

Home Energy Effectiveness Toolkit

A framework to help guide you to effectively understand and capably improve the health and efficiency of your home energy systems



August 2024

The City of Ann Arbor
Office of Sustainability
and Innovation



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The City of Ann Arbor
Office of Sustainability and Innovation



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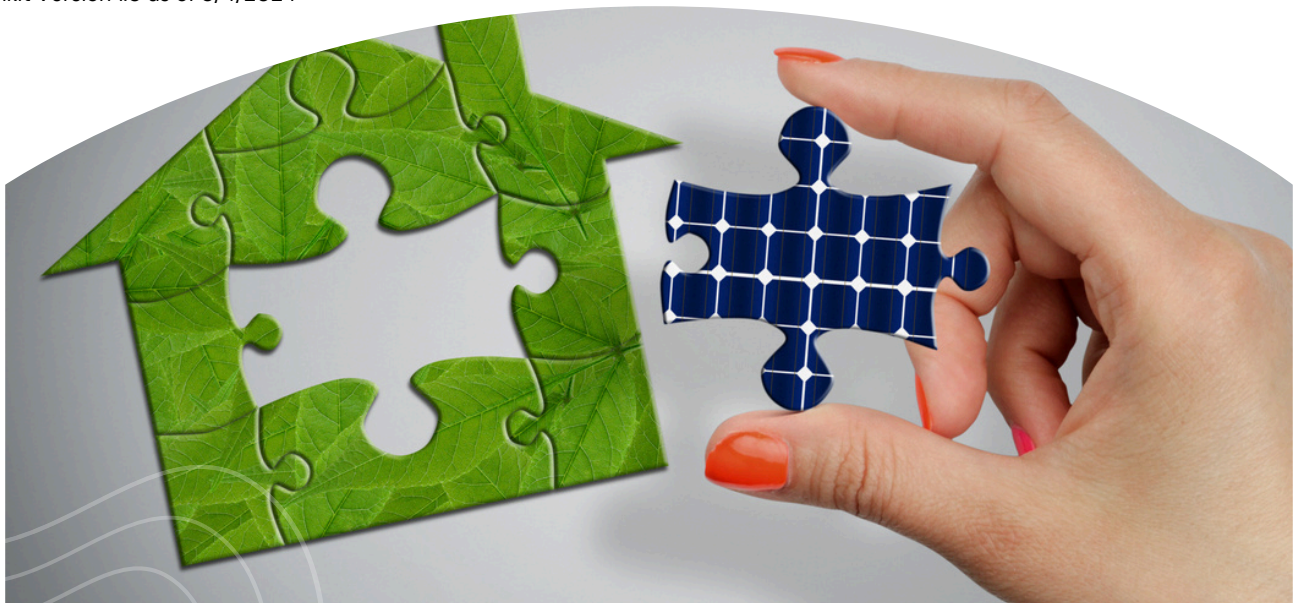
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Toolkit Version 1.0 as of 8/4/2024



Toolkit Framework & Concepts

We utilized [reDirect](#)'s Supportive Environments for Effectiveness (SEE) framework to inform this toolkit. The SEE framework proposes that:

THE ENVIRONMENTS THAT IMPACT US ENCOMPASS THE SITUATIONS AND CIRCUMSTANCES WHERE WE INTERACT WITH BASIC INFORMATION – SEEKING IT, MAKING SENSE OF IT, AND SHARING IT.

WHEN ENVIRONMENTS SUPPORT OUR NEEDS, WE FEEL LESS OVERWHELMED AND CAN MORE EFFECTIVELY COLLABORATE, COMMUNICATE, AND CONTRIBUTE IDEAS.

Upgrading your home energy systems can be a complex endeavor. We are here to help you. Throughout your entire journey on your path to zero emissions, we encourage you to:

- **Take your time** and explore this information in bite-sized chunks, and at your own pace.
- **Take breaks** when you feel fatigued, or overwhelmed with information. Depending on your familiarity and experience with home energy updates, you may find yourself weeding through a lot of new information. Taking breaks can help you to better make sense of this information.
- **Reach out to us for help.** On Page 5 of this toolkit, we provide several resources to support you on your home energy journey.
- If energy upgrades are new to you, consider starting by conducting an energy audit or a single weatherization measure. Treat these like **small experiments**:¹ they might be imperfect, but you'll learn from the process and build your confidence and capability along the way.

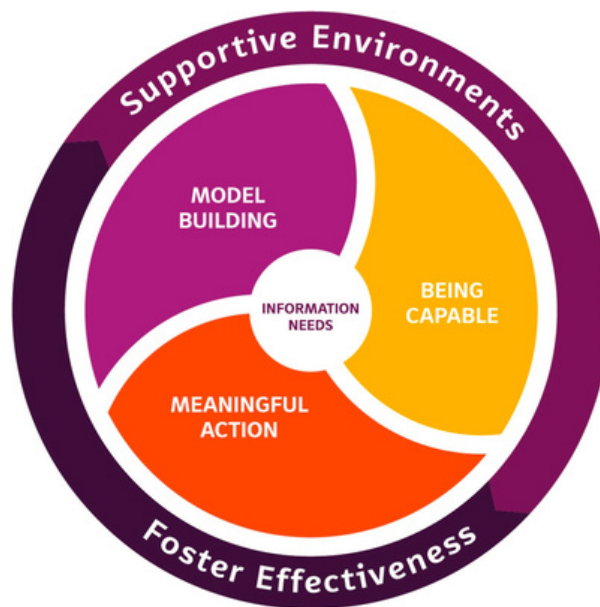
¹ Kaplan, Rachel. The Small Experiment: Achieving More with Less. Environmental Design Research Association, 1996.

Supportive Environments for Effectiveness (SEE)

The **SEE** framework brings out the best in ourselves and others by reminding us that:

- **Building mental models** increases our understanding through exploration, individually and collectively, to help us navigate the world around us.
- Feeling competent and clear-headed allows us to feel **capable** of reaching our goals.
- Genuine participation and engagement allows us to take **meaningful action** toward the things that matter most to us.

We've created this toolkit with **Model Building** in mind. Whatever your experience with home energy updates, these resources will allow you to start from where you're at, and help you explore materials to grow your understanding of your home energy infrastructure.



Our toolkit provides information about energy upgrades in small, manageable segments to help you **Feel Capable** of implementing these systems in your own home, noting the necessary tools, resources, and skills along the way.

The energy efficiency segment of your journey to carbon neutrality creates opportunities for you to take **Meaningful Action** for yourself, your neighbors, and the Ann Arbor community. We hope this toolkit allows you to fully participate in our home energy programs, knowing that your actions have a positive impact.

Look for these icons throughout the toolkit to understand where our approach aligns with SEE:

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Toolkit Layout

White pages in this guide represent supportive information that will help you **build mental models**, **be capable**, and take **meaningful action**. They are single pages of *essential* information that provide brief overviews of the material, which serve as an introduction to more detailed information if you want to dig deeper.

Light green pages present more detailed information about energy efficiency measures and incentives available to you. These pages go much deeper than the *Essentials*, and they direct you to even more in-depth information from local, state, and federal government and energy industry websites.

ESSENTIALS

CONTENT DETAILS

REBATE MEASURES - ELECTRIFICATION PAGE | 18

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Electric Panel Upgrades ESSENTIALS

WHAT DO YOU NEED TO KNOW?

- Your electric panel is the hub that distributes electricity throughout your home.
- If you plan to electrify your home by adding heat pumps or electric appliances, you may need to **increase the capacity of your electric panel**.

WHY IS IT IMPORTANT?

- A newer, larger electric panel will provide capacity to run your expanded home electricity needs.
- Electrifying your home energy will reduce emissions and pollution both inside and outside of your home, which has a meaningful impact on our environment.

HOW DO YOU IMPLEMENT IT?

- Contact a licensed electrician and share with them your plans to electrify your home.
- If you are having solar panels or heat pumps installed, your contractor will address your electric panel during their process.
- Combine multiple incentive and rebate programs** from Ann Arbor, the Inflation Reduction Act, DTE, and federal tax credits to reduce your costs.

EXPECTED TIMELINE

- Quote:** 1 - 2 hours
- Installation:** 4 - 8+ hours

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Electric Panel Upgrades

WHAT?

- Now that your home is weatherized, you might think about electrifying it to move towards consuming renewable energy.
- You will want to evaluate the capacity of your current **electrical panel**.
- Your electrical panel brings in electricity from an outside source, either a public utility or from your own solar panels, and it distributes power throughout your house. If you used natural gas to heat your home and for your stove, your home may not have needed a higher capacity electrical panel.

WHY?

- Adding new electrical equipment** like solar panels, cold climate air source heat pumps, e-bikes, EV automobiles, and electric appliances may call for you to upgrade your electrical panel.
- Consider having a minimum 200 amp panel installed, or adding sub-panels to total at least 200 amps. These will distribute power to all of your new electrified equipment that used to run on fossil gas.
- BENEFITS:** By moving away from fossil gas you will minimize indoor and outdoor pollution and improve your air quality.

HOW?

- A licensed electrician will inspect your current electric panel.
- You should explain to the electrician the additional electrical demands your home may need based on the specific electrification upgrades you plan to make.
- The electrician will size and install a new electric panel or add sub panels depending on your home's wiring and future electric needs.

SUPPORT

- Ann Arbor home energy rebates:** \$1,000 standard amount / \$2,000 for income qualified households.
- Coming early 2025 - **Inflation Reduction Act Home Energy Rebates** administered through the **State of Michigan:** home electrification and appliance upgrade rebates up to \$14,000 cap.
- Energy Efficient Home Tax Credit (25C):** Electric panel upgrade installed after Jan 1, 2023 may qualify for a tax credit up to 30% of the cost capped at \$600.

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Keys to Home Energy Effectiveness



Know from where you are starting your journey, and accept that as a great beginning.

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Mental Model Building – develop your understanding at your own pace, and then use your growing knowledge foundation to explore.

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Being Capable – To develop clarity and confidence, segment the material into bite-sized amounts of information, and take frequent breaks.

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Taking Meaningful Action – Participate, seek and provide feedback, and do *small experiments*. Try implementing a single efficiency measure to build your competence, gain momentum, and see your impact.

Ann Arbor Home Energy Programs & Resources

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HOME ENERGY ADVISOR

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- Free program open to all Ann Arbor residents (homeowners and renters)
- Will identify efficiency / electrification / renewable energy opportunities
- Virtual & on-site assessments available
- Two customized reports – *Home Decarbonization Guide* & *Path to Zero* – that detail recommended next steps

a2zerohea.org

advisor@a2zerohea.org

[734-290-6643](tel:734-290-6643)

HOME ENERGY REBATES

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- Rebates will help advance sustainability and our **A²ZERO goals**
- \$1.9 million annual community investment program will offer 1,300+ sustainability-related rebates to city residents
- >50% of the rebates for income qualified households
- Support to help navigate Ann Arbor rebates, and to introduce you to utility, county, state, and federal programs that may be available

[Energy Rebates](#)

[Email Rebate Team](#)

[734-726-4747](tel:734-726-4747)

GREEN ENERGY NEIGHBORS

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- Free service developed and administered by A²ZERO Ambassadors
- Connects individuals considering energy efficiency improvements (“Learners”) with people in the community who have already made some of these changes (“Mentors”)

[Green Energy Neighbors website](#) Greenenergyneighbors@gmail.com

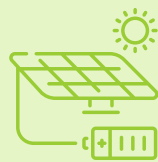
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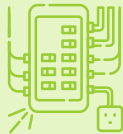
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Home Energy Efficiency Hierarchy of Measures



4. Solar Batteries & E-bikes



3. Electrification:
electric panel upgrades
air source heat pumps
heat pump water heaters



2. Weatherization:
Air Sealing + Insulation =
attic/roof, rim/band joist, floor area, walls – above
grade / knee / basement / crawl space

1. Home Energy Assessment (A²ZERO)* /
Home Energy Audit (contractor)**



*Home energy assessments are free to all Ann Arbor residents.
**Home energy audits are not currently eligible for A²ZERO rebates.

Foundational measures help you understand how efficiently your home operates, and they also work to create an insulated air sealed space.

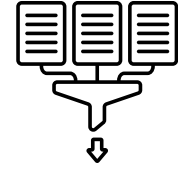
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Home Energy Assessments & Audits

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WHAT DO YOU NEED TO KNOW?

- Ann Arbor offers **FREE home energy assessments** to residents.
- City assessments can be virtual or in person, or short consult calls for urgent or single questions.
- Home energy audits are conducted by third parties, and may be eligible for a \$50 **DTE rebate** and a \$150 **federal tax credit**.

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WHY ARE THEY IMPORTANT?

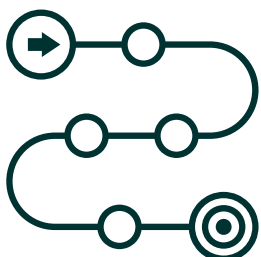
- Assessments & audits provide you with **foundational knowledge** about your home's current energy efficiency, infrastructure, and age.
- They also help you create a **roadmap** to improve your home's energy efficiency to increase safety and comfort, and to reduce cost.

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HOW DO YOU IMPLEMENT IT?

- Contact the **Ann Arbor Home Energy Advisor (HEA)** team to discuss your options or to schedule an appointment.
- Visit the weatherization section of this toolkit to determine if you qualify for **free weatherization services** from the **county** or **DTE**. If you qualify, they may complete a free audit for you.
- Heat pump installers may also complete a home energy audit for you as part of their design and installation process.



EXPECTED TIMELINE

- **Scheduling Wait Time:** 2 - 3 weeks
- **Audit / HEA Assessment:** 3 - 6 hours
- **Results Meeting:** 1 - 2 weeks after assessment; 30-minute meeting

Home Energy Assessments & Audits

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WHAT?



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- Home energy assessments are offered by the Ann Arbor Home Energy Advisor Program and are very similar to an audit. Both include an energy bill review, exterior inspection, blower door test, HVAC & water heater inspection, appliance & lighting review, and an assessment of your home insulation.
- **Third-party home energy audits** will also include thermal imaging. By using infrared cameras, the auditor can detect areas where heat or cool air is escaping from the home.

WHY?



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- Assessments and audits provide you with a baseline measurement of your home's energy efficiency.
- You will receive a detailed report that outlines steps you can take to improve your home's energy efficiency.
- Making these improvements can lead to **improved safety, comfort, and efficiency**, which can **lower your utility bills**.

HOW?

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- The US Department of Energy (DOE) provides a **do-it-yourself home energy assessment**.
- The DOE also offers guidance for finding and hiring a **professional home energy auditor**.
- Have a trained **A²ZERO Home Energy Advisor** assess your home energy systems.

SUPPORT



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- The **A²ZERO Home Energy Advisor** program is free to Ann Arbor residents.
- DTE offers utility customers a **\$50 rebate** for having a paid home energy audit completed.
- In 2023, the **IRS released guidelines** for homeowners to claim a tax credit up to \$150 for completing a qualified home energy audit. You can claim this credit when you file your tax return.



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Home Energy Advisor *In-Home* Assessment



WHAT TO EXPECT

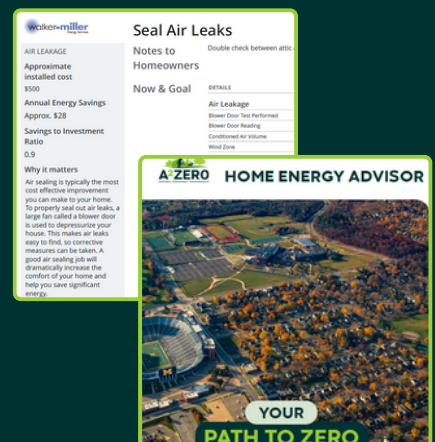
- Trained energy advisor will arrive on time and be on site for approximately 3 hours.
- You will give your advisor a brief home tour, including equipment locations and basement / attic access points, and share your concerns, goals, and interests.
- You remain in your home while the advisor completes their assessment.

TYPICAL IN-HOME ASSESSMENT AGENDA

- **Exterior assessment:** Advisor measures home dimensions, window types/ #/sizes, exterior HVAC equipment, wall siding.
- **Interior:** Advisor examines attic/wall insulation, interior HVAC, water heater, kitchen appliances, lighting.
- **Blower Door Test:** Advisor measures level of air leakage from the home. During this 20-minute test, HVAC must be shut off and all windows and doors must remain closed.
- Advisor answers questions and discusses next steps.

POST-ASSESSMENT FOLLOW-UP

- Advisor uses home data to create two PDF reports – **Home Decarbonization Guide & Path to Zero** – delivered by email within ~1 week.
- 30-minute follow-up call / Teams video meeting occurs within 1-2 weeks.



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advisor@a2zerohea.org

[734-290-6643](tel:734-290-6643)



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Home Energy Advisor *Virtual* Assessment



WHAT TO EXPECT

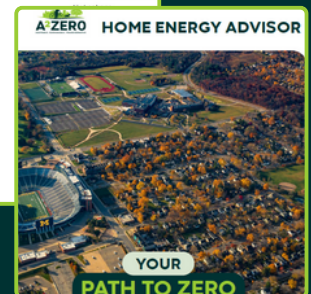
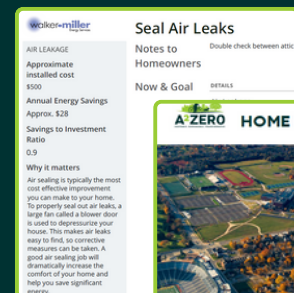
- Trained energy advisor will meet with you by video.
- Appointment will last from 30 minutes to 2 hours.
- You will provide answers to questions about your home heating and cooling systems, which will require you to find the serial and model numbers from your furnace and air conditioner.
- Advisor may ask you about your windows (number, age, and number of glass panes) and your insulation.

TYPICAL VIRTUAL ASSESSMENT AGENDA

- Appointment begins with you sharing any issues or concerns about your home.
- Advisor will gather information about your home before the walk through begins.
- You will walk through your home on video to gather missing information as well as show any problem areas (HVAC, windows, insulation, air leaks).
- At the end of the walk through, your advisor will answer your questions and provide high-level recommendations that will appear in your reports.

POST-ASSESSMENT FOLLOW-UP

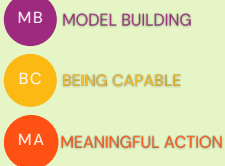
- Advisor uses home data to create two PDF reports – **Home Decarbonization Guide & Path to Zero** – delivered by email within ~1 week.
- 30-minute follow-up call / Teams meeting occurs within 1–2 weeks.



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Home Energy Advisor *Consult Call*

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REASONS TO CALL

- To learn more about *what an assessment entails* and whether it makes sense for you to have a whole home assessment.
- Question about a **specific energy efficiency measure**.
- To better understand financial incentives (i.e. **rebates** or **tax credits**) for energy efficiency measures.
- Help searching for a **qualified contractor** for planned work.
- **HVAC systems no longer functioning** and you want to discuss rebate-eligible alternatives to fossil gas systems.

WHAT TO EXPECT

- **SCHEDULE AN APPOINTMENT**
- For urgent matters, call or email if an appointment time is not available soon enough.

CONSULT CALL OR ASSESSMENT?

- **CONSULT CALLS:** urgent, single measure questions, more info about full home energy assessments, incentive / rebate questions.
- **FULL ASSESSMENT:** considering more than one measure, don't know much about your home's envelope / air sealing / insulation, interested in building a plan to move your home towards net zero carbon emissions

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advisor@a2zerohea.org

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Home Energy Rebates Program Overview

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REBATE PROGRAM HIGHLIGHTS



- **\$1.9 million** community investment program
- **Annually renewing** program from July – June
- **1,300+** rebates available this program year
- **>50%** of all rebates allocated to **income qualified** households
- **Reserved & unreserved** dollars available for eligible efficiency & electrification measures

ENERGY MEASURE PRIORITIZATION



Eligible Rebate Measures

1. Home energy **assessment** (free) / audit*
2. **Weatherization** – air sealing & insulation
3. **Electrification** – electrical panel & heat pumps
4. PV (solar) **batteries** and **e-bikes**

*Home energy audits are not currently eligible for A²ZERO rebates.

SUPPORT



[ENERGY REBATES WEBSITE](#)



[ENERGY REBATES TEAM EMAIL](#)



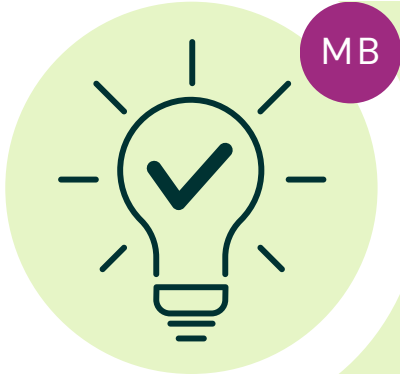
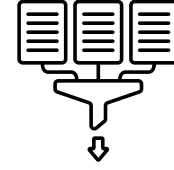
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Weatherization *ESSENTIALS*



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WHAT DO YOU NEED TO KNOW?

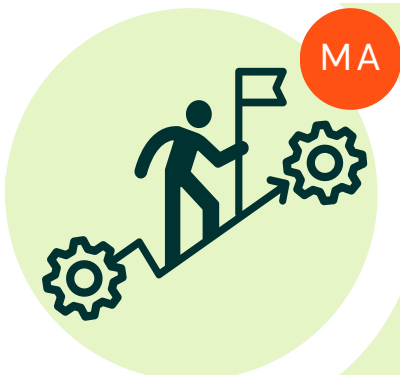
- Weatherizing your home involves **air sealing** and **insulating** it, similar to wearing an insulating layer under a windproof / waterproof jacket.
- Use the information gained from your assessment or audit to determine what weatherization steps you need to do.
- Take advantage of multiple incentive programs to reduce cost.



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WHY IS IT IMPORTANT?

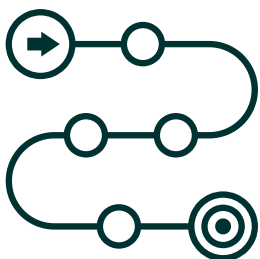
- Weatherizing your home, both air sealing and properly insulating it, is essential to making sure your home has a tight envelope so your heating and cooling infrastructure runs efficiently.
- Electrifying your home without first weatherizing it will most likely result in higher utility bills.
- After an audit, **weatherizing is the most important step** in your home efficiency journey.



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HOW DO YOU IMPLEMENT IT?

- See if you qualify for **free county** or **DTE weatherization programs**.
- Through Michigan Saves, find a qualified **decarbonization pilot contractor** who has pledged to air seal *before* insulating.
- Planning to install a heat pump? Ask your contractor if they include weatherization reviews in their process, as **Pearl Edison** does.
- **Combine multiple incentive** and **rebate programs** from local / state / federal / utility programs to reduce your costs.



EXPECTED TIMELINE

- **County / Utility Application Process:** up to 3 months
- **County / Utility Project Initiation:** 6+ months after application approval
- **Audit / Design:** 3 - 6 hours
- **Installation:** 4 - 8 hours



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Weatherization Overview



“**Weatherization**, also known as *air sealing* and *insulating*, operates like wearing a windproof jacket over an insulating inner layer. The outer layer keeps the air and wind out, while the inner layer insulates.”

–Julie Roth, City of Ann Arbor Energy Manager



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NOTE: This home weatherization section is **long** and **complex**, and also **very important**. Financial support programs exist at the utility, city, county, state, and federal levels. **Take your time, ask questions**, and sketch out all of the layers of options to braid and stack multiple financial incentives to minimize your costs.

WHY IS WEATHERIZATION IMPORTANT?

Weatherizing your home creates a tight and insulated building envelope. If your home energy assessment or audit reveals leaks or lack of insulation, you will want to air seal and insulate before implementing any home electrification measures.

WHAT ARE AIR SEALING AND INSULATION?

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AIR SEALING REDUCTION

Air sealing involves identifying and sealing leaks and gaps in the building envelope where air can escape or enter. This **reduces drafts, improves indoor air quality**, and **enhances the overall energy efficiency** of the home by preventing conditioned air from leaking out and unconditioned air from coming in.

INSULATION

Home insulation refers to materials and methods used to prevent heat loss or gain within a house by creating a barrier between the interior and exterior environments. Effective insulation helps **maintain a consistent indoor temperature**, improving energy efficiency and comfort.



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Weatherization *Definitions*

WEATHERIZATION MEASURE DEFINITIONS

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ATTIC AND ROOF INSULATION

Insulating the attic and roof involves adding insulation materials to the space directly under the roof, reducing heat loss in the winter and heat gain in the summer. This improves overall energy efficiency by maintaining consistent indoor temperatures and reducing the need for heating and cooling.

ABOVE-GRADE WALL INSULATION

This involves adding insulation to the exterior walls of a home that are above ground level. It helps to minimize heat transfer through the walls, keeping the home warmer in winter and cooler in summer, thus reducing energy consumption.

KNEE WALL INSULATION

Knee walls are short walls, typically found in attics, that support the roof rafters. Insulating these walls helps to prevent conditioned air from escaping into the attic and unconditioned air from entering the living spaces, enhancing overall energy efficiency.

RIM/BAND JOIST INSULATION

The rim or band joist is the perimeter of the floor framing where the floor joists meet the outer wall. Insulating this area helps to prevent air leaks and improves the thermal envelope of the home, reducing energy loss.

BASEMENT WALL INSULATION

Insulating basement walls involves adding insulation to the walls of the basement. This reduces heat loss through the foundation and helps maintain a more consistent temperature in the basement, contributing to the overall energy efficiency of the home.

CRAWL SPACE WALL INSULATION

For homes with crawl spaces, insulating the walls of the crawl space can prevent heat loss and reduce moisture issues. It helps to keep the floors above warmer in winter and cooler in summer, improving energy efficiency and comfort.

FLOOR AREA INSULATION

Insulating the floor area, especially above unconditioned spaces like crawl spaces or garages, prevents heat loss through the floor, enhancing the comfort of the living spaces and reducing energy consumption for heating and cooling.



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Free Weatherization Programs



Free Utility & County Programs

THESE PROGRAMS PROVIDE **FREE SERVICES WORTH THOUSANDS OF DOLLARS** TO WEATHERIZE YOUR HOME. BOTH PROGRAMS ARE COMPLEX AND MAY TAKE MONTHS TO IMPLEMENT. TAKE YOUR TIME AND CONTACT EACH PROGRAM FOR DETAILS.

Depending on your household income, DTE may offer you free services through their **Energy Efficiency Assistance program**. You will need to apply through DTE and connect with a **partner community organization** to receive services.

Washtenaw County offers similar services through the **Weatherization Assistance Program**. They perform a free energy audit, and based on the results, they provide eligible repairs on the home for free. Homeowners and renters who meet the **eligibility requirements** are welcome to apply.

Household Size	Household Income Qualification Limits	
	DTE Weatherization Program*	Washtenaw County Weatherization Program**
1	\$30,120	\$66,300
2	\$40,880	\$75,750
3	\$51,640	\$85,200
4	\$62,400	\$94,650
5	\$73,160	\$102,250
6	\$83,920	\$109,800
7	\$94,680	\$119,250
8	\$105,440	\$128,700
9+	+\$10,760 each additional member	+\$9,450 each additional member

* Eligible for DTE’s EEA program if your household income is at or below 200% percent of the federal poverty guidelines. Your active enrollment in the Low Income Self Sufficiency Plan or other state low-income public assistance programs (SNAP, WIC, etc.) also qualifies you for the program.

** Household must be at or below 80% AML of the federal poverty level to qualify for the Washtenaw County Weatherization Assistance Program. Income eligibility is established based on the previous 3 months income for the household. If a member of the household receives Supplemental Security Income (SSI), State Disability Assistance (SDA), cash benefits through the Family Independence Program (FIP) then the applicant is automatically eligible for weatherization. Receipt of any of these benefits within the previous 3 months makes an applicant eligible. The county will need documentation of those benefits, and also documentation of any other income that the applicant may have.

All information current and websites visited as of 7/2/24.

Weatherization Rebates & Incentives

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There are several programs that provide financial incentives aimed at reducing up-front costs of energy efficiency, electrification, and renewable energy upgrades. There is an opportunity to combine these programs by “stacking” or “braiding” resources to reduce costs.

Stacking or **braiding** resources means blending different financial incentives or funding sources to maximize resources for a specific goal, like funding home energy upgrades. It’s about using multiple supports together to make a bigger impact to your home.

1. ASSISTANCE PROGRAMS: THESE PROGRAMS PROVIDE HIGHLY/FULLY SUBSIDIZED ENERGY EFFICIENCY IMPROVEMENTS TO INCOME ELIGIBLE HOUSEHOLDS. (SEE PAGE 16 FOR DETAILS)

- If you do not qualify for a free weatherization program, contact a **qualified decarbonization pilot contractor** through Michigan saves. These contractors have pledged to air seal before insulating.

2. REBATE PROGRAMS: TYPICALLY REQUIRE HOUSEHOLDS TO MAKE INVESTMENTS, THEN APPLY FOR REBATES WITH PROOF OF PURCHASE. CONTRACTORS MAY BUILD REBATES INTO QUOTES

- **Utility Rebates:** DTE customers are eligible to receive rebates for energy efficiency upgrades and ENERGY STAR® appliances.
- **Ann Arbor Home Energy Rebates:** This program offers rebates for qualified energy efficiency and electrification home improvements (see **Technical Requirements** for rebate eligibility).
- **Inflation Reduction Act Home Energy Rebates** administered through the **State of Michigan:** coming early 2025, home efficiency upgrade rebates up to an \$8,000 cap.

3. TAX CREDITS: TAX CREDITS ARE LIKE DISCOUNTS ON YOUR TAXES. ONCE YOU MAKE A HOME IMPROVEMENT, YOU MAY APPLY FOR THESE CREDITS WHEN YOU FILE YOUR TAX RETURN

- **Energy Efficient Home Tax Credit (25C):** Improvements related to adding insulation, air sealing, energy efficiency, doors and windows, air conditioners, and heat pumps made to homes after Jan 1, 2023 may qualify for a tax credit up to \$3,200.

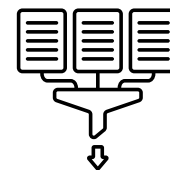
4. FINANCING: LOAN PROGRAMS TAILORED SPECIFICALLY TO FUNDING ENERGY EFFICIENCY, ELECTRIFICATION, AND RENEWABLE ENERGY UPGRADES IN HOMES AND BUILDINGS.

- **Michigan Saves:** A statewide program offering financial capital through a network of lenders that offer favorable terms based on a negotiated contract. Homeowners make the upgrades with the help of their authorized contractors through an authorized lending partner.

- MB MODEL BUILDING
- BC BEING CAPABLE
- MA MEANINGFUL ACTION

Electric Panel Upgrades

ESSENTIALS



MB

WHAT DO YOU NEED TO KNOW?

- Your electric panel is the hub that distributes electricity throughout your home.
- If you plan to electrify your home by adding heat pumps or electric appliances, you may need to **increase the capacity of your electric panel** to at least 200 amps.



BC

WHY IS IT IMPORTANT?

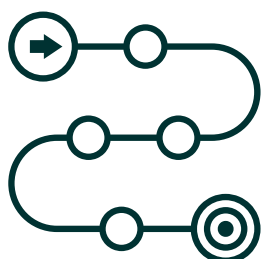
- A newer, larger electric panel will provide capacity to run your expanded home electricity needs.
- Electrifying your home energy will reduce emissions and pollution both inside and outside of your home, which has a meaningful impact on our environment.



MA

HOW DO YOU IMPLEMENT IT?

- Contact a licensed electrician and share with them your plans to electrify your home.
- If you are having solar panels or heat pumps installed, your contractor will address your electric panel during their process.
- **Combine multiple incentive and rebate programs** from Ann Arbor, the Inflation Reduction Act, DTE, and federal tax credits to reduce your costs.



EXPECTED TIMELINE

- **Quote:** 1 - 2 hours
- **Installation:** 4 - 8+ hours

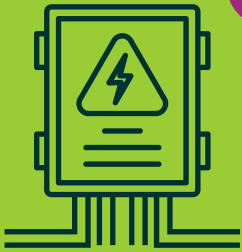
MB MODEL BUILDING

BC BEING CAPABLE

MA MEANINGFUL ACTION

Electric Panel Upgrades

WHAT?



MB

- Now that your home is weatherized, you might think about electrifying it to move towards consuming renewable energy.
- You will want to evaluate the capacity of your current electric panel.
- Your electrical panel brings in electricity from an outside source, either a public utility or from your own solar panels, and it distributes power throughout your house. If you used natural gas to heat your home and for your stove, your home may not have needed a higher capacity electrical panel.

WHY?



BC

- **Adding new electrical equipment** like solar panels, cold climate air source heat pumps, e-bikes, EV automobiles, and electric appliances may call for you to upgrade your electrical panel.
- Consider having a minimum 200 amp panel installed, or adding sub-panels to total at least 200 amps. These will distribute power to all of your new electrified equipment that used to run on fossil gas.
- **BENEFITS:** By moving away from fossil gas you will *minimize* indoor and outdoor *pollution* and *improve your air quality*.

HOW?



MA

- A licensed electrician will inspect your current electric panel.
- You should explain to the electrician the additional electrical demands your home may need based on the specific electrification upgrades you plan to make.
- The electrician will size and install a new electric panel or add sub panels depending on your home's wiring and future electric needs.

\$ SUPPORT



- **Ann Arbor home energy rebates:** \$1,000 standard / \$2,000 for income qualified households (see [Technical Requirements](#) for rebate eligibility).
- **Coming early 2025 - Inflation Reduction Act Home Energy Rebates** administered through the [State of Michigan](#): home electrification and appliance upgrade rebates up to \$14,000 cap.
- **Energy Efficient Home Tax Credit (25C):** Electric panel upgrade installed after Jan 1, 2023 may qualify for a tax credit up to 30% of the cost capped at \$600.

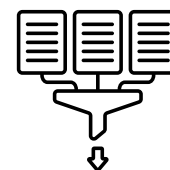
MB MODEL BUILDING

BC BEING CAPABLE

MA MEANINGFUL ACTION

Air Source Heat Pumps

ESSENTIALS



WHAT DO YOU NEED TO KNOW?

MB



- Heat pumps use electricity to **transfer heat** from the outside air into your home to heat it in the winter, and heat from the inside air to the outside to cool it in the summer.
- They can replace both your furnace and your air conditioning.
- Heat pumps efficiently maintain a constant temperature in your home.

WHY IS IT IMPORTANT?

BC



- Heat pumps allow you to electrify your home to reduce fossil gas pollution.
- Cold climate air source heat pump technology has dramatically improved in the last decade. SEE RESOURCES FROM MAINE, NEW YORK, AND CANADA on page 22 of this toolkit.

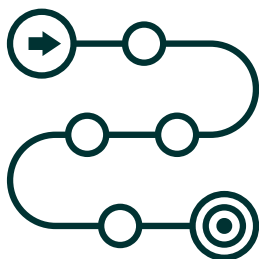
HOW DO YOU IMPLEMENT IT?

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- Contact the [Ann Arbor Home Energy Advisor team](#), explore the Michigan Saves [Decarbonization Pilot Contractor list](#), or reach out to [Pearl Edison](#).
- Take advantage of [Ann Arbor rebates](#), [DTE rebates](#), and state and [federal tax incentives](#).

EXPECTED TIMELINE



- **Quote:** Instant through Pearl Edison
- **In-home Evaluation:** 4 - 6 hours
- **Project Initiation:** 1 day to 2 weeks
- **Installation:** 8+ hours

MB MODEL BUILDING

BC BEING CAPABLE

MA MEANINGFUL ACTION

Air Source Heat Pumps

MB

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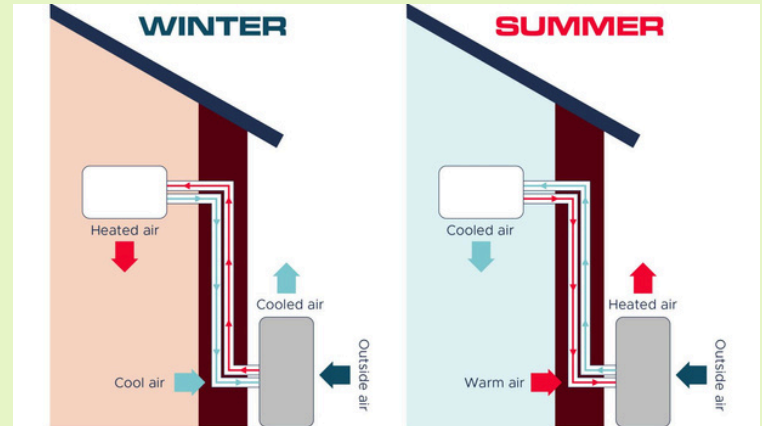
MA

IMPORTANT: Your home must be properly air sealed and insulated for you to achieve efficiency and savings from an electric cold climate air source heat pump.



PERCEIVED COMPLEXITY

At first glance, installing a heat pump in your home might seem like a daunting task. Taking time to formulate a **mental model** of what a heat pump is and learning how it works will help build understanding and encourage you to explore more. We will provide you with information and connect you with caring and patient people who will answer your questions so you grow comfortable and confident about deciding whether to replace your fossil fuel furnace with an electric heat pump. This support provides clarity, and allows you to **be capable** and take **meaningful action** to improve the health, comfort and efficiency of your home heating and cooling system.



Credit: ourfuture.energy.

WHAT IS A HEAT PUMP?

A cold climate air source heat pump is a system that moves heat, both ways, between your house and the outside air. During colder times of the year, a heat pump will transfer heat from the outside air into your house. It does this by absorbing heat in pressurized refrigerant lines. In the warmer months, a heat pump will move heat from inside your home to the outside. **Think of a heat pump as a heat transfer unit that moves heat rather than generating it by burning fossil fuels.** A common every day example of a heat pump is your refrigerator, which transfers heat to keep your food cold.

WHY SHOULD YOU CONSIDER INSTALLING A HEAT PUMP?

IMPROVED HEALTH

- Removing fossil fuel burning equipment from your home reduces both indoor and outdoor pollution.

INCREASED COMFORT & CONVENIENCE

- Heat pumps produce more even home heating and cooling, which doesn't require you to adjust your thermostat. They operate more efficiently when the thermostat is set to a static temperature.
- Heat pumps replace both your furnace and your air conditioner. They seamlessly switch between heating and cooling, eliminating the need for you to manually turn on your furnace or your air conditioner.

INCREASED EFFICIENCY

- The best high efficiency gas furnaces approach 96% efficiency.
- High efficiency heat pumps typically operate at 200–400% efficiency, so for every unit of energy used, they provide 2 to 4 units of heating or cooling. This can result in lower energy bills if your home is air sealed and well insulated.

REDUCED POLLUTION

- Heat pumps run on electricity, which is increasingly generated from renewable solar and wind sources. Eliminating your gas furnace will reduce your methane emissions, a powerful byproduct of burning fossil gas. Methane is 25 times more potent than carbon dioxide, so reducing methane emissions can have a powerful pollution-reducing impact.

MB MODEL BUILDING

BC BEING CAPABLE

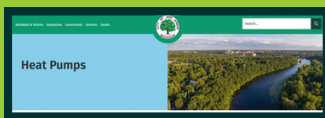
MA MEANINGFUL ACTION

Air Source Heat Pumps

INFORMATIONAL RESOURCES

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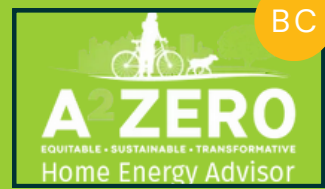
CITY OF ANN ARBOR



[A²ZERO Heat Pump Website](#)



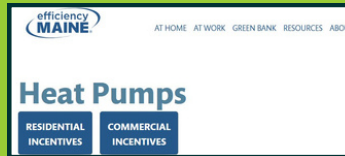
[A²ZERO Heat Pump Workshop](#)
(~2 hours)



[A²ZERO Home Energy Advisor Website](#)

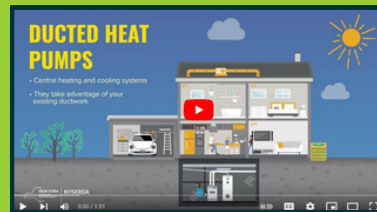
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EFFICIENCY MAINE



[Efficiency Maine Website](#)

NY STATE ENERGY RESEARCH & DEVELOPMENT AUTHORITY



[NY State Energy Authority Ducted Heat Pump Video](#) (~2 minutes)

NATURAL RESOURCES CANADA



[Natural Resources Canada Cold Climate Heat Pumps in Ontario Video](#) (~4.5 minutes)

U.S. DEPARTMENT OF ENERGY



[energy.gov Heat Pump Website](#)



[U.S. Dept. of Energy Clean Energy 101 Heat Pump Video](#) (~1.5 minutes)

CONTRACTOR RESOURCES

BC

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[Ann Arbor's Home Energy Advisors](#) will help you source a qualified heat pump contractor.

Michigan Saves has created a list of [Decarbonization Pilot Contractors](#) who have agreed to design electric cold climate air source heat pump solutions first (including water heaters) before reverting to fossil fuel solutions.

Pearl Edison is a full-service design-install air source heat pump contractor based in southeast Michigan. They provide a concierge experience by creating an instant online estimate; reviewing your home to complete a home heating and cooling load calculation; designing your system; sourcing all local/county/state/federal/utility eligible rebates and incentives; and hiring and supervising thoroughly vetted contractors, including weatherization if your home needs it. Find out more by visiting the [Pearl Edison website](#).

FINANCIAL RESOURCES

MA

- **Ann Arbor Home Energy Rebates:** max \$3,500 income qualified rebate / max \$2,500 standard rebate (see [Technical Requirements](#) for rebate eligibility).
- **Inflation Reduction Act Home Energy Rebates** administered through the **State of Michigan:** coming early 2025, home electrification heat pump rebate up to \$8,000.
- **Energy Efficient Home Tax Credit (25C):** heat pumps installed after Jan 1, 2023 may qualify for a tax credit up to \$2,000.

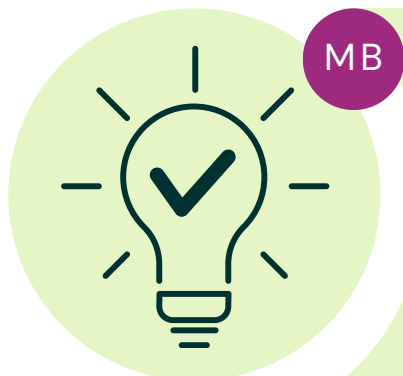
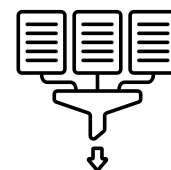
MB MODEL BUILDING

BC BEING CAPABLE

MA MEANINGFUL ACTION

Heat Pump Water Heaters

ESSENTIALS



MB

WHAT DO YOU NEED TO KNOW?

- Heat pump water heaters (HPWH) work similarly to air source heat pumps, transferring heat from the air to water in the tank.
- Stand alone HPWHs will cool and dehumidify the surrounding air since they transfer heat from it to the water.
- HPWHs require a minimum room size to operate properly.



BC

WHY IS IT IMPORTANT?

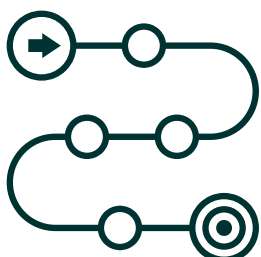
- Heat pump water heaters use electricity and heat in the ambient air rather than fossil gas to heat your water.
- Since they don't burn gas, heat pump water heaters don't need to be vented, and they don't directly produce any indoor or outdoor pollution.



MA

HOW DO YOU IMPLEMENT IT?

- Qualified HVAC and plumbing contractors will install your HPWH.
- If you are considering replacing your furnace / air conditioning with an air source heat pump, ask the contractor if they will also install a HPWH.
- Take advantage of [Ann Arbor rebates](#), [DTE rebates](#), and [federal tax credits](#).



EXPECTED TIMELINE

- **Quote:** 1 - 2 hours for contractor to evaluate your space & provide a quote
- **Installation:** 2 - 4+ hours depending on complexity

MB MODEL BUILDING

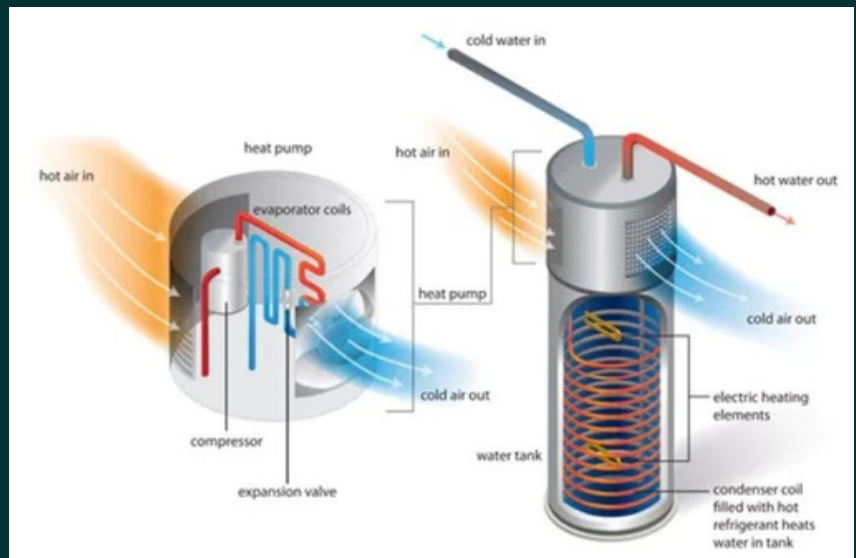
BC BEING CAPABLE

MA MEANINGFUL ACTION

Heat Pump Hot Water Heaters

HOW DO HEAT PUMP WATER HEATERS (HPWH) WORK? MB

- Heat pump water heaters (HPWHs) work similarly to air source heat pumps by **transferring heat from the air to the water** in the tank.
- This process also **cools and dehumidifies the surrounding ambient air**.
- Can be more efficient than fossil gas or electric hot water heaters since they **transfer heat** rather than generate it.
- Many HPWHs are considered hybrids:
 - Operate most efficiently when using only the heat pump to heat water
 - During periods of high demand, they use a less efficient electric heating element to heat water.

Credit: energystar.gov

CONTRACTOR RESOURCES BC MA

[Ann Arbor's Home Energy Advisor](#) will help you source a qualified heat pump contractor.

Michigan Saves has created a list of [Decarbonization Pilot Contractors](#) who have agreed to design heat pump solutions first (including water heaters) before reverting to fossil fuel solutions.

Pearl Edison is a full-service design-install air source heat pump contractor based in southeast Michigan. They provide a concierge experience to design and install air source heat pump home heating and cooling systems, and they may only install a HPWH with a whole-house heating and cooling system. Find out more by visiting the [Pearl Edison website](#).

FINANCIAL RESOURCES MA

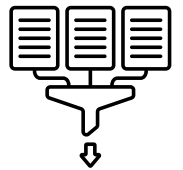
- [Ann Arbor Home Energy Rebates](#): max \$2,000 income qualified rebate / max \$1,000 standard rebate (see [Technical Requirements](#) for rebate eligibility).
- [DTE Rebates](#): depends on the efficiency rating of the HPWH.
- [Inflation Reduction Act Home Energy Rebates](#) administered through the [State of Michigan](#): coming early 2025, home electrification heat pump water heater rebate up to \$1,750.
- [Energy Efficient Home Tax Credit \(25C\)](#): HPWHs with $\geq 75\%$ thermal efficiency rating installed after Jan 1, 2023 may qualify for a tax credit up to \$2,000.

MB MODEL BUILDING

BC BEING CAPABLE

MA MEANINGFUL ACTION

Solar Energy Battery Storage **ESSENTIALS**



MB

WHAT DO YOU NEED TO KNOW?

- Residential solar batteries store energy from the sun as chemical energy that you can use in the future.
- They are **optional**, and can be installed at the time you install your solar array or at a later date.
- Batteries may allow you to install a smaller solar array since it allows you to use more of the solar energy that you capture.



BC

WHY IS IT IMPORTANT?

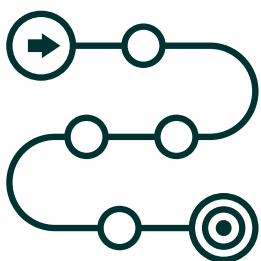
- Batteries create resilience during power outages, allowing you to use stored electricity sometimes for up to 3 days.
- They allow you to store solar energy to use rather than purchasing it from the grid / your local utility.



MA

HOW DO YOU IMPLEMENT IT?

- Contact [Ann Arbor Solarize](#).
- Contact [Ann Arbor Green Energy Neighbors](#).
- Reach out to the [Solar United Neighbors Solar Help Desk](#).
- Take advantage of [Ann Arbor rebates](#) and [federal clean energy tax credits](#).



EXPECTED TIMELINE

- The answer depends on your specific solar energy system
- Contact your solar energy installer for more details



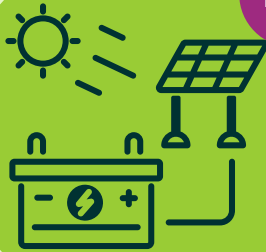
MB MODEL BUILDING

BC BEING CAPABLE

MA MEANINGFUL ACTION

Solar Energy Battery Storage

WHAT?



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- Residential PV, or solar battery storage, involves capturing energy from the sun and storing it in a battery in chemical form, like in a lithium ion battery.
- **Batteries are optional.** Your solar array is “grid-tied” most of the time, which means it feeds excess power you generate into the grid, and then you receive energy back from the grid when you are not generating (e.g., nighttime).
- Batteries can enable you to install a somewhat smaller solar system, as it helps you utilize more of the solar you produce when you need it. A battery will increase your up-front cost.

WHEN & WHY?



BC

- **WHEN:** You can add battery storage to your home solar array when you install it (which may reduce the total cost of the solar + battery system), or you can add battery storage in the future.
- **WHY: Less Expensive Power** – A battery enables you to store your excess energy on site and use it later in the evening, instead of purchasing it back from the utility at a higher rate than what you sell it to them for. **Resilience** – acts as a back-up generator, helping to power your home when the power goes out. If you have a battery back-up, the system switches to this in a power outage.

HOW?



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- Visit the [Ann Arbor Solarize](#) page to find educational materials, learn about the city’s group buy program, and source contractors.
- Find a certified solar battery contractor through Michigan Saves [list of authorized contractors](#).
- Non-profit organization Solar United Neighbors has launched a “[Solar Help Desk](#).” This is a free service that can help you answer your solar questions, understand your solar estimate(s), and more.

\$ SUPPORT



MA

- **Ann Arbor Home Energy Rebates:** income qualified rebate = 30% of cost up to \$3,500 / standard rebate = \$2,000. **Storage capacity > 13 kWh required** (see [Technical Requirements](#) for rebate eligibility).
- In 2023, the IRS released guidelines for homeowners to **claim a tax credit** up to 30% of the costs of new, qualified clean energy property (including PV batteries) for your home installed anytime from 2022 through 2032. You can claim this credit when you file your tax return.

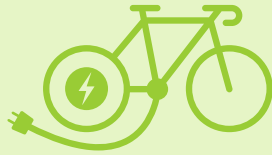


MB MODEL BUILDING

BC BEING CAPABLE

MA MEANINGFUL ACTION

E-Bikes






E-BIKE CLASSES & DEFINITION

MB

To qualify as an **e-bike in Michigan**, the bike must meet the following requirements:

- It must have a seat or saddle for the rider to sit.
- There must be fully operational pedals.
- It must have an electric motor of no more than 750 watts (or 1 horsepower).

 <p>Class 1</p> <p>Equipped with a motor that provides assistance only when the rider is pedaling and disengages or ceases to function when the bike reaches a speed of 20 miles per hour.</p>	 <p>Class 2</p> <p>Equipped with a motor that propels the bike, whether the rider is pedaling or not, to a speed of no more than 20 miles per hour, and disengages or ceases to function when the brakes are applied or throttle is released. Has throttle and peddle assist.</p>	 <p>Class 3</p> <p>Equipped with a motor that provides assistance only when the rider is pedaling and disengages or ceases to function when the bike reaches a speed of 28 miles per hour.</p>
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E-BIKE BENEFITS

BC

- **Physical and psychological:**
 - e-bikes allow you to work almost as hard as you would on a conventional bike without as much muscle strain or sweat.
 - they help you explore more places you aren't as likely to go on a conventional bicycle.
- **Financial:**
 - less expensive to buy, maintain, and insure than a car.
- **Environmental:**
 - produce far fewer emissions and pollution, and they are much quieter than cars and trucks.

REBATES & TECHNICAL REQUIREMENTS

MA

- **Ann Arbor Home Energy Rebates:**
 - STANDARD E-BIKES: income qualified rebate = up to 50% of cost up to \$1,000 / standard rebate = \$250.
 - CARGO E-BIKES: income qualified rebate = up to 50% of cost \$1,200 / standard rebate = \$500.
- **Technical Requirements:**
 - UL 2849 Certified. Motor may not exceed 750 watts and not powered by gas. No retrofit kits. 3 wheels or less and have operable pedals. All three classes of E-bikes will qualify. Rebate may not exceed purchase price.

Home Energy Efficiency Path to Zero Stories

MB MODEL BUILDING

BC BEING CAPABLE

MA MEANINGFUL ACTION

BACKGROUND:

- Household of 4, with 2 adults and 2 children, and a dog. Adults each work full-time, kids in elementary school
- \$64,800 annual household income
- \$3,000 available to spend right now on efficiency upgrades
- Home is cold and drafty in the winter, and gas furnace runs almost constantly
- Home is warm, especially the second floor, in the summer despite central AC
- Gas water heater (age = 11), gas furnace (21), central AC (20) gas stove/oven (12), gas dryer (9)
- These residents feel overwhelmed with all the possible efficiency measures, and excited by Ann Arbor's recently launched Home Energy Advisor and Rebate programs

GOALS:

- make the home more comfortable
- reduce utility bills
- eliminate fossil gas home infrastructure and appliances
- minimize total and upfront costs as much as possible

SUPPORTIVE ENVIRONMENTS FOR EFFECTIVENESS APPROACH TO HOME ENERGY EFFICIENCY

Once the family heard about Ann Arbor's Home Energy Advisor and rebate programs, they started exploring the city websites for more information. They found the Home Energy Effectiveness Toolkit (HEET) and embraced the SEE framework. They used the HEET to start **building mental models**, but they still felt overwhelmed by all of the information. They studied the toolkit in small bite-sized pieces over a period of a few weeks, taking frequent breaks to make sure they **felt capable**. Over time, they understood the importance of accepting where they were starting their journey, and their feeling of overwhelm was OK and to be expected.

They soon felt comfortable enough to **take meaningful action** and start **conducting small experiments**. They scheduled an in-home consultation with Ann Arbor's Home Energy Advisor team who visited the home and shared the following findings:

- home needed to be weatherized
- heat pumps could reduce utility bills post-weatherization and increase comfort
- Path to Zero report steps that the family followed:
 - Contacted Pearl Edison for an easy estimate for a cold climate air source heat pump and heat pump water heater; Pearl Edison provided a quote, visited the home, completed a home energy audit, and confirmed the need for weatherization
 - They encouraged the household to apply for the Washtenaw County Weatherization Program, The county air sealed and insulated their home for free (total cost was \$8,000)
 - Pearl installed a new electric panel (\$2,500 cost), and installed a heat pump (\$16,000) to replace their aging gas furnace and central air conditioner
 - They also installed a new heat pump hot water heater (\$2,500), and tied it into their heat pump

Home Energy Efficiency Path to Zero Stories

MB MODEL BUILDING

BC BEING CAPABLE

MA MEANINGFUL ACTION

PROJECT FINANCIALS:

Efficiency / Electrification Measure	Cost	Program Assistance	AA Rebate	DTE Rebate	Federal Tax Credit	Total Net Cost	Savings	Savings %
Audit	(\$325)	\$325	N/A	N/A	N/A	\$0	\$325	100%
Weatherization	(\$8,000)	\$8,000	N/A	N/A	N/A	\$0	\$8,000	100%
Electric Panel	(\$2,500)	N/A	\$2,000	N/A	\$500	\$0	\$2,500	100%
Cold Climate Air Source Heat Pump	(\$16,000)	N/A	\$3,500	\$250	\$2,000	(\$10,250)	\$5,750	36%
Heat Pump Water Heater	(\$2,500)	N/A	\$2,000	\$500	\$0	\$0	\$2,500	100%
TOTALS	(\$29,325)	\$8,325	\$7,500	\$750	\$2,500	(\$10,250)	\$19,075	65%
Paid up front						(\$2,000)		
Financed through Michigan Saves for 48 months @ 7.5%						(\$8,250)		
Monthly Payment						(\$199)		
Total Interest						(\$1,325)		

Ann Arbor's innovative and supportive home energy programs catalyzed this household's home energy efficiency journey. Initially they felt overwhelmed and stuck because home energy infrastructure was so unfamiliar to them. After learning about all of the support, both programmatic and financial, they felt comfortable enough to start building their understanding, which gave them confidence to start exploring some of the possible home energy efficiency measures. By spending time in this HEET guide, they gradually expanded their mental models, which gave them confidence and helped them feel competent so they could act and move forward on their journey.

Working with the Home Energy Advisor team, Pearl Edison, the Washtenaw County Weatherization Program, and DTE, the family was able to obtain both a home energy assessment from the city and an audit from Pearl Edison. They had the county weatherize their home for free due to their household income level. This program, plus the substantial rebates from the city and smaller ones from DTE combined with tax credits reduced their total costs for an audit, weatherization, an upgraded electric panel, a cold climate air source heat pump, and a heat pump hot water heater from almost \$30,000 to about \$10,000. They financed 80% of the cost through Michigan Saves, a non-profit green bank connecting consumers with contractors and providing low-cost financing for home energy projects.

The family felt inspired, confident, and competent through their process of conducting small experiments to implement home energy efficiency upgrades over the course of 9 months. They continue to share their positive experience with family, friends, and neighbors and they are now exploring the possibility of installing a solar array on their home through the Ann Arbor Solarize program.

Appendix

Useful Links to Information

ENERGY ADVISING, AUDITS & REBATES

- [Ann Arbor Home Energy Advisor](#)
- [Ann Arbor Green Energy Neighbors](#)
- [Ann Arbor Home Energy Rebates & Technical Program Requirements Resource Guide](#)
- [DTE Home Energy Audit Rebates](#)
- [Federal Home Energy Audit Rebates](#)

WEATHERIZATION & ENERGY EFFICIENCY PROGRAMS, REBATES, AND TAX INCENTIVES

- [Washtenaw County Weatherization Assistance Program](#)
- [DTE Energy Efficiency Assistance Program](#)
- [DTE Home Energy Efficiency Rebates](#)
- [Michigan Saves Decarbonization Contractor Pilot](#)
- [Federal Energy Efficient Home Tax Credit \(25C\)](#)
- [Federal Inflation Reduction Act Home Energy Rebates](#)
 - administered through the [State of Michigan](#) (*coming in 2025*)

HEAT PUMPS

- [Ann Arbor Heat Pump Info](#)
- [Ann Arbor Heat Pump Workshop \(Video\)](#)
- [Michigan Saves Decarbonization Contractor Pilot](#)
- [Pearl Edison \(heat pumps\)](#)
- [Efficiency Maine](#)
- [NY State Energy Research & Development Authority](#)
- [US Department of Energy](#)
- [US Department of Energy Heat Pump 101 Video](#)
- [Natural Resources Canada](#)

BATTERIES & SOLAR

- [Ann Arbor Solarize](#)
- [Solar United Neighbors Solar Help Desk](#)

E-BIKES

- [E-bikes in Michigan](#)

FINANCING & CONTRACTORS

- [Michigan Saves](#)

SUPPORTIVE ENVIRONMENTS FOR EFFECTIVENESS

- [reDirect Foundation](#)

References

Kaplan, Rachel. The Small Experiment: Achieving More with Less. Environmental Design Research Association, 1996.