified by DER in their order, for each investor-owned utility (IOU).

[31] Same as the CIP utility discount rate.

Table 12: Benefit-cost inputs for gas-saving measures

Measure-level Inputs	Utility-specific Inputs	Global Inputs
Utility Project Costs	CIP Utility Discount Rate[32]	Participant Discount Rate (residential customers)
Project Life	Participant Discount Rate (non-residential customers)[33]	Societal Discount Rate
Energy Savings/Unit	Gas Retail Rate[34]	Environmental Compliance
Number of Units	Demand Cost[35]	Gas Environmental Damage Factor
Incremental Costs		Gas Escalation Rate
Variable O&M		Gas Commodity Cost
		Peak Reduction Factor

Relevant filings

Utility-specific inputs are filed every three years in the utility Triennial Plans and approved by the DER. The 2024-2026 Triennial Plans include:

- Minnesota Department of Commerce. "Decision in the Matter of Xcel Energy's 2024-2026 Energy Conservation and Optimization Triennial Plan" (December 1, 2023). Docket No. G,E002/CIP-23-092.
- Minnesota Department of Commerce. "Decision in the Matter of Minnesota Power's 2024-2026 Energy Conservation and Optimization Triennial Plan" (December 1, 2023). Docket No. E015/CIP-23-093.
- Minnesota Department of Commerce. "Decision in the Matter of Otter Tail Power Company's 2024-2026 Energy Conservation and Optimization Triennial Plan" (December 1, 2023). Docket No. E017/CIP-23-094.
- Minnesota Department of Commerce. "Decision in the Matter of CenterPoint Energy's 2024-2026 Energy Conservation and Optimization Triennial Plan" (December 1, 2023). Docket No. G008/CIP-23-095.

[32] Specified by DER for each IOU.

[33] Same as the CIP utility discount rate.

[34] Per DER, this is calculated using each utility's currently approved tariffed non-natural gas margin (using a weighted average if multiple customer classes are participating), demand cost, and the DER-specified gas commodity cost.

[35] Per DER, this value is sourced from the utility's March 2023 Purchased Gas Adjustment filing.

- Minnesota Department of Commerce. “Decision in the Matter of Minnesota Energy Resources Corporation’s 2024-2026 Energy Conservation and Optimization Triennial Plan” (December 1, 2023). Docket No. G011/CIP-23-098.

DER specified inputs and global inputs are noted in the Minnesota Department of Commerce Decision on the 2024-2026 CIP Cost-Effectiveness Methodologies for Electric and Gas Investor-Owned Utilities (Docket No. E,G999/CIP-23-046; filed March 31). All filings can be found on the State of Minnesota’s Public Utilities Commission electronic docket system, eDockets available here.

Calculating statewide inputs

Measure-level inputs will be estimated based on the methodology outlined in each ETA initiative’s Energy Savings Plan. Global inputs will be per the latest DER guidance.

To estimate statewide values for utility-specific inputs (as shown in Tables 4 and 5 above), CEE will calculate a load-weighted statewide average using values from ETA utilities, as well as from non-ETA utilities when available. Other statewide data source may supplement utility-specific data. This follows the methodology employed in the 2018 Minnesota Potential Study. Data sources will include:

- NREL's Cambium data sets (to estimate the value of avoided energy and avoided emissions)
- Confidential data requests for trade secret utility-specific data points
- Appropriate proxies (co-op borrowing rates, muni bond rates, etc.) to determine the value of benefits occurring outside of ETA funder utility service areas and calculate load-weighted statewide average