

# MICHIGAN FARMWORKER HOUSING

## ***HEALTHY BUILDING:*** RECOMMENDED STANDARDS



Summer 2024

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***Introduction***

# 01\_Environmental Systems

## *Reversible Heat Pump*

### Air Source Heat Pump System For Farmworker Housing

Agriculture in Michigan depends on rotations of domestic and migrant farmworkers. Farmworker housing may be in operation from early to late fringe season and must be kept at a comfortable temperature the entire duration of occupancy. Owners and operators of farmworker housing in Michigan are encouraged to invest in an air-source heat pump system, as a cost-effective, yet flexible building mechanical system that improves the comfort and livability of farmworker housing. Air source heat pump systems are capable of “reversing” from heating to cooling with the flip of a switch and offer many benefits over conventional mechanical systems.



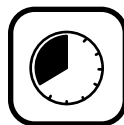
Claim up to **30% tax credits** for heat pump project costs



Heat pump reach up to **300% to 400%** energy efficiency



Lower annual energy-related CO<sub>2</sub> emissions by **36% to 64%**



Long service life of around **20-25 years** with **low maintenance**

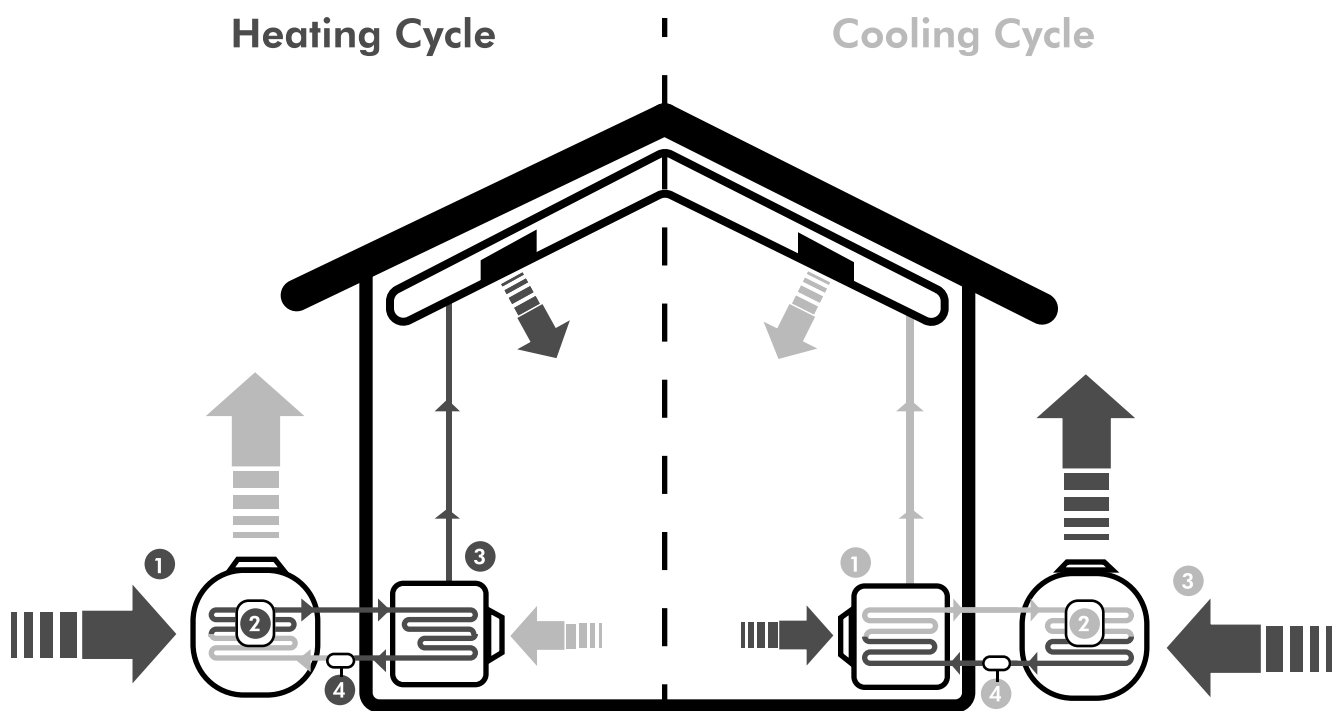
#### Benefits

#### Challenges

- Low running costs can help to reduce building energy bills.
- Heat pumps operate using electricity and produce no emission during operations
- Operate at high efficiency through support from electricity and environment
- Modern heat pump units have life expectancies which are higher than average boiler system

- Higher upfront installation cost, which could deter developers whom are averse to higher upfront costs.
- Less efficient in cold weather due to dependence on outdoor temperature conditions.
- Design, planning, and implementation process could be more complicated without professional services, especially within the context of farmworker housing.

## System Diagram



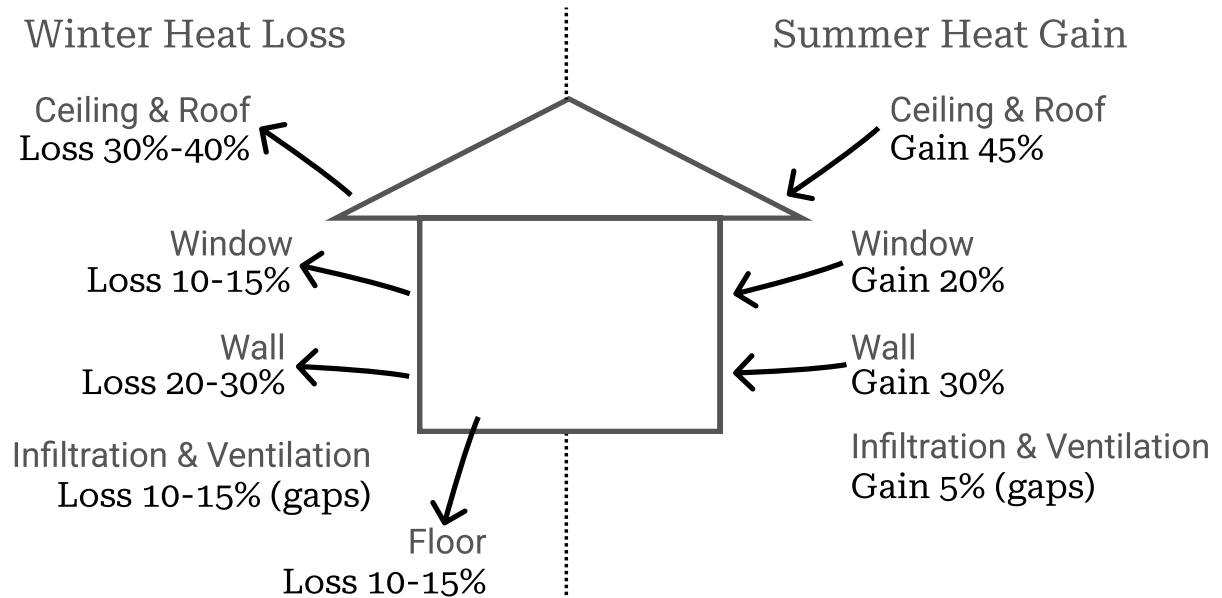
- 1 Heat from outdoor air is absorbed by liquid refrigerant, which evaporates in a low-temperature gas.
- 2 Compressor raises temperature and pressure of refrigerant gas
- 3 The high-temperature, high-pressure refrigerant gas releases heat to indoor air and condenses into a high-temperature refrigerant liquid.
- 4 The liquid refrigerant is passed through an expansion valve, relieving pressure and temperature as the cool refrigerant is cycled into the outdoor coil unit

- 1 The heat from warm air indoors is absorbed by a cool refrigerant coil, which evaporates into a low-temperature gas, and the cool air is ducted back throughout the building
- 2 Compressor raises temperature and pressure of refrigerant gas
- 3 Hot, high pressure refrigerant gas is passed through the outdoor coil, passing heat to outdoor air and condensing into a high temperature refrigerant liquid
- 4 The liquid refrigerant is passed through an expansion valve, relieving pressure and temperature as the cool refrigerant is cycled indoors

# Insulation

## Why Insulate?

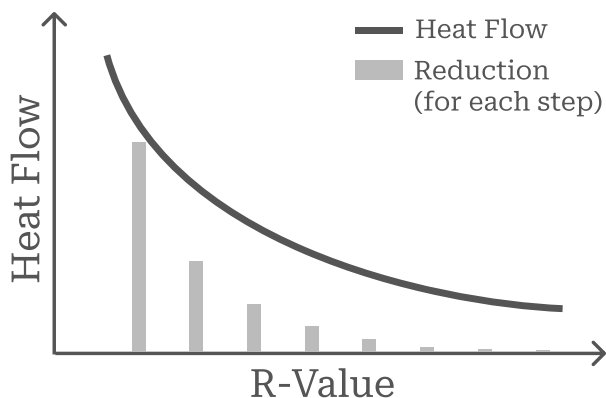
Without Insulation...



Approximate Winter Heat Loss and Summer Heat Gain

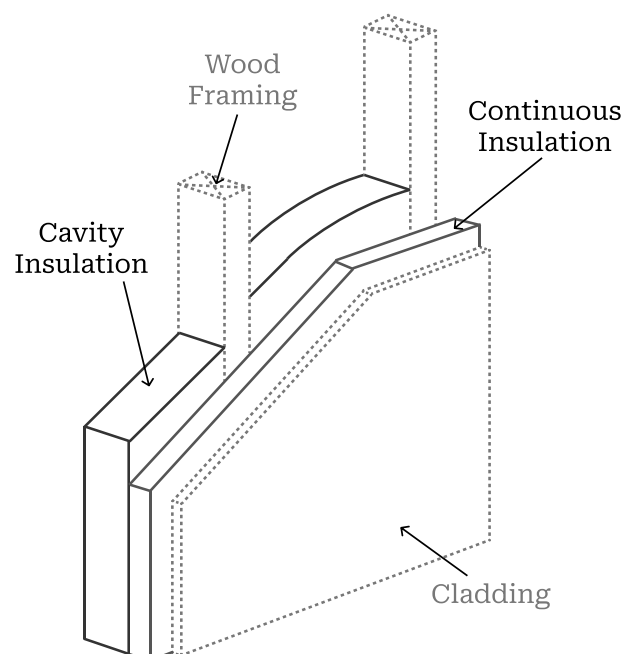
While using air conditioning/heating to sustain temperature spends energy dollars.

### The "Diminishing Returns" of Adding More Insulation



Rule: Adding any insulation to uninsulated homes can save more energy than adding more insulation to already-insulated homes.

### Types of Installations



# Insulation Strategies

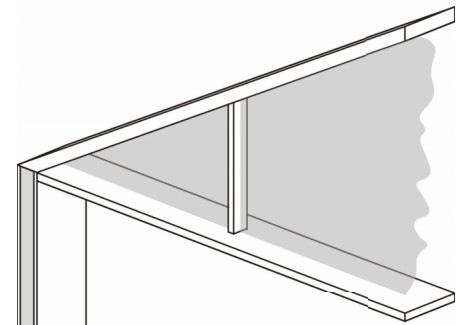
## Material Recommendation (Cavity)

### Blown-in Cellulose:

- R13: Typically **\$1.5** per square foot
- R49: Typically **\$6.0** per square foot
- Pros: **Easy to install, Pest Resistant**
- Cons: **Packs down easily, Molding**

### Blown-in Fiberglass:

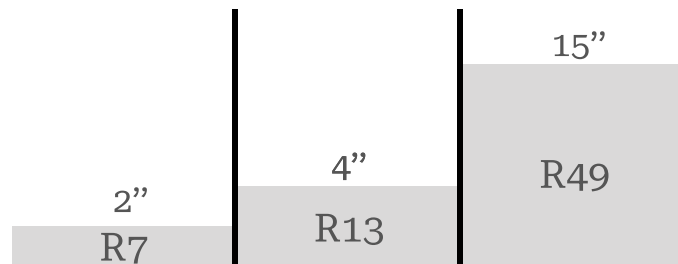
- R13: Typically **\$1.2** per square foot
- R49: Typically **\$3.5** per square foot
- Pros: **Non-combustibility, Sound-dampening**
- Cons: **Coverage, Less effective to air leaks**



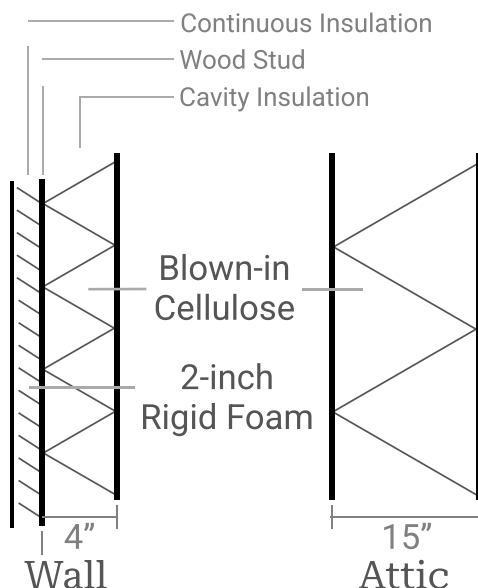
Insulation Placement

## Thickness

The effectiveness of insulation improves with increased thickness.



## Implementation Sample (Based on 2024 Market Value)



### 2,000 sqft R13 wall + 2,000 sqft R49 attic

#### Material Cost:

Cellulose:  $2000 \times \$1.5 + 2000 \times \$6.0 = \$15,000$

Fiberglass:  $2000 \times \$1.2 + 2000 \times \$3.5 = \$9,400$

Installation Cost: Typically **\$2,000 - \$3,000**

Overall Cost: **\$11,400 - \$18,000**

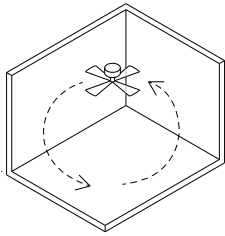
Savings: **\$5,500/yr** if fuel is electricity

Payback for investment: **< 4 years**

# Ventilation

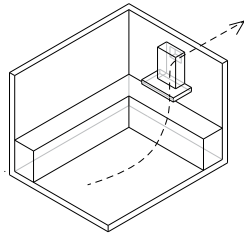
## ACTIVE SYSTEMS: VENTILATION

Active environmental systems use of electricity to regulate building temperature. A major active system is air ventilation, which can cool interior temperatures and circulate air in buildings. This is important for maintaining air temperature and air quality.



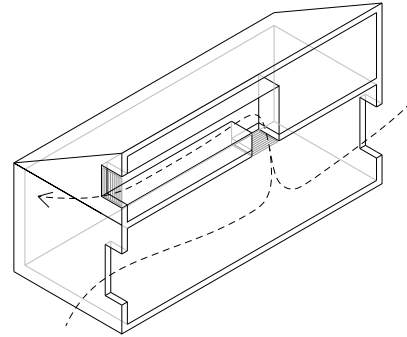
### Ceiling Fans:

Offer cooling through air circulation. Great option when outside air quality is bad (eg: during wild fires)



### Hood/Ceiling Vents:

Ventilates air out and helps air quality and prevent mold growth. Great for damp spaces like kitchens/bathrooms.



### Whole House Fan:

Pulls cool outside air from windows and pushes hot inside air out through the attic. Whole house fans typically use less energy than air conditioners, and helps keep temperatures down.

The options listed above mostly deal with permanent systems that control air quality and temperature through air circulation. The following options cover varying A/C options.

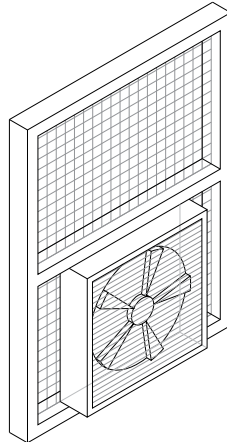
### Box Fans:

+Offers cooling through air circulation  
+Cheap and available  
+Portable

-May damage window screens  
-Doesn't actually cool air

### Air filters:

Box fans aren't designed for air filters in mind, however, there are DIY options and filters sold for window box fan set-ups.



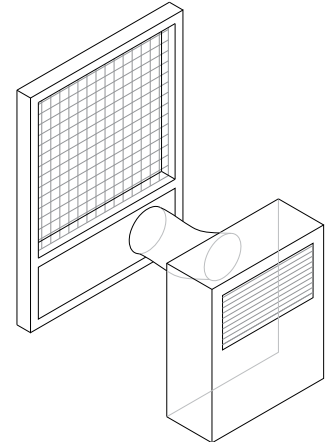
### Portable A/C Unit:

+Fairly affordable and available  
+Works for varying window types  
+Portable/easy to install

-May damage window screens  
-Not as efficient as window units

### Air filters:

Air filters are often built into the portable units, with filters being washable and replaceable.



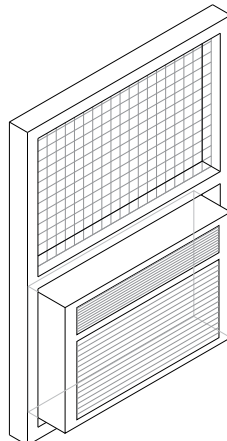
### Window A/C Units:

+Fairly affordable and available  
+More efficient than portable units

-Difficult to install  
-Permanent

### Air filters:

Similar to the portable A/C units, filters are also often built into window A/C units. There are often more filter options for window units however.



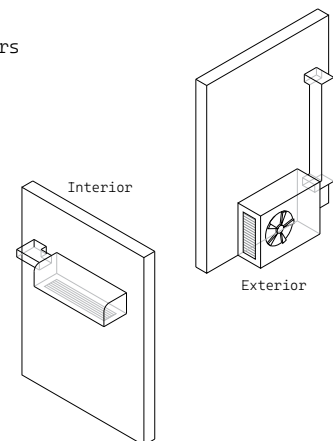
### Mini-Split:

+Longer lifespan than others  
+Cools larger area  
+Energy efficient  
+Can lower humidity

-Expensive up-front cost  
-More complicated installation

### Air filters:

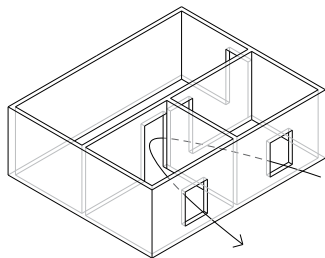
Like the portable and window A/C units, Mini-Splits often have filters built into their system.





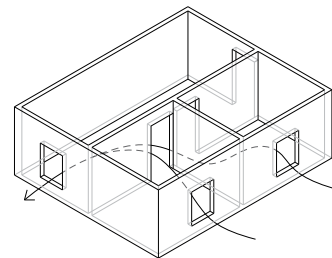
# PASSIVE SYSTEMS: VENTILATION

Passive environmental systems are a set of building techniques/features designed to keep buildings cooler in the summer and warmer in the winter, without the use of electricity. Some examples include window shades and insulation. These passive systems reduce the use of electricity which can reduce energy costs while making buildings more comfortable to live in. A major passive system is air ventilation. Proper ventilation of air can cool temperatures throughout a structure with the help of wind, while also improving inside air quality by bringing more outside air in.



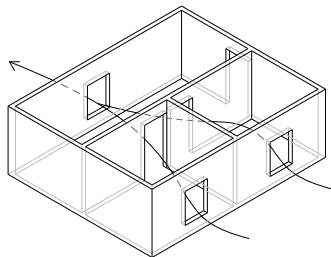
## Single-Sided Ventilation:

Building only has openings on one side.  
This is the least effective way of passive ventilation.



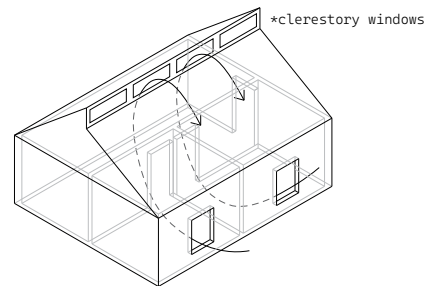
## Angled Cross Ventilation:

Building only has openings on two sides, but not on opposite sides. Ventilation is better than single-sided.



## Cross Ventilation:

Building only has openings on opposite sides.  
This is one of the most effective ventilation methods, with air exchange being high.

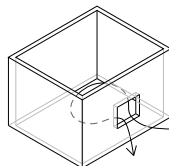


## Stack Ventilation:

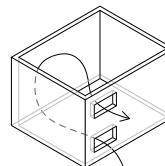
Building has windows at a high location.  
One of the most effective methods, as the height difference allows hot air out and cool air in.

The height placement of windows matters as well. **Windows that are placed at different heights, as well as on different sides of walls are able to circulate more air throughout a space.** This is because the height difference between windows creates a pressure difference, leading to more ventilation. These windows also allow for higher hot air to flow out and lower cool air to come in.

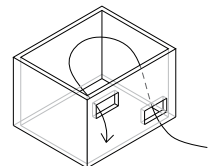
Good



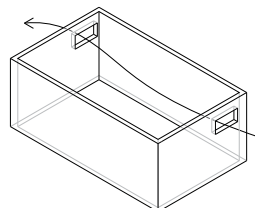
Better



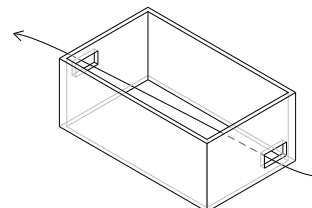
Best



Better



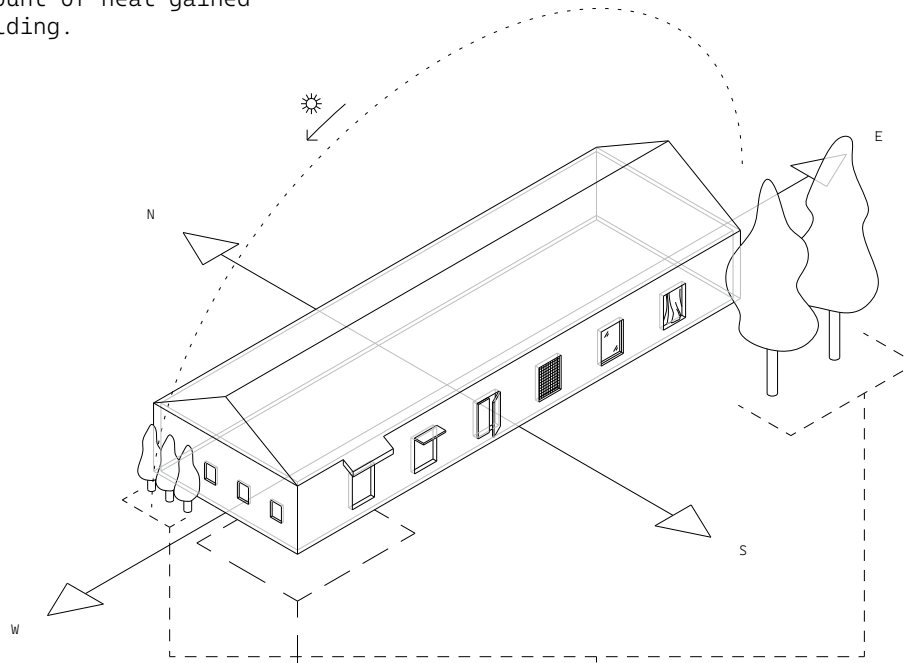
Best



# Shading

## PASSIVE SYSTEMS:SHADING

Proper shading reduces the amount of sun that gets into the building through window/door openings, which reduces the amount of heat gained inside the building.

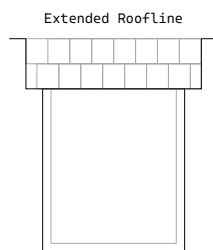


**Smaller East/West facing windows** on the side of buildings will reduce the amount of light and heat let in by intense morning and late afternoon summer sunlight.

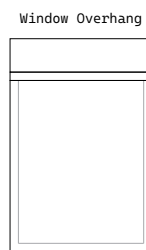
**Trees and other vegetation** on the sides of the building, in particular the South side, reduce the amount of direct sunlight contacting the building, reducing the amount of heat gained.

There are various kinds of window coverings and shades that can reduce the amount of sunlight let in throughout the day.

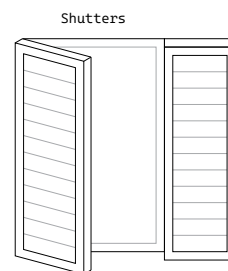
However, although they are more exposed to the elements, **exterior shading options are more effective than interior shades** like curtains or window covers. This is because exterior coverings prevent direct sunlight from contacting the window glass/pane. This reduces the amount of direct sunlight that the building interior comes into contact with.



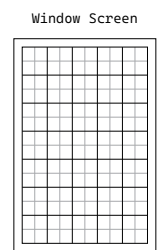
Extended Roofline



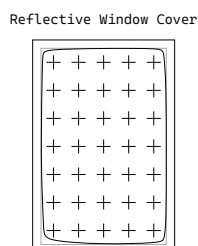
Window Overhang



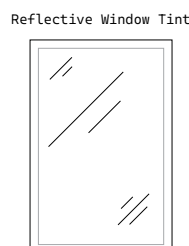
Shutters



Window Screen



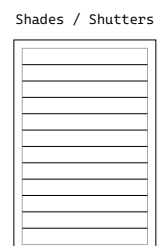
Reflective Window Cover



Reflective Window Tint



Curtains

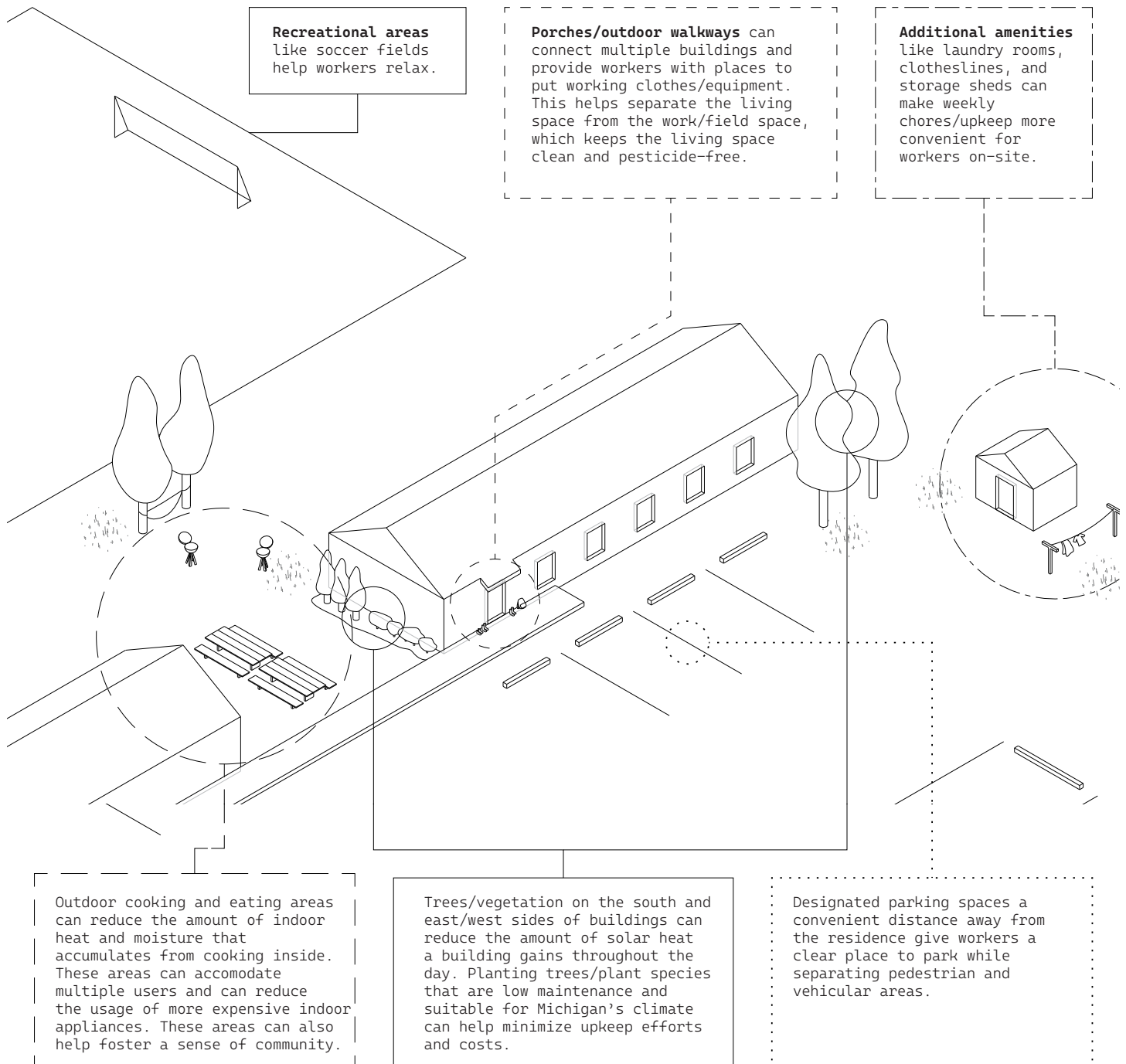


Shades / Shutters

# 02\_Site Strategies

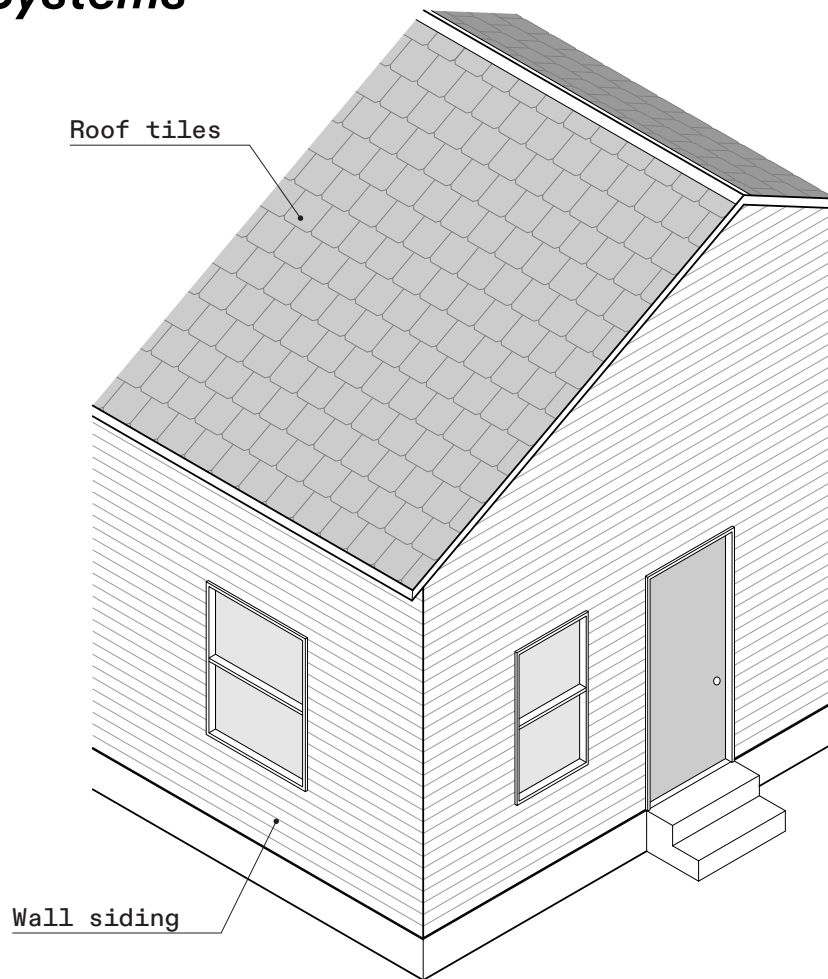
## Landscape

Carefully considered outdoor areas and siting strategies can lessen the heat load within dwellings while also improving the quality of life for migrant workers. Investing in the quality of worker living conditions can lead to a more healthy and productive workforce.



# 03\_Materials and Fixtures

## Cladding Systems



## SIDING CHOICES

### VINYL

- + Least upfront cost
- + Rot resistant, low maintenance
- Prone to warping and fading
- Not environmentally friendly material

### FIBER-CEMENT

- + Excellent fire resistance
- + Lasts 30-50 years
- Higher upfront cost
- Requires specialized labor

### WOOD

- + Sustainable and biodegradable
- + Natural insulation properties
- Higher upfront cost
- Requires regular maintenance

### METAL

- + Highly durable and weatherproof
- + Low maintenance
- + Can be recycled
- Higher cost upfront
- High surface temperature in summer

# Interior Finishes

## Score Guidelines:

**Cost (\*)** price of upgrade and labor (higher score = more affordable)

**Durability** lifespan and damage resistance

**Maintenance** ability to clean and ease of care

*\*based on 2024 market price*

**Backsplash**

**Fiber Reinforced Panels**

Cost	●●●●
Durability	●●●○
Maintenance	●●○○

**Glass / Metal**

Cost	●●○○
Durability	●●●○
Maintenance	●●●○

**Tile**

Cost	●●●○
Durability	●●●○
Maintenance	●●●●

**Countertop**

**Plastic laminate**

Cost	●○○○
Durability	●●○○
Maintenance	●●●○

**Coated concrete**

Cost	●●○○
Durability	●●●○
Maintenance	●●○○

**Ceramic tile**

Cost	●●●○
Durability	●●●●
Maintenance	●●○○

**Wall & Ceiling**

**Drywall**

Cost	●○○○
Durability	●●○○
Maintenance	●●○○

**Painted OSB**

Cost	●●○○
Durability	●●●○
Maintenance	●●●○

**Fiber Reinforced Panels**

Cost	●●●○
Durability	●●●●
Maintenance	●●●●

**Flooring**

**Painted Plywood**

Cost	●○○○
Durability	●●○○
Maintenance	●●○○

**Coated concrete**

Cost	●●●○
Durability	●●●○
Maintenance	●●●○

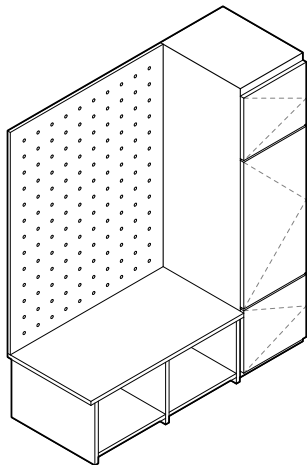
**Ceramic tile**

Cost	●●○○
Durability	●●●●
Maintenance	●●●●

## FINISHES SUGGESTION

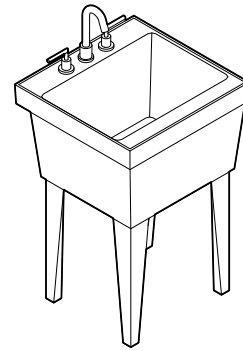
Learn more at [www.michigan.gov/mdard/environment/migrantlaborhousing](http://www.michigan.gov/mdard/environment/migrantlaborhousing)

## Personal Space Recommendations



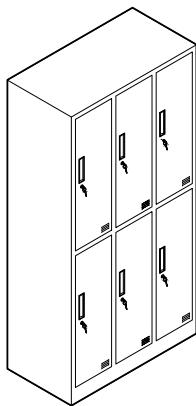
**Mudroom**

A mudroom with benches, hooks, and storage bins to keep field gears separate from living area. The flooring in the mudroom is designed to withstand heavy traffic and is made from easy-to-clean materials like tile, stone, or vinyl.



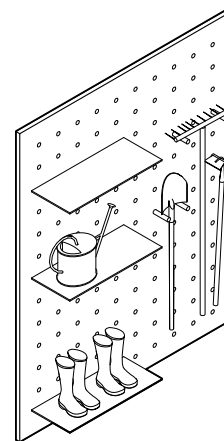
**Sanitation station  
at Entryway**

Handwashing and sanitation stations near the entry to maintain cleanliness. These stations should be equipped with soap, water, hand sanitizers, and paper towels or air dryers. Clear signage should be provided to guide individuals to these stations, emphasizing the importance of hand hygiene.



**Personal lockers**

Chests, trunks, bed with storage for personal valuables, offering ample space and often feature locks and decorative designs while maximizing space efficiency in small living areas.



**Shelving units**

Keep work clothes, which may have been exposed to pesticides, separate from the living areas; ensure that farmworkers maintain a healthier living environment.

# 04\_Resources

## Energy Rebate Program

### PROGRAM BACKGROUND

The Inflation Reduction Act (IRA), signed into law on Aug. 16, 2022, provisions a combined \$8.8 billion dollars of Home Efficiency Rebates (IRA Section 50121) and Home Electrification Rebates (IRA Section 50122) to be administered through state energy offices. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) is preparing to open the combined Home Energy Rebate Program to households in October 2024\* to distribute \$211.1 million in energy rebates to single- and multi-family households across the state. While the rebate program design and requirements have yet to be finalized, details shared at a series of town halls throughout 2024 as well as guidelines within the IRA itself lay out broadly the parameters of the program.

### MICHIGAN'S \$211M FUNDING ALLOCATION

#### HOME EFFICIENCY REBATES: \$105.9M

- Whole-house energy saving retrofits
- Additional low-income (< 80% AML) incentives
- For 20% modeled or 15% measured energy savings

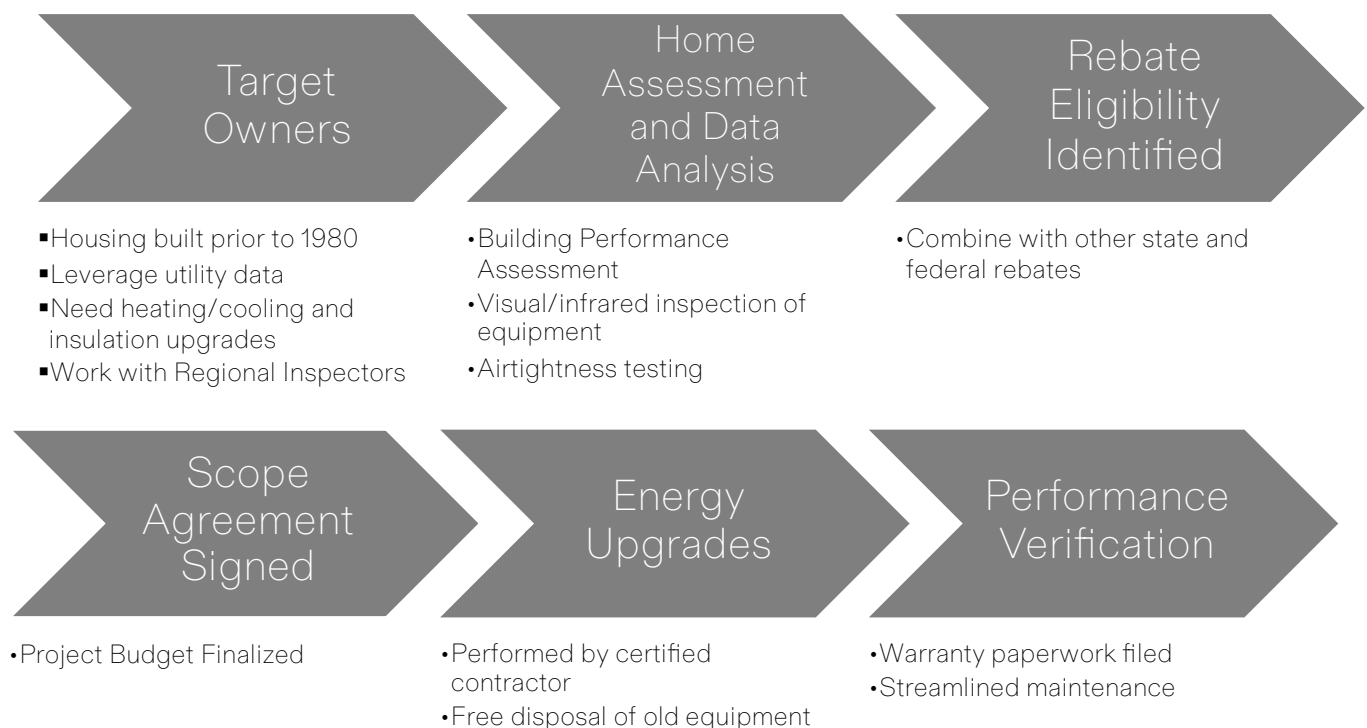
#### ELECTRIFICATION AND APPLIANCE REBATES: \$105.3M

- Rebates for qualified electrification projects
- Additional low-income (< 80% AML) incentives

#### QUALIFIED PRODUCTS AND MAX. REBATE:

Heat pump, space heating/cooling .....	\$8,000
Heat pump, hot water.....	\$1,750
Heat pump, clothes dryer .....	\$840
Electric kitchen oven/cooktop .....	\$840
Insulation, air sealing, and ventilation.....	\$1,600
Electric wiring.....	\$2,500

## TAX REBATE PROCESS: HOW IT WORKS



**\*Program launch date tentative. Please refer to EGLE for latest information.**

<https://www.michigan.gov/egle/about/organization/materials-management/energy/rfps-loans/home-energy-rebate-programs>

## ***Conclusion***



## ***Credits***