

**Analysis of the Policy Context and Potential for an
Air Source Heat Pump Pilot Program to be
Incorporated into Minnesota's Energy Conservation Program
Structure for Cooperative Electric Utilities**

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Technological Opportunity

Advancements in technology for Air Source Heat Pumps (ASHPs) create the potential for substantial energy efficiency gains in cold climate states such as Minnesota. Due to improvements in such areas as refrigerants and variable speed drives, the new cold-climate ASHPs can function at temperatures of 0 degrees Fahrenheit or below, and can save 60 to 80% of space heating fuel use or more.

The potential for ASHPs to contribute energy savings for Minnesota is very large. Over 12 % of Minnesota homes heat with electricity, and another 16% heat with either oil or propane. Together these represent over 547,000 Minnesota homes. For oil and propane alone, Minnesota homes spent over \$660 million in 2013. The new advanced cold-climate ASHPs provide an opportunity for significant energy and dollar savings for Minnesota households, and for the state economy.

CEE is presently conducting field trials of ASHP units in a sample of Minnesota homes. If the results of the field trials document the potential for cost-effective energy efficiency gains, the question then becomes: what policies could be utilized to facilitate the capture of those energy efficiency savings for Minnesota?

State Policy Framework in Minnesota

The Conservation Improvement Program (CIP)

Minnesota has a long history of a strong policy commitment to energy efficiency. In many respects, the Conservation Improvement Program (CIP) policy for electric and natural gas utilities has been the cornerstone of energy efficiency policy in Minnesota.

CIP has been in operation since the 1980s and was incorporated by Governor Pawlenty into the Next Generation Energy Initiative of 2007. CIP serves utility ratepayers by avoiding unnecessary and expensive infrastructure investments. By all accounts, the Minnesota CIP policy has been very effective at achieving electricity and natural gas savings in Minnesota.

Gaps in Minnesota's CIP Policy Framework With Regard to ASHPs

The Minnesota CIP policy is directed toward electric and natural gas utilities. While ASHPs do provide some electricity savings (from air conditioning load, and to the extent they replace other electric space heating technologies), much of their energy savings (and overall cost-effectiveness) comes from displacing other space heating fuels that are less efficient (oil and propane, in particular). At present, with a limited exception for certain low-income customers¹, there is no way to credit savings in deliverable fuels (e.g., oil and propane) toward a utility's CIP goals.

A possible additional impediment to the use of ASHPs under CIP is the issue of fuel switching. Historically in Minnesota, using a CIP program to encourage a customer to switch

¹ In an August 3, 2012 policy guidance memorandum, DER declared that electric utilities could provide energy efficiency measures to low-income customers that used delivered fuels for space and water heat, in conjunction with the Weatherization Assistance Program, and claim electric savings toward their CIP goals.

fuel sources between electric and natural gas utilities is at least discouraged, if not prohibited. This issue will be discussed further in a later section.

To summarize, while CIP provides an excellent policy structure for achieving electricity and natural gas savings, Minnesota has no comparable structure or funding for achieving heating oil and propane savings. Yet as we've seen in recent years, heating oil and propane costs can be quite a burden on Minnesota customers.

Other Minnesota Policies for Energy Efficiency

Fortunately, it is the case that Minnesota's policy commitment for energy efficiency goes beyond just the CIP policy for those two utility energy sources (electricity and natural gas). Several of these other policies could be seen as providing support for the concept of encouraging the use of ASHPs to save energy fuels such as heating oil and propane.

For example, the Next Generation Energy Act of 2007 declared that "the state has a vital interest in providing for increased efficiency in energy consumption...", and established a goal for reduction in "per capita use of fossil fuel..." (Sec. 216c.05, subdiv. 1 and subdiv. 2).

In addition, Minnesota has established a very strong policy commitment regarding the reduction of greenhouse gases. As an example, that Next Generation Energy Act also established very aggressive goals for reduction in "statewide greenhouse gas emissions across all sectors" (Sec. 216H.02, subdiv. 1)

Most recently, in 2015 legislation was enacted (HF 550, commonly known as the "Propane bill") which explicitly opened the door to displacing the use of other fuels, such as propane, with a utility fuel source. For example, in the definition of "Energy improvement", it included: "the installation of infrastructure, machinery, and appliances that will allow natural gas to be used as a heating fuel on the premises of a building that was previously not connected to a source of natural gas." (Sec. 6, Subd. 5, (4)) This establishment of a public policy to allow expansion of a utility fuel source (natural gas) to displace propane (and heating oil) use would be analogous to allowing expansion of utility electric energy (via ASHP equipment) to similarly reduce reliance on propane and heating oil use.

Clearly, there are several established state policies in Minnesota that support the concept of reducing the use of fossil fuels such as propane and heating oil. The problem is that there is no established infrastructure and funding source for achieving those savings - - such as exists for electricity and natural gas under CIP. In the case of ASHPs, there is a technology that could achieve substantial savings in those fossil fuels (and their associated greenhouse gas emissions), but there is no present way to recognize those savings in the current application of utility CIP savings goals.

This raises the question: would it be possible to modify the CIP operating protocols such that the fossil fuel savings from ASHPs could be recognized and credited toward utility CIP goals?

Areas Where CIP Policy Framework Could be Amenable to Fossil Fuel Savings from ASHPs

To begin, the CIP statute defines “Energy conservation” as “demand-side management of energy supplies resulting in a net reduction in energy use” [216B.241, subdivision 1(d)]. This does not restrict energy conservation to only electricity and natural gas.² It goes on to define “Energy conservation improvement” as “a project that results in energy efficiency *or energy conservation*” [subdivision 1 (e), emphasis added].

Notably, the subsequent language in the statute setting minimum CIP spending requirements and energy savings goals all uses the terminology “energy conservation improvement”. This would seem to open the door to some flexibility beyond direct electricity and natural gas savings.

Indeed, there are several examples of just such flexibility. The statute allows for “waste heat recovery” to be an energy conservation improvement. [216B.241 subdivision 1(e) and subdivision 10]; allows for natural gas utilities to claim purchases of biomethane as a CIP measure [subdivision 5b]; and allows electric co-ops to count community solar projects toward their CIP savings goal [subdivision 5c(2)(c)].

Additional components of the statute that would be supportive of fossil fuel savings include the requirement for inclusion of participant and “societal” benefits in determining cost-effectiveness [subdiv. 1c(f)], and the requirement for the Commissioner to report “estimated carbon dioxide reductions” achieved by the CIP programs [Subdiv. 1c(g)].

Interestingly, as previously noted, the DER has already provided³ for a limited inclusion of savings in deliverable fossil fuels for electric utilities under CIP, in the case of low-income customers. In that policy guidance, the DER included two particular rationales for allowing CIP to incorporate deliverable fuel savings:

1. An equity concern for ratepayers paying for CIP programs but with little opportunity to benefit:

“First, electric utility customers that use delivered fuels for their space and water heating equipment do not have access to ratepayer-funded programs that address their space and water heating equipment because CIP requirements do not apply to delivered fuels providers.” (p.1), and

2. Benefits to customers and society:

“However, there is opportunity for these customers to benefit from reduced energy consumption and resulting reductions in fuel expenses, and there is opportunity for society to benefit from reduced consumption of fossil fuels.” (p.2)

We would note that those two rationales provided by DER for allowing CIP credit for deliverable fuel savings would also apply to the ASHP program envisioned in this report.

² This is distinct from the subsequent definition of “energy efficiency”, which does specifically mention “electric energy or natural gas”.

³ CIP Policy Guidelines: Energy Savings from Delivered Fuels, Minnesota Division of Energy Resources, August 3, 2012.

Authority for Further Flexibility Under CIP

Finally, it is important to recall that the statute explicitly provides substantial authority for the Commissioner to modify a utility's CIP energy savings goals. The pertinent language reads as follows:

“(d) In its energy conservation improvement plan filing, a utility or association may request the commissioner to adjust its annual energy-savings percentage goal based on its historical conservation investment experience, customer class makeup, load growth, a conservation potential study, ***or other factors the commissioner determines warrants an adjustment.***”
[subdiv. 1c(d) emphasis added]

Importantly, the statute does specify that a CIP plan must include savings of at least 1% of a utility's gross annual sales, and that these flexible elements would only apply above that 1% savings level. The statute goes on to list electric utility infrastructure projects and waste heat recovery as examples of types of additional projects that could be included under this flexibility.

In summary, the existing CIP statute contains numerous elements that suggest it might be possible, and consistent with overall state policy objectives, to include fossil fuel savings from ASHPs in a CIP program. Indeed, the DER has already opened the door to that incorporation of fossil fuel savings in certain low-income programs.

The Fuel Switching Issue

As in many states, the potential for utilities promoting fuel-switching within an energy efficiency program has been a concern in Minnesota. The concern focuses on the possibility that a utility might use its energy efficiency programs as a means to lure customers away from a utility providing a different energy type, which could adversely affect the interests of the customers of the other utility (to whom regulators have some responsibility). That concern should not be an issue with the ASHP program being contemplated here, as there is no second utility involved. Moreover, a careful look at the history of this issue in Minnesota suggests that it should be possible to avoid having the ‘fuel switching’ concern be a roadblock to the use of ASHPs in the type of CIP program we are suggesting.

Our analysis of this issue begins with an October 29, 2003 Staff memorandum and accompanying report by the Minnesota Department of Commerce. The general issue at hand was “cross-fuel conservation”, and the specific precipitating incident was a Minnegasco program to rebate electricity-driven equipment. The concern expressed was that Minnegasco did not net out the increase in one fuel that occurred with the decrease in the other fuel.

“...Advocacy Staff...noted that Minnegasco did not take into account the source Btus that were used to generate the electricity for the equipment” and recommended that “the Commissioner require Minnegasco to account for the increase in electric use as well as the decrease in gas use when performing a benefit-cost analysis.” (p.1)

This concern would not be a problem for the ASHP program being contemplated here, as the program would be required to demonstrate cost-effectiveness considering the net impact on all fuels.

The precipitating incident led to a Commissioner request for a meeting of interested parties, which subsequently produced a report entitled “Report to the Commissioner of the Department of Commerce: BTU Comparison in a Benefit-Cost Analysis for the Conservation Improvement Program, Docket No. G008/CIP-00-864.07”

The report ultimately contained a recommendation against utility fuel switching programs, but opened the door to “fuel neutral conservation”, which it defined as follows:

“Fuel-neutral conservation occurs when a utility provides a rebate for an energy-efficient measure regardless of the fuel source and of whether that utility is the provider of that fuel source.” (p.2)

It also recognized that fuel switching could be cost-effective from a societal perspective:

“...fuel switching has been defined as “converting customers from one fuel to another when the costs of conversion are less than the costs to society of not converting.” (p.2)

Thirdly, it called for the use of a “net Btu analysis” when a measure decreased the use of one utility’s fuel and increased the use of another utility’s fuel, and concluded:

“If the measure is cost-effective from a societal perspective, then a utility could issue a grant, loan or other incentive to the customer.” (p.3)

The ASHP program being contemplated would be cost-effective from a societal perspective, and would incorporate a net Btu analysis.

Finally, it should be noted that the entire discussion focused on the issue of fuel switching regarding electric and natural gas utilities...entities for which the state has specific regulatory responsibilities. The ASHP program being contemplated does not involve any fuel switching between electric and gas utilities.

The next document considered in this review was the March 7, 2005 Commission Order in Docket No. G008/CIP-00-864.07. There the Commission stated that “Targeted fuel-switch projects are not allowed in the Conservation Improvement Program.”

Here again, the order is explicitly in the context of fuel switching between electric and natural gas utilities. It does not broach the issue of fuel use changes involving other unregulated fuel sources. Moreover, the ASHP program being contemplated is not merely a “switch” of fuel types. It involves substantial conservation of the electric co-ops electricity, through dramatic improvement in air conditioning efficiency, and through the incorporation of building shell measures, where appropriate.

Furthermore, it is noteworthy that the Order does open the door to recognizing the value of projects that require saving more than one fuel type in order to be cost-effective.

“Projects that may deem it necessary to have a combination of natural gas and electric energy savings for the integrity of the project will submit that project to the Minnesota Department of Commerce for review. Upon completion of the review, the Deputy Commissioner will issue a decision on the project, including a limit on expenditures for the project.” (p.2)

Finally, the order concludes with an explicit statement that the Department does not want to discourage programs that save multiple fuels.

“The intention of the Department is to encourage energy-saving projects that will continue to provide specific optimal energy savings while not discouraging programs that save both electricity and natural gas.” (p.3)

The final document we would note is an October 8, 2013 posting by the Minnesota Department of Commerce⁴, addressing the issue of combined heat and power systems and the implications for fuel neutrality and fuel switching. The document notes the historical prohibition on fuel switching in CIP, and that “unlike traditional natural gas efficiency programs, CHP will likely increase the natural gas consumption.”

Importantly, the entire focus of the discussion is once again on the effect of fuel switching between electric and natural gas utilities.

“How should fuel switching concerns be handled so that one utility customer of a specific fuel type (electric) is not subsidizing the cost of CHP project incentives or utility load building that may be provided to another utility customer for a different fuel type (natural gas)?” (p.4)

Clearly that electric vs. gas utility customer protection issue is not a concern for the ASHP program being contemplated here, as there is no natural gas utility involvement.

In addition, this document once again emphasizes the need to consider the net change in total energy consumption after considering any increases and decreases in the use of different types of fuels (p.4). That is what is being proposed for the ASHP program being contemplated here.

Lastly, the document also explicitly notes as a rationale for CHP that “these improvements can lead to a reduction in carbon emissions and greenhouse gases while helping Minnesota achieve its energy policy goals.” (p.2) That is a rationale that applies to the ASHP program as well.

The amount of reduction in greenhouse gas emissions from the suggested program will depend upon:

– fuel mix of the utility (the trend is towards increasingly decarbonized electricity sources)

⁴ MDOC DOER *Energy Savings Goal Study* call for comments.

- the efficiency/COP of the heat pump
- correct sizing of the heat pump and back-up source
- envelope improvements that are made at the same time

It should be noted that ASHPs can also potentially enable higher penetrations of wind generation, as the load profile of ASHPs loosely follows the load profile of wind generation (i.e., higher relative usage in the shoulder months). Because the minimum efficiency of ASHPs is greater than the average efficiency of stand-alone air conditioners, ASHPs can also have a significant summer peak load reduction impact as well.

In summary, while there is technically a history of prohibition against programs featuring targeted fuel switching between electric and natural gas utilities, we could find no specific rulings regarding programs that do not involve a fuel switch between electric and natural gas utilities. Moreover, we found considerable support for the concept of using a multi-fuel net Btu savings basis for judging whether a project is desirable and cost-effective. Finally, as previously noted, Minnesota statute gives considerable discretion for the Commissioner to approve alternative approaches in a utility's CIP plans (e.g., waste heat recovery, biomethane gas production, community solar, etc.)

For all of these reasons, we believe that the historical concern regarding fuel switching between utilities should not be a barrier to the ASHP program being contemplated here.

Other Benefits to Minnesota

In addition to serving the broad state policies of reducing fossil fuel use and reducing greenhouse gas emissions, increasing the use of ASHPs can provide other economic benefits to the state as well. Data from the U.S. Energy Information Administration confirms that Minnesota has to import 100% of the heating oil and propane consumed in the state. In recent years, Minnesota households have spent over \$660 million on heating oil and propane. To the extent that ASHPs can reduce that dollar drain, that would keep more money circulating in the Minnesota economy. This type of concern was no doubt part of the rationale for the "Propane Bill" HF 550 mentioned earlier.

There seems little doubt that reducing the importation of propane and heating oil from other states would be beneficial to the state of Minnesota. The pertinent question is: could the cornerstone energy conservation policy vehicle in Minnesota...the CIP program...be utilized to help achieve that objective?

Recommendations

Based on the results of our review, we would recommend the following.

Using the authority for flexibility provided in the CIP statute [216B.241, Subdivision 1c(d)], one or more electric co-ops should submit in their CIP plan filings, proposals for pilot programs to promote ASHPs. The proposed programs should contain the following elements.

1. The program should be targeted to existing homes that use electricity, propane or heating oil as their space heating fuel (not utility natural gas)⁵. All income levels would be eligible.
2. To help ensure that the program is genuinely focused on energy conservation, the program should include incentives and assistance to facilitate building shell conservation improvements (i.e., insulation and air sealing) in the homes that install ASHPs. (The Department may want to consider making the installation of any cost-effective shell improvements a pre-condition for receiving the ASHP incentive.)
3. Cost-effectiveness would be based on the total energy savings (electricity and heating fuel) of the package of measures installed in the home (ASHPs plus any building shell conservation measures), net of any increase in electricity use from the ASHP.
4. Any net electricity savings from the package would be directly credited toward the co-op's energy savings goal under CIP.
5. As long as the co-op meets the minimum 1% electricity savings from its normal CIP programs, any net savings in propane or heating oil from this ASHP program could be applied to the co-op's CIP energy savings goal above the 1% level (using an appropriate mmbtu to kWh conversion).

Attachment A provides a generic example description of the type of program envisioned in the above recommendation.

⁵ Because Minnesota already has an effective policy structure and funding source for achieving natural gas savings, and because including natural gas would raise concerns about fuel switching between utilities, we are recommending that these pilot projects not target homes heated with utility natural gas.

ATTACHMENT A:

EXAMPLE AIR SOURCE HEAT PUMP (ASHP) PILOT PROGRAM⁶

Utility XYZ has a special energy saving program for customers that heat primarily with electricity, propane or fuel oil. Save on your heating and cooling bills by participating in our new high efficiency air source heat pump (ASHP) program.

Improve the comfort, safety and durability of your home with energy saving measures such as air source heat pumps, air sealing, ceiling insulation and wall insulation to earn rebates up to \$_____.

Program	Amount	Product
Proper Installation Rebate	\$50 rebate	Proper installation of ENERGY STAR® ASHP) [e.g., ACCA MANUAL J AND MANUAL S REQUIREMENTS]
ENERGY STAR® ASHP Rebate	\$400 rebate	ENERGY STAR® ASHP [MAY WANT TO SPECIFY DIFFERENT REBATE LEVELS FOR DIF. TIERS OF SEER, EER AND HSPF]
Combo Rebate on ENERGY STAR® ASHP and ECM Fan Motor	\$400 rebate for ENERGY STAR® ASHP (plus \$200 rebate for new ECM Fan Motor)	Proper installation of ENERGY STAR ® ASHP with integrated all season, whole house applicable ECM Fan Motor on existing forced air furnace
Combo Rebate on New Forced Air Furnace with ECM Fan Motor and Properly Installed ENERGY STAR® ASHP	\$600 rebate	New forced air furnace with ECM fan motor and properly installed ENERGY STAR® ASHP
Mini-Split Ductless ASHP System Rebate	\$500 rebate	Mini-split ductless system for homes that do not have ducts Note: Electricity must be the existing primary heating source
Ceiling Insulation	\$400 rebate	

⁶ This is just a generic program example. Specific details could vary.

Wall Insulation \$400 rebate

Air Sealing with Blower Door Test \$200 rebate

IMPORTANT to advise customers: If an ASHP is the main heating source, customer will need a backup heat source when temperatures are below XX°F, typically mid-November through mid-March.

Additional Details on Program Rebates Available

(Note: homes heated with utility natural gas are not eligible for this special program.)

Proper Installation Rebate - \$50

Offers a \$50 rebate on the proper installation of an ENERGY STAR® Air Source Heat Pump (ASHP). The ASHP can be furnace integrated or mini-split ductless.

Customer must purchase and have installed a new ENERGY STAR® ASHP by **[DATE]**. Customer must use a program participating contractor to qualify for the rebate. Contractors will complete the paperwork necessary for the rebate.

ENERGY STAR® ASHP Rebate - \$400

Offers a \$400 rebate on ENERGY STAR® qualified, furnace integrated Air Source Heat Pumps (ASHP) with proper installation.

Customer must purchase and have installed a new ENERGY STAR® qualified, furnace integrated ASHP by date. Customer must use a program participating contractor to qualify for the rebate. Contractors will complete the paperwork necessary for the rebate.

Applies to both replacement of non-ENERGY STAR® ASHPs and new ASHPs.

Combo Rebate on ENERGY STAR® ASHP with New ECM Fan Motor - \$600

Offers a \$600 combo rebate on the proper installation of a new ENERGY STAR® qualified, furnace integrated Air Source Heat Pump (ASHP) plus an all season, whole house applicable Electronically Commutated Fan Motor (ECM) in an existing, non-electric forced air furnace.

Customer must purchase and have installed a new ENERGY STAR® qualified, furnace integrated ASHP plus an all season, whole house applicable ECM in an existing, non-electric forced air furnace by date. Customer must use a program participating contractor to qualify for the rebate. Contractors will complete the paperwork necessary for the rebate.

Applies to both replacement of non-ENERGY STAR® ASHPs and new ASHPs.

Combo Rebate on ENERGY STAR® ASHP and ECM Fan Motor in New Forced Air Furnaces - \$600

Offers a \$600 combo rebate on new forced air furnaces (gas, propane, or oil) with integrated Electronically Commutated Fan Motors (ECM) and properly installed of a new ENERGY STAR® qualified furnace integrated Air Source Heat Pump (ASHP).

Customer must purchase and have installed a new forced air furnace with an integrated ECM and properly installed new ENERGY STAR® qualified furnace integrated ASHP by date. Customer must use a program participating contractor to qualify for the rebate. Contractors will complete the paperwork necessary for the rebate.

New Mini-Split Ductless ASHPs for Homes with Electricity as the Primary Heating Source - \$500

Offers a \$500 rebate on Mini-Split Ductless Air Source Heat Pump (ASHP) systems for homes that do not have ducts and have electricity as the primary heating source and a minimum of two indoor units. Includes mini-split ductless heat pumps with electric baseboard/radiant heating, slab heating or electric boiler as the primary heating system. New installations only.

Customer must purchase and have installed a new qualifying Mini-Split Ductless ASHP (SEER \geq 16 and HSPF \geq 9). Customer must use a program participating contractor to qualify for the rebate. Contractors will complete the paperwork necessary for the rebate.