Residential Air-Source Heat Pump Local Government Toolkit

For Municipal Staff

Midwest Air Source Heat Pump Collaborative

This initiative is delivered by Center for Energy and Environment, Slipstream, MEEA, and Elevate.

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ELEVATE

MEEA MIDWEST ENERGY EFFICIENCY ALLIANCE

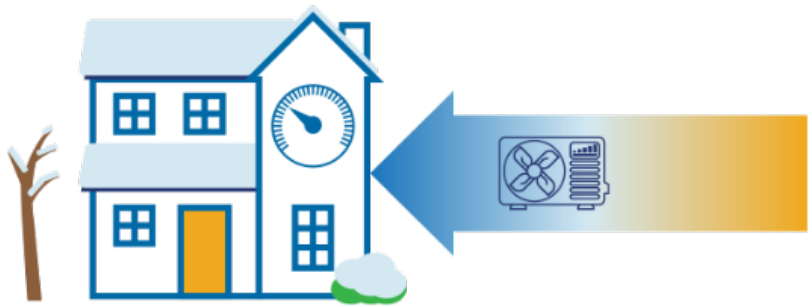
Overview

- Heat Pump Basics
- Heat Pump Benefits
- Technology Considerations
- Cost Considerations
- Program & Policy Design
- Next Steps & Resources

Heat Pump Basics

What is an Air-Source Heat Pump (ASHP)?

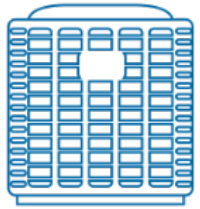
In the summer,
heat is pumped from the inside of a home to the outside



In the winter,
heat is pumped from the outside of a home to the inside

For more detail, see a short video on "what is a heat pump?"

ASHPs are the same technology used in:



Air Conditioners

Refrigerators

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Air-Source Heat Pump Overview

- Heat pump types
  - **Air-source heat pumps (ASHPs) are the most common and the focus of this toolkit**
  - Geothermal heat pumps
- ASHP is a broad term used to describe a variety of heat pump types and configurations
  - Cold-climate rated
  - All-electric vs. hybrid systems
  - Ducted, ductless, or hydronic distribution (e.g. boilers)
- **Takeaway:** heat pump designs are customizable and suitable for a wide variety of applications including single-family, multifamily, and manufactured homes

Image source: Green Energy Futures

Heat Pump Benefits

Reduce Carbon Emissions and Utility Bills

- **Increase energy efficiency**
  - ASHPs are 2-4x more efficient than electric resistance or fuel burning heat systems
  - ASHPs are typically 2x more efficient than window AC units
- **Reduce utility bills**
  - Switching from **electric resistance or propane fuel** for heat can save 30-55% on your heating costs
  - Hybrid heat pumps allow for optimizing economics and respond to fuel price volatility
- **Enable achieving zero emissions over time**
  - Electrifying heating systems enables solar or other renewable energy sources to power heating

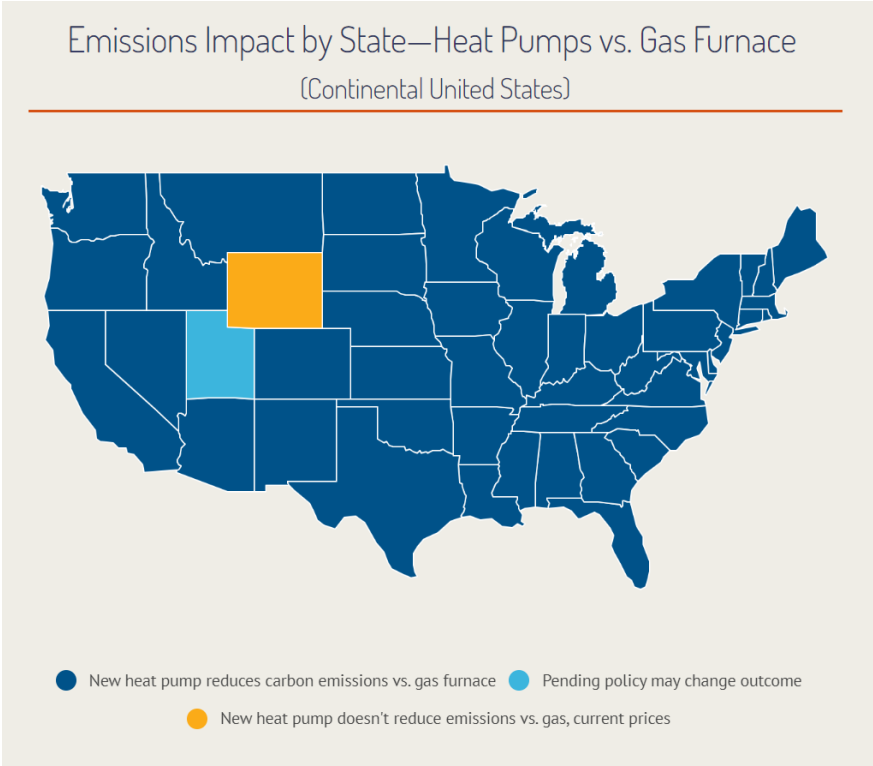

Image source: RMI

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Improve Indoor Air Quality and Safety

- **Improve indoor air quality and comfort**
  - ASHPs may offer both air filtration and dehumidification
  - ASHPs may improve comfort by through longer run times and efficient operation
- **Improve safety**
  - Removes combustion equipment
  - In cases where cooling is added, improves health and safety during periods of extreme heat

Technology Considerations

Cold Climate ASHPs (ccASHPs)

- Readily available ccASHPs are on the market, engineered to efficiently heat homes in extremely cold conditions, typically at or below 5°F
- NEEP maintains a list of ccASHPs that meet specific performance criteria
- The Department of Energy's Cold Climate Heat Pump Technology Challenge is accelerating the development and market for cold climate heat pumps.
- **In the Midwest, cold-climate heat pumps are recommended for most applications**

Image source: Energy News Network

Hybrid ASHPs

- Hybrid heat pumps (also referred to as “dual-fuel” heat pumps) use an electric heat pump *and* fossil-fuel heating to warm a home
- Offers the resident flexibility to tailor energy usage and operational expenses to their preferences and respond to fuel rate fluctuations
- Watch a short video from Focus on Energy to learn how dual-fuel heat pump systems work
- **In the Midwest, hybrid systems will likely be optimal where the existing heating fuel is natural gas**

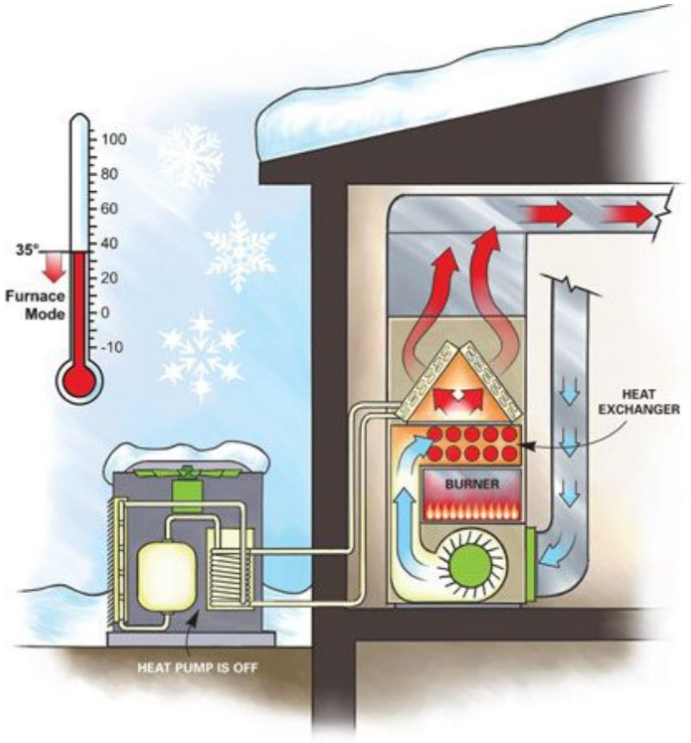

Image source: Family Handyman

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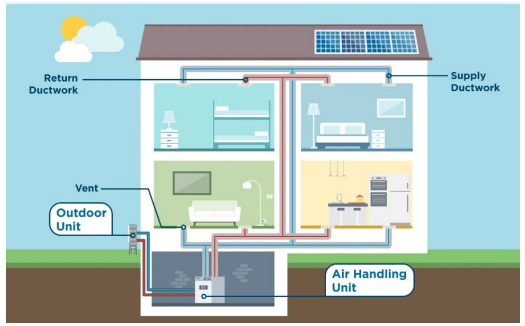
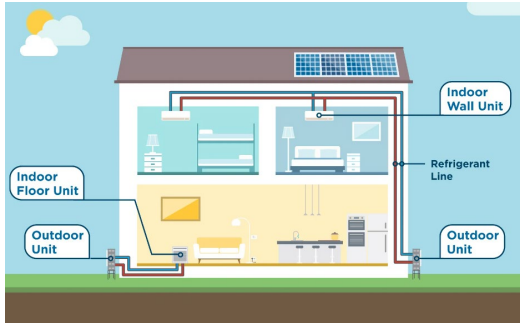
Distribution Types

- For ASHP retrofits, the best distribution type for a building is highly dependent on the existing distribution system

Ducted Systems:
Utilize existing ductwork



Ductless Systems:
Installed where ductwork not feasible



Images source: Massachusetts Clean Energy Center

Short-run Ducted Systems:
Installed where large ducting system not feasible

Image source: BetterBuiltNW

Hydronic Systems:
Use water to transfer heat to emitters

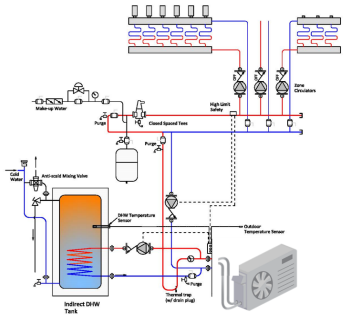


Image source: BASC

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Applicable Building Types

- Unique design considerations for specific building types
  - Single-family homes
  - Small multifamily (2-4 units)
  - Large multifamily (5+ units)
  - Manufactured homes
- Retrofits and new construction are both feasible

Preparing for Installation: Weatherization

- **Weatherization is a commonly recommended first step, especially in the Midwest**
  - Weatherization should be done prior to installation of the ASHP, to ensure the ASHP is correctly sized
  - Results in improved comfort and reduced energy bills
- Common weatherization measures include air sealing and adding insulation
- An energy audit can determine necessary weatherization upgrades

Preparing for Installation: Electrical Upgrades

- An upgrade to the electrical service or panel(s) may be required to meet increased electrical needs
- Early on, an electrician should assess the building service size and available space in existing electrical panel(s)
- Panel size requirements will depend on other appliances and loads in the home (typically, between 100 and 200-amp panels are needed)
- The Watt Diet Calculator recommends solutions to reduce or eliminate electrical upgrade requirements.

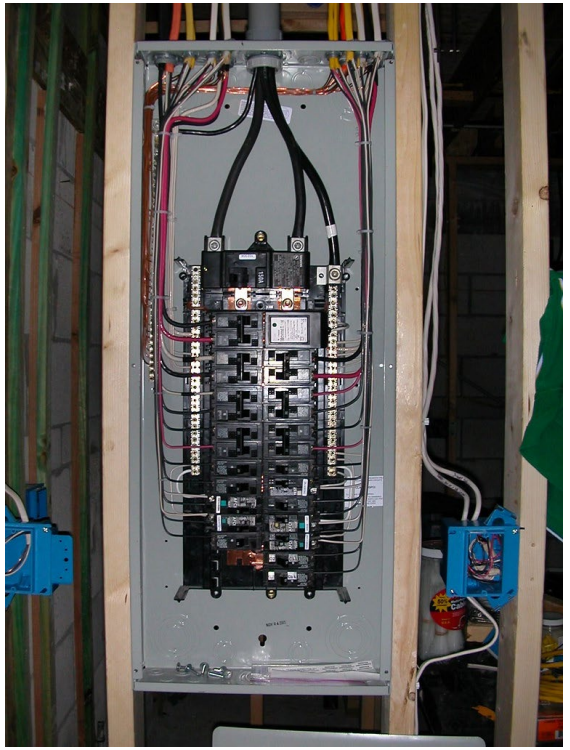
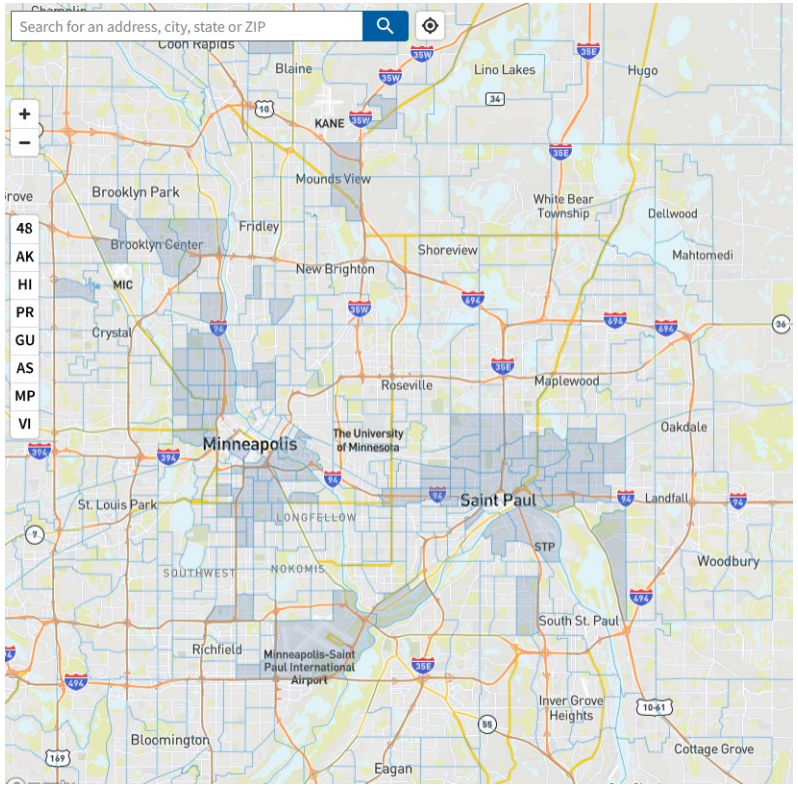


Image source: Flickr

Cost Considerations

Cost Considerations

- Cost-effectiveness depends on **operating costs** and **upfront costs**
- Prioritizing retrofits **in low- and moderate-income households (LMI) is critical**; increased incentives are often available if a property meets geographic location or income criteria, such as (requirement varies by incentive):
  - Climate and Economic Justice Screen Tool (CEJST)designates census tract that are disadvantaged
  - Below 80% Area Median Income (AMI)
- Research has shown that customers are willing to pay up to 20% more for heat pumps when they deliver utility bill cost savings and improve comfort



CEJST census tracts in Minneapolis highlighted in blue

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Operating Costs

- The impact of ASHPs on utility bills is largely dependent on:
  - Existing heating fuel and fuel rate
  - Climate zone
  - Other retrofits completed in combination with the ASHP (e.g., weatherization, solar)
- Online calculators that estimate utility bill impacts of ASHPs:
  - ComEd (Northern Illinois)
  - RMI (National)
- Maintenance is similar to air conditioner maintenance
  - Centrally Ducted: $20-150 per year
  - Mini-Split: $100 per year

Upfront Costs

- Upfront costs of an ASHP is largely dependent on:
  - Size, efficiency, and complexity of the ASHP design
  - Additional upgrades required (e.g., weatherization and electrical needs)
- Average upfront costs
  - Centrally ducted system: $10,000-$30,000
  - Ductless system: $5,000-$30,000
    - Due to a wide variety of applications the potential cost of a ductless system can vary significantly
  - Rewiring America has a summary of cost estimates for different US regions
- Incentives are available to offset upfront costs
  - Federal incentives through the **Inflation Reduction Act (IRA)**: tax credits, rebates, and financing
  - State incentives
  - Local incentives

Image source: Efficiency Maine

Federal Tax Credits and Deductions

- **Section 25C**
  - Applies to owner-occupied and renters
  - Covers HVAC and other energy efficiency upgrades (see table)
  - 2025 Standards per CEE RES HVAC Initiative
- **Section 179D**
  - Applies to mid/high-rise multifamily and commercial
  - Based on modeled energy reductions
- **Section 45L**
  - Applies to new construction or substantial rehab for single-family, multifamily, and manufactured homes
  - Based on ENERGY STAR® or DOE Zero Energy Ready certification

Section 25C summary (source: DOE)

EQUIPMENT TYPE	TAX CREDIT AVAILABLE FOR 2023-2032 TAX YEARS
Home Clean Electricity Products	
Solar (electricity)	30% of cost
Fuel Cells	
Wind Turbine	
Battery Storage	
Heating, Cooling, and Water Heating	
Heat pumps	30% of cost, up to $2,000 per year
Heat pump water heaters	
Biomass stoves	
Geothermal heat pumps	30% of cost
Solar (water heating)	
Efficient air conditioners*	30% of cost, up to $600
Efficient heating equipment*	
Efficient water heating equipment*	30% of cost, up to $600
Other Energy Efficiency Upgrades	
Electric panel or circuit upgrades for new electric equipment*	30% of cost, up to $600
Insulation materials*	30% of cost
Windows, including skylights*	30% of cost, up to $600
Exterior doors*	30% of cost, up to $500 for doors (up to $250 each)
Home Energy Audits*	30% of cost, up to $150
Home Electric Vehicle Charger	30% of cost, up to $1,000 **
* Subject to cap of $1200/year ** *See eligibility requirements from IRS here and a map of eligible locations*	

Federal Rebates

- **Home Electrification and Appliance Rebates (HEAR)**
  - State-administered point-of-sale rebates
  - Applies to single-family and multifamily
  - Rebates based on income criteria
- **Home Efficiency Rebates (HER)**
  - State-administered whole-house rebates based on modeled energy savings
  - Applies to single-family and multifamily
  - Income thresholds not required

HEAR Summary (source: Rewiring America)

Electrification upgrade type	Maximum rebate
Electric panel	$4,000
Electric/induction stove, cooktop, range, or oven	$840
Electric wiring	$2,500
Heat pump water heater	$1,750
Heat pump air conditioner/ heater	$8,000
Heat pump clothes dryer	$840
Weatherization (insulation, air sealing, and ventilation)	$1,600

Federal Financing

- **Greenhouse Gas Reduction Fund**
  - Provides low-cost loans for building decarbonization
  - Financing available through participating lenders
    - Loans at the national scale are available through Climate United, Coalition for Green Capital, and Power Forward Communities
    - Loans will also be available through local lenders like CDFIs, but these are not known yet
  - Applies to single-family and multifamily residential buildings, commercial buildings, or community facilities

CLIMATE UNITED

CGC Coalition for Green Capital

POWER FORWARD

State Incentives

- State Energy Offices can offer various incentives to assist with energy efficient equipment upgrades and often can provide guidance on federal opportunities as well.

Illinois	Indiana	Iowa	Kansas
Kentucky	Michigan	Minnesota	Missouri
Nebraska	North Dakota	Ohio	South Dakota
Wisconsin			

Local Incentives

- Many local utilities across the Midwest offer incentives for ASHPs, weatherization, and electrical upgrades
- DSIRE is a comprehensive database for local incentives and policies

DSIRE® | NC CLEAN ENERGY TECHNOLOGY CENTER

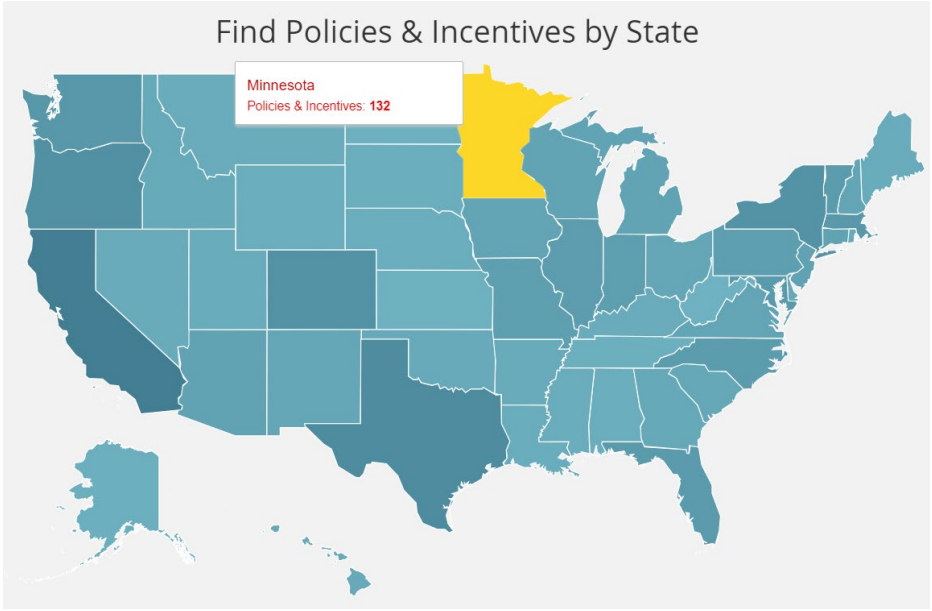

Image source: DSIRE

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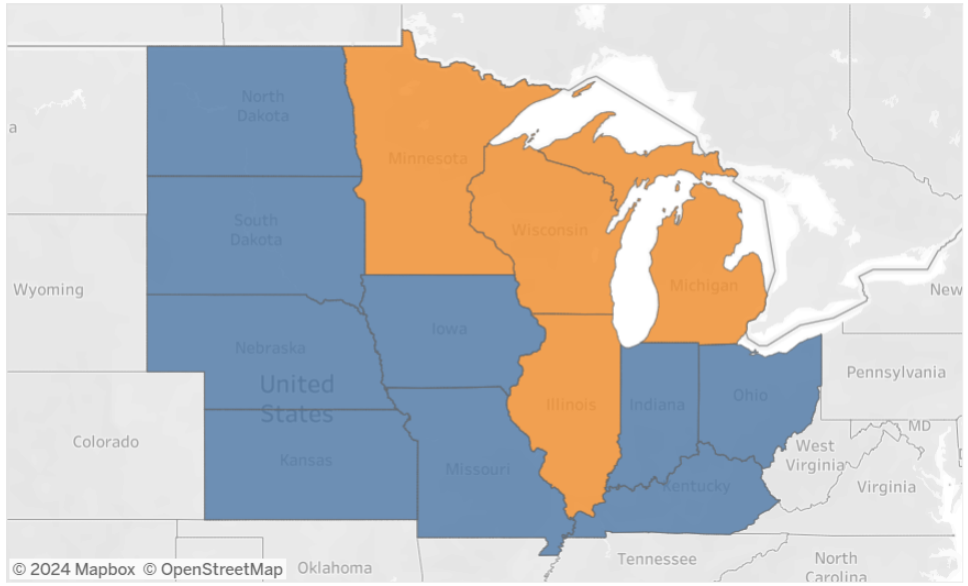
Program & Policy Design

Midwest Policy Trends

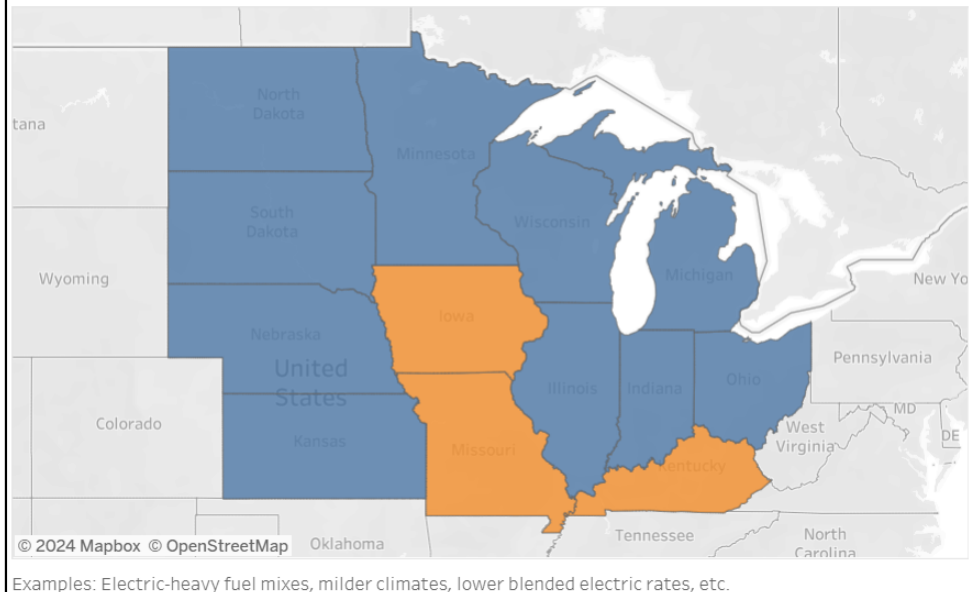
KEY TRENDS/TAKEAWAYS

States With Favorable ASHP Policy



Examples: Policies enabling fuel switching, statewide utility collaborative programs (e.g., Minnesota Air Source Heat Pump Collaborative), or statewide energy efficiency program implementation (e.g., Focus on Energy)

States With Favorable Market Conditions



Examples: Electric-heavy fuel mixes, milder climates, lower blended electric rates, etc.
Listed market conditions are in states that have expressed interest and requested more information regarding ASHP adoption - other states may have similar opportunities

Image source: Midwest ASHP Collaborative

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Program & Policy Design

- Local governments in the Midwest can support ASHP adoption through:
  - ASHP programs
  - Workforce development
  - Building codes and standards
  - Internal operations
  - Technical assistance for engineers, builders, general contractors, technicians, etc.

- Rewiring America's Electrification Policy Menu provides local leaders with guidance on policy options to support the adoption of ASHPs, including **local rules**, **financing, electrification**, and **local leadership**

Community-Driven Retrofit Programs

- **Building retrofit programs** support building owners and decision-makers in implementing energy efficiency and electrification upgrades in their buildings
- Community-driven building retrofit programs **prioritize community desires and needs** in the development, delivery, and outcomes of a building retrofit program
  - **Co-creation** between the local government and community can lead to equitable program outcomes.
  - Local governments can use the Guidelines for Creating Community-Driven Retrofit Programs to navigate the creation of these programs.
- A **one-stop shop model** can provide a suite of building retrofit services in one location

Program Example: Madison, WI

- **The Efficiency Navigator**
  - One-stop-shop building retrofit program
  - Focuses on small to medium-sized multifamily affordable housing
  - Provides free technical assistance and building energy efficiency upgrades
  - **When upgrades will reduce overall energy costs and emissions, ASHPs are installed in participating buildings**

Efficiency Navigator

Making multi-family housing affordable and resilient

A partnership with Sustain Dane and Elevate

Financial Assistance & Incentive Programs

- Local governments can establish programs to reduce upfront costs and financial barriers to building upgrades. This may include:
  - Rebates
  - Cost share
  - Free building energy upgrades for income-eligible properties
- A program should:
  - Identify a funding source
  - Set requirements for upgrades covered by the program
  - Create programs that stack with other offerings and incentives to maximize savings

Program Example: Chicago, IL

- **Green Homes Chicago**
  - Provides up to $50k in free energy upgrades to low-income homeowners
  - Eligible properties include 1–4-unit owner-occupied residential buildings
  - Upgrades may include insulation, heat pump HVAC systems, and electric appliances

Building Codes & Appliance Standards

Example considerations:

- **Heat pump installation requirement for A/C**
  - Requires all air conditioning units be heat pumps
- **Zero-Pollution standards for local appliance sales**
  - Requires new equipment to emit little or no pollution during operation
- **Electric-ready building codes for new buildings**
  - Requires new buildings have electric service and wiring for electric appliances
- **All-electric building codes for new buildings and renovations**
  - Requires buildings to be equipped with electric space heating, water heating, and electric appliances

Local Government Operations

- Permits and Inspections
  - Develop an application or incorporate ASHPs into existing permit applications
  - Establish internal protocols for consistent enforcement
  - Offer incentives for ASHP permit applications
  - Provide engineers and inspectors with training
- Fire & Safety
  - Building awareness of safety benefits when replacing fossil fuel equipment with ASHPs
- Sustainability
  - Community education and engagement on ASHP basics, benefits, and incentives

Next Steps & Resources

Recommendations & Next Steps

Early Stage → Later Stage

- Direct staff to **research air source heat pump** technology as it relates to their department's purview
- Conduct research to **help elected officials and executive officers** understand any implications for your municipality
- Reach out to **your peers at other municipalities** about what their knowledge and experience with air source heat pumps
- Update departmental **procedures and policies** where needed

Links to Key Resources

- Midwest ASHP Glossary of Terms 2024
- ASHP Basics
  - Midwest ASHP Collaborative
  - DOE Air-Source Heat Pumps
  - DOE Ductless Mini-Split Heat Pumps
  - ENERGY STAR Air-Source Heat Pumps
  - Rewiring American Upgrade Your Heating and Cooling with a Heat Pump
- Technology
  - ENERGY STAR Product Finder
  - Rewiring America Guide to Heat Pump Quotes
  - Focus on Energy How Dual-Fuel Heat Pumps Work
- Policy Considerations
  - Rewiring America Local Government Electrification Policy Menu
  - Rewiring America Electrification Resources for Local Leaders
  - C40, BEI, Elevate Guidelines for Creating Community-Driven Retrofit Programs
  - Shift Zero Policy Toolkit to pursue zero carbon building stock

Links to Key Resources

- Equipment and Maintenance Costs
  - EIA Buildings Sector Appliance and Equipment Costs (ASHP p.39-44)
- Energy Savings Calculators and Reports
  - CEE Developing Electric Rates for Hybrid ASHPs in the Midwest
  - Efficiency Maine Heating Cost Comparison
  - ComEd Savings Calculator
  - ENERGY STAR Life Cycle Cost Estimate
  - RMI GreenUpgrade Calculator
- Incentives
  - DOE Making Our Homes More Efficient: Clean Energy Tax Credits for Consumers
  - ENERGY STAR Federal Tax Credits and Incentives for Energy Efficiency
  - Midwest ASHP Collaborative State Energy Office Incentives List
  - Rewiring America Electrification Incentives Calculator
  - DSIRE USA Database

Links to Key Resources

- Community & Stakeholder Engagement
  - ECC and PODER Climate Equity & Community Engagement in Building Electrification
- Case Studies & Examples
  - Madison, WI: Efficiency Navigator
  - Chicago, IL: Green Homes Chicago
  - Ann Arbor, MI: Electrification Badging
  - Detroit, MI: Design Build Green Hub
- Tracking Tools
  - RMI Equitable Home Electrification Toolkit Roadmap

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