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FOCUS ON ENERGY® Market Transformation Assessment Study

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Introduction

In December 2023, the Focus on Energy evaluation team kicked off a Market Transformation Assessment Study (MT Assessment) to help the Public Service Commission of Wisconsin (PSC) better understand potential opportunities associated with investment in market transformation (MT) programs in Wisconsin. The goal of the study is to support future PSC decisions regarding investment in market transformation initiatives (MTIs) and the appropriate emphasis for Focus on Energy to place on MTIs in the next quadrennium (Quadrennium V). PSC research priorities addressed in the MT Assessment include the following:

- **Assess alignment with Wisconsin's statewide energy efficiency program policy.** As a first step in the study, the evaluation team identified key policy questions that needed to be considered before MT could assume a larger role in Focus on Energy.
- **Understand how other state and utility programs have approached market transformation and related policy challenges.** Other states, including Illinois, Minnesota, and California, have recently approved investments in and pursued MT programs. The evaluation team investigated and summarized how those states have addressed policy issues associated with regulatory approval, management, and evaluation of MT programs and how those approaches could be adapted to Wisconsin.
- **Identify and prioritize market transformation program opportunities.** A core objective of this study was to identify the most promising energy efficiency MT opportunities for Wisconsin. The study's approach relied primarily on scanning MT initiatives from other regions and assessing them for their relevance and potential impact on Wisconsin. In the next phase of the study, the team will develop concept descriptions, along with estimated budgets and impacts, for the five most promising MT opportunities.
    - **Develop a roadmap for implementing energy efficiency market transformation in Wisconsin.** The ultimate goal of this study is to provide the PSC with a roadmap that identifies the key steps required to incorporate MT programs into the Focus on Energy Quadrennium V portfolio. The final roadmap will address both policy decisions and recommended MT investments.

The study consists of two phases, which will be conducted over two years. These phases are summarized below; the full scope of work is included in Appendix A.

- **Phase 1** took place over calendar year (CY) 2024 and included two primary tasks:
    - Phase 1. Policy analysis. Identify key policy questions that the Commission will need to consider before MT can assume a larger role in the statewide program. The policy analysis also included a summary of processes and frameworks that other states have used to pave the way for investment in market transformation.
    - Phase 1. Opportunity assessment. Identify and conduct a preliminary assessment of market transformation opportunities that may be a good fit for the Wisconsin market. The

opportunity assessment began with a review of the 2021 Focus on Energy Potential Study,1 recent market research, and recent evaluation findings to identify opportunities with unaddressed energy efficiency potential in Wisconsin. The evaluation team compiled a list of 20 opportunities to develop opportunity descriptions and high-level market characterizations and identified the top five opportunities for further development in Phase 2.

- **Phase 2** will take place in CY 2025. In this final phase, the evaluation team will conduct additional research on the most promising MT opportunities identified in Phase 1. By the end of this phase, the team will develop a forecast of energy impacts and cost-effectiveness as well as a concept description and budget for how to advance five of the most promising market transformation opportunities during Quadrennium V.

This report presents the evaluation team's analysis methodology and findings from Phase 1. The policy analysis methodology and findings are presented throughout the *Phase 1. Policy Analysis* section of this report, including appendices that include references to research sources, interviewees who contributed, and procedural histories from Minnesota, California, and Illinois, three states that recently integrated MT programs into their energy efficiency framework.

The opportunity assessment methodology and findings are presented in the *Phase 1. Opportunity Assessment* section of this report, including detailed scoring criteria and findings related to each of the opportunities considered*. Appendix D. Opportunity Summaries* includes the full summary description for each of the opportunities considered.

[1] https://focusonenergy.com/about/2021-potential-study-documents

Phase 1. Policy Analysis

As part of the MT Assessment, the evaluation team conducted a policy review to identify key policy questions that the Commission will need to consider before MT can assume a larger role in the statewide program. The policy review addressed these questions:

- How does MT align with Wisconsin's statewide energy efficiency program policy?
- Where might there be uncertainty with integrating MT? What might need to be restructured within Focus on Energy to support MT? Where might the Commission need to make decisions to allow Focus on Energy to go down the path of MT versus market effects?
- What are the key distinctions between resource acquisition (RA) and MT programs—particularly in terms of how impacts are measured—and the associated policy implications?
- Are there any parallels with other state programs that encountered similar policy questions? How did they approach them?
- How are other programs addressing cost-effectiveness requirements for MT?

This section of the report summarizes the evaluation team's approach to and findings from the policy review. The section concludes with discussion points for the Commission's consideration and recommendations for incorporating these findings into Wisconsin's MT roadmap.

Approach

The policy analysis synthesizes information the evaluation team collected from the following activities:

- **Wisconsin policy review**: A review of Wisconsin's enabling legislation, administrative code, and Commission dockets pertaining to statewide energy efficiency program policy.
- **Regional MT program and policy review:** Review of MT-related documentary history from other regions, including Minnesota, Illinois, Midwest Energy Efficiency Alliance (MEEA), and California.
- **In-depth interviews:** In-depth interviews with 10 individuals who have had experience seeking approval for new MT investments in California, Minnesota, and Illinois or who have been involved in related Wisconsin policy.

Appendix B. Bibliography includes a bibliography of documents reviewed, *Appendix C. List of Interviewees* includes a list of people interviewed, and *Appendix D*. *Procedural Histories* includes a list of procedural histories.

Wisconsin Policy Review

The evaluation team conducted a policy review to assess the alignment of the existing Wisconsin statewide energy efficiency program policy with an enhanced focus on MT. To identify potential policy issues associated with introducing and integrating MT investments into the statewide energy efficiency program, the team reviewed enabling legislation, associated administrative code, and quadrennial planning proceedings and decisions. The team also reviewed the current evaluation framework documented in the strategic evaluation plan.

While the enabling legislation does not explicitly call for MT, it does include language consistent with it and does not prohibit MT. Moreover, Wisconsin Statute §196.374(3)(b) authorizes the Commission to set statewide program goals, priorities, and targets and directs the Commission to prioritize programs that moderate the growth in electric and natural gas demand and usage.

However, if it were to pursue investment in MT initiatives, the Commission would need to address current policy related to evaluation and cost-effectiveness. The *Evaluation Policy Considerations* section of this report discusses these policy issues.

Enabling Legislation Provisions Consistent with MT Investments

Focus on Energy, originally formed by the Wisconsin Legislature in 1999 and funded by the Utility Public Benefits fund, delivers energy efficiency and renewable energy services for residential and business customers throughout the state. The Department of Administration rolled out the Focus on Energy Program statewide in 2001. In 2005, Wisconsin Act 141 (Act 141) transferred oversight of Focus on Energy to the Commission and established collective utility funding for statewide energy efficiency and renewable energy resource programs.

In addition to the mechanism for funding statewide energy efficiency and renewable resource programs, Wisconsin Statute §196.374 includes these provisions, which seem to position Wisconsin well for the ability to invest in MT:

- Subsection (2)(a) specifies the purpose of statewide energy efficiency and renewable resource programs:
  - "[Programs] shall be to help achieve environmentally sound and adequate energy supplies at reasonable cost. It also specifies that the programs shall include initiatives and market strategies that address the needs of individuals or businesses facing the most significant barriers to creation of or participation in markets for energy efficient products that the individual or business manufactures or sells or energy efficiency services that the individual or business provides."
- Subsection (3)(b)1 states the following:
  - "The Commission shall set or revise goals, priorities, and measurable program targets at least every 4 years and give priority to programs that moderate the growth in electric and natural gas demand and usage, facilitate markets and assist market providers to achieve higher levels of energy efficiency, promote energy reliability and adequacy, avoid adverse environmental impacts from the use of energy, and promote rural economic development.

In particular, the language regarding market barriers and facilitating markets to achieve higher levels of energy efficiency seems well aligned with MT strategy.

Administrative Code Provisions Consistent with MT Investments

PSC 137.04 elaborates on Commission and administrator responsibilities with respect to statewide program performance goals and cost-effectiveness and includes provisions that are also consistent with MT investments (Wis. Stat. s. 35.93).

Cost-Effectiveness

Subsection (12) addresses cost-effectiveness:

- "The program administrator shall deliver energy efficiency and renewable resource programs that pass a portfolio level test of net cost−effectiveness, as determined by the commission."
  - "The program administrator shall screen each energy efficiency and renewable resource program for net cost−effectiveness at least once a year."

The policy of requiring cost-effectiveness at the portfolio level could be interpreted to allow Focus on Energy to include program investments that are not forecast to be cost-effective within a quadrennium or other time period determined by the Commission—as long as the entire portfolio is cost-effective. That flexibility is important for the successful integration of MT initiatives, which generally become cost-

effective over a longer period of time than four years.[2] The policy of requiring annual cost-effectiveness screening for each program is consistent with standard practices for MT evaluation.[3]

Performance Goals

Subsection (13) directs the Commission to establish performance goals and reporting:

- "The Commission shall, in consultation with the program administrator, establish annual and multi−year performance goals for the statewide programs. These goals shall be consistent with commission goals, priorities, and measurable targets under §196.374 (3)(b)1."

The evaluation team interprets this provision as allowing the Commission to set distinct performance goals for MT programs (versus RA programs), which are likely needed to motivate the desired level of MT efforts within the Focus on Energy portfolio.

Quadrennium Planning Decisions Regarding MT Investments

The last three of the Commission's final quadrennial planning decisions explicitly considered the appropriate balance between RA and MT as a policy priority for the subsequent quadrennium. The decision for the Quadrennium IV marked a change in the Commission's stance on the appropriate program balance, which acknowledged the maturity of RA programs and directed the assessment of future MT program opportunities.

Quadrennium II (2015-2018) and Quadrennium III (2019-2022) Decisions

The final decision for Quadrennium II (PSC 2014c) ordered Focus on Energy to continue to "emphasize short-term energy savings" and to set qualitative targets for long-term market effects. It also ordered the program administrator to prioritize designs simultaneously to achieve short-term energy savings while targeting longer-term market changes. The decision notes it is important to consider the impact of the Focus on Energy program on market development and finds the approach of setting qualitative targets for long-term market effects over the next four years "may also help to position Focus better to assist the state in achieving carbon savings as the carbon rules become more certain."

Notably, Commissioner Callisto dissented on the "qualitative targets" approach to market development, reflecting the other options identified and associated discussion in the Quadrennial II planning memo. His dissent advocated for a requirement to establish performance metrics to reflect specific market

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[2] This feature of MT initiatives is well documented (for example, Minnesota Center for Energy and Environment [MN CEE] 2022 and Prahl and Keating 2014) and is discussed further under MT Programs are Long-Term Investments and Require Separate Goals in this report.

[3] The evaluation policy and frameworks adopted by California Market Transformation Administrator (CalMTA), MN CEE, and the Illinois Technical Reference Manual (TRM) all include annual cost-effectiveness assessment. Northwest Energy Efficiency Association (NEEA) also updates its cost-effectiveness at least annually and conducts independent third-party assessment periodically (CalMTA 2024, MN CEE 2022, Illinois TRM 2023).

development and transformation goals—separate from RA goals—and that those MT goals "should be set beyond the next quadrennium to reflect the long-range nature of certain efforts."

The decision for Quadrennium III (PSC 2018) was essentially the same, except there was no dissent on the findings.

Quadrennium IV (2023-2026) Decision

The decision for Quadrennium IV states, "Focus' resource acquisition-oriented programs have matured, and Focus should begin looking at other opportunities for savings," and it "should increase the program's emphasis on long-term MT by identifying ways to adapt Focus' existing portfolio to achieve long-term market effects and develop strategies to support this direction." In addition, the order directs the Focus on Energy evaluator to develop an assessment of Focus on Energy's "MT potential in coordination with the program administrator and Commission staff, with input from stakeholders."

Cost-Effectiveness Policy Limitations

Quadrennial decisions have established the current policy related to measuring program cost-effectiveness, which conforms with standard practice for RA program evaluation. However, standard practice for evaluating MT program cost-effectiveness differs from that for RA programs and has not been addressed in previous quadrennial plan decisions. The following *Evaluation Policy Considerations* section discusses the specific cost-effectiveness policy issues that would need to be addressed to support greater investment in MT.

Policy Issues Associated with Integrating Market Transformation

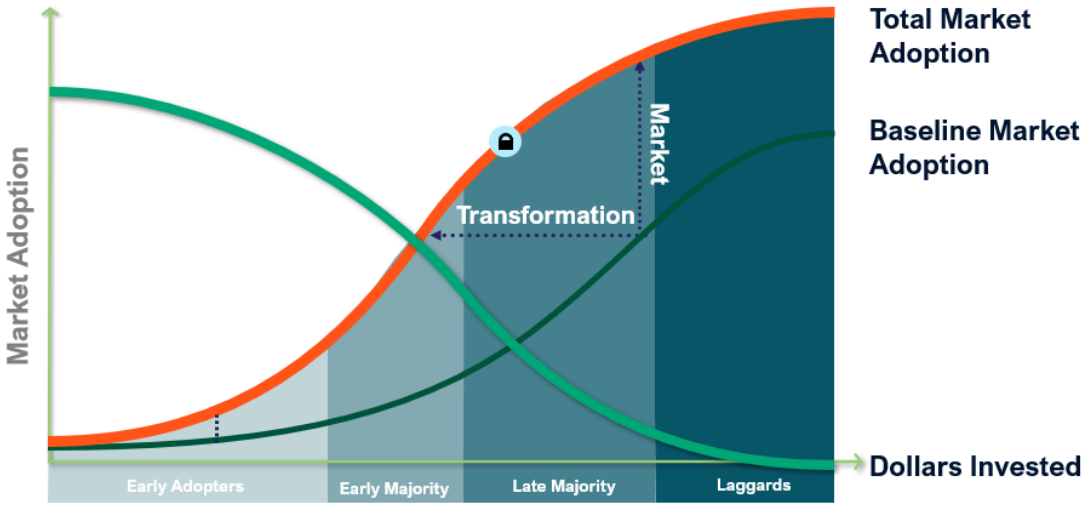
Although the current policy is reasonably aligned with MT investments, the evaluation team has identified several policy issues and areas of uncertainty that would need to be addressed by the Commission's decisions to support successful MT investments.

Planning and Goal-Setting Policy Considerations

MT Programs are Long-Term Investments and Require Separate Goals

MT is a strategic program approach designed to achieve structural market changes leading to lasting, long-term energy impacts. Successful MT programs tend to be highly cost-effective over their lifetime because market impacts tend to accelerate following the early years of investment and continue to accrue over the long term after programmatic investments decline or cease. New MT programs need time to produce those structural market changes, so their benefit/cost ratios would typically be very low if evaluated over a truncated period, such as a quadrennium. This asynchronicity of costs and benefits (Figure 1) is characteristic of MT programs and is the reason it is standard practice to evaluate MT program cost-effectiveness based on lifetime impacts, which must be forecasted initially and then trued up over time. In other words, MT programs are appropriately viewed as a long-term investment, with most program impacts realized in future quadrennia. This long-term investment profile necessitates a different planning and goal-setting approach.

Figure 1. Market Transformation Impacts Versus Investment over Time



Source: Adapted from Northwest Energy Efficiency Alliance's (NEEA's) 2015-19 Business Plan.
https://neea.org/resources/read-neeas-2015-19-business-plan

The planning memos for Quadrennium II and IV acknowledged this feature of MT programs and its implications for goal setting.

Quadrennium II Planning Memo

The Quadrennium II planning memo (PSC 2014b) identified three alternatives pertaining to the balance between RA and MT programs. The first alternative was to maintain an emphasis on short-term savings via RA programs, which was ultimately adopted. The second alternative called for separate performance metrics reflecting specific market development and MT goals. The Wisconsin's Citizen's Utility Board (CUB) and Clean Wisconsin (PSC 2024a and PSC 2024b) supported this approach.

CUB supported its opinion by stating that Wisconsin Statute § 196.374(3)(b)1 requires the Commission to give priority to programs that "facilitate markets and assist market providers to achieve higher levels of energy efficiency." CUB further stated the priorities to support markets and market actors are, in effect, MT priorities and should be reflected in Focus on Energy's performance metrics. Thus, to bolster the ability of Focus on Energy to meet both long-term and short-term objectives, CUB recommended the Commission establish performance metrics reflecting specific market development and transformation goals.

The memo went on to note a decision to increase MT activities would need to be considered in establishing the short-term RA acquisition goals because "devoting additional resources to jump-start MT activities, while providing more benefits in the long term, may result in lower near-term savings than in the absence of market transformation goals or targets."

The third alternative in the planning memo to balance RA and MT further emphasized MT by calling for a re-evaluation of the existing framework for designing programs and setting savings goals. The memo referred to the following Evaluation Working Group (EWG) finding:

- "Many of the effects of market transformation activities typically occur over a longer timeframe than the one-year and four-periods over which savings are currently tracked. While some market transformation programs (in certain equipment/appliance markets) may generate significant immediate savings, not all valuable market transformation efforts should be expected to do so."

The memo also notes:

- "If Alternative Three is chosen, a timeline for specific transformation activities could be developed, with input from the EWG, Evaluator and Program Administrator, that may extend beyond the quadrennium. If this were the case, reasonable metrics for progress would be developed for the quadrennium," and
    - "When setting goals for the 2015-2018 period: greater emphasis on longer-term market transformation activities may mean fewer energy savings in the short term."

Quadrennium IV Phase II Memo

The Quadrennium IV Phase II memo (PSC 2022) elaborated on the need for separate MT goals:

- "It can take multiple years for market transformation efforts to demonstrate measurable impacts. Thus, programs emphasizing market transformation require long-term planning and commitments (for example, 10-to-20 year timeframes)."
    - "The Commission may also consider establishing quantifiable goals for the Program Administrator to encourage a greater programmatic emphasis on market transformation in Quad IV. The Commission's decisions in the Quad II and Quad III Planning Processes to set qualitative targets for long-term market effects have been challenging to establish, have not yielded concrete outcomes, and have offered little incentive for specific program action."

Greater MT Investment has Resource Implications

In addition to re-iterating the need and rationale for separate MT and RA goals, the Quadrennial IV planning memo discussed the funding and resource implications of moving beyond an incremental approach to MT:

- "Greater emphasis on market intervention would mean less funding available to achieve energy savings in the near-term which has implications for the program's resource acquisition savings targets."
    - "A greater emphasis on market transformation is likely to result in fewer incentives given directly to customers as the program would need to allocate funds to incentivize various supply chain actors, including retailers, contractors, distributors, and manufacturers to stock and promote targeted qualifying equipment."

Although MT investment may reduce RA program achievement in the short term by diverting resources, planning beyond the quadrennial time horizon should reveal that MT investment would increase overall program achievement and build the pipeline of energy-saving opportunities over the long term.

Evaluation Policy Considerations

Impact Evaluation Approach for MT Programs Differs from the Approach for RA Programs

The Focus on Energy Quadrennium IV Strategic Evaluation Plan (SEP) is an internal reference document used by the statewide program evaluator, administrator, and the Commission and updated as needed. SEP includes a framework for measuring RA program impacts (Cadmus 2023). MT programs are fundamentally different in that they seek to accelerate market adoption by inducing structural market changes that increase and accelerate market adoption and produce sustained market effects. Unlike RA program evaluations, which assess energy savings associated with technology measures and practices among known customer program participants, MT program evaluations must estimate the adoption of the targeted technology or practice among a population of end users who are unknown to the program administrator. In both cases, evaluators use statistical methods to estimate measure adoption and savings, but those methods are substantially different.

Whereas the methods and protocols for evaluating direct energy savings impacts from traditional utility RA programs are well established and documented in numerous evaluation, measurement, and verification protocols, the body of knowledge for MT impact evaluation is less formal and not as widely established. Over the past few years, however, Illinois adopted and documented MT-specific evaluation frameworks and approaches (Illinois TRM 2023), New York (NYSERDA 2023), and California (CalMTA 2024). Minnesota uses similar approaches, documented in each MT initiative's Energy Savings and Market Evaluation Plan (MN CEE 2024). The approaches used by those states are similar to the evaluation approach used successfully by the NEEA for more than 25 years—elements of which have also been applied to estimate market effects for Focus on Energy and other utilities' midstream programs.

In short, MT programs require a different evaluation approach with these implications:

- The SEP would have to be modified to accommodate MT programs if they were adopted as a component of the statewide programs. Experience in other states indicates that MT evaluation approaches should be vetted by stakeholders before seeking approval for MT investments.
    - Each target market addressed by an MT program requires unique sources of data and requires the development of baseline market forecasts. Certain market data (for example, sales data or end-use characteristics studies) can be difficult or expensive to acquire and update over time and may require a commitment of additional resources.

In its comments on Quadrennium II planning proceedings (PSC 2014a), the EWG also noted the need to establish practices for forecasting MT impacts and assessing the present value of those expected benefits. Such approaches are discussed in other states' frameworks and protocols.

Current Cost-Effectiveness Policy Disadvantages MT Programs

Wisconsin administrative code requires the program administrator to deliver programs that "pass a portfolio level test of net cost−effectiveness, as determined by the Commission." Commission decisions have re-affirmed that quadrennial goals and cost-effectiveness should represent lifecycle savings associated with annual and quadrennial program participation. The current policy calls for the administrator to ensure a benefit/cost ratio of at least 1.0 on an annual and quadrennial basis, using a modified Total Resource Cost (TRC) test (Focus on Energy 2024).

Because many MT programs are not cost-effective based on impacts realized in the first several years of operation, the current policy of assessing quadrennial cost-effectiveness would likely result in most MT programs not meeting a benefit/cost ratio of at least 1.0 in the quadrennium that they are launched. If the evaluator were to assess MT programs together with the RA program portfolio in the quadrennium they are introduced, it would likely have the effect of depressing overall portfolio cost-effectiveness. On the other hand, MT programs should have the opposite effect of increasing quadrennium portfolio savings and cost-effectiveness as the proportion of mature MT programs in the portfolio increases.

Best practices in MT program evaluation support assessing cost-effectiveness over the program lifetime (10 to 20 years) to align with the MT investment profile (Prahl and Keating 2014). The approach to handling cost-effectiveness for MT programs varies by region and is discussed further in the following *Regional MT Program and Policy Review* section.

Administrative Policy Considerations

If Wisconsin decides to pursue a long-term energy efficiency investment strategy, the Commission should review administrative policies to ensure they align with those long-term goals.

Goals and Compensation Structure

A review of the Focus on Energy program administrator's contract was outside the scope of this policy review, but it is likely that current performance goals and compensation would need to be revised to align with a greater portfolio emphasis on MT. If savings-based compensation were tied to in-quadrennial energy savings alone, it would bias investments toward those maximizing short-term savings and disadvantage investments with longer-term impacts—even if those investments had higher long-term savings potential and benefit/cost ratios.

As discussed earlier, separate goals for RA and MT programs would help to ensure an appropriate balance of program resources, together with alignment of administrator performance compensation with those goals. These comments on the Quadrennium IV planning docket submitted by the EWG further describe the issue:

"If the Commission wishes to increase Focus' emphasis on market transformation, it should consider reevaluating its existing frameworks for designing programs and setting savings goals. In particular, many of the effects of market transformation activities typically occur over a longer timeframe than the one-year and four-year periods over which savings are currently tracked. While some market transformation programs (in certain equipment/appliance markets) may generate significant immediate

savings, not all valuable market transformation efforts should be expected to do so. Such efforts may not appear attractive to a Program Administrator with a limited budget and an aggressive near-term savings target. As a result, cost-effective initiatives that could reduce the barriers to increased energy efficiency going forward may be foregone."

Net Versus Gross Lifecycle Savings

The Quadrennium III planning decision (PSC 2018) ordered the Commission's Focus on Energy goals to be set based on net lifecycle savings and the program administrator's contract goals set on gross lifecycle savings. If the Commission decides to pursue an MT portfolio, it should consider the potential impact of this policy on the Focus on Energy program administrator. For example, if the Commission set the program administrator contract goals based on gross savings, but MT programs are evaluated based on net savings (which is common practice), RA programs would generate more savings toward administrator performance goals. This potential disincentive to pursue MT programs could be avoided by setting separate performance goals for RA programs and MT programs. Other options exist for how the Commission can avoid administrator bias against MT programs—the key point is to be deliberate about setting performance goals that align with policy goals.

MT Program Implementation Framework

California (CPUC 2019), Minnesota (MN CEE 2023), and NEEA (NEEA 2024) have all adopted similar MT program frameworks. These frameworks include program phases or stages representing the lifecycle of an MT program or initiative. The stages reflect different program activities and levels of investment and are typically "gated" for approval based on demonstration of readiness for advancement to the next level of investment. Frameworks like this provide a mechanism for managing the greater risk associated with long-term investments in emerging technologies and approaches. Wisconsin does not currently have an MT program implementation framework, but experiences from other states suggest the existence of a program framework is important for stakeholder buy-in to MT.

Regional MT Program and Policy Review

The evaluation team conducted a regional policy review to gain insights from other states and regions. The MEEA, Illinois, Minnesota, and California have all pursued regional or statewide MT programs over the past few years, which has augmented the body of experience and lessons learned regarding approaches to addressing the policy issues identified above. New York, which administers a market development (MT) portfolio via the New York State Energy Research and Development Authority (NYSERDA), and Northwest utilities that administer an MT portfolio via NEEA, also provide reference points for addressing these issues. This section summarizes other states' experiences and approaches to these policy issues. *Appendix D* summarizes the procedural histories for Illinois, Minnesota, and California.

Evaluation Policy

Evaluation Methods

The aforementioned states and regions have adopted evaluation frameworks that include a similar set of widely accepted best practices for MT program evaluation (CalMTA 2024, Illinois TRM 2024, and NYSERDA 2023). Illinois, Minnesota, and California all engaged stakeholders on MT evaluation approaches and policies prior to funding MT portfolios.

In Minnesota, for example, stakeholders were largely unfamiliar with the standard MT evaluation methodology. The MN CEE, which developed the proposal for Minnesota's new MT program, the Minnesota Emerging Technology Accelerator (META), included substantial discussion on that topic as part of its stakeholder engagement efforts, described below in the Stakeholder Engagement section of this report.

MT evaluation policy was central to discussions about MT program investments by the Midwest MT Collaborative (disbanded in 2021) and has remained a topic of interest at the Illinois Stakeholder Advisory Group (IL SAG) Market Transformation Savings Working Group. Illinois' overarching evaluation policy framework is included as an attachment to its TRM and has been updated over time.

California MT evaluation policy was the subject of white papers commissioned by the California Public Utilities Commission (CPUC) in 2011 and 2014 and was a focus of the California Energy Efficiency Coordinating Committee (CAEECC) Market Transformation Working Group (MTWG) during the year preceding and for two years following the CPUC decision that funded the CalMTA. CalMTA developed the California MT initiative evaluation framework during 2023 (the first year of CalMTA operations), and the CPUC approved it in early 2024.

Each of these states follows a documented, overarching MT evaluation approach and develops more detailed evaluation plans and protocols for each specific MT initiative for approval by the designated approving authority.

Cost-Effectiveness Requirements

Due to the long-term nature of MT investments and their foundational difference from RA programs, measuring cost-effectiveness has been a central policy issue across MT programs. MT cost-effectiveness approaches and policies are similar across states and regions: they recognize that the fundamentally different, long-term investment profile of MT programs versus RA programs requires a different approach to assessing cost-effectiveness. MT administrators and regulators have generally accepted the need to assess MT program cost-effectiveness over the program lifetime, as opposed to using the two-to-four-year planning cycle typical of most utilities.

Table 1 summarizes the different regions' cost-effectiveness policies.

Table 1. Market Transformation Cost Effectiveness Policy, by State

State/Region	POLICY	
	Threshold	Measurement
CalMTA California	Portfolio must be ≥1.0 TRC Test, and Program Administrator Cost Test	• Estimated for 20-year program lifetime • Benefits are impacts attributable to the MT initiative, per evaluation policy (which is to subtract the market baseline and all utility-verified reported savings) • Forecasted at the time of MT initiative adoption, with annual true-ups based on tracking data • Discussions occurring regarding CPUC's desire for a cost-effectiveness schedule (i.e., when does the return on investment turn positive?) • CalMTA alone is accountable for savings and cost-effectiveness; individual utilities do not include costs or savings in their cost-effectiveness calculations
Illinois	Portfolio must be >1.0 Portfolio calculation TRC and Utility Cost Test (UCT)	• Utilities include MT program costs and benefits expected to fall within the relevant four-year planning years or cycles for purposes of calculating portfolio cost-effectiveness (i.e., only planning cycle costs and benefits are included)[a] • Utilities include separate MT cost-effectiveness metrics (TRC and UCT) in plans, which are based on expected *lifetime* costs, benefits, and risks; ComEd believes a separate reporting of cost-effectiveness metrics based on a truncated time horizon would likely be misleading[a] • MT savings are evaluated annually, included with portfolio savings, and counted toward utility goals and performance incentives. The energy savings framework for each MT program will include the anticipated duration of savings • Necessary baseline market adoption estimates are applied prospectively (not retrospectively)—consistent with how other portfolio adjustments are treated
MN CEE - META (Minnesota)	Estimated benefit/cost ratios provided for starter portfolio initiatives. Total Societal Cost Test	• Estimated for 20-year program lifetime • MN CEE reports costs and net benefits each year, and utilities incorporate those results into overall portfolio[b] • Forecasted at the time of MT initiative adoption, with annual true-ups based on tracking data • META proposal included the expectation of eight years to break even;" this was an important negotiation point because of expected negative net benefits in the first quintennial funding period • Savings attributed to funding utilities based on share of funding, which utilities incorporate into their portfolio cost-effectiveness
NEEA (Washington, Oregon, Idaho, Montana)	Portfolio >1.0c Total Societal Cost Test	• Estimated for 20-year program lifetime • Ratio calculated based on co-created savings (includes utility-verified reported savings) • Forecasted at the time of MT initiative adoption, with annual true-ups based on tracking data • NEEA attributes savings to funding utilities based on share of funding, which utilities incorporate into their planning cycle portfolio cost-effectiveness, per the rules of each state's regulator

[a] Illinois updated its approach to counting MT program costs and benefits in 2023, as summarized in ComEd' Summary of the Illinois TRM Attachment C Revisions: Policy Questions. April 13, 2023. Summary of Illinois TRM Attachment C Revisions (ilsag.info)

[b] Minnesota utilities may be able to opt out based on an existing provision that they can do so for programs they are not running directly. They may want to consider this option if they are not sufficiently exceeding performance targets, but there is uncertainty as to whether they would be allowed to start counting benefits later.

c NEEA uses co-created energy impacts to calculate the benefit/cost ratio for collaborative regional MT initiatives; this approach calculates net impacts based on market total units minus market baseline units, but it does not subtract verified market units that received an incentive from a utility RA program. This approach may be appropriate for Focus on Energy because it acknowledges the synergies between MT and RA programs.

Budget and Portfolio

MT Administrators have taken various approaches to MT portfolio development and investment level (Table 2). A December 2019 CPUC decision ordered the creation and funding of a new California statewide MT Administrator and called for a $20 million annual startup budget for three years, followed by a $50 million annual budget in the subsequent five years. The decision directed the administrator to develop the portfolio via an open solicitation of ideas, which it assessed according to a variety of criteria. The evaluation team estimates the fully funded budget to be approximately 7% of the investor-owned utilities' portfolio budget.

MN CEE took a different approach to developing the portfolio for its new MT program, META: it proposed 11 specific ideas for consideration, which it narrowed down to five starter portfolio initiatives based on stakeholder input. MN CEE included the starter portfolio initiatives in its META proposal to the Minnesota Department of Energy Resources. MN CEE based its initial budget on statute, which provides a budget cap for META based on a percentage of the overall conservation investment plan budgets of participating utilities: 2% in years 1 and 2, 3.5% in years 3 and 4, and 5% in year 5 (MN CEE 2022).

NEEA has operated for more than 27 years and has an ongoing process for developing MT initiatives and approving funding for the best opportunities that fit within the budget. NEEA negotiates the budget every five years based on an extensive renewal process that includes significant stakeholder engagement around proposed five-year strategic and business plans and approval by its funder-dominated board.

Table 2. Budget and Portfolio Selection Process by State Organization

State/ Organization	Annual MT Budget	Approximate % of Total Conservation Spending	Portfolio Selection
CalMTA	$50M ($20M startup)	7%	Initial portfolio developed based on open Request for Ideas
META	$12M (growing from $5M)	5%	Starter portfolio of primarily NEEA initiatives
NEEA	$35M	7%	Well developed initiative development lifecycle, with emerging technology activities intended to feed the pipeline for future opportunities

Performance Goals and Incentives

In states where the MT savings are allocated to and counted by the utility, goals and performance incentives have been an important stakeholder issue. For example, the impact of MT program investment on performance incentives was a critical issue for Minnesota utilities. During stakeholder engagement, Minnesota utilities expressed considerable concern about the time it would take for MT initiatives to deliver positive net benefits. They were reluctant to support META if they could not count long-term benefits toward their performance goals. Although they understood that negative net savings would negatively impact performance over the first five-year funding period, they ultimately agreed to count those negative short-term benefits to ensure the Minnesota Public Utilities Commission would allow them to include the expected higher long-term benefits in subsequent periods.

Although Wisconsin utilities do not receive performance incentives based on Focus on Energy energy savings, the administrator's performance bonus is affected by quadrennial energy savings.

Governance

Governance has been a topic of interest for several MT program administrators, such as Minnesota, NEEA, and California. Governance may be less of a concern for an established statewide entity like Focus on Energy with an existing funding and governance structure, but it may be worth considering the need for any modifications that may be desirable given the different subject-matter expertise required for MT program design and evaluation and the longer-term nature of MT investment. These are a few highlights from other MT administrators' experiences:

- The Minnesota Department of Commerce Division of Energy Resources (DER) directed MN CEE to make governance the first topic for stakeholder engagement. MN CEE proposed a governance structure that includes collaboration with participating utilities and is implemented via four advisory committees: a market strategy advisory committee, an emerging technology advisory committee, an evaluation advisory committee, and a coordinating committee that advises on key META operational issues and ensures activities have buy-in and support from funders.
- NEEA is governed by a 20-member Board of Directors that includes representatives from funding utilities. As NEEA's approach to MT matured, it formalized several advisory committees, including a portfolio advisory committee, an emerging technology advisory committee, and an evaluation and cost-effectiveness advisory committee.
    - CalMTA is a program of the CPUC, with CPUC staff providing oversight of the contract with Resource Innovations, the CalMTA program administrator. Its structure is similar to Focus on Energy in that the CPUC's Energy Division oversees the CalMTA program administrator contract. Resource Innovations is responsible for every aspect of standing up and managing the new CalMTA program, including establishing efficient administrative functions; recommending and seating a nine-member market transformation advisory board (MTAB); managing stakeholder and MTAB communications; identifying, ranking, planning, and overseeing the implementation of MT initiatives; forecasting MT initiative impacts and developing MT impact forecasts; and collaborating with the Energy Division project manager on evaluation oversight. MTAB provides input into decisions related to portfolio and program design and is responsible for assessing program performance. After launching, CalMTA decided to create an EWG to advise the evaluation lead and the Energy Division's evaluation lead on the selection of third-party evaluators, approaches, and results.

All three entities have adopted formal MT initiative lifecycle frameworks, which vary slightly in nomenclature but are essentially the same. They lay out a stage-gate process for developing, testing, and deploying new MT initiatives and provide a useful mechanism for accountability and decision-making. It is worth noting that Illinois (and the Midwest MT Collaborative, when it was active)—unlike other MT entities—lacked a designated MT administrative body, mandated funding mechanism, and funding commitment—accordingly, it also had no real governance structure. While Illinois and the IL SAG MT Savings Working Group have done extensive work to establish a framework for investing in MT

programs, the vision of a statewide MT program has not been realized; Illinois' MT program investment decisions generally occur at the individual utility level.

Stakeholder Engagement

Stakeholder engagement is critical to other states' and regions' MT program investment decisions. California and Minnesota both conducted extensive stakeholder engagement processes and NEEA does so every five years as part of its funding renewal process:

- MN CEE developed a comprehensive stakeholder engagement plan as part of its META proposal development. It mapped out agendas for a series of eight stakeholder meetings that included utilities and the MN DER, identifying key topics and issues for each meeting. MN CEE also conducted a public meeting and held one-off meetings with specific stakeholders, such as advocates and potential intervenors. MN CEE introduced the starter portfolio ideas early in the engagement process to make the potential investments more tangible. Notably, the DER asked MN CEE to start with the topic of governance to give stakeholders a sense of how accountability would work and asked that a stakeholder coordinating committee be involved in decision-making. This approach gave stakeholders confidence that the new MT administrator would not be making significant investment decisions without their input.
- California conducted a formal stakeholder engagement process via the CAEECC over a three-year period from 2018 to 2021. CAEECC was established to ensure stakeholders had transparent access to information and opportunities to provide input into energy efficiency matters under the purview of the CPUC. The CPUC had previously commissioned and developed several working papers on the topic of MT programs and evaluation (Prahl and Keating 2011, Prahl and Keating 2014, and Keating and Fogel 2014), and those papers were the starting point for the CAEECC's MTWG. Working group members included representatives from the CPUC, investor-owned utilities, Regional Energy Networks, and a variety of consultants, contractors, clean energy advocates, and industry representatives. Discussion about specific MT initiatives was not under the MTWG's purview—prior to the CPUC Decision that created and funded a new MT administrator, the group focused on recommending an MT program framework. After the CPUC decision, the MTWG reconvened on the topic of MT savings attribution to the new MT portfolio versus utility RA programs. Since forming, CalMTA has continued to conduct extensive stakeholder outreach related to program design and coordination.
- NEEA conducts a stakeholder engagement process every five years, beginning midway through its five-year funding cycle. The process is led by the organization of NEEA's Board of Directors, which comprises representatives from 13 utility funders, two program administrator funders, and five public interest and government entities, which begins with the collaborative development of draft strategic and business plans for the upcoming five-year period. NEEA conducts broad stakeholder outreach and solicits public comment on the draft plans approximately 18 months before the current funding cycle ends. The board reviews the region's collective input, and NEEA revises the draft plan as appropriate. After finalizing the plans, NEEA executes the funding agreements during the final year of the current funding cycle.

Conclusions and Considerations

Wisconsin Policy

1. **Wisconsin is well positioned to increase its investment in MT from the point of view of the enabling legislation.** Wis. Stat. §196.374 (2) directs the energy utilities in Wisconsin to collectively establish and fund a statewide energy efficiency program with the purpose of helping to achieve environmentally sound and adequate energy supplies at a reasonable cost, with the Commission's approval of any administrator contract. Unlike other states and regions that pursued MT without an existing entity and governance structure, Focus on Energy's longstanding existence and success provides Wisconsin with a head start. While no mandate exists for MT investments, the enabling legislation and administrative code contain no policy conflicts.
2. **The Commission will need to address the cost-effectiveness policy associated with MT investments**. Specifically, it will need to address these policy issues:
   - Should the Commission's decision on MT investments be based on the investment lifetime cost-effectiveness forecast, consistent with the approach other states and regions have taken?
   - Should Quadrennium V benefits and costs associated with MT investments be included in the statewide quadrennial portfolio cost-effectiveness requirement for evaluation purposes?
3. **The long-term nature of MT investments requires sustained investment to realize the full potential return on those investments.** MT is a strategic program approach designed to achieve structural market changes leading to lasting, long-term energy impacts. Successful MT programs tend to be highly cost-effective over their lifetime because market impacts tend to accelerate following the early years of investment and continue to accrue over the long term after programmatic investments decline or cease. New MT programs need time to produce those structural market changes, so it is important to agree on how MT investments will be evaluated in the short term before cost-effectiveness is achieved.
4. **The experiences of other states suggest work toward an evaluation framework may be desirable or necessary to gain support for MT initiatives that go beyond incremental investments**. All of the reviewed MT administrators use evaluation approaches consistent with each other, and accepted methods are well documented in published frameworks or protocols for California, Illinois, Minnesota, and New York. Those methods have also been referenced by the Wisconsin EWG, so it should not be difficult to agree upon a Wisconsin MT evaluation framework.

Stakeholder Buy-In

1. **Shifting investment to a new MT portfolio has short-term resource implications that could cause stakeholder resistance.** Potential resource implications include costs associated with developing infrastructure for MT (for example, developing an operational framework and market data acquisition); costs associated with developing new MT initiatives (for example, market research and market forecast development); reduction in RA program participants and total incentives paid to customers; and depressed Quadrennium V energy impacts because the budget for RA programs would decline and savings associated with MT investment would accrue primarily in later years.
2. **Other states and regions have used a variety of approaches to successfully make the business case for MT investments,** including these:
   - Showing substantial long-term energy savings potential incremental to what could be achieved with RA program investment alone, with an attractive long-term return on investment (benefit/cost ratio)
   - Demonstrating or describing the need for MT initiatives to fulfill long-term policy goals and to fill the pipeline for future energy savings opportunities due to declining opportunities associated with RA programs
   - Offering examples to illustrate the synergistic impacts of MT initiatives and RA programs working in tandem to result in greater long-term savings
   - Securing letters of support from local businesses and industry actors (for example, in its proposal for the META program, MN CEE secured such letters from Clean Energy Economy MN, Electrical Association of MN, Mitsubishi Electric Trane U.S, Daikin North America, Auer Steel & Heating Supply, and Stevens Equipment Supply)
3. **Stakeholder engagement and buy-in will be critically important to gaining support for substantial MT investment and will be time-consuming.** The experiences of other states in garnering support for MT suggest that a champion and extensive stakeholder engagement is needed to advocate and build support for an MT approach in Wisconsin. Wisconsin may want to develop the stakeholder engagement plan component of its MT roadmap and consult with the delegated commissioner as appropriate within the next year.
4. **The starter portfolio approach employed by MN CEE in its META proposal proved to be successful in convincing stakeholders to embrace MT, a concept that was largely unfamiliar.** It also allowed META to start program development shortly after proposal approval. This approach, supported by the MT Assessment study, seems like a good fit for Wisconsin because it would offer greater tangibility to stakeholders and require less Quadrennium V startup resources than an open solicitation and initiative-by-initiative approval approach would require.

Planning and Administration

1. **MT budgets and goals should be separate from RA budgets and goals.** Because the two program types have different investment profiles, distinct budgets and goals are required to ensure the appropriate balance of resources. Goals and associated performance compensation should be reviewed to ensure alignment with policy.

   Per Wisconsin Statute §196.374 (3)(b), the Commission is authorized to set goals, priorities, and measurable targets for programs and to prioritize programs that "moderate the growth in energy demand and usage, facilitate markets and assist market providers to achieve higher levels of energy efficiency, promote energy reliability and adequacy, avoid adverse environmental impacts from the use of energy, and promote rural economic development."

2. **The experiences of other states suggest an MT program framework will be important for success.** Like the MT evaluation frameworks, MT program frameworks are similar for all the existing MT administrators. They generally include program phases or stages representing the stages of an MT program or initiative lifecycle. The stages reflect different program activities and levels of investment and are typically gated for approval. Those methods are also well documented, which should provide a good reference for a Wisconsin framework.

The program administrator selected for a future MT portfolio should be able to articulate its approach for the substantial work required to fully develop the starter MT portfolio so that it is ready to implement at scale. The other states and regions discussed in this report have separate administrators for their MT programs; if Focus on Energy continues with a single administrator for RA and MT programs, it would be the only statewide program with a single administrator responsible for both. This is not necessarily good or bad, but it warrants some consideration during the RFP process.

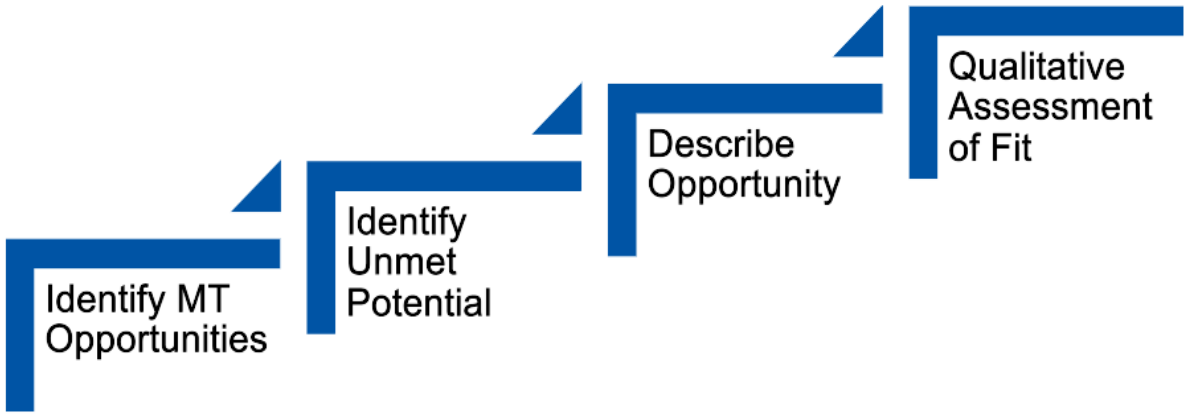
The evaluation team completed the first step of the MT Assessment study, the policy/background analysis task, in the summer of 2024. Findings from that task were presented to the PSC in a memo dated September 27, 2024.[4]

[4] Market Transformation Policy Review Memo. September 27, 2024.

Phase 1. Opportunity Assessment

This report section summarizes the evaluation team's methodology and findings from Phase 1 of the MT Assessment Study. The objective of Phase 1 was to identify and conduct a preliminary assessment of MT opportunities that may be a good fit for the Wisconsin market. During this phase, the team created for each opportunity a high-level description of the opportunity, the technology, and the relevant market sector(s) and segment(s) to enable the team to assess or score each opportunity based on an agreed-upon set of criteria. This scoring allowed the team to identify the most promising set of MT opportunities for Wisconsin. Figure 2 shows the steps the team followed for the Phase 1 MT Assessment.

Figure 2. Phase 1 Assessment Process



In Phase 2 – the next and final phase of the study – the team will conduct further investigation of the highest-scoring opportunities from Phase 1 to forecast potential energy impacts and cost-effectiveness and develop a concept description and budget for how to advance up to six of the most promising MT opportunities in Quad V.

MTI Opportunity Descriptions

The evaluation team began the Phase 1 assessment by reviewing the 2021 Focus on Energy Potential Study[5] and recent market research and evaluation findings to identify opportunities with unaddressed energy efficiency potential in Wisconsin.

The opportunity descriptions included the following information:

- A definition of the technology or practice
- A characterization of the addressable market and the estimated market size
- Preliminary vision for long-term outcomes
- Preliminary theory of market transformation, including:

[5] https://focusonenergy.com/about/2021-potential-study-documents

- Market barriers and opportunities
- Possible points of market leverage and associated interventions that could influence widespread market change
- Mechanism for locking in market change

The descriptions did not address savings evaluation methods other than to refer to the technical potential estimated in the 2021 Focus on Energy Potential Study, which largely relied on the applicable Wisconsin Technical Reference Manual (TRM) during the study period. A small number of the MT measures considered, such as ENERGY STAR Manufactured Homes, were not included in the Potential Study. For these measures, the team derived savings potential from the estimated market size and the 2024 Focus on Energy TRM. Note, however, that refined savings potential estimates and cost-effectiveness estimates will require more in-depth secondary and primary research, which is part of the Phase 2 assessment.

The MT opportunity summaries present market and technology characteristics that could inform intervention strategies for each MTI opportunity. These summaries also include a high-level history of the market in Wisconsin or the upper-Midwest, including any Focus on Energy programs that have targeted the end use or practice, and a high-level description of the current state of the market. It should be noted that although the evaluation team attempted to gather Wisconsin-specific information for each of the MTI opportunities, this was not always possible.

The Phase 1 assessments examined a total of 20 MTI opportunities. Each of the detailed opportunity assessments was submitted to the PSC and the Focus on Energy program administrator, APTIM, as a stand-alone document. The section below presents the scores for each of the scored opportunities as well as some high-level findings that support the scores.

MTI Opportunity Scoring

Phase 1 opportunity identification and scoring relied primarily on scanning publicly available MT and emerging technology program documentation from other regions and assessing them for relevance and potential impact to Wisconsin. In Phase 2 the team will develop concept descriptions, along with estimated budgets and impacts, for the most promising MT opportunities identified in Phase 1.

Opportunity Disposition

Table 3 lists the 20 opportunities considered by the evaluation team and summarizes scoring, including the rationale for opportunities that were not scored. The opportunities and scoring are discussed in more detail in the Scoring Outcomes section.

Table 3. MTI Opportunities and Scoring Disposition

Opportunity	Scored
High-Performance Windows	Yes
Ductless Heat Pumps	Yes, opportunities merged during scoring process
Air-Source Heat Pumps	
Variable Speed Heat Pump	
Efficient Rooftop Units	Yes
Luminaire Level Lighting Controls (LLLCs)	Yes
Cold Climate Package Terminal HP	Yes, opportunities merged during scoring process
Window-mounted Heat Pump	
Heat Pump Water Heaters	Yes
Efficient Manufactured Homes	Yes
HVAC Gas Heat Pump	Yes
Real-Time Steam Trap Monitoring	Yes
Advanced Motors	Yes
Foodservice Decarbonization	Yes
Energy Star Retail Products Platform (ESRPP)	Draft scoring completed, but excluded from final scoring because PSC and APTIM staff were not in favor of proceeding with ESRPP
Induction Cooktops and Ranges	No, consolidated with ESRPP opportunity
Codes & Standards	No, Focus on Energy policy prohibits lobbying
Efficient Pumping in Agriculture	No, insufficient data to characterize market
Efficient Streetlighting	No, significant portion are utility-owned and utilities prohibited from participating in Focus on Energy programs
Thermal Storage for HVAC	No, insufficient data to characterize market

Of the 20 MTI opportunities investigated in Phase 1, the team scored 11 MTI opportunities in the final assessment.

During the scoring process, the team combined opportunities that address similar markets or use similar delivery networks that could likely be addressed via a single MTI.

- Window heat pumps largely address the same market as packaged terminal heat pumps, which the team also presented as an opportunity. The team combined similar opportunities.
- Air-source heat pumps, ductless mini-split heat pumps, and variable speed heat pumps initially scored as separate opportunities but were consolidated into a single heat pump opportunity. Market research suggested the three options are often available from the same installer and distributor networks, and many of the barriers were similar across the three equipment types. The evaluation team and PSC then decided it would be appropriate to consolidate into a single MTI opportunity.

Four of the 20 opportunities were not scored, and two were consolidated and received draft scoring as a single opportunity that was not included in the final scoring.

- Efficient streetlamps were not scored because many of the streetlamps are owned by the utilities in Wisconsin, and the Focus on Energy Policy Manual states that utilities are not eligible to participate in Focus on Energy programs as customers.[6]
- Codes and standards were excluded from scoring because of potential concerns about code advocacy violating the Policy Manual's lobbying prohibition.
- Efficient pumps for agriculture and thermal HVAC storage were also removed because very little information could be found to characterize a market for potential intervention.
- Induction cooktops and ranges are supported through the national ESRPP, which the team presented together as a single opportunity for draft scoring.

Finally, ESRPP was eventually removed from consideration following the PSC's and APTIM's review of the draft scoring. Focus on Energy pursued ESRPP as a pilot program between 2016 and 2018, and PSC and APTIM staff expressed hesitancy about revisiting ESRPP because of previous challenges aligning Focus on Energy objectives with ESRPP. Some of the issues encountered with ESRPP as a pilot, such as separating MTIs from a resource acquisition framework and performance expectations of the energy efficiency portfolio, may be relevant to MTIs in general.

Scoring

The evaluation team proposed to PSC and APTIM a set of scoring criteria that considered the characteristics in the opportunity descriptions and are generally considered to be indicative of promising MT opportunities. Table 4 presents and describes each of the scoring criteria. Additionally, detailed descriptions of the individual scoring criteria are also presented in the *Scoring Criteria* section below.

[6] https://focusonenergy.com/administrative-resources

Table 4. Scoring Criteria and Definitions

Scoring Criteria	Definition	Examples
Potential Value to Focus on Energy	The value the MTI opportunity could provide to Focus on Energy and stakeholders in Wisconsin.	• Energy savings potential • Expanding the reach of efficiency measures • Simplifying program offerings • Addressing decarbonization or policy goals
Compelling Value Proposition / Non-Energy Benefits	Performance of target technology or practice is sufficiently above current practice to yield benefits to consumers.	• Less wiring due to integrated controls and improved maintenance due to monitoring equipment performance for LLLCs. Energy savings and easy setup for advanced motors.
Readiness of Technology / Practice	Technology or practice is sufficiently developed and ready for scale if barriers were reduced or eliminated.	• Manufacturing processes and supply chain are established, if not at scale currently.
Identifiable Market Barriers	Market structures, or lack of structures, that hinder adoption of preferred energy-saving technology, practice, or measure.	Common supply-side barriers • Raw materials • Limited manufacturing capabilities • Limited suppliers • Paths to market • Lack of inventory • Limited skilled installers Common demand-side barriers • Lack of awareness • Lack of information • Availability • Price • Quality, features, performance
Identifiable Market Leverage Points	Key market structures that can be influenced to create changes in the market that increase adoption of target measure or practice.	• Distributors, contractors, trade groups, promotion network • Regulations - building codes, required safety or performance standards • Voluntary product performance standards • Testing protocols to demonstrate product performance
Mechanism for Lastingness	Measurable end-states of leverage points that would lock in energy savings, permanently moving the market forward.	• Federal or state performance standards or code changes • Changes in manufacturer practices/product lines

MTI opportunity scoring largely reflected the evaluation team's level of confidence in the information gathered for each opportunity and how well it could inform potential MTI strategies. Each criterion for the opportunities was scored on a scale ranging from one to three, with higher scores reflecting relevant market dynamics that are clearly identified and indicate a clear path for Phase 2 concept descriptions. Lower scores reflect market characterizations that are less clearly identified and have more uncertainty

in describing market dynamics, particularly with respect to providing pathways for further MTI concept development. Each opportunity's overall score was the sum of the scores across the six criteria.

For example, MTI opportunities with clearly identified and addressable market barriers scored higher than opportunities with hypothetical or theoretical barriers. MTI opportunities with demonstrated performance benefits and a clear value proposition relative to competing options scored higher than opportunities without sufficient use cases to demonstrate a clear benefit. Lower scores might reflect uncertainty around a technology because it is not well proven in some key applications, the size of the market is not well understood, or market actors and their roles are not well understood.

MTI opportunities that are active in other jurisdictions tended to score highly as these often have published MTI business plans and supporting market research. Active MTIs also have clearly articulated logic models with market barriers and leverage points, expected short- and long-term outcomes, a clear value proposition to market actors, and market intervention strategies.

Energy savings potential is also a key assessment criterion. In the Phase 1 assessment, the estimated range of savings potential and the size of the affected market were largely derived from the 2021 Potential Study. More refined estimates of savings potential and cost-effectiveness will require more in-depth primary research, which is part of the Phase 2 assessment.

Scoring Criteria

The evaluation team focused on six key criteria for scoring the MTI opportunities, each described in more detail:

- Potential value to Focus on Energy
- Compelling value proposition/non-energy benefits
- Readiness of technology to scale
- Market barriers
- Potential market leverage points
- Mechanisms for lastingness

Potential Value to Focus on Energy

This criterion describes the value the MTI opportunities could provide to Focus on Energy and stakeholders in Wisconsin. This value could come from potential savings, enhancing or expanding the reach of current measures, streamlining existing offerings, or addressing future priorities such as carbon emissions.

For Phase 1, the evaluation team focused on high-level estimates of savings potential that were readily available. Savings estimates are largely represented by technical potential estimates derived from potential studies.

MTI savings will differ from technical potential for any opportunities that are developed further in Phase 2. MTIs typically focus on increasing adoption above a naturally occurring market baseline level, and incremental savings are estimated at the market level. The savings baseline for MTI opportunities is

often a function of a naturally occurring mix of competing technologies or practices. Technical baselines are not necessarily representative of MTIs as they are derived from estimates of saturations of less efficient products currently installed among the building stock in Wisconsin.

Phase 2 will include expected savings estimates for those MTI opportunities that are determined to be the most promising. Phase 2 savings estimates will be based on estimates of current market shares, expected rates of adoption absent the influence of an MTI and assuming an MTI is funded, and market-level savings resulting from expected incremental adoption.

The Phase 1 assessments did not include cost-effectiveness estimates in the scoring criteria. The target markets are complex, and savings estimates depend on the size of the market (potential customers and typical sales) as well as the expected share of the market. Cost-effectiveness will be considered in Phase 2 for the most promising opportunities after the team develops more comprehensive estimates of savings and increased market shares.

Compelling Value Proposition/Non-Energy Benefits

This criterion considers whether a potential compelling value proposition can be identified to motivate end users to adopt the more efficient product or technology and to motivate market actors to supply or promote it. Because market transformation is focused on achieving sustained market change, targeted products or technologies must offer a value proposition to the market—for commercial end users and market actors—there must be a business case for market adoption. Experience with MT programs has demonstrated that the value proposition that catalyzes market adoption is often something other than energy savings.

Readiness of Technology to Scale

Readiness to scale is a high-level assessment of the current supply chain to determine the likelihood that a target technology could scale to meet increased demand if an MTI is successful in reducing demand-side barriers to adoption.

Market Barriers

This criterion considers whether there are identifiable market barriers preventing the efficient technology or practice from widespread adoption. Adoption barriers for the target technology or practice could exist on the supply or demand side. These barriers are not necessarily specific or quantifiable (for example, if price is a barrier, it is not clear what price reduction would be sufficient to spur increased adoption).

Possible Market Leverage Points

Market leverage points are known market intervention points or aggregation nodes in the technology or service market structure that can be leveraged to cause amplified influence and broad market change. They could also identify trends or policies that could be similarly leveraged to address market barriers and increase adoption of the target technology or practice. As with barriers, leverage points could be supply- or demand-side focused.

Existing MTIs in other territories or states can provide key leverage points for new MTI sponsors. Multiple initiatives targeting the same opportunity increase the scale of leverage in the market as more potential customers in a region are covered. Manufacturers and other market actors are more likely to adapt practices if multiple states or territories are attempting to influence the market in the same direction.

Mechanism for Lastingness

In the strictest sense, only changes to mandatory efficiency requirements or building codes can transform a market completely to lock in savings without the chance of reverting to less efficient products once program support is discontinued. However, some market outcomes (for example, manufacturer discontinuation of less efficient products or changes in standard practice) can indicate that a target technology or practice has achieved lasting mainstream status. The existence of an identified market or regulatory mechanism for lastingness is an important criterion for assessing the strength of market transformation potential.

Scoring Outcomes

Table 5 lists the top five MTI opportunities that the evaluation team recommends for further development in Phase 2. These opportunities scored the highest of the 11 MTI opportunities evaluated, with scores ranging from 14 to 16 of a maximum of 18 points.

Table 5. Top Five Opportunity Scores

MTI Opportunity	Residential Heat Pumps (Ducted and Ductless)	Efficient Rooftop Units	Luminaire Level Lighting Controls	High-Performance Windows	Packaged Terminal and Window Heat Pumps
Potential Value to Focus on Energy	2	2	2	2	2
Compelling Value Proposition / Non-Energy Benefits	2	3	3	2	2
Readiness of Technology to Scale	3	3	2	3	3
Identified Market Barriers	3	3	3	2	3
Possible Market Leverage Points	3	3	3	3	2
Expected Outcomes/Mechanism for Lastingness	3	2	3	3	2
Total Score	**16**	**16**	**16**	**15**	**14**

High-performance windows, residential heat pumps, efficient rooftop units, and luminaire level lighting controls are all technologies with active MTIs in other states, including neighboring Illinois and Minnesota. These opportunities have clearly articulated value propositions for market actors, including end users, distributors, and installers. Publicly available MTI business plans, evaluation reports, or market characterization reports from MT programs in other states identify market barriers and leverage points that likely would be applicable to Wisconsin.

Additionally, market-based interventions benefit from scale. Collaboration with other MT programs on existing MTIs would greatly increase the market leverage because markets are often regional or national rather than state-specific.

Remaining Opportunities

Table 6 presents the scores for the remaining six opportunities. Although the evaluation team does not recommend these opportunities for further development as MTIs in Phase 2, these opportunities present savings that could potentially be realized through other program designs. Heat pump water heaters are the exception due to pending changes in federal standards described below that reduce savings potential effective 2029.

Table 6. Remaining Opportunity Scores

MTI Opportunity	Heat Pump Water Heaters	Efficient Manufactured Homes	HVAC Gas Heat Pump	Real-Time Steam Trap Monitoring	Advanced Motors	Foodservice Decarbonization
Potential Value to Focus on Energy	2	1	1	1	3	1
Compelling Value Proposition / Non-Energy Benefits	1	2	2	2	2	1
Readiness of Technology to Scale	3	2	1	3	1	3
Identified Market Barriers	2	2	3	1	1	2
Possible Market Leverage Points	2	2	2	1	1	1
Expected Outcomes/ Mechanism for Lastingness	2	2	1	2	1	1
Total Score	**12**	**11**	**10**	**10**	**9**	**9**

Heat pump water heaters scored lower than the top five MTI opportunities for two main reasons: first, their value proposition to end users was not sufficiently clear, as suitable space can be a barrier for many homes. More significantly, federal standards were recently finalized, which will require the most common-size electric water heaters to achieve efficiency gains with heat pump technology by 2029.[7] Savings would be limited to fuel-switching applications, and gas efficiency standards would also increase under the new standard, reducing even fuel-switching savings.

Foodservice decarbonization lacked a compelling value proposition and would face significant barriers that would likely be difficult to address via an MTI. Switching from gas to electricity could increase energy costs for foodservice establishments that already operate on very tight margins.

Savings potential estimates for the efficient manufactured homes opportunity were highly uncertain, ranging from 119,000 to 1.4 million lifecycle MMBtu. Sales volumes on an annual basis in Wisconsin are typically between 700 and 800 homes, compared to 3,000 to 12,000 homes in leading states, and savings per home differ significantly depending on assumed heating fuels. Additionally, the supply of efficient manufactured homes and building components is relatively low in Wisconsin, though efforts

[7] Department of Energy. "Energy Conservation Standards for Consumer Water Heaters; Final rule". May 6, 2024. https://www.regulations.gov/document/EERE-2017-BT-STD-0019-1426

are underway to increase the supply of panels for modular homes.[8] This opportunity could warrant additional research and monitoring of the market to better understand savings potential and market leverage points.

Real-time steam trap monitoring scored low with respect to market characteristics. California recently adopted building code standards to improve steam trap efficiency for industrial buildings without leveraging market actors. Wisconsin could achieve significant savings for steam processes, but the evaluation team's research did not indicate that MTIs are ideally suited to provide those savings.

Advanced motors scored low with respect to market barriers and leverage points. The evaluation team's research suggested that the market for motors varies based on applications. HVAC and refrigeration motors are different from pumps and agricultural motors. Addressing these markets would take strategies tailored to each specific application and may be better suited to codes and standards-based interventions.

[8] Energy News Network. "Milwaukee plans to build net-zero modular homes for lower-income residents — but it's not easy". December 11, 2024. https://energynews.us/2024/12/11/milwaukee-plans-to-build-net-zero-modular-homes-for-lower-income-residents-but-its-not-easy/?

Phase 2. Next Steps

The evaluation team will complete Phase 2 of the MT Assessment Study in 2025. In Phase 2, the team will conduct additional research on the five most promising MT opportunities identified in Phase 1 (see Table 5). The team will focus on market research and technology reviews for each opportunity, such as reviewing secondary literature and analyzing publicly available data sources like demographic data, building stock, and industry forecasts. The team will focus on Wisconsin-specific data sources, where available, when estimating baseline market conditions, market adoption forecasts, and projections of energy savings.

The goals of Phase 2 are the following:

- Develop preliminary estimates of potential energy impacts, program costs, and cost-effectiveness for each MT opportunity.
- Provide a detailed market overview and preliminary theory of market transformation – i.e., how the MTI could address market barriers and short-, medium-, and long-term expected outcomes.

The evaluation team will produce a comprehensive report that summarizes Phase 2 activities, findings, and recommendations by December 31, 2025. The report will include a comprehensive roadmap for advancing MT activities in Quadrennium V, including policy decisions and procedural steps required to support future MT investments.

Appendix A. Scope of Work

The Public Service Commission of Wisconsin (PSC) has requested a Market Transformation Assessment study (MT Assessment) to better understand potential opportunities associated with investment in market transformation (MT) programs. The goal of this Assessment is to support future PSC decisions regarding investment in market transformation and the appropriate emphasis for Focus on Energy in the next quadrennial (Quadrennium V). PSC priorities for the M3AT Assessment include the following:

- **Assess alignment with Wisconsin's statewide energy efficiency program policy.** The PSC would like to identify key policy questions that need to be considered before MT could assume a larger role in the Focus on Energy program.
- **Understand how other state and utility programs have approached market transformation and related policy challenges.** Other states, including Illinois, Minnesota, and California, have recently approved investments in and pursued MT programs. The PSC would like to understand how those states have addressed policy issues associated with regulatory approval, management, and evaluation of MT programs and how those approaches could be adapted to Wisconsin.
- **Identify and prioritize market transformation program opportunities.** The core of this study is to identify the most promising energy efficiency MT opportunities. The PSC and the evaluation team have discussed an approach that relies primarily on scanning MT initiatives from other regions and assessing them for relevance and potential impact to Wisconsin. The team will develop concept descriptions, along with estimated budgets and impacts, for the most promising MT opportunities.
- **Develop a roadmap for implementing energy efficiency market transformation in Wisconsin.** The ultimate goal of this study is to provide the PSC with a roadmap that identifies the key steps required to incorporate MT programs into the Focus on Energy Quadrennium V portfolio—both policy decisions and recommended MT investments.

This document summarizes the evaluation team's proposed approach to conducting the Market Transformation Assessment Study for the PSC and provides additional details on how the team proposes to address each of the objectives above.

Scope of Work

The evaluation team's overall approach is based on its experience advising other market transformation entities across North America. The team will leverage its knowledge of Focus on Energy's current programs and the Wisconsin market. Each anticipated activity is outlined below.

Task 1. Project Management and Stakeholder Engagement

The evaluation team will provide ongoing project management support throughout the period of this engagement. This includes:

- **Planning and kickoff meetings and work plan development.** The evaluation team will meet with staff from the PSC and program administrator (APTIM) in early February 2024 for a project

kickoff meeting. This meeting will be conducted remotely and will focus on a review of the project scope, address questions and concerns, and discuss areas for refinement.

- **Stakeholder engagement.** The evaluation team will work with PSC staff to determine the appropriate stakeholder engagement throughout the study and solicit APTIM's input at the kickoff meeting. The team will hold up to six stakeholder meetings throughout the study, during which it will deliver presentations to inform and consult with stakeholders at key points. PSC staff and the evaluation team will draft a preliminary schedule of stakeholder meetings following the completion of Task 2 (Policy Analysis—an important component of the market transformation roadmap. Potential topics include the MT assessment methodology discussion, policy considerations, review of MT evaluation and cost-effectiveness approaches, opportunity scoring criteria, preliminary and final Phase 1 study results, and preliminary and final Phase 2 study results.
- **Ongoing project management.** The evaluation team proposes meeting with PSC staff every two weeks to discuss project progress and discuss emerging issues. The team will work with PSC staff to adjust the frequency of meetings throughout the study to ensure timely discussions.

Deliverables

- Draft and final work plan
- Stakeholder draft and final meeting slides
- Stakeholder meeting minutes and recordings
- Project management meeting minutes

Task 2. Policy Analysis

- At the outset of this project, the evaluation team will conduct a policy analysis to identify the key policy questions that need to be considered before market transformation could assume a larger role in the Focus on Energy program. The team will review the relevant statute and administrative code and consult with policy experts, as needed, to address these questions:
- How does Market Transformation align with Wisconsin's statewide energy efficiency program policy?
- Based on this assessment, where might there be uncertainty with integrating Market Transformation? What might need to be re-structured within the program to support MT? Where might Commission decisions be needed to allow the program to go down the path of MT vs. Market Effects? For example:
  - Would Focus on Energy need to adopt an MT-specific program funding framework?
  - Would Focus on Energy need to adopt an MT-specific impact evaluation policy and approach to cost-effectiveness? How can PSC staff assure Commissioners that MT investments will be cost-effective before Focus on Energy spends a lot of money identifying the best opportunities?
- Are there any parallels from other states/programs that encountered similar policy questions? How did they approach them?

- How are other programs addressing cost-effectiveness requirements for MT?

The evaluation team will also review and summarize the process and frameworks that other states have used to pave the way for investment in market transformation. For example, in 2022, the Minnesota Department of Commerce Commissioner issued a decision that approved the Minnesota Center for Energy and Environment's proposal to implement an MT entity in Minnesota - the MN Efficient Technology Accelerator (META). The decision followed a year-long process pursuant to enabling legislation that was signed into law in 2021. META's proposal included a process for portfolio selection, a methodology for evaluation and cost-effectiveness, and a proposed governance structure. Other states, including Illinois and California, have recently approved MT investments and have gone through similar processes and adoption of MT frameworks.

Deliverables

- Draft and final policy analysis memo that identifies potential policy issues and decisions needed to enable the advancement of MT investment in Wisconsin
- Summary of other state/regional MT program implementation and evaluation frameworks, as appropriate
- Draft and final slides for a meeting to discuss issues with stakeholders
- Stakeholder meeting minutes and recordings

Task 3. Phase 1 MT Opportunity Assessment

The evaluation team will take a phased approach to the MT assessment work. The objective of Phase 1 is to identify and conduct a preliminary assessment of market transformation opportunities that may be a good fit for the Wisconsin market. During this phase of the MT Assessment, the team will create a preliminary high-level description of each opportunity that defines the technology, relevant market sector(s) and segment(s), and opportunity description—sufficient to assess each one based on an agreed-upon set of criteria. The team will identify the most promising set of opportunities for additional investigation and concept development in Phase 2. The team's approach to the Phase 1 assessment is further described below.

Task 3a. Identify Market Transformation Opportunities

The evaluation team will begin the Phase 1 assessment by reviewing the 2021 Focus on Energy potential study and recent market research and evaluation findings to identify unaddressed energy efficiency potential in Wisconsin. The team will also assess the potential opportunity to support the development of more stringent state building codes.

The team will also conduct secondary research to update its preliminary inventory of MT efforts in other regions (presented in October 2023) with a comprehensive list and description of market transformation opportunities that have been considered or are being implemented in other regions. The research will include a review of publicly available MT and emerging technology program documentation from other regions. The team will also review Wisconsin-specific market data by customer sector, market research,

and evaluation studies, the 2021 Focus on Energy *Energy Efficiency Potential Study*, and Wisconsin's Technical Resource Manual.

The team will assess the list of known MT opportunities against current knowledge of energy efficiency market conditions and unrealized potential in Wisconsin to identify which opportunities are most likely to be relevant to Wisconsin.

Deliverable

- List of MT opportunities for consideration, with a qualitative assessment of fit for Wisconsin

Task 3b. Develop Opportunity Descriptions and Scoring Criteria and Assess Opportunities

Opportunity Descriptions

The evaluation team will create a preliminary description of each MT opportunity, including:

- A definition of the technology or practice
- The addressable market and estimated market size
- Vision for long-term outcomes
- Preliminary theory of market transformation
  - Market barriers and opportunities
  - Possible points of market leverage and associated interventions that could influence widespread market change
  - Mechanism for locking in market change
- High-level approach to evaluating energy savings and cost-effectiveness

Preliminary opportunity descriptions will rely upon publicly available secondary research and conversations with market and technology experts.

Scoring Criteria and Opportunity Assessment

The evaluation team will propose a set of criteria for scoring the initial list of MT opportunities and submit the criteria to PSC staff for feedback and discussion. Criteria will likely include a mix of expected impacts, cost-effectiveness, market transformation characteristics (for example, identifiable points of market leverage and a mechanism for lastingness), and other Wisconsin-specific priorities. Once the criteria are agreed upon, the team will conduct a preliminary assessment of the identified opportunities against these criteria to identify the most promising opportunities. The team anticipates that energy savings potential will be a key assessment criterion and will create a roughly estimated range of savings potential for the Phase 1 assessment based on the size of the affected market, per unit energy savings, and technology cost. Note, however, that more refined savings potential estimates and cost-effectiveness estimates will require more in-depth secondary and primary research that is part of the Phase 2 assessment.

Deliverables

- Preliminary MT Opportunity descriptions (up to 12)
- Proposed scoring criteria – draft and final
- Excel workbook with individual and composite criteria scores for each MT opportunity, with the capability to adjust criteria weights
- Draft and final presentation slides to facilitate a workshop with PSC staff and stakeholders, as appropriate, about the most promising opportunities

Task 3c. Phase 1 Reporting

The team will develop a comprehensive draft report that summarizes the Phase 1 MT Assessment activities, findings, and recommendations. The team will also create a slide deck to support a meeting with stakeholders.

Deliverables

- Draft and final report
- Draft and final slides for a stakeholder meeting

Task 4. Phase 2 MT Opportunity Assessment

The objectives of the Phase 2 Assessment are to conduct additional research on the most promising MT opportunities identified in Phase 1—sufficient to develop a forecast of energy impacts and cost-effectiveness; and develop a concept description and budget for how to advance up to six of the most promising market transformation opportunities during Quadrennium V. The evaluation team's approach to the Phase 2 assessment is further described below.

Task 4a. Conduct Additional Research, Estimate Energy Savings Potential, and Score Opportunities

The evaluation team will conduct additional market research and technology reviews needed to develop preliminary estimates of potential energy impacts and cost-effectiveness and to develop quantitative metrics and insights to enable scoring of the most promising MT opportunities identified in Phase 1.

Estimating Energy Savings and Cost-Effectiveness

Estimation of energy impacts for MT programs requires research to define these inputs:

- Targeted market segments and adoption cases/conditions and size of each
- Unit energy savings associated with the technology or practice measure(s) for each use case
- Baseline (naturally occurring) market adoption—market adoption that would occur over the next 20 years, absent the MT program
- Total market adoption—market adoption forecast to occur over the next 20 years, with MT program investment
- Incremental costs
- Estimated program budget

The evaluation team will conduct a mix of market research activities to inform the development of estimates of market adoption. It will review secondary literature and analyze available market and technology data using sources such as publicly available databases, including demographics, building stock, sales and shipment reports, and industry forecasts. The team will also develop insights from interviews with stakeholders and industry experts and consider purchasing relevant market data – if available and the PSC feels it is appropriate to do so.

The team will develop energy impacts using the Wisconsin TRM as a primary source and supplement it by additional technology review to gather inputs such as per-unit savings and effective useful life (EUL).

The team will use a cost-effectiveness tool that it developed internally to estimate cost-effectiveness using the Modified Total Resource Cost (MTRC) test. The team will conduct additional market research to develop incremental cost estimates by use case. For each initiative, the team will calculate cost effectiveness incorporating forecasted market adoption for the initiative, estimated energy impacts, incremental costs, and program budget.

Scoring and Scenario Analysis

After estimating energy impacts and cost-effectiveness for each MT opportunity, the evaluation team will score each opportunity using an Excel-based scoring tool that allows the PSC to run sensitivity analysis based on criteria weighting. In addition, the team will estimate portfolio cost-effectiveness by estimating TRC across different combinations of initiatives assessed during Phase 2 so that the PSC can assess the costs and benefits associated with different portfolio scenarios.

Deliverables

- Documentation of energy savings and cost-effectiveness inputs and assumptions
- Excel scoring tool workbook and outputs
- Portfolio cost-effectiveness outputs

Task 4b. Refine MT Initiative Concepts

Based on the additional research conducted in task 4a, the evaluation team will develop concept descriptions for up to six of the highest-scoring MT concepts, along with estimated budgets and impacts. Each concept description will include these elements:

- Technology/practice description
- Market overview
- Preliminary MT theory
- Estimated budget, impacts, and cost-effectiveness
- Knowledge/research gaps and activities required to address those gaps
- Budget and timeline

Deliverables

- Concept descriptions for up to six of the most promising MT initiatives

Task 4c. Phase 2 Reporting

The evaluation team will develop a comprehensive draft report that summarizes the Phase 2 MT Assessment activities, findings, and recommendations. The Phase 2 report will include a comprehensive roadmap for advancing MT activities in Quadrennium V, including policy decisions and procedural steps required to support future MT investments.

Deliverables

- Draft and final report

Schedule

The evaluation team anticipates initiating Phase 1 of the MT Assessment Study in early 2024. It will target having a draft of the Phase 1 assessment ready for review in the fourth quarter of 2024 and a final draft by December 2024. The team anticipates commencing the Phase 2 assessment in January 2025, with a draft of the Phase 2 assessment report ready for review by the end of the third quarter of 2025 and a final draft report by December 2025. Key delivery dates and milestones are outlined below.

Task	Start	End
1. Project Management and Stakeholder Engagement	1/4/2024	12/31/2025
2. Policy Analysis	2/5/2024	5/24/2024
3. Phase 1 MT Opportunity Assessment	2/5/2024	10/25/2024
3a. Identify MT Opportunities	2/5/2024	6/28/2024
3b. Develop Opportunity Descriptions, Scoring Criteria, Initial Assessment	2/5/2024	9/27/2024
3c. Phase 1 Reporting	9/30/2024	Presentation: 10/25/24 Final Report: 12/12/24
4. Phase 2 MT Opportunity Assessment	11/4/2024	10/24/2025
4a. Conduct Research and Refine Potential	11/4/2024	5/23/2025
4b. Refine MT Initiative Concepts	5/23/2025	9/26/2025
4d. Phase 2 Reporting	9/26/2025	Presentation: 10/24/24 Final Report: 12/19/24
Total		

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Appendix C. List of Interviewees

The evaluation team conducted interviews with the following key stakeholders between March 2024 and May 2024:

- Kegan Daugherty, Solution Delivery Manager, Market Transformation, Resource Innovations
- Molly Graham, Director, Market Solutions and Education, MEEA
- Alison Lindburg, Director, Building Codes and Policy, MEEA
- Carl Nelson, Senior Director of Market Transformation, Minnesota Center for Energy and Environment
- Jeff Harris, Chief Market Transformation Officer, NEEA
- Jolene Sheil, Manager, Focus on Energy Portfolios, Public Service Commission of Wisconsin
- Margie Gardner, Vice President of Market Transformation, Resource Innovations
- Jeanette LeZaks, Director of Research & Innovation, Slipstream
- Robin Lisowski, Managing Director of Policy, Slipstream
- Ralph Prahl, Independent Consultant

Appendix D. Procedural Histories

Minnesota CEE Emerging Technology Accelerator

Date	Action	Who	Notes
May 25, 2021	Energy Conservation and Optimization Act enacted	MN Legislature, Governor Tim Walz	• Modernized Minnesota's Conservation Improvement Program by providing a more comprehensive approach to energy efficiency programming (2021 MN Legislature: ECO Act passes thanks to hard work, collaboration | Center for Energy and Environment (mncee.org).
June 22, 2021	Legislation enacted to allow establishment of META	MN Legislature, Governor Tim Walz	• Minnesota lawmakers passed the Commerce and Energy Omnibus Finance and Policy bill — carrying forward a slew of clean energy initiatives including authorization for Minnesota's Department of Commerce to approve the establishment of an energy efficiency market transformation program, if that program meets specified criteria, and after significant stakeholder engagement (At long last: A big moment for clean energy legislation in Minnesota | Center for Energy and Environment (mncee.org).
July 14, 2021	Notice of Intent	CEE	• MN CEE submitted a notice of intent to file a proposal to implement the META with the MN Dept of Commerce, Division of Energy Resources pursuant to MN Statutes Section 216B.241 subdivision 14.
August 13, 2021	Determination of Eligibility	Department of Commerce, Division of Energy Resources (DER)	
August 2021 – April 2022	Stakeholder Engagement	CEE	• Dozens of stakeholder meetings, included 8 meetings with planned agendas with utility stakeholders and the DER, a public meeting, and targeted individual stakeholder meetings.
April 15, 2022	Proposal to Implement META	CEE	• CEE filed a Proposal to Implement META pursuant to 216B.241 subdivision 14(d)
May 3, 2022	Notice of Comment Period	DER	
May 20, 2022	Comments received	DER	
May 27, 2022	Reply comments submitted	CEE	
June 8, 2022	Information Requests (IRs)	DER	
June 20, 2022	Response to IRs	CEE	
July 1, 2022	Decision	DER	• Approved as proposed with a modification to proposed governance and structure: utilities electing to participate are to contribute funds directly to the DER, in consultation with CEE and Coordinating Committee, in the same manner as those utilities required to participate.

Illinois Utilities/Midwest Market Transformation Collaborative

Date	Action	Who	Notes
December 7, 2016	The Future Energy Jobs Act enacted	Governor	• Transfers responsibility for "market transformation" activities from Illinois Department of Commerce and Economic Opportunity (DCEO) to utilities, who were previously paying into the DCEO budget, starting in 2018. MT initiatives were predominantly programs to support market adoption of energy efficiency, such as education and training (for example, Building Operator Certification and Illinois Home Performance), but the legislation opened the door to the possibility of additional MT investments.
2018	Nicor approaches NEEA and engages MEEA	Jim Jerozol	• Brings MEEA into the conversation (he is chair of MEEA at the time)
2018-2019	MW MT Collaborative Launches	RI, MEEA	• MEEA facilitated the Collaborative with Margie Gardner (Resource Innovations) and Jeff Harris (NEEA) serving as subject matter experts. Nicor Gas and Commonwealth Edison are founding members. PowerPoint Presentation (ilsag.info) Later joined by North Shore Gas, DTE, Ameren Illinois, Xcel Energy, Consumers Energy, and CenterPoint Energy.
March 11, 2019	IL SAG, MT Savings Working Group launches		• Market Transformation Savings Working Group - Illinois Energy Efficiency Stakeholder Advisory Group Illinois Energy Efficiency Stakeholder Advisory Group (ilsag.info)
2019 - 2020	Collaborative considers a variety of MT initiatives		
August 2019	Evaluation Framework finalized and adopted as TRM Attachment C	ILSAG MTWG	
2021	Midwest Collaborative disbands	MEEA, Midwest Collaborative Board	• The collaborative identified MT opportunities, but they were not universally supported by Illinois utilities or other Collaborative members. Illinois utilities are each pursuing "MT" opportunities that meet their needs.
September 22, 2023	TRM section on MT evaluation updated		• Added greater specificity around energy savings framework • Utilities will include four-year planning cycle costs and benefits at the portfolio level. • Separate benefit/cost ratios (TRC and UCT) for MT programs will be included in plans in the same manner as all programs

California Market Transformation Administrator

Date	Action	Who	Notes
2011	White Paper	Prahl & Keating	• Prahl, Ralph, and Ken Keating. November 2011. Planning and Evaluating Market Transformation: What the Industry has Learned, and Possible Implications for California
2014	White Paper	Prahl & Keating (referenced D.19-12-021)	• Prahl, Ralph, and Ken Keating. December 9, 2014. Building a Policy Framework to Support Energy Efficiency Market Transformation in California. MT_Policy White Paper_final_Dec 9 2014.doc (live.com)
2014	CPUC Staff Paper on MT Framework	Keating and Fogel	• Keating, Ken, and Cathy Fogel. December 9, 2014. Guidance on Designing and Implementing Energy Efficiency Market Transformation Initiatives.
2015	SB 350 Signed into law	CA Governor	• Calls for the CPUC to review and update its policies governing energy efficiency programs funded by utility customers to facilitate doubling of energy efficiency savings by 2030. In updating its policies, directs the commission to authorize market transformation programs with appropriate levels of funding to achieve deeper energy efficiency savings.
August 28,2018	EE Market Transformation Staff Proposal	CPUC Staff	• Market Transformation Staff Proposal– Attachment A: Report and Recommendations to the CPUC March 18, 2019.
December 6, 2018	CAEECC MTWG formed	CAEECC	• Used CPUC white papers as starting point.
March 18, 2019	CAEECC MT Working Group issues Phase I recommendations	CAEECC MT Working Group	• Primarily focused on MT initiative framework. • Microsoft Word - MTWG Final Report 3-18-19 .docx (caeecc.org)
December 5, 2019	Decision 19-12-021	CPUC	• Establishes funding for a new California MT Administrator and adopts MT initiative framework.
February 1, 2021	CAEECC MT Working Group issues Phase II recommendations on resolving evaluation issues	CAEECC MT Working Group	• Primarily focused on attribution of impacts to MT programs versus RA programs. • 849f65_fbc2ed9084ba4c5fb1c309651e52229c.pdf (caeecc.org)
11/30/2022	Administrator (Resource Innovations) Selected	CPUC	• RI proposal and contract brands the MT Administrator as CalMTA; contract is signed.
4/1/2024	Evaluation Framework Approved	CPUC	• Consistent with white papers and NEEA, Illinois, Minnesota, and NYSERDA frameworks.

Appendix E. Opportunity Summaries

Appendix E contains opportunity summaries for promising technologies. Each topic area includes an overview of the product, its potential market, and an evaluation and score of the product's value to Focus on Energy, as well as readiness and potential to accelerate adoption in the market.

Advanced Motors

Summary	
Advanced motors are efficient motors with built-in control systems that automatically adjust to the speed required to meet a specific output demand. There are two types of advanced motors: switched-reluctance motors (SRMs) and electronically commutated motors (ECMs). These advanced motors act similarly to variable frequency (or variable speed) drives (VFDs), which are controls installed in pre-existing induction motors. While advanced motors provide the control capacity of a VFD, they are also more efficient than standard induction motors with installed VFDs. Advanced motors are a beneficial solution for commercial and industrial customers because of the amount of energy typically consumed by HVAC systems; they can replace existing induction motors to add controls and reduce energy usage. The market for advanced motors has lagged because of a few market barriers, including higher upfront costs and a lack of awareness about their benefits among consumers and contractors. Additionally, there is only one primary manufacturer for SRMs—Turntide, which is based in the U.S. VFDs and advanced motors are both included in existing technical reference manuals, but VFDs tend to be the first choice for contractors. Utilizing midstream and upstream programs, NEEA's Extended Motor Products (XMP) is increasing awareness, availability and acceptance of efficient motor options, increasing stocking and sales of efficient motor-driven products.[9] A market transformation program focused on advanced motor systems in Wisconsin could leverage existing programs designed to promote VFD installation, to increase education and awareness around advanced motors and accelerate their adoption.[10] While incentive programs have typically focused on heating and cooling applications, a market transformation initiative could expand to include a wide range of uses such as hydronic and water pumping.	
Product and Market Definition	• Applications: Suitable for residential single-family, multifamily apartment buildings, commercial, and industrial facilities in retrofit and new construction. • Competing Solutions: Variable Speed Drives (VSDs) currently dominate the retrofit market. Current Federal Standards for commercial electric and small electric motors apply only to single-speed motors.
Potential Value to Focus on Energy	• Technical/Economic Potential: 1,557,400 lifecycle MMBTU (commercial only).11 • Current Focus on Energy Measure: Advanced motors (residential, commercial, and industrial). MTI could scale beyond traditional program delivery.

[9] Northwest Energy Efficiency Alliance. July 2024. *Extended Motor Products.* https://neea.org/our-work/programs/xmp

[10] Focus on Energy. July 2024. *Save on Your Pump Systems with Focus on Energy.* https://assets.focusonenergy.com/production/inline-files/2024/BIZ-GOV-VSD-Bonus-Pump-Assessment-GD.pdf

[11] Cadmus. July 2024. *Focus on Energy Potential.* https://cadmusgroup.shinyapps.io/focus-tool/. Values represent a cumulative 12-year life-cycle savings potential using the following assumptions: current policy, base scenario, combined gas and electric for all sectors, and all segments.

Summary	
Compelling Value Proposition/ Non-Energy Benefits	• Advanced motors and controllers are designed specifically to be installed and commissioned at the same time. • Advanced motors are more efficient than standard induction motors. The California eTRM includes a measure characterization document for software-controlled switch reluctance motors, where SRMs are defined as capable of outperforming the National Electrical Manufacturers Association's premium efficiency motor.[12] • Integration with control functions and EMS/BMS, less wiring due to integrated controls, improved maintenance due to monitoring, and easy setup. Allows for future unforeseen needs to be met easily due to intelligent capabilities.
Readiness of Technology to Scale	• Largely one domestic manufacturer of SRMs at the moment, but current motor manufacturers could adapt to produce advanced motors with computer systems embedded.
Market Barriers and Considerations	• Currently, advanced motors are not widely distributed. SRMs are only offered by a handful of distributors for largely a single manufacturer. • The market lacks a robust and knowledgeable contractor base who are willing and able to recommend and install advanced motors in emergency replacement situations. • Higher upfront costs for advanced motors than for VFDs or induction motors. • Not a single market for motors because motors depend on the application – HVAC, refrigeration, water circulation – and these markets would likely require different strategies to address different barriers.
Market Leverage Points	• A market transformation program focused on advanced motor systems in Wisconsin could leverage existing programs currently promoting VFD installations, shifting focus to increase education and awareness around advanced motors and accelerate adoption.[13] • Existing offerings in Wisconsin could be used to leverage existing relationships with installer network.
Expected Outcomes	• Incremental manufacturing costs will drop as production scales. • Expanded knowledge among contractor base of SRM & ECM benefits and applications.
Mechanisms for Lastingness	• Building codes or minimum efficiency standards • Substantial changes to/expansion of manufacturing

[12] California Energy Efficiency Measure Data. January 2024. *Software-Controlled Switch Reluctance Motor.* https://www.caetrm.com/measure/SWHC041/05/

[13] FOE. July 2024. *Save on Your Pump Systems.* https://assets.focusonenergy.com/production/inline-files/2024/BIZ-GOV-VSD-Bonus-Pump-Assessment-GD.pdf

Criteria	Score	Rationale
Potential Value to Focus on Energy	**3**	• Substantial technical savings potential. • Could expand existing Focus on Energy measure beyond RA program.
Compelling Value Proposition / Non-Energy Benefits	**2**	• Clean value to customers with respect to efficiency and motor performance. Increased monitoring capabilities, easier set up with integrated controls. • Less clear value proposition for distributors and installers. Motors used in various applications. Installers/distributors may have different priorities and potential value propositions depending on application.
Readiness of Technology to Scale	**1**	• Single manufacturer for SRMs. ECMs not clear.
Market Barriers	**1**	• Some known barriers but some unknown. Availability and higher upfront costs apply broadly for different motors applications. • Given market for motors segmented with different applications, different applications would face barriers unique to those applications.
Possible Market Leverage Points	**1**	• Some known leverage points. • Similar to the barriers, different applications would have some unique leverage points unique to those applications. • Would likely require specific market characterizations for various applications of motors, such as refrigeration, to identify barriers and leverage points.
Mechanism for Lastingness	**1**	• Short term changes due to expanded manufacturing may indicate structural changes in markets for some applications. • Codes vary by application and there is not a singular code for motors, so locking in savings may be complex and piecemeal.

Air Source and Ductless Heat Pumps

Summary	
Air-source heat pumps (ASHPs) transfer heat between inside a home and the outside air, providing both space heating and cooling to a building. Homes and businesses that currently have ductwork in them may be good candidates for a ducted ASHP. Ductless heat pumps (DHPs) provide space conditioning and heating without a duct system. These are among the most energy-efficient technologies for delivering space conditioning, requiring significantly less energy than natural gas-powered furnaces, electric resistance heaters, and standard air conditioners paired with a gas furnace or electric heat. These technologies have different applications, but they can be applied to most single-family homes, multifamily, and commercial buildings. A future MTI focusing on ASHPs could include ASHPs for both ducted and ducted applications. Installers, distributors, and manufacturers often offer heat pumps options for both ducted and ductless applications. The space heating and cooling equipment markets present significant opportunities to improve heating and cooling efficiency, reduce fossil fuel use, and reduce greenhouse gas emissions through ASHP & DHP adoption. Wisconsin has 2.7 million housing units,[14] 70% of which use natural gas for heating.[15] Upgrading these existing systems with heat pump technology would significantly reduce greenhouse gas emissions, while significantly increasing the efficiency of the HVAC system. The Wisconsin air conditioning replacement market addresses around 80,500 homes per year,[16] and over the past 30 years, Wisconsin's summer climate has increased an average of 2°F to 3°F, which has led to an increase in the number of residents who need new space cooling equipment.[17] ASHP & DHP installations would also address this growing need in Wisconsin.	
Product and Market Definition	• Applications: Suitable for residential single-family, multifamily apartment buildings, hotels, small businesses, though packaged terminal heat pump and new, saddle style window options may be more compelling for some multifamily and lodging applications. Retrofit and new construction. Provides both heating and cooling, which allows for replacing two systems simultaneously in a retrofit application or reducing the equipment installed in new construction. • Baseline Assumption: Standard efficiency central and room air conditioners, natural gas furnaces and boilers, and electric baseboard heaters (federal standard 2023, 14.3 SEER2, 7.5 HSPF2). • Competing Solutions: Central ACs and furnaces currently dominate the retrofit and new construction market. Packaged terminal heat pumps compete within the heat pump market. There are Federal Standards that began in 2023 for ASHPs, 2015 for electric and gas furnaces, and future 2028 standards for gas furnaces.
Potential Value to Focus on Energy	• Could complement or expand existing Focus on Energy measure: ASHPs (residential, commercial, and industrial). • In the Wisconsin residential market, heating energy consumption is over 76% fossil fuel, which provides a significant opportunity for electrification and carbon emissions reductions via the adoption of ASHPs should electrification be a priority in the next quadrennium

[14] United States Census Bureau via Index Mundi. July 2018. *Wisconsin Number of Housing Units by County.* https://www.indexmundi.com/facts/united-states/quick-facts/wisconsin/housing-units#map

[15] United States Energy Information Administration. 2009. *Household Energy Use in Wisconsin.* https://www.eia.gov/state/print.php?sid=WI

[16] Focus on Energy EERD Report. October 2021. *Air Source Heat Pumps in Wisconsin Multifamily and Single-Family Applications*. p. 27. https://s3.us-east-1.amazonaws.com/focusonenergy/staging/inline-files/2021/EERD_ASHP_Project-Final_Report.pdf

[17] Wisconsin Initiative on Climate Change Impacts. July 2024. *Trends and Projections*. https://wicci.wisc.edu/wisconsin-climate-trends-and-projections/

Summary	
	program cycle.[18] • Technical Potential: 10,155,807 MMBTU (low technical potential. residential, commercial, and industrial). [19]
Compelling Value Proposition/ Non-Energy Benefits	• ASHPs provide heating and cooling, while providing significant greenhouse gas emission reductions compared to traditional furnace systems. • Heat pumps can meet Wisconsin's growing need for summer space cooling in new construction projects while also supplying heat. Heat pumps are a compelling retrofit solution for residents with existing furnaces. • Minimizes re-circulation of airborne contaminants, allows for right-sizing to meet building needs, improves safety compared to fossil fuel baseline technologies (e.g., no toxic indoor emissions), reduces noise compared to baseline technologies, and costs less to maintain than traditional heating and cooling technologies.
Readiness of Technology to Scale	• Multiple existing manufacturers. There are currently 15 ENERGY STAR certified partners for ASHPs.
Market Barriers and Considerations	• Manufacturers, distributors, contractors, and customers are becoming more familiar with ASHPs but remain skeptical about whether ASHPs will meet space conditioning needs in colder climates. • Site-specific upfront costs for ASHPs are higher than the upfront costs of a furnace or air conditioning unit and can vary significantly ($8,000 to $24,000) depending on the system type, operation, and climate.[20] • In cold climates and at current energy prices, ASHPs cost more to operate than a natural gas furnace and may require a backup heating system to reduce costs and energy use during periods of very low temperatures. However, ccHPs operate efficiently in cold weather, offering a single solution for efficient heating and cooling down to -15°F.[21] • Potential cost increase for customers when switching from gas to electric. • The technology requires a robust and knowledgeable contractor market willing and able to recommend and install heat pumps in an emergency replacement situation. If a gas heating appliance fails, heat pumps can be more complex, so the technology is not currently considered ideal for emergency replacement in a fuel-switching scenario.
Market Leverage Points	• The Administration's Defense Production Act (DPA) allocated $250 million to accelerate heat pump manufacturing in the U.S. Manufacturers can use DPA incentives to lower production costs, which utilities and government programs can leverage to increase ASHP adoption.[22] By November 2023, the United States Department of Energy (US DOE) successfully provided $169 million in funding to manufacturers. On February 14, 2024, the DOE announced the availability of $63 million to accelerate the growth of heat pump manufacturing

[18] United States Energy Information Administration. July 2024. *RECS Survey Data.* https://www.eia.gov/consumption/residential/data/2020/

[19] Focus on Energy did not model ccHPs or backup gas-powered heat pumps. The technical and economic potential savings represent advanced efficiency heat pumps with high HSPF or COP efficiencies. This should provide a reasonable assessment for savings potential for ASHPs.

[20] Slipstream. July 2023. *Planning for Wisconsin Air Source Heat Pump Market Transformation*.

[21] US DOE February 2022. *Residential Cold Climate Heat Pump Technology Challenge.*

[22] US DOE. April 2023. *Biden-Harris Administration Announces $250 Million to Accelerate Electric Heat Pump Manufacturing Across America.* https://www.energy.gov/articles/biden-harris-administration-announces-250-million-accelerate-electric-heat-pump

Summary	
	domestically, in a second wave of funding.[23] • In July 2023, Slipstream published their "Planning for Wisconsin Air Source Heat Pump Market Transformation" report for the Center for Energy and Environment (CEE).[24] In their ASHP market transformation report, Slipstream provides a playbook of recommended actions that market players, including Focus on Energy, utilities, and communities can take to facilitate ASHP market transformation in Wisconsin. • Minnesota's Center for Energy and Environment (CEE), Northwest Energy Efficiency Alliance (NEEA) are pursuing MT initiatives for ASHPs. Market scale via multiple sponsors can increase leverage.
Mechanisms for Lastingness	• CEE aligned its market transformation study goals with the Midwest ASHP Collaborative, which CEE and Slipstream formed in 2022 with the goal of making ASHP technologies the first choice for contractors and homeowners by 2030.[25] • Federal Standards continue to categorize and provide regulations for ASHP technology. • Building codes or minimum efficiency standards for space conditioning.

Criteria	Score	Rationale
Potential Value to Focus on Energy	**2**	• Mid-level savings potential compared to other MTI opportunities. • Clarity on electrification in the next quadrennium would increase confidence in potential value to Focus of Energy. • Current programs deliver measure, but MT could scale beyond the reach of traditional RA programs.
Compelling Value Proposition / Non-Energy Benefits	**2**	• Technical savings potential. Clear value to customers with respect to summer cooling while cold weather performance is still a source of hesitation for some potential customers.
Readiness of Technology to Scale	**3**	• Technology is widely available with multiple manufacturers and distribution networks.
Market Barriers	**2**	• Clearly identifiable barriers. Barriers around emergency replacements after failure of existing systems may be more challenging for MTIs to address.
Possible Market Leverage Points	**2**	• Multiple known leverage points. Existing MTIs across the U.S. Increased federal support for domestic manufacturing and electrification retrofits.
Mechanism for Lastingness	**3**	• Multiple identifiable criteria with measurable outcomes.

[23] Ibid.

[24] Slipstream. July 2023. *Planning for Wisconsin Air Source Heat Pump Market Transformation.* https://slipstreaminc.org/sites/default/files/documents/publications/planning-wisconsin-air-source-heat-pump-market-transformation-report-2023.pdf

[25] Midwest Energy Efficiency Alliance. July 2024. *Midwest ASHP Collaborative.* https://www.mwalliance.org/midwest-ashp-collaborative

Efficient Manufactured Homes

Summary	
Efficient manufactured homes offer a housing option designed and built to be energy efficient. Manufactured homes are built at or above ENERGY STAR® certification levels and in accordance with the Manufactured Home Construction and Safety Standards, established by the U.S. Department of Housing and Urban Development.[26] Efficient, ENERGY STAR-certified manufactured homes are a particularly beneficial solution for income qualified customers as they offer a cost-effective housing option with comparatively low long-term energy costs. Wisconsin customers can also leverage existing Resource Acquisition program incentives designed to increase market adoption in the state.[27] Though higher than some neighboring states, the market for ENERGY STAR®-certified manufactured homes in Wisconsin has lagged that of 31 other states.[28] Supply chain constraints and insufficient supply of these homes compared to demand are exacerbating factors, along with likely barriers associated with higher upfront costs and lack of consumer awareness of their benefits. To address these issues, Focus on Energy recently implemented a New Manufactured Homes Pilot program for 2024-2025 that provides rebates for single- and double-wide construction of efficient manufactured homes. The program aims to double the number of ENERGY STAR manufactured homes in its first year and then double participation in the following year. Currently, the program primarily targets dealers interested in energy savings and quality for customers, wanting to distinguish themselves from competitors, and manufacturers concerned about competition from other home builders.[29] In addition, this technology is already making an impact in Wisconsin through agencies such as the local Habit for Humanity affiliate in La Crosse, Wisconsin, and the Couleecap Community Action Agency that help customers get set up with a contractor, provide training for the installers, and promote the technology.[30]	
Product and Market Definition	• Applications: New Construction Residential • Baseline Assumption: Code-compliant manufactured home. • There are 63 manufactured home retailers in WI. The pilot program aims to recruit 40 of them for participation.

[26] Joint Center for Housing Studies Harvard University. July 2024. *Overcoming Barriers to Manufactured Housing: Promising Approaches from Five Case Studies.* https://www.jchs.harvard.edu/sites/default/files/research/files/harvard_jchs_pew_report_3_2024.pdf

[27] United States Department of Energy Office of Energy Efficiency & Renewable Energy. July 2024. *DOE's Role in Manufactured Housing.* https://www.energy.gov/eere/buildings/does-role-manufactured-housing

[28] ENERGY STAR Manufactured Homes Market Share Report | 2020. https://www.research-alliance.org/ENERGY_STAR_Manufactured_Homes_Market_Share_Report.pdf

[29] Focus on Energy. July 2024. *Manufactured Homes Pilot Implementation Plan 2024-2025*. Resource shared privately with Cadmus.

[30] Joint Center for Housing Studies Harvard University. *Overcoming Barriers to Manufactured Housing: Promising Approaches from Five Case Studies.* https://www.jchs.harvard.edu/sites/default/files/research/files/harvard_jchs_pew_report_3_2024.pdf

Summary	
Potential Value to Focus on Energy	• Efficient manufactured homes provide an opportunity to expand homeownership for low- and moderate-income households while increasing comfort and decreasing energy burden.[31] • Technical and Economic Potential: Not in 2021 Energy Efficiency Potential Study scope. In 2023, 850 manufactured homes were delivered in Wisconsin. Potential savings per-home vary based on the combinations of fuels used – electric only, electric plus natural gas, or electric plus propane. If all 850 homes were ENERGY STAR certified, potential lifetime savings range from 119,000 to 1.4 million MMBTu.[32]
Compelling Value Proposition / Non-Energy Benefits	• Increased durability and comfort, lower operating costs, less maintenance than traditional homes. • Certified ENERGY STAR manufactured homes provide a high level of energy efficiency relative to traditional manufactured homes, with typical savings of 30% compared to comparable non-ENERGY STAR homes.
Readiness of Technology to Scale	• There are 4 manufactured/modular home builders located in Wisconsin[33] with 2 certified to build to Energy Star specifications.[34] • The market for manufactured homes is relatively small with only 850 manufactured homes delivered in Wisconsin in 2023.
Market Barriers	• Higher upfront costs compared to homes that are not ENERGY STAR- certified.[35] • Low supply of ENERGY STAR-certified homes relative to demand makes it challenging to procure them.
Market Leverage Points	• The existing Focus on Energy pilot program and incentives provide a point of leverage to encourage the adoption of Efficient Manufactured homes. • Changes to the ENERGY STAR Certification program in 2020 has significantly increased participation in the program which may translate to continued manufacturer participation as new versions of the specification are introduced. • Inflation Reduction Act New Energy Efficient Home Credit offers $2,500 available for homes certified to eligible ENERGY STAR Manufactured New Home (MH) program requirements.[36] • Northwest Energy-Efficient Manufactured Housing Program collaborative between the home builders, retailers and utilities across the northwest has shown success in increasing efficiency of manufactured homes.[37]

[31] Joint Center for Housing Studies Harvard University. *Overcoming Barriers to Manufactured Housing: Promising Approaches from Five Case Studies.* https://www.jchs.harvard.edu/sites/default/files/research/files/harvard_jchs_pew_report_3_2024.pdf

[32] Per-unit lifetime savings sourced from 2024 Wisconsin Focus on Energy TRM

[33] Wisconsin Manufacturers - Wisconsin Housing Alliance

[34] Systems Building Research Alliance. ENERGY STAR Plants

[35] United States Department of Energy Office of Energy Efficiency & Renewable Energy. July 2024. *DOE's Role in Manufactured Housing.* https://www.energy.gov/eere/buildings/does-role-manufactured-housing

[36] https://www.energystar.gov/about/federal-tax-credits/ss-45l-tax-credits-home-builders

[37] NEEA. Manufactured Homes Transition Market Progress Evaluation Report. December 2023. https://neea.org/img/documents/Manufactured-Homes-Transition-MPE-Report.pdf

Summary	
	• Manufactured home retailers and showrooms
Expected Outcomes	• Increased number of manufacturers building homes to ENERGY STAR specifications. • Reduced costs as efficient homes achieve mainstream status.
Mechanism for Lastingness	• Planned federal efficiency and ENERGY STAR standards. • Changes to manufacturer practices.

Criteria	Score	Rationale
Potential Value to Focus on Energy	**1**	• Potentially low, uncertain savings potential due to low number of homes delivered each year and different combinations of energy fuels. All-electric homes provide greatest savings, but shipment numbers do not indicate energy fuel shares.
Compelling Value Proposition / Non-Energy Benefits	**2**	• Federal incentives to builders for meeting ENERGY STAR requirements. Significant energy savings and increased comfort for homeowners.
Readiness of Technology to Scale	**2**	• Multiple builders nationally build to ENERGY STAR specifications. ENERGY STAR standards have been revised as of 2020 for manufactured homes with v3 expected to be in effect by 2026.
Market Barriers	**2**	• Supply and demand side barriers identified.
Possible Market Leverage Points	**2**	• Multiple leverage points, including federal rebates for builders and NW program. However, supply remains relatively low at present, so uncertain how much leverage these offer.
Mechanism for Lastingness	**2**	• Voluntary standards exist with planned revisions. Unclear process or viability of mandatory standards.

Efficient Manufactured Homes

Summary	
Efficient Rooftop Units (ERTUs) combine multiple, variable HVAC technologies, including a heating component and/or cooling component, and may also include a supply air fan within a single cabinet and are installed on the roofs of commercial buildings. Although the cooling and heating components may include a range of technologies, they most commonly consist of an integrated refrigeration system and a gas furnace. Units that include an integrated heat pump with backup gas furnace are referred to as a Dual Fuel Heat Pump RTU. Since ERTUs include high-performance features, they are more efficient than standard RTUs. The features that are most often included in ERTUs promoted by MT initiatives for cold climates are energy recovery ventilators, condensing heat exchangers, variable speed fans, low-leakage dampers, and upgraded enclosure insulation. ERTUs are a potentially impactful market transformation opportunity for Wisconsin due to the state's focus on decarbonization and the fact that 48% of commercial floor space utilizes RTUs for space heating and cooling. The ERTU initiative also allows for penetration into the commercial space for electrification with Dual Fuel Heat Pump ERTUs and provides options for increasing the efficiency of units that incorporate a gas furnace. This is also a stagnant market that is ready for rapid change: RTU heating efficiency has improved by only 1% in the past 30 years.[38]	
Product and Market Definition	• Applications: Commercial buildings, retrofit, and new construction. • Non-Energy Benefits: Noise reduction, better temperature and humidity control, and increased comfort.[39] • Baseline Assumption: Standard efficiency RTU with electric AC and natural gas heating. • ERTUs can efficiently provide heating and cooling for entire buildings by distributing air through ductwork to various zones. • Competing solutions: Standard RTUs.
Potential Value to Focus on Energy	• Technical Potential: The potential for this opportunity is spread across several measures in the 2021 Focus Potential Study, so it is difficult to quantify specifically for Wisconsin. [40] • The Minnesota Market Transformation plan identified a potential of 15,700,000 MMBTU (high technical potential). [41]

[38] ETA. July 2024. *High Performance RTU Market Transformation Plan.* https://www.etamn.org/sites/default/files/research-papers/RTU%20MT%20Plan_Final%202.pdf#:~:text=Even%20though%20it%20is%20the%20most%20common%20commercial,only%20improving%20by%201%20%25%20over%20that%20time

[39] Cadeo. July 2024. *High Performance RTU Market Characterization.* https://www.etamn.org/sites/default/files/research-papers/Final%20RTU%20Market%20Characterization.pdf

[40] Cadmus. July 2024. *Focus on Energy Potential*. https://cadmusgroup.shinyapps.io/focus-tool/. Values represent a cumulative 12-year lifecycle savings potential using the following assumptions: current policy, base scenario, combined gas and electric for all sectors and all segments.

[41] ETA. July 2024. *High Performance RTU Market Transformation Plan.* https://www.etamn.org/sites/default/files/research-papers/RTU%20MT%20Plan_Final%202.pdf#:~:text=Even%20though%20it%20is%20the%20most%20common%20commercial,only%20improving%20by%201%20%25%20over%20that%20time

Summary	
Compelling Value Proposition / Non-Energy Benefits	• ERTUs with gas furnaces may reduce commercial HVAC energy use by up to 40%.[42] • The most impactful measures for ERTUs with gas furnaces in heating-dominated climates include: Energy Recovery(25%), Condensing Gas Furnace(8%), Increased Enclosure Insulation(4%), Reduced Damper Leakage(3%), and Efficient Cooling(1%)[43]
Readiness of Technology to Scale	• ERTU's are currently being produced in low numbers and can have long lead times. • Manufacturers have the capability to produce efficient units and are evaluating opportunities to grow market share including higher efficiency units.[44] • MN manufacturer research found that manufacturers expect to see more product offerings and improvements in heat pump RTU performance over the next 2–10 years. [45]
Market Barriers and Considerations	• Historically, this has been a slow market due to established biases among contractors who believe it is more work to install ERTU systems and customer misconceptions that ERTUs only provide cooling savings and not heating savings that favor conventional, familiar systems. • ERTU systems are more technically complex than RTUs and require additional contractor training to install and operate. • ERTU systems have higher upfront costs.[46]
Market Leverage Points	• Many local government entities promote the adoption of technologies like ASHPs. The increasing awareness of using heat pump technologies to mitigate global climate change may assist an MT initiative that includes heat pump model ERTUs. • Expand awareness and increase confidence in technology • Engage with distributors and manufacturers • Multiple current MTIs focusing on ERTUs: NICOR Gas, NEEA, MN ETA, and CalMTA. Collaborate with national and regional partners.

[42] BetterBricks. July 2024. *Efficient Gas Rooftop Units*. https://betterbricks.com/uploads/resources/Efficient-RTU_Fact-Sheet.pdf

[43] Northeast Energy Efficiency Association. July 2024. *Energy Savings from Efficient Rooftop Units in Heating Dominated Climates*. https://neea.org/img/documents/Energy-Savings-from-Efficient-Rooftop-Units-in-Heating-Dominated-Climates.pdf

[44] Cadeo. *High Performance RTU Market Characterization.*

[45] ETA. July 2024. *High Performance RTU Market Transformation Plan*. *https://www.etamn.org/sites/default/files/research-papers/RTU%20MT%20Plan_Final%202.pdf#:~:text=Even%20though%20it%20is%20the%20most%20common%20commercial,only%20improving%20by%201%20%25%20over%20that%20time*

[46] Cadeo. *High-Performance RTU Market Characterization*.

Summary	
Mechanism for Lastingness	• Once demand has been established and manufacturers increase production of ERTUs, manufacturers are unlikely to revert established product lines back to inefficient units. • ERTUs considered best practice in commercial buildings • Voluntary and mandatory codes and standards or emissions requirements

Criteria	Score	Rationale
Potential Value to Focus on Energy	**2**	• Not captured in Wisconsin potential study. However, Minnesota showed significant potential. Need to expand research to estimate Wisconsin potential before making determination.
Compelling Value Proposition / Non-Energy Benefits	**3**	• Significant HVAC savings potential for customers but confidence in and awareness of technology is low.
Readiness of Technology to Scale	**3**	• Installations are accustomed to long lead times for units and complex installations. Could provide manufacturers sufficient time to meet increased demand.
Market Barriers	**3**	• Barriers clearly identified. Additional training needed for more complex installations. Price is a barrier.
Possible Market Leverage Points	**3**	• Market leverage points identified. Multiple existing MTIs across the U.S. Collaboration and scale provide crucial leverage and information to address barriers.
Mechanism for Lastingness	**2**	• Voluntary standards and establishing best practices are less stringent mechanisms to lock in savings or could have lower market caps than mandatory standards.

ENERGY STAR Retail Products Platform

<table>
<tr><th colspan="2">Summary</th></tr>
<tr><td colspan="2">The ENERGY STAR Retail Products Platform (ESRPP) is a collaborative midstream initiative of ENERGY STAR, energy efficiency program sponsors, retailer partners, and other key stakeholders, facilitated by the U.S. EPA. ESRPP is not an MTI on its own. Rather, ESRPP provides a platform for sponsors to target various residential appliance markets for transformation. ESRPP continues to refine the suite of qualified product categories and currently includes:
• Clothes washers and dryers, including ventless combo models
• Refrigerators and freezers
• Room air conditioners
• Smart thermostats
• Induction cooktops and ranges
• Air purifiers
A nationwide collaboration, the ESRPP allows participants to leverage each other's resources and shared objectives, to avoid duplication of effort and redundancy across neighboring service territories, and to streamline operations. The focus is asking retailers to take a more comprehensive view of energy-efficient products and providing them with incentives from utilities and other energy efficiency program sponsors to change their inventories to sell increasing numbers of ENERGY STAR-certified products. In the long term, the ESRPP is expected to offer a gateway for energy efficiency programs to capture energy savings in the growing "miscellaneous/plug load" product categories at a significantly lower cost than current programs incur by changing retailer product assortments, shifting manufacturing processes toward more efficient models, and increasing the stringency of appliance standards.
Focus on Energy previously implemented an ESRPP pilot from 2016-2018. The pilot provided incentives for soundbars, air purifiers, dehumidifiers, clothes washers and dryers, refrigerators, freezers, and room air conditioners. The pilot was discontinued after 2018 due to uncertainty regarding evaluation methods, as well as a lack of framework within Wisconsin for claiming MT savings and cost-effectiveness over timeframes that extend beyond the quadrennium program and evaluation cycles.
Since then, ESRPP evaluation methods have evolved and states such as California and Illinois have developed comprehensive frameworks for recognizing MT savings and cost-effectiveness over longer time horizons. Momentum continues to increase nationally with Program sponsors that cover 30% of the US market.</td></tr>
<tr><td>Product and Market Definition</td><td>• ENERGY STAR certified appliances and consumer electronics sold through national and regional retailers.
• Product suite includes clothes washers & dryers (including ventless combo appliances), residential refrigerators & freezers, room air conditioners, induction cooktops and ranges, smart thermostats, and air purifiers.
• Market and program strategies vary for each product category</td></tr>
<tr><td>Potential Value to Focus on Energy</td><td>• Consolidate or complement current Focus on Energy rebate or D2C offerings.
• Top-loading clothes washers, Wi-Fi thermostats, refrigerators and air purifiers offered a combined MWh potential of 541,743 and 45,867,000 therms 12-year cumulative savings according to the 2021 Wisconsin potential study.
• Coordination among sponsors increases leverage with national retailers and streamlines process compared with rebate programs.
• Allows sponsors to choose product lines or efficiency tiers that provide most value.
• Efficient products are accessible and transparent opportunity for retailers to reduce carbon emissions.</td></tr>
<tr><td>Compelling Value Proposition / Non-Energy Benefits</td><td>• Lower administrative burden for participating retailers than traditional rebate programs.
• Allows retailers flexibility in how incentive dollars are used – increase profitability of qualified models, special marketing or promotional efforts
• National scale and coordinated effort eliminate qualified products varying from region to</td></tr>
</table>

Summary	
	region. • Absent sufficient scale, incentives are small relative to the revenue for product categories.
Readiness of Technology to Scale	• Emerging technology awards recognize distinguishing features in the market, such advanced adaptive compressors in refrigerators. • National strategies are informed by ongoing research to identify most promising target markets. • Testing and labeling criteria exist for many products.
Market Barriers	• Price – efficient units typically cost more than standard models • Existing testing procedures don't always capture full performance benefits (e.g., advanced adaptive compressors for refrigerators prior to 2021) • Efficient models may be riskier or less profitable for retailers. • Consumers may not have information about performance benefits for some products. • Qualified models may be less widely available.
Market Leverage Points	• Appliance standards, mandatory and voluntary • Retailers, merchandisers, manufacturers, distribution/trade groups • Provides full category sales data for supported product categories to understand and quantify market shares, product viability, and when changes to appliance standards would be feasible without disrupting the market. • Multiple current sponsors of various product categories within ESRPP, representing more than 30% of U.S. households.
Expected Potential Outcomes	• Increased scale at national level as ESRPP builds confidence with retailers and utility sponsors • Improved testing protocols to provide accurate measurement of product performance • Increased market shares of sponsored products at participating retailers
Mechanism for Lastingness	• Changes to manufacturer production lines • Voluntary and mandatory appliance standards

Criteria	Score	Rationale
Potential Value to Focus on Energy	**3**	• Substantial technical savings potential for multiple measures offered via ESRPP.
Compelling Value Proposition / Non-Energy Benefits	**2**	• Streamlined operations for participating retailers. Incentives may not be sufficient to move national market absent sufficient coordinated support. Provides estimates of real-world energy use to consumers to help consumers make informed choices.
Readiness of Technology to Scale	**3**	• Multiple product categories have existing mature efficient products that could scale as market shares increase. Full category sales data show clear opportunities within a given product market.
Market Barriers	**3**	• Clear identification of barriers and well-developed logic models already developed.
Possible Market Leverage Points	**3**	• Multiple known leverage points at national level. Existing Focus on Energy has history of retailer-based programs to leverage relationships. Well-developed logic models already developed by other sponsors and could be tailored to Focus on Energy MTIs.
Mechanism for Lastingness	**3**	• Clear pathways to influence standards with history of successful interventions to increase standards.

Foodservice Decarbonization

Summary
Commercial foodservice decarbonization focuses on electrifying the most common commercial cooking equipment fueled by natural gas or propane, including combination ovens, fryers, griddles, char-broilers, six-burner ranges, and water heating equipment. Electric cooking equipment uses less energy to heat cooking elements than gas equipment, resulting in greater efficiency. It also improves indoor air quality by eliminating end use natural gas and propane combustion byproducts. While data are not available on total energy consumed by the Wisconsin foodservice industry, restaurants generated an estimated $14.9 billion in sales in 2023.[47] In 2021, there were an estimated 13,000 restaurants in the state generating approximately 278,000 jobs.[48] The majority of these establishments likely contain more than one piece of equipment that could be replaced with an electrified alternative, which could lead to emissions reductions and other non-energy benefits such as improved indoor air quality and safety. As of 2018, only about 20% of foodservice establishments nationwide used electric cooking equipment, leaving a large market share for fuel switching.[49] Furthermore, converting baseline equipment to efficient alternatives offers significant technical and economic savings potential. The Midwest Market Transformation Collaborative (MMTC) is running a midstream and upstream commercial foodservice market transformation program, which aims to increase engagement with and education about efficient commercial

[47] Wisconsin Restaurant Association. July 2024. *Industry Insights.* https://www.wirestaurant.org/industry-insights.html

[48] Ibid.

[49] Electric Power Research Institute. April 2018. *Efficient Electrification at EPRI*. http://mydocs.epri.com/docs/PublicMeetingMaterials/ee/Electrification-APR.pdf

Summary	
foodservice equipment. This program presents an opportunity for Focus on Energy to collaborate, benchmark, and leverage lessons learned and best practices to accelerate market adoption.[50]	
Product and Market Definition	• Applications: Commercial restaurant retrofit and new construction. • Baseline assumption: Standard efficiency gas combustion cooking equipment. • Competing solutions: Efficient gas appliances.
Potential Value to Focus on Energy	• The 2021 Focus on Energy Potential Study did not calculate potential savings for converting gas cooking equipment to electric. All potential savings estimates are for like-to-like replacements. • Technical Potential: 2,595,541 MMBTU for baseline to ENERGY STAR® electric conversions; 8,891,100 MMBTU for baseline to efficient gas conversions.51 • Economic Potential: 1,221,648 MMBTU for baseline to ENERGY STAR electric conversions; 8,508,900 MMBTU for baseline to efficient gas conversions.52
Compelling Value Proposition / Non-Energy Benefits	• Increased safety through elimination of harmful exhaust gases, open flames, potential for gas leaks, lower greenhouse gas emissions, more precise temperature control, easier cleaning, increased space availability and improved air quality compared to fossil fuel baseline technologies.53
Readiness of Technology to Scale	• Multiple manufacturers produce equipment for various electric and gas CFS equipment types, though demand drives the stocking practices at the distributor and dealer networks. 54 • Manufacturers often sell direct to large purchasers, such as national chains. To scale technology of electric commercial food service equipment, we need to transform the stocking practices and awareness of electric kitchen equipment through engagement with the distributors and equipment dealer networks. 55
Market Barriers	• Efficient cooking equipment has high upfront cost relative to the baseline.56 • Customers have low levels of trust and understanding of new technology, including the perception that electric cooking equipment impacts flavor or reduces food quality.57 • Because of the high risk of closure for foodservice establishments—80% do not last five

50 Midwest Market Transformation Collaborative. July 2024. *Opportunity Brief: Commercial Food Service*. https://www.ilsag.info/wp-content/uploads/CFS_Opportunity_Brief_posted_Feb-2020.pdf

51 Cadmus. July 2024. *Focus on Energy Potential.* https://cadmusgroup.shinyapps.io/focus-tool/. Values represent a cumulative 12-year lifecycle savings potential using the following assumptions: current policy, base scenario, run separately for gas and electric, commercial sector, and all segments. Potential represents all measures in "Cooking Equipment" measure category.

52 Ibid.

53 Electric Power Research Institute. April 2018. *Efficient Electrification at EPRI*.

54 MMTC. July 2024. *Opportunity Brief: Commercial Food Service*.

55 Ibid.

56 Ibid.

57 Ibid.

Summary	
	years—many restaurants purchase cooking equipment secondhand.58 This market is saturated with gas combustion equipment, which leads many restaurant owners to purchase this existing equipment from the secondary market.59 • Thin profit margins and high turnover rates in the foodservice sector make large capital expenditures on cooking equipment a risky proposition for business owners. • Fuel switching could increase energy costs.
Market Leverage Points	• The Midwest Market Transformation Collaborative is pursuing a midstream and upstream cooking equipment electrification program.60 • Build on Focus on Energy's midstream offering, focusing on distributors and manufacturers. • Business owners may be attracted to the non-energy benefits of improved indoor air quality (due to avoided gas and particulate emissions), safety (due to absence of combustible fuels), and physical space availability (as some electric cooking equipment does not require hoods or vents).61 • Educate and train food service design consultants, service agents, and independent manufacturer's sales representatives on the benefits of high efficiency, electric commercial food service equipment, proper installation, and barriers to overcome information gap from purchaser.
Expected Outcomes/Mechanism for Lastingness	• Reducing the first cost of new high-efficiency, electric commercial equipment at the time of sale • Increased the availability of efficient equipment on the shelves. Manufacturers increase electric commercial product availability through distributor and sales channels. • Health and safety requirements focused on indoor air quality could lock in savings. • Mandatory standards, however, these might be unlikely as the market does not seem ready for electrification.62

58 Insurance Journal. March 2024. *Squeezed from All Sides: Restaurants Pressured by Labor, Food, Insurance Costs.* https://www.insurancejournal.com/magazines/mag-features/2024/03/18/764913.htm

59 Midwest Market Transformation Collaborative. *Commercial Food Service.*

60 Ibid.

61 Direct Supply. April 2023. *What Products Should Be Under the Hood in a Commercial Kitchen?* https://www.directsupply.com/blog/what-products-should-be-under-the-hood-in-a-commercial-kitchen/

62 https://www.mwalliance.org/resources/commercial-kitchens-not-ready-forsake-gas-can-profitably-cut-carbon

Criteria	Score	Rationale
Potential Value to Focus on Energy	**1**	• Unclear potential savings from fuel switching as potential estimates are like-for-like replacement/efficiency upgrades. • Clarity of emissions goals/benefits in the next quadrennium could provide some additional value, though efficiency could also achieve significant emissions reductions as well.
Compelling Value Proposition / Non-Energy Benefits	**1**	• Benefits mostly focused on air quality and efficiency savings may not be sufficient to overcome risk aversion among businesses that are already high risk and low margin.
Readiness of Technology to Scale	**3**	• Technologies exist in market already. No indications supply could not meet increased demand.
Market Barriers	**2**	• Clearly identified and articulated barriers, though barriers are significant and may not be addressable via MTI.
Possible Market Leverage Points	**1**	• Historical activity via Focus on Energy offerings bring established relationships in market. Midwest Market Transformation Collaborative offers opportunities to collaborate and increase scale/leverage. However, there is no research from MMTC to demonstrate success and barriers are substantial given turnover of foodservice businesses.
Mechanism for Lastingness	**1**	• Clear markers of market progress and short/medium team increased adoption. Unclear how likely mechanisms would be to lock in long term savings.

High-Performance Windows

Summary	
High-performance windows (HPWs) increase the comfort and thermal performance of residential buildings in retrofit and new construction applications. HPWs meet the ENERGY STAR® Version 7.0 specifications requiring a U-Factor of ≤ 0.22 and solar heat gain coefficient (SHGC) rating of ≥ 0.17 for the northern climate zone. HPWs present an impactful opportunity for market transformation in Wisconsin given the state's temperature extremes and the high unmet potential identified for related measures in the 2021 Potential Study. According to the 2020 Residential Energy Consumption Survey, 44% of U.S. households had single-pane windows, while 78% had double-pane windows (these categories overlap). The market share for triple-pane windows (the primary equipment type in ENERGY STAR Version 7.0) is only 2%, suggesting a significant retrofit opportunity.[63] In 2023, there were approximately 2.7 million housing units in Wisconsin, meaning that the potential market for HPWs is over 2.5 million units. The 2021 Potential Study estimated the technical potential of HPWs at nearly 73 million MMBTU. Minnesota is actively pursuing HPW market transformation programs, which may provide applicable resources and best practices for Wisconsin.	
Product and Market Definition	• Applications: Residential single- and multifamily new construction and retrofit. • Competing Solutions: ENERGY STAR Version 6.0 (U-Factor of ≤ 0.27) dominates manufacturers' current product offerings at an estimated 80% market share. The new construction market is less likely to adopt ENERGY STAR Version 7.0 than the retrofit market.
Potential Value to Focus on Energy	• Technical Potential: 72,997,709 MMBTU (high technical potential).[64] Technical potential is likely overstating potential impacts as it assumes all currently installed windows could be replaced with an efficient option. Annual window sales are likely smaller. Assuming 5% of homes in replace their windows each year, a more conservative estimate of savings would be 3,649,885 lifecycle MMBTU annually.[65] • Could expand current reach of Focus on Energy Measure: Efficient windows (single-family and multifamily)
Compelling Value Proposition / Non-Energy Benefits	• HPWs are approximately 40% more energy efficient compared to double-pane baseline windows. Windows account for 30% to 40% of heat loss in winter and increased cooling energy consumption in summer months. • Non-Energy Benefits: Increased occupant comfort and property value, decreased outside noise, reduced condensation and moisture, and ease of handling and installation due to lighter construction.[66]

[63] United States Energy Information Administration. March 2023. *Structural and geographic characteristics: Housing characteristics table by housing unit type.* https://www.eia.gov/consumption/residential/data/2020/#structural

[64] Cadmus Group. July 2024. *Focus on Energy Potential*. https://cadmusgroup.shinyapps.io/focus-tool/. Values represent a cumulative 12-year lifecycle savings potential using the following assumptions: current policy, base scenario, combined gas and electric for all sectors and all segments.

[65] Windows have a useful life of approximately 20 years. Five percent of homes replacing their windows assumes an equal share of homes, 1/20th, replace their windows each year.

[66] Center for Energy & the Environment. October 2023. *High Performance Windows: Market Characterization.* https://www.etamn.org/sites/default/files/research-papers/HPW%20Market%20Characterization_Final_100923.pdf

Summary	
Readiness of Technology to Scale	• The technology to upgrade to HPW's exists, but manufacturers need to redesign and adapt existing manufacturing processes. • Compliance with ENERGY STAR Version 7.0 will require changes to most window designs sold today, either to squeeze higher levels of performance out of modified double glazing or by a shift to triple-glazed products. In either case, additional components and more manufacturing steps will raise both the production cost and market price of these new products.[8] • Supply chains and their downstream costs exhibit wide variability and flexibility.
Market Barriers and Consideration	• Currently, the low market penetration of HPWs prevents manufacturers from committing to higher production levels.[67] • Lack of awareness of the new ENERGY STAR Version 7.0 standards in the new construction market.[68] • Higher product costs compared to standard-efficiency windows due to a more complex manufacturing process and more expensive production equipment, with an estimated incremental cost between $1.80 and $2.10 per square foot, once production has scaled.[69] In the near term, before economies of scale are achieved, incremental production costs may be even higher. • Triple pane windows may add costs to installations as well as having higher production costs. Additional weight from the windows can add labor costs as well as framing costs.[70] However, newer "thin-triple-pane" windows offer similar performance with reduced weight.[71]
Market Leverage Points	• Illinois,[72] Minnesota,[73] and the Northwest Energy Efficiency Alliance[74] all have chosen to pursue HPWs through market evaluations, technology accelerators, and market transformation initiatives. Given the similar climate and building stock, HPWs appear to be a good fit for Wisconsin and regional collaborators increase leverage. • While HPWs are more costly than standard-efficiency windows, their non-energy benefits can be leveraged for consumer and contractor education and marketing. • The updated ENERGY STAR Version 7.0 requirements provide an opportunity to market HPWs through brands familiar to homeowners and contractors.

67 Pacific Northwest National Laboratory. *High-Performance Window System.*

68 Ibid.

69 Northwest Energy Efficiency Alliance. January 2023. *Study of High-Performance Windows Incremental Manufacturing Cost.* https://neea.org/resources/study-of-high-performance-windows-incremental-manufacturing-cost

70 US Department of Energy. "Double or Triple? Factors Influencing the Window Purchasing Decisions of HighPerformance Home Builders". June 2019. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28809.pdf

71 US Department of Energy. November 2022. https://www.energy.gov/eere/buildings/articles/epas-new-energy-starr-specifications-windows-doors-and-skylights-made. Accessed December 31, 2024.

72 Nicor Gas. June 2021. *Thin Triple Windows (TTW) – Market Transformation Program Update*. https://www.ilsag.info/wp-content/uploads/Nicor-Gas-MT-Thin-Triple-Window-Update-SAG-062921-Final.pdf

73 Efficient Technology Accelerator. July 2024. *High Performance Windows.* https://www.etamn.org/high-performance-windows

74 Northwest Energy Efficiency Alliance. August 2022. *High-Performance Windows Market Characterization Study.* https://neea.org/resources/high-performance-windows-market-characterization-study

Summary	
Expected Outcomes	• HPWs are the dominant product for new and retrofit markets, incremental manufacturing costs will also drop. • Specialized marketing to target: • Net zero demonstration homes • Emphasizing energy savings • Emphasizing comfort • Leveraging tax credits, utility incentives or other policies.
Mechanism for Lastingness	• Considered best practice for new homes and retrofits • Updated building codes • High adoption of voluntary standards

Criteria	Score	Rationale
Potential Value to Focus on Energy	**2**	• High potential savings relative to other opportunities and well suited to Wisconsin climate.
Compelling Value Proposition / Non-Energy Benefits	**2**	• Clear value to customers with both energy and non-energy benefits. Other existing MTIs have articulated value proposition for distributors/manufacturers.
Readiness of Technology to Scale	**3**	• Technology exists in production but needs to be expanded in manufacturing. Likely could scale quickly if clear expectation of increased demand.
Market Barriers	**2**	• Market barriers are clearly identified and well known
Possible Market Leverage Points	**3**	• Multiple known leverage points and multiple existing MTIs to collaborate with and increase scale.
Mechanism for Lastingness	**3**	• Multiple identifiable criteria with measurable outcomes.

Heat Pump Water Heaters

Summary	
Heat Pump Water Heaters (HPWHs) use electricity to move heat between locations rather than using fuel to directly generate heat. HPWHs can be two to three times more energy efficient than conventional electric resistance water heaters.[75] Products include 120-volt and 240-volt options in sizes ranging from 40 to 80 gallons. ENERGY STAR®-qualified products require uniform energy factor of 3.3 and a sound rating below 50 db. Products may also include connectivity and controls to optimize electricity demand during peak demand periods. HPWHs are 75% more efficient than conventional electric water heaters.[76] According to energystar.gov, HPWHs can save a household $550 a year on its energy bill, with an expected average lifetime savings of more than $5,600 for a family of four compared to standard electric-resistant water heaters.[77] HPWHs are an impactful market transformation opportunity for Wisconsin because of the high unmet potential identified for related measures in the 2021 Potential Study. Additionally, Focus on Energy can leverage existing programs to ensure successful implementation of this measure: market transformation programs administered by the Northwest Energy Efficiency Alliance (NEEA) between 2005 and 2023 have increased the market share of HPWHs from 5% to 18% in Oregon, Washington Idaho, and Montana.	
Potential Value to Focus on Energy	• Technical Potential: 72,440,707 MMBTU. • 65,708,832 MMBTU (90%) is for CO2 and geothermal HPWH. • Economic Potential: 19,761,548 MMBTU.[78] • Does not include CO_2 and geothermal HPWH. • Bulk of savings potential is near term as DOE recently issues a final rule for water heater standards effective 2029 that will significantly reduce savings potential.[79]
Compelling Value Proposition/Non-energy Benefits	• Significant energy savings compared to other storage heaters. • Environmental benefits. • Dehumidifying basement space that may typically require a dehumidifier • Tax credits via IRA[80]
Readiness of Technology to Scale	• Supply chain sometimes faces issues, including availability of components, logistical delays, and distributor stocking practices. • Heat pump technology is widely utilized and multiple manufacturers offer HPWHs.

75 United States Department of Energy. July 2024. *Heat Pump Water Heaters.* https://www.energy.gov/energysaver/heat-pump-water-heaters

76 Center for Energy and Environment. March 2021. *NEEA's Efficient Technology Initiatives*. NEEA's Efficient Technology Initiatives

77 ENERGY STAR. July 2024. *Save More with ENERGY STAR Certified Heat Pump Water* Heaters. https://www.energystar.gov/products/heat_pump_water_heaters/benefits-savings

78 All potential is for electric to electric

79 Department of Energy. "Energy Conservation Standards for Consumer Water Heaters; Final rule". May 6, 2024. https://www.regulations.gov/document/EERE-2017-BT-STD-0019-1426

80 https://www.energy.gov/energysaver/articles/inflation-reduction-act-2022-what-it-means-you

Summary	
Potential Market Barriers	• High upfront cost relative to the baseline: traditional tank electric water heaters cost between $450 and $1,200 and gas water heaters cost between $500 and $2,000 compared to the $1,500 to $3,000 price tag for HPWHs.[81] • Low customer understanding and trust of new technology. Installers are concerned about complaints about reliability and hot water availability and limit recommendations. Retailers report higher than expected return rates for HPWHs.[82] • Standard HPWH units require dedicated 240-volt electrical outlets, which would mean costly electrical upgrades for many buildings. However, some new models are compatible with 120-volt outlets. Installations are also potentially limited by space and ventilation considerations as HPWHs are often larger than the units they are replacing and may require drains for condensation. • Limited emergency replacement options due to stocking practices. • Limited number of contractors who are familiar enough with the technology to recommend it.
Potential Market Leverage Points	• Contractors are interested in learning more, as efficient equipment is a means of distinguishing themselves in a competitive market. Continue encouraging manufacturers and distributors to promote the technology and offer installation and maintenance best practices training sessions. • HPWH can be adapted into almost any program design and market sector, thus giving substantial opportunity for collaboration with existing efforts. • HPWH technology is rapidly improving in efficiency and cost-effectiveness and will likely continue to become more affordable and efficient. • There are many opportunities to collaborate with other market transformation initiatives on HPWH deployment, including the Northwest Energy Efficiency Alliance and the California Market Transformation Administrator. • Retailers account for a substantial share of water heaters. Leveraging existing relationships with retailers through other offerings could help to build trust and increase recommendations. • Federal tax credits under IRA
Expected Outcomes/Mechanism for Lastingness	• Increased recommendations and installations from installers. • Increased availability in retailer stores for emergency and DIY replacements. • Federal standards for water heaters. NEEA's HPWH initiative has a goal of federal standards requiring heat pump technology for 45+ gallon electric models.

[81] ENERGY STAR. July 2024. *Is a heat Pump Water Heater Right for Your Home?* https://www.energystar.gov/products/ask-the-experts/heat-pump-water-heater-right-your-home

[82] https://neea.org/img/documents/Heat-Pump-Water-Heater-Market-Progress-Evaluation-Report-7.pdf

Criteria	Score	Rationale
Potential Value to Focus on Energy	**2**	• Substantial technical potential savings. However, pending federal code changes reduces savings potential largely to fuel switching applications effective 2029. Decarbonization priorities, if any, may add value.
Compelling Value Proposition / Non-Energy Benefits	**1**	• Multiple considerations about whether a HPWH is a good option for a given home (available space, drains, electrical outlets), performance concerns, and higher costs are not clearly outweighed by energy savings and decarbonization potential.
Readiness of Technology to Scale	**3**	• Technology is widely available with multiple manufacturers and distribution networks.
Market Barriers	**2**	• Clearly identifiable barriers, though barriers are significant. Barriers around emergency replacements after failure of existing systems and reliability may be more challenging for MTIs to address.
Possible Market Leverage Points	**2**	• Multiple known leverage points with distributors and retailers. History of RA offering activity and relationship with retailers and contractors. • Existing MTIs across the U.S. • IRA credits for homeowners could be leveraged to increase adoption. • Not clear leverage points are sufficient to overcome barriers.
Mechanism for Lastingness	**2**	• Multiple identifiable criteria with measurable outcomes for short and medium-term changes to market. • Process advocating for federal standards changes well understood. NEEA's goal of updating standards by 2025 seems unlikely as market shares of HPWHs are still low and market seems somewhat reluctant.

Gas Absorption Heat Pump

Summary	
HVAC gas absorption heat pumps (GAHPs) are a highly energy-efficient gas heat pump technology used for space heating and/or water heating, as well as space cooling. In Wisconsin, contractors install 88-91% AFUE furnaces in SF homes and 81-82% furnaces in MF homes, each depending on income level (standard/limited income).[83] GAHPs are the first gas technology to offer fuel efficiencies greater than 100%; in many use cases they can produce between 1.0 and 1.6 units of energy for every unit of energy they consume[84], making them much more efficient natural gas alternatives to standard furnaces or boilers. GAHPs generate heat from natural gas and do not rely on extracting heat from the ambient air. Since they can maintain relatively high efficiencies and operate closer to their rated capacity even in very cold temperatures, they are an excellent option for the Wisconsin climate and do not require a backup heat source like many electric heat pumps that are not cold climate models.[85] The space heating and cooling equipment market presents significant opportunities to improve heating and cooling efficiency, reduce natural gas use, and reduce greenhouse gas emissions through GAHP adoption. Wisconsin has 2.7 million housing units,[86] 63.4% of which use natural gas for heating.[87] The Wisconsin air conditioning replacement market addresses around 80,500 homes per year,[88] and over the past 30 years, Wisconsin's summer climate has increased an average of 2°F to 3°F, which has led to an increase in the number of residents who need new space cooling equipment.[89] GAHPs can be a less costly alternative to electric heat pumps for customers with existing natural gas systems who want to upgrade their HVAC or water heating systems while providing space cooling. Switching from gas to electric for heating can have additional costs associated with capping gas lines and upgrading electrical capacity.	
Product and Market Definition	• Applications: Suitable for multifamily apartment buildings and hotels, small businesses, residential retrofit, and new construction buildings. Can be installed as a centrally ducted system or a building with a hydronic system. Provides heating, cooling and/or water heating, which allows for replacing multiple systems simultaneously in a retrofit application or reducing the equipment installed in new construction. Can be added onto existing heating systems like a boiler, providing space heating and domestic water for

[83] Cadmus. May 17, 2024. *Focus on Energy Calendar Year 2023 Evaluation Report*. https://assets.focusonenergy.com/production/inline-files/Evaluation_CY_2023_Vol-II_final.pdf

[84] North American Gas Heat Pump Collaborative. January 1, 2022. *Accelerating North America's Decarbonization Strategy with Gas Heat Pumps.* https://gasheatpumpcollab.org/wp-content/uploads/2024_NAGHP_GHP-Resource-Report_V2.pdf

[85] Ibid.

[86] United States Census Bureau via Index Mundi. July 2018. *Wisconsin Number of Housing Units by County.* https://www.indexmundi.com/facts/united-states/quick-facts/wisconsin/housing-units#map

[87] United States Energy Information Administration. *Household Energy Use in Wisconsin.* Last updated December 19, 2024. https://www.eia.gov/state/print.php?sid=WI

[88] Focus on Energy. October 2021. *Air Source Heat Pumps in Wisconsin Multifamily and Single-Family Applications*. https://s3.us-east-1.amazonaws.com/focusonenergy/staging/inline-files/2021/EERD_ASHP_Project-Final_Report.pdf

[89] Wisconsin Initiative on Climate Change Impacts. July 2024. *Trends and Projections*. https://wicci.wisc.edu/wisconsin-climate-trends-and-projections/

Summary	
	multi-family, which significantly improves the incumbent systems' efficiency.[90] • Competing Solutions: Existing equipment, such as efficient furnaces and boilers, central air conditioning, and electrical heat pumps, along with stand-alone electric heat pump water heaters.
Potential Value to Focus on Energy	• GAHPs bring high-efficiency heat pumps to markets or regions where natural gas is still the preferred fuel source. Retrofitting or replacing an old unit is very cost-effective and can save consumers money and energy in the long run. • GAHPs further driver sustainability by using refrigerants like ammonia, water, lithium bromide, and CO_2 which have very low or zero Global Warming Potential. Gas and dual-fuel utilities are eager to reduce carbon emissions in the natural gas sector. • Technical/Economic Potential: Not in the scope of the 2021 Focus on Energy Potential Study. GAHPs are positioned to capture a portion of the market share of the electrical heat pump market. • At least one Wisconsin utility has already been exploring a gas heat pump pilot but has not found any available units for pilot installation. • Reduces added winter load to grid from electrification efforts.
Compelling Value Proposition / Non-Energy Benefits	• GAHPs can reduce natural gas use significantly compared to furnaces and boilers because they have higher efficiency ratings and can create heating and cooling zones that reduce overall energy usage. • Non-Energy Benefits: Cheaper option for existing natural gas customers than transitioning to electric heat pumps or heat pump water heaters, lower noise, and safer than baseline technologies (e.g., no toxic indoor emissions), and use existing 120V, 15A circuits, unlike other heat pump technologies that often require 240V service upgrades. • Gas heat pumps are designed to be compatible with lower carbon fuels of the future, like renewable natural gas (RNG) and hydrogen blends, paving the way for the gas industry to transition to cleaner fuel sources in the coming years.[91] • Gas heat pumps offer plug-and-play installation at relatively low cost.
Readiness for Technology to Scale	• Commercial gas heat pumps are market-ready and already achieving promising results across North America. • Residential gas heat pumps are not yet commercially available for purchase and installation. • Manufacturers are developing three types of gas heat pump technologies: engine-driven vapor compression, sorption (absorption/adsorption), and thermal compression. Each type uses different refrigerants and pressurization methods.[92] • Manufacturers design gas heat pumps to use the infrastructure that is already available in a building, like existing ductwork and piping. This eliminates the barrier of having to

[90] North American Gas Heat Pump Collaborative. *Accelerating North America's Decarbonization Strategy with Gas Heat Pumps.*

[91] North American Gas Heat Pump Collaborative. *Accelerating North America's Decarbonization Strategy with Gas Heat Pumps.*

[92] North American Gas Heat Pump Collaborative. *Accelerating North America's Decarbonization Strategy with Gas Heat Pumps.*

Summary	
	change a building's existing infrastructure to scale the technology.[93] • NICOR gas estimates adoption rates will be near zero until 2030 for residential gas HPs.
Market Barriers	• As the market continues to be directed toward cleaner forms of energy, gas-source heat pumps may be a second-choice technology. • Lack of performance specifications to meet the varying international and regional trends and requirements surrounding emissions limits (GHG, Oxides of Nitrogen (NOx), and building codes (ZNE)).[94] • There is a noted lack of awareness about this technology in the supply chain. Contractors are unfamiliar with the technology, resulting in low stocking and an inexperienced installer network. Consumers share this lack of awareness since they rely on the supply chain to inform them.[95] • Residential gas HPs have very few manufacturers, the technology is largely unknown among suppliers and customers, and has a higher upfront cost than other gas heating systems.[96]
Market Leverage Points	• Wisconsin has 2.7 million housing units,[97] 64.4% of which use natural gas for heating and 57% for water heating.[98] GAHPs provide an excellent opportunity to replace older inefficient equipment or for efficiency gains that can combine heating, cooling and water heating. • As Wisconsin customers purchase more standard electric heat pump HVAC systems, they will need a backup source for heat in the winter, where a gas absorption heat pump can act as an efficient backup source of heat.[99] • Gas heat pumps are a promising solution that align with policy goals of equitable, reliable decarbonization, and they can be deployed quickly once products are commercially available.[100] • Gas heat pumps offer a solution to help flatten the demand for electricity in areas where

93 North American Gas Heat Pump Collaborative. *Accelerating North America's Decarbonization Strategy with Gas Heat Pumps.*

94 GTI Energy. November 2019. *The Gas Heat Pump Technology and Market Roadmap*. https://www.gti.energy/wp-content/uploads/2020/09/Gas-Heat-Pump-Roadmap-Industry-White-Paper_Nov2019.pdf

95 Ibid.

96 NICOR Gas. "Residential HVAC Gas Heat Pumps: Natural Market Baseline". PowerPoint Presentation (ilsag.info)

97 United States Census Bureau via Index Mundi. July 2018. *Wisconsin Number of Housing Units by County.* https://www.indexmundi.com/facts/united-states/quick-facts/wisconsin/housing-units#map

98 United States Energy Information Administration. *Household Energy Use in Wisconsin.* Last updated December 19, 2024. https://www.eia.gov/state/print.php?sid=WI

99 GTI Energy. November 2019. *The Gas Heat Pump Technology and Market Roadmap*. https://www.gti.energy/wp-content/uploads/2020/09/Gas-Heat-Pump-Roadmap-Industry-White-Paper_Nov2019.pdf

100 North American Gas Heat Pump Collaborative. *Accelerating North America's Decarbonization Strategy with Gas Heat Pumps.*

Summary	
	the pace of electrification is causing new, high-cost peak loads.[101] • NICOR gas currently pursuing residential gas heat pump MTI.
Mechanism for Lastingness	• Nothing clearly identified and no clearly stated desired outcomes in secondary research. • Decarbonization could risk market progress.

Criteria	Score	Rationale
Potential Value to Focus on Energy	**1**	• Unclear savings potential but gas usage in Wisconsin is prevalent and could be an opportunity. • Interest from at least one utility in Wisconsin indicates some value.
Compelling Value Proposition / Non-Energy Benefits	**2**	• Ease of installation and no need for electrical upgrades with some electric heat pumps. Could also work as backup heat with hybrid heat pump systems or with alternate heating fuels.
Readiness of Technology to Scale	**1**	• Unclear if ready to scare for residential applications. NICOR gas expects no adoption until 2030. Currently available for commercial applications and could potentially scale.
Market Barriers	**3**	• Clear articulation of multiple barriers.
Possible Market Leverage Points	**2**	• Multiple known leverage points via trade networks and installers. Only one other active MTI, so less scale than other opportunities. • Applications could also include improvements to water heating systems and provide comprehensive efficiency solutions.
Mechanism for Lastingness	**1**	• Long-term expected outcomes not articulated in secondary research and no clear mechanisms for locking in long-term savings.

[101] North American Gas Heat Pump Collaborative. *Accelerating North America's Decarbonization Strategy with Gas Heat Pumps.*

Luminaire-Level Lighting Controls

Summary	
Luminaire-Level Lighting Control (LLLC) systems are a subset of Networked Lighting Controls (NLCs); they have embedded sensors and controllers that enable autonomous, individual luminaire control.[102] Individual luminaire control is highly flexible and responsive and, as a result, generally more energy efficient than luminaires without individual controls. The 2021 Wisconsin Potential Study identified significant unmet potential for measures related to LLLCs. Furthermore, this measure may be able to leverage existing Resource Acquisition programs in Wisconsin to stimulate adoption. Focus on Energy previously implemented an NLCs pilot in 2017 with the goal of accelerating the market adoption of NLCs through LLLCs. The pilot reached five customers: two from the commercial sector, one from industrial, and two from schools and government.[103] Additionally, contractor surveys asking about LLLCs were fielded in Minnesota in 2023. This research shows that LLLCs make up 1% of the total percentage of all lighting projects in Minnesota. Currently, lighting with no controls and a manual switch makes up most of the lighting market (77%).[104] The rest of the lighting market is comprised of standalone controls (17%), light fixtures with embedded sensors (4%), and networked lighting controls (0.5%). Other work done to promote LLLCs through NLCs includes training on installation and incentive programs by DesignLights Consortium (DLC) in California, Illinois, and Washington.[105] The Ameren Illinois energy efficiency program also offers in-person training and webinars to installers and distributors to become more familiar with LLLCs, helping to raise awareness in the market.[106]	
Product and Market Definition	• Applications: Suitable in various building types with ideal applications including offices, schools, hospitals, healthcare facilities, and higher education per Ameren Illinois' 2023 LLLC update.[107] • Competing solutions: Standalone controls, NLCs, and non-networked light fixtures with embedded sensors. • Minnesota contractor interviews conducted in 2023 identified that the term "embedded controls" is used to define LLLCs by manufacturers.[108]

[102] Cadeo Group. July 2024. *Luminaire Level Lighting Control (LLLC) Market Characterization*. https://www.etamn.org/sites/default/files/research-papers/CEE%20LLLC%20Market%20Char%20Report%2013OCT23.pdf

[103] The Cadmus Group LLC. July 2024. *Focus on Energy Calendar Year 2017 Evaluation Report. Volume II.* https://assets.focusonenergy.com/production/WI%20FOE%20CY%202017%20Volume%20II%20FINAL.pdf

[104] Cadeo Group. July 2024. *Luminaire Level Lighting Control (LLLC) Market Characterization*. https://www.etamn.org/sites/default/files/research-papers/CEE%20LLLC%20Market%20Char%20Report%2013OCT23.pdf

[105] DesignLights Consortium (DLC). July 2024. "Lighting Controls Training Program." https://www.designlights.org/our-work/networked-lighting-controls/lighting-controls-training-programs/

[106] Ameren Illinois. June 2024. *Luminaire Level Lighting Controls (LLLC) Update*. https://www.ilsag.info/wp-content/uploads/AIC_LLLC-MT_SAG_05.22.23-FINAL.pdf

[107] Ibid.

[108] Cadeo Group. July 2024. *Luminaire Level Lighting Control (LLLC) Market Characterization*. https://www.etamn.org/sites/default/files/research-papers/CEE%20LLLC%20Market%20Char%20Report%2013OCT23.pdf

Summary	
Potential Value to Focus on Energy	• Focus on Energy: Technical potential: 575,412 MMBTU (medium technical potential).[109] Current Focus on Energy offering for advanced lighting and controls design.
Compelling Value Proposition / Non-Energy Benefits110	• Building Owners/Managers: • Allows precise control for efficient energy management: motion control, daylight harvesting, scheduling, and personal controls, integration with building management and HVAC systems. • Simplifying energy code compliance, reducing the number of components required in new construction and major renovations.[111] • Flexibility/customization. Individual luminaires can be controlled separately to improve comfort and specific needs. • Extended lifespan reducing operating hours, maintenance costs, and waste. • Leverage data in smart buildings: track usage and occupancy, enhance security.
Readiness of Technology to Scale	• Likely immediate growth opportunity in upper Midwest. Minnesota contractor interviews conducted in 2023 found low prevalence of LLLCs (1%) in existing buildings. • Multiple existing manufacturers, though limited number. • Minnesota's Center for Energy and Environment (CEE), Northwest Energy Efficiency Alliance (NEEA), Ameren Illinois are all pursuing MT initiatives for LLLCs. Increased scale via multiple MTI sponsors can increase leverage.
Market Barriers	• Installation of LLLCs is more costly compared with lighting systems with no controls.[112] However, LLLC installation is simpler and less expensive than non-networked controls, which may mitigate a portion of the overall incremental cost. • Contractors' lack of sales knowledge and ability to convey the full value of LLLCs, including a complete understanding of energy and non-energy benefits. • End users' lack of familiarity with the value of LLLCs and which applications provide the greatest opportunities to realize benefits. • Need for greater awareness of current incentives for advanced lighting controls among installers, including LLLCs[113] • Minnesota contractor interviews also indicated that contractors preferred working with embedded and wireless controls but lacked the ability to sell LLLCs and the technical skills to implement them.[11]
Possible Market Leverage Points	• Manufacturers, Lighting standards organizations, Commercial Real Estate owners/managers • Trade network – Lighting manufacturer rep agencies, contractors and installers • Existing Focus on Energy program incentives for LLLCs could transition to MT initiative to reduce higher upfront costs of LLLCs to start building momentum and connecting with installer network. • Minnesota research found designers and specifiers are aware of LLLCs, understand their value, and

[109] The Cadmus Group LLC. July 2024. "Focus on Energy Potential." https://cadmusgroup.shinyapps.io/focus-tool/

[110] Center for Energy and Environment. *Luminaire Level Lighting Controls Market Transformation Plan*. Fall 2023 LLLC Market Transformation Plan_FINAL.pdf (etamn.org)

[111] Luminaire-Level Lighting Controls: Energy savings through enhanced lighting controls. Luminaire Level Lighting Controls | ETA (etamn.org)

[112] Northwest Energy Efficiency Alliance. January 7, 2021. *2020 Luminaire Level Lighting Controls Incremental Cost Study*. https://neea.org/img/documents/2020-LLLC-Incremental-Cost-Study.pdf

[113] NEEA's Market Progress Evaluation Report found that, from the manufacturer perspective, greater awareness of utility incentives was necessary among installers. Luminaire Level Lighting Controls - Market Progress Evaluation Report #1

Summary	
	have a positive opinion of the technology. Leveraging these early adopters and case studies to build confidence in the rest of the supply chain.[114] • Existing MTIs in Minnesota, Illinois, NEEA provides scale and amplifies leverage beyond the influence of Wisconsin alone.[115]
Expected Potential Outcomes	• Broad product array that complies with national specification and support common qualified product lists (QPLs). • Products cheaper and easier to install. Price is no longer a barrier relative to competing products. • LLLC training curriculum offered by manufacturers. • Key market actors, such as lighting designers/firms, lighting sales agencies become champions of LLLCs: e.g., specifying systems for installation in projects alongside the demos and trainings currently offered for networked lighting control systems.
Mechanism for Lastingness	• Building codes and standard practice guides include LLLCs • Sufficient progress of expected outcomes to indicate LLLCs have become dominant, mainstream option for lighting installations.

Criteria	Score	Rationale
Potential Value to Focus on Energy	**2**	• Low potential savings relative to other measures. Well established MTIs in neighboring states would ease entry and roadmap to MTIs.
Compelling Value Proposition / Non-Energy Benefits	**3**	• Clear value to customer with ease of control and fewer components.
Readiness of Technology to Scale	**2**	• Technology exists in production, though the number of manufacturers is limited. Some uncertainty whether barriers exist to other manufacturers adding technology.
Market Barriers	**3**	• Clear identification of barriers.
Possible Market Leverage Points	**3**	• Multiple known leverage points via trade networks and installers. Existing Focus on Energy program provides connection that can be expanded.
Mechanism for Lastingness	**3**	• Multiple identifiable criteria with measurable outcomes.

[114] Center for Energy and Environment. June 2024. *Luminaire Level Lighting Control (LLLC) Market Characterization.* https://www.etamn.org/sites/default/files/research-papers/CEE%20LLLC%20Market%20Char%20Report%2013OCT23.pdf

[115] Ameren Illinois Luminaire Level Lighting Controls (LLLC) Market Transformation Initiative Business Plan AIC-LLLC-MTI-Business-Plan-11.01.23-Final-Draft.pdf (ilsag.info)

Packaged Terminal & Window Heat Pumps

Summary

Packaged terminal heat pumps (PTHPs) are variable-speed, high-efficiency, through-the-wall heat pumps. Homes and businesses that currently do not have ductwork in them may be good candidates for PTHPs as well as multi-family homes and hotels since they can provide individual control for each unit. Saddle or window heat pumps are also ductless and are an alternative to PTHPs with a less invasive installation method. Their unique space-saving, U-shaped design allows them to fit over a windowsill without modifying the structure of a building unlike PTHPs. Saddle heat pumps are ideal for efficiently heating and cooling small to medium sized spaces making them a great option for renters and owners of small offices, studios, apartments and condos. Saddle heat pumps are a great option to use as an additional heating and cooling source, whereas PTHPs are designed to be used as the sole source of heating and cooling. PTHPs and Saddle Heat Pumps are among the most energy-efficient technologies for delivering space conditioning, requiring significantly less energy than natural gas-powered furnaces, electric resistance heaters, and standard air conditioners paired with a gas furnace or electric heat.

The space heating and cooling equipment markets present significant opportunities to improve heating and cooling efficiency, reduce fossil fuel use, and reduce greenhouse gas emissions through ASHP adoption. Wisconsin has 2.7 million housing units,[116] 70% of which use natural gas for heating.[117] In Wisconsin, there are 221,138 electrically heated multifamily units which is approximately 22% of the multifamily market, and about 46% of the electric heating occurs in multifamily homes. [118] Given the cost effectiveness and savings potential of PTHPs and saddle heat pumps in units that are electrically heated, it makes sense to target outreach to areas with high numbers of electrically heated units and large multifamily properties. Over the past 30 years, Wisconsin's summer climate has increased an average of 2°F to 3°F, which has led to an increase in the number of residents who need new space cooling equipment.[119] PTHPs or saddle-style window HPs could efficiently serve both heating and cooling needs in multifamily properties as well as motels and lodging.

Wisconsin's cold winter climate can cause standard heat pumps to operate inefficiently at very low temperatures, requiring customers to have backup gas-powered or electric resistance heaters. Cold-climate PTHPs and advanced saddle heat pumps may also present a best-fit opportunity in Wisconsin since they function efficiently down to -15°F. [120] In New York, the success of NYSERDA and NYPA's Clean Heat for All Challenge trial in 2023 led to the New York City Housing Authority moving forward with the widespread installation of 30,000 cold climate saddle window heat pumps. [121]

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116 United States Census Bureau via Index Mundi. July 2018. *Wisconsin Number of Housing Units by County.* https://www.indexmundi.com/facts/united-states/quick-facts/wisconsin/housing-units#map

117 United States Energy Information Administration. 2009. *Household Energy Use in Wisconsin.* https://www.eia.gov/state/print.php?sid=WI

118 Focus on Energy EERD Report. October 2021. *Air Source Heat Pumps in Wisconsin Multifamily and Single-Family Applications*. p. 27. https://s3.us-east-1.amazonaws.com/focusonenergy/staging/inline-files/2021/EERD_ASHP_Project-Final_Report.pdf

119 Wisconsin Initiative on Climate Change Impacts. July 2024. *Trends and Projections*. https://wicci.wisc.edu/wisconsin-climate-trends-and-projections/

120 United States Department of Energy. February 2022. *Residential Cold Climate Heat Pump Technology Challenge.* https://www.energy.gov/sites/default/files/2021-11/bto-cchp-fact-sheet-102821.pdf

121 New York State Energy Research and Development Authority. September 20, 2023. "Clean Heat for All Challenge." https://www.nyserda.ny.gov/About/Newsroom/2023-Announcements/2023-09-20-Governor-Hochul-Announces-Installation-Of-Window-Heat-Pumps-For-New-York-City

Summary	
Product and Market Definition	• Applications: Suitable for multifamily apartment buildings and hotels, small businesses, residential retrofit, and new construction buildings. Provides heating and cooling, which allows for replacing multiple systems simultaneously in a retrofit application or reducing the equipment installed in new construction. • Baseline Assumption: Residential single-family homes use standard efficiency air conditioning systems with a natural gas furnace and standard efficiency gas and electric water heaters and boilers. Multifamily buildings and hotels often use packaged terminal air conditioners (PTACs) with electric resistance heaters and a cooling EER meeting minimum efficiency guidelines. • Competing solutions: Existing ductless equipment, such as efficient furnaces, and electrical heat pumps, along with mini-split ductless heat pump.
Potential Value to Focus on Energy	• In Wisconsin, about 22% (221,138 units) of multifamily homes are electrically heated and about 46% of electric heating occurs in multifamily units.[122] Areas with high numbers of electrically heated units and large multifamily properties present significant opportunity for PTHPS and saddle heat pumps due to their cost effectiveness and savings potential in units that are electrically heated. • Technical potential: 2,993 MMBTU (low technical potential). This technical potential is based on commercial lodging PTHPs, though PTHPs would be applicable to other market segments, which could increase savings potential.
Compelling Value Proposition/ Non-Energy Benefits	• PTHPs and saddle heat pumps are ideal HVAC upgrade solutions for residential customers because installation does not require a vented system and can provide heating or cooling to a specific section of the home. Well suited to multifamily and lodging markets. • Ease of installation, user-friendly operation, minimizes re-circulation of airborne contaminants, allows for right-sizing to meet building needs, improves safety compared to fossil fuel baseline technologies (e.g., no toxic indoor emissions), and provides both heating and cooling. Saddle style HPs are even easier than PTHPs without the need for permanently altering building walls. • Cold climate technology options for PTHPs and saddle heat pumps can operate efficiently down to -15°F are suited to Wisconsin's climate.
Readiness of Technology to Scale	• Manufacturers have recently developed a variety of cold climate heat pump solutions that address gaps in existing heat pump designs related to cold-weather performance, installation requirements, and affordability.[123] • According to the DOE, there are over 33 manufacturers selling standard size PTHP equipment in the U.S. that comply with federal conservation standard. [124] • Scalability is more uncertain for saddle heat pumps since it is a newer technology with

[122] Focus on Energy. October 2021. *Energy EERD Report: Air Source Heat Pumps in Wisconsin Multifamily and Single-Family Applications*. p. 27. https://s3.us-east-1.amazonaws.com/focusonenergy/staging/inline-files/2021/EERD_ASHP_Project-Final_Report.pdf

[123] DOE. February 2022. *Residential CC Heat Pump Challenge.* https://www.energy.gov/sites/default/files/2021-11/bto-cchp-fact-sheet-102821.pdf

[124] United States Department of Energy. Air Conditioners and Heat Pumps - Package Terminal, Compliance Database. https://www.regulations.doe.gov/certification-data/CCMS-4-Air_Conditioners_and_Heat_Pumps_-_Package_Terminal.html#q=Product_Group_s%3A%22Air%20Conditioners%20and%20Heat%20Pumps%20-%20Package%20Terminal%22

Summary	
	fewer manufacturers than PTHPs. However, if they find a way to bolster through long-term MT efforts, market shares could increase significantly. • PTHP technologies are already being manufactured at a high rate and expect continued growth as demand for these technologies grows. Window saddle HPs are newer to the market but are gaining ground via support from efforts such as NYSERDA's Clean Heat for All effort.
Market Barriers and Considerations	• Manufacturers, distributors, contractors, and customers are becoming more familiar with PTHPs and saddle heat pumps but remain skeptical about whether they will meet space conditioning needs in colder climates. • PTHPs are federally categorized as room air conditioners and have different test procedures and performance metrics than standard heat pumps. This complicates comparison to other heat pumps and less efficient, conventional gas and electric space-conditioning solutions. • The replace-on-failure market has certain needs that do not promote the adoption of heat pumps. The technology requires a robust and knowledgeable contractor market willing and able to recommend and install heat pumps in an emergency replacement situation. If a gas heating appliance fails, it is not simple or fast to replace it with a PTHP, so the technology is not well suited to emergency replacement in a fuel-switching scenario. However, saddle heat pumps offer a solution to this issue due to their fast and easy installation method.
Market Leverage Points	• The Department of Energy initiated the Residential Cold Climate Heat Pump Challenge in 2021 to promote manufacturing of next generation cold climate heat pumps. In addition to Focus on Energy and Wisconsin Office of Energy Innovation, there are currently 4 industry partners that have generated CCHPs that meet the DOE's requirements and are entering the next stage of this program.[125] This will continue to increase development and production of efficient CCHPs. • PTHPs and saddle heat pumps provide cooling, which can benefit the growing need for summer space cooling in Wisconsin. • Currently active in the market via Focus on Energy incentive offerings could be leveraged to expand reach via MTI. • In August 2023, the Northwest Energy Efficiency Alliance (NEEA) was granted approval to begin a market transformation program for advanced residential heat pumps (advanced features, such as two-stage and variable speed models).
Mechanisms for Lastingness	• Carbon emissions goals for buildings • Building codes and HVAC standards

[125] Department of Energy Residential Cold Climate Heat Pump Challenge. https://www.energy.gov/eere/buildings/residential-cold-climate-heat-pump-challenge

Criteria	Score	Rationale
Potential Value to Focus on Energy	**2**	• Clarity on electrification in the next quadrennium would increase confidence in potential value to Focus of Energy. • Current programs deliver measure, but MT could scale beyond the reach of traditional RA programs. • PTHPs work well for multifamily applications and underserved customer segments where the lack of ductwork could be barriers to traditional heat pumps.
Compelling Value Proposition / Non-Energy Benefits	**2**	• Clear value to customers with respect to summer cooling. Cold climate technologies have improved over earlier models. However, cold weather performance is still a source of hesitation for some potential customers.
Readiness of Technology to Scale	**3**	• Technology is widely available with multiple manufacturers and distribution networks.
Market Barriers	**3**	• Clearly identifiable barriers.
Possible Market Leverage Points	**2**	• Multiple known leverage points. Existing MTIs across the U.S. Increased federal support for domestic manufacturing and electrification retrofits.
Mechanism for Lastingness	**2**	• Multiple identifiable criteria with measurable outcomes.

Real-time Steam Trap Monitoring

Summary	
Steam heating systems are essential in various industries across the United States, with over 45% of all the fuel burned by U.S. manufacturers used to raise steam, according to the U.S. Department of Energy. [126] Despite their critical role, these systems often suffer from efficiency issues due to leaking steam traps.[127] In a typical space heating system, about 20% of the steam leaving a central boiler plant is lost through leaking traps. Steam traps are automatic valves designed to remove condensate, air, and other non-condensable gases while preventing or minimizing the passing of steam. By removing condensate, steam traps reduce heat loss, minimize steam leaks, optimize heat transfer, and enhance overall system reliability. However, when steam traps fail, they can significantly impact the efficiency and safety of the steam system. Real-Time Steam Trap Monitoring (RSTM) systems offer a tailored solution to improve the efficiency and reliability of steam systems, particularly in Wisconsin's industrial sector. These systems enable continuous monitoring of steam traps, allowing for the immediate detection and diagnosis of failures. RSTM systems help prevent potential system leaks in real-time and reduce the time required to remedy trap failures. This proactive approach not only saves energy and reduces operational costs but also mitigates risks associated with excess condensate, such as reduced steam line flow capacity and water-hammer incidents. Implementing RSTM in Wisconsin's steam systems can lead to significant energy savings, improved operational efficiency, and enhanced safety for industrial customers.	
Product and Market Definition	• Applications: Any boiler that produces steam to provide space heating or processing in an industrial setting. • Baseline assumption: Steam traps are addressed irregularly based on business priorities and availability. • Competing solutions: Steam trap audits performed by facility staff or external technicians.
Potential Value to Focus on Energy	• Technical Potential: According to Codes and Standards Enhancement (CASE) Initiative 2022 California Energy Code first year after changing the code to install steam trap monitoring for new construction and additions can save 0.064 GWh/yr, 3.156 million therms/yr natural gas savings and time dependent valuation (TDV) energy savings of 803,050,000 TDV kBtu/yr (kilo British thermal units). There is also savings in GHG emissions statewide in first year which is estimated to be 17,227 Metric Tons CO2e/yr.[128] WI might not be this big but there is going to be high potential for savings based on this study.
Compelling Value Proposition/ Non-Energy Benefits	• Operational Cost Savings (example): The airport in Minneapolis, Minnesota, installed 700 steam trap monitoring systems integrated together. This monitoring system is saving about $420,000 per year through energy efficiency, reduced audits and preventative repairs.[129] • Adoption of RSTMs could circumvent a number of these hurdles because real-time monitoring allows for immediate leak detection, reduction in maintenance, increased safety,

[126] U.S. Department of Energy. July 1999. *Steam Trap Performance Assessment* https://www1.eere.energy.gov/femp/pdfs/FTA_SteamTrap.pdf

[127] SteamPedia, July 23, 2024, *The Complete Steam Guide* https://www.forbesmarshall.com/Knowledge/SteamPedia/Steam- Trapping/The-Complete-Steam-Trap-Guide

[128] Codes and Standards Enhancement (CASE) Initiative 2022 California Energy Code, July 30, 2024, *Steam Trap Monitoring*, https://title24stakeholders.com/wp-content/uploads/2020/06/NR_Steam-Trap-Monitoring_Draft-CASE-Report-1.pdf

[129] Campbell Sevey. July 24, 2024. *MSP Airport Puts Monitoring of 700 Steam Traps on Autopilot – Saving up to $420,000/Year*.https://www.campbell-sevey.com/wp-content/uploads/2019/02/CS_CASE_STUDIES_MSP_Airport.pdf

Summary	
	increased plant efficiency and risk mitigation. • Non-energy benefits: Reduces energy and maintenance costs. Increases equipment longevity by minimizing corrosion and erosion in equipment. Optimizes system performance which minimizes the risk of steam leaks, reduces water consumption, and lowers greenhouse gas emissions.
Readiness of Technology to Scale	• RSTM technology has made significant advancements in recent years. With the development of wireless and battery-less sensor technologies, continuous real-time monitoring has become more feasible and widespread. • Companies like Everactive, Armstrong International, and Emerson develop the technology for RSTM that is readily available and used in various industries.
Market Barriers	• Initial cost – The upfront investment for installing real-time monitoring systems can be significant, although these systems often lead to long-term savings. • Integration challenges – Integrating new monitoring technologies with existing systems can be complex and time-consuming, especially for older facilities where infrastructure may not be compatible. • There is limited data on market adoption and trends, and awareness of the technology is low.
Possible Market Leverage Points	• Wisconsin has many properties that would be ideal candidates. The dairy industry and large manufacturing plants use steam for processing food, chemicals, and other products. • RSTMs can be installed in big cities, such as Milwaukee, that use steam to heat and power several buildings. The We Energies steam system provides heat to college campuses, apartments, and other customers in downtown, the Menomonee Valley, and parts of the South Side, east of Interstate 94.[130] • Use cases and educational materials about how this technology works and how it can save energy and money. • Engaging with designers and manufacturers to develop promotional materials and identify channels to distribute information. • Market trends and dynamics not well documented in available literature. •
Mechanism for Lastingness	• Update building codes and standards to ensure new and existing buildings incorporate energy-efficient technologies, including RSTMs.

[130] Steam has provided heat and power for downtown Milwaukee for 125 years. Why? And what's its outlook in a green-energy future? July 24, 2024, https://www.jsonline.com/story/money/business/energy/2023/07/05/downtown-milwaukees-steam-system-a-hidden-125-year-old-source-of-heat-power/70303242007/

Criteria	Score	Rationale
Potential Value to Focus on Energy	**1**	• Savings potential difficult to estimate. Potential could be high in Wisconsin with large numbers of facilities with substantial steam use. Further research could provide more robust savings potential estimates.
Compelling Value Proposition / Non-Energy Benefits	**2**	• Monitoring could provide significant benefits to end use customers with substantial steam use. However, savings and the potential value to a customer is dependent on how frequent issues might be identified in monitoring and the magnitude of the savings, so there is uncertainty and value may likely be determined on a customer-to-customer basis.
Readiness of Technology to Scale	**3**	• Technology is well developed and could scale via multiple manufacturers.
Market Barriers	**1**	• Some clear barriers, such as cost and lack of information, could be addressed relatively easily. However, there is little information available regarding market trends to understand how awareness is spread.
Possible Market Leverage Points	**1**	• As with barriers, some leverage points could be addressed. However, given the lack of understanding of market trends, it is uncertain how much these might increase adoption and what factors are successful in raising awareness and adoption.
Mechanism for Lastingness	**2**	• Clear pathways to influence standards with history of successful interventions to increase standards.

Variable Speed Heat Pump

Summary	
Variable-speed heat pumps (VSHPs) contain a variable capacity compressor that adjusts the heat pump's motor speed based on a building's heating and cooling load. The motor is automatically adjusted to run at whatever speed is required for the desired temperature output, rather than at a preset single or double rate. VSHPs use less energy than single- or dual-speed heat pumps when operated alone or when paired with natural gas-powered furnaces or electric resistance heaters. Homes and businesses with existing ductwork may be good candidates for a ducted VSHP. The space heating and cooling equipment markets present significant opportunities to improve heating and cooling efficiency, reduce fossil fuel use, and reduce greenhouse gas emissions through VSHP adoption. Wisconsin has 2.7 million housing units,[131] 70% of which use natural gas for heating.[132] The Wisconsin air conditioning replacement market addresses around 80,500 homes per year,[133] and over the past 30 years, Wisconsin's summer climate has increased an average of 2°F to 3°F, which has led to an increase in the number of residents who need new space cooling equipment.[134]	
Product and Market Definition	• Applications: Suitable for retrofit or new construction of multifamily apartment buildings and hotels, small businesses, and residential homes. Provides both heating and cooling, creating an opportunity to replace two systems simultaneously in a retrofit application or reduce the equipment installed in new construction. Must be installed as a ducted central system. • Competing Solutions: Window unit Acs and furnaces currently dominate the retrofit and new construction market. Currently only Federal Standards, that began in 2023, for ASHPs, 2015 Standards for electric and gas furnaces, and future 2028 Standards for gas furnaces.
Potential Value to Focus on Energy	• In the Wisconsin residential market, heating energy consumption is over 76% fossil fuel, which provides a significant opportunity for electrification and greenhouse emissions reductions via the adoption of VSHPs.[135] • Technical Potential: 3,811,696 MMBTU (medium technical potential).[136]

[131] United States Census Bureau via Index Mundi. July 2018. *Wisconsin Number of Housing Units by County.* https://www.indexmundi.com/facts/united-states/quick-facts/wisconsin/housing-units#map

[132] United States Energy Information Administration. August 2023. *Household Energy Use in Wisconsin.* https://www.eia.gov/state/print.php?sid=WI

[133] Focus on Energy EERD Report. October 2021. *Air Source Heat Pumps in Wisconsin Multifamily and Single-Family Applications*. p. 27. https://s3.us-east-1.amazonaws.com/focusonenergy/staging/inline-files/2021/EERD_ASHP_Project-Final_Report.pdf

[134] Wisconsin Initiative on Climate Change Impacts. July 2024. *Trends and Projections*. https://wicci.wisc.edu/wisconsin-climate-trends-and-projections/

[135] United States Energy Information Administration. July 2024. *RECS Survey Data.* https://www.eia.gov/consumption/residential/data/2020/

[136] Focus on Energy did not model VSHPs. The technical and economic potential savings represent advanced efficiency heat pumps with high HSPF or COP efficiencies. This should provide a reasonable assessment for savings potential for VSHPs.

Summary	
Compelling Value Proposition/ Non-Energy Benefits	• VSHPs provide heating and cooling, while providing significant greenhouse gas emission reductions compared to traditional furnace systems. • The continuous variable nature of VSHPs provides more savings than single- or dual-speed air-source or ground-source heat pumps. VSHPs adjust the motor within the heat pump to run at whatever speed is required for the desired temperature output, rather than at a preset single or double rate. • Minimizes re-circulation of airborne contaminants, allows for right-sizing to meet building needs, improves safety compared to gas combustion baseline technologies (e.g., no risk of toxic indoor emissions), and reduces noise compared to baseline technologies.
Readiness of Technology to Scale	• Multiple existing manufacturers for ASHPs that can adapt easily to manufacture VSHPs. • Minnesota's Center for Energy and Environment (CEE), Northwest Energy Efficiency Alliance (NEEA) are pursuing MT initiatives for ASHPs. Market scale via multiple sponsors can increase leverage towards advanced ASHPs, such as VSHPs.
Market Barriers and Considerations	• Upfront costs for VSHPs are around 20% more than single- or two-stage ASHPs, but costs vary significantly. VSHPs with improved cooling efficiencies generally cost more than VSHPs with improved heating efficiency. • Manufacturers, distributors, contractors, and customers are becoming more familiar with VSHPs but remain skeptical about whether VSHPs will meet space conditioning needs in colder climates. • In cold climates, VSHPs cost more to operate than a furnace and may require a backup heating system to maintain temperature setpoints during very low temperatures. However, cold climate heat pumps operate efficiently in cold weather, offering a single solution for efficient heating and cooling down to -15°F.[137] • The replace-on-failure market has certain needs that do not promote the adoption of heat pumps: ▪ The technology requires a robust and knowledgeable contractor base that is willing and able to recommend and install VSHPs as emergency replacements. • If a gas heating appliance fails, replacing it with a heat pump is not simple or fast, so the technology is not well suited to emergency replacement in a fuel-switching scenario.
Market Leverage Points	• In 2023, the Biden-Harris Administration's Defense Production Act (DPA) allocated $250 million to accelerate electric heat pump manufacturing in the U.S. Manufacturers can use the incentives from the DPA to lower production costs, which utilities and government programs can leverage to increase ASHP adoption.[138] By November 2023, the DOE successfully provided $169 million in funding to manufacturers. On February 14, 2024, the DOE announced the availability of $63 million to accelerate the growth of heat pump

[137] US DOE February 2022. *Residential Cold Climate Heat Pump Technology Challenge.* https://www.energy.gov/sites/default/files/2021-11/bto-cchp-fact-sheet-102821.pdf

[138] United States Department of Energy. April 2023. *Biden-Harris Administration Announces $250 Million to Accelerate Electric Heat Pump Manufacturing Across America.* https://www.energy.gov/articles/biden-harris-administration-announces-250-million-accelerate-electric-heat-pump

Summary	
	manufacturing domestically in a second wave of funding.[139] • The Wisconsin air conditioning replacement market addresses around 80,500 homes per year,[140] and over the past 30 years, Wisconsin's summer climate has increased an average of 2°F to 3°F, which has led to an increase in the number of residents who need new space cooling equipment.[141]The growing need for summer space cooling in Wisconsin can be supplied via VSHPs.
Expected Outcomes/Mechanisms for Lastingness	• Federal Standards should begin to categorize and provide regulations for VSHPs and variable speed motor technology. • Manufacturers and distributors develop marketing plans for VSHPs. • Increased number of contractors/installers familiar with and recommending VSHPs. • Voluntary standards. • Increased stringency in new building codes or HVAC standards.

Criteria	Score	Rationale
Potential Value to Focus on Energy	**1**	• Technical potential not additive with advanced ASHPs. An MTI could include both technologies but VSHPs alone do not offer much savings in addition to what ASHPs would achieve.
Compelling Value Proposition / Non-Energy Benefits	**2**	• Streamlined operations for participating retailers. Incentives may not be sufficient to move national market absent sufficient coordinated support. Provides estimates of real-world energy use to consumers to help consumers make informed choices.
Readiness of Technology to Scale	**3**	• Multiple product categories have existing mature efficient products that could scale as market shares increase. Full category sales data show clear opportunities within a given product market.
Market Barriers	**3**	• Clear identification of barriers and well-developed logic models are already developed.
Possible Market Leverage Points	**2**	• Multiple known leverage points at the national level. Existing Focus on Energy has a history of retailer-based programs to leverage relationships. Well-developed logic models are already developed by other sponsors and could be tailored to Focus on Energy MTIs.

[139] United States Department of Energy. February 2024. *Biden-Harris Administration Announces $63 Million to Accelerate Electric Heat Pump Manufacturing Across America as Part of Investing in America Agenda*. https://www.energy.gov/articles/biden-harris-administration-announces-63-million-accelerate-electric-heat-pump

[140] Focus on Energy EERD Report. October 2021. *Air Source Heat Pumps in Wisconsin*. p. 27. https://s3.us-east-1.amazonaws.com/focusonenergy/staging/inline-files/2021/EERD_ASHP_Project-Final_Report.pdf

[141] Wisconsin Initiative. July 2024. *Trends and Projections*. https://wicci.wisc.edu/wisconsin-climate-trends-and-projections/

Criteria	Score	Rationale
Mechanism for Lastingness	**2**	• HVAC performance standards could lock in savings, but with so many competing technologies, standards would likely be less stringent than VSHPs.