

College of Saint Benedict and Saint John's University

DigitalCommons@CSB/SJU

---

Environmental Studies Student Work

Environmental Studies

---

12-1-2022

## What Technologies and Barriers are Present in Sustainable Heating and Cooling

Mason D. Nibbe

College of Saint Benedict/Saint John's University, mnibbe001@csbsju.edu

Follow this and additional works at: [https://digitalcommons.csbsju.edu/environmental\\_studies\\_students](https://digitalcommons.csbsju.edu/environmental_studies_students)



Part of the [Environmental Studies Commons](#), and the [Sustainability Commons](#)

---

### Recommended Citation

Nibbe, Mason D., "What Technologies and Barriers are Present in Sustainable Heating and Cooling" (2022). *Environmental Studies Student Work*. 6.

[https://digitalcommons.csbsju.edu/environmental\\_studies\\_students/6](https://digitalcommons.csbsju.edu/environmental_studies_students/6)

This Poster is brought to you for free and open access by DigitalCommons@CSB/SJU. It has been accepted for inclusion in Environmental Studies Student Work by an authorized administrator of DigitalCommons@CSB/SJU. For more information, please contact [digitalcommons@csbsju.edu](mailto:digitalcommons@csbsju.edu).

# What Technologies and Barriers Are Present In Sustainable Heating and Cooling

Author: Mason D. Nibbe

ENVR 320 Fall 2022

Advisor: Corrie Grosse

## Abstract:

Sustainable heating and cooling practices can save homeowners money and reduce their carbon emissions. In the cold upper Midwest, Minnesota specifically, there are ways houses can be more efficient in terms of heating. The most efficient and practical are heat pumps systems, passive solar designs, and proper insulation of the building. This study is targeted at both existing buildings and the construction of new buildings. This project focuses on what sustainable heating and cooling practices, technologies, and barriers are present in the heating, ventilation, and air-conditioning (HVAC) industry. I find that using any sustainable solution is helpful, but multiple solutions supplementing each other have better results.

## Background:

Minnesota is significantly more dependent on non-renewable sources of energy compared to the rest of the country. Minnesota has the potential to make a large change toward greener heating and cooling solutions. By reducing energy demand GHG emissions will decrease while increasing energy security.

Energy Source Used for Home Heating	Minnesota	U.S. Average
Natural Gas	66.20%	47.80%
Electricity	17.30%	39.50%
Propane	11.20%	4.80%
Other/None	5.30%	7.90%

Figure 1. Source of energy used to heat homes in Minnesota.

## Methods:

A literature review was conducted to gain background knowledge of different systems and designs for green heating and cooling. The results of case studies were compared against each other to create efficiencies and cost analysis. To find out about incentives, tax breaks, and overall support, government sources were reviewed. To get the opinions of experts in the field and to bring the literature review together, three interviews were held. Each interview was conducted one on one over the phone.

- Steve Sherman: 44 years of experience and is currently the sales manager at Mission Mechanical.
- Ryan Hjelle: 17 years of experience and is currently the vice president of business at Ellingson's.
- Wade Nibbe: 17 years of experience in installation, maintenance, and now management.

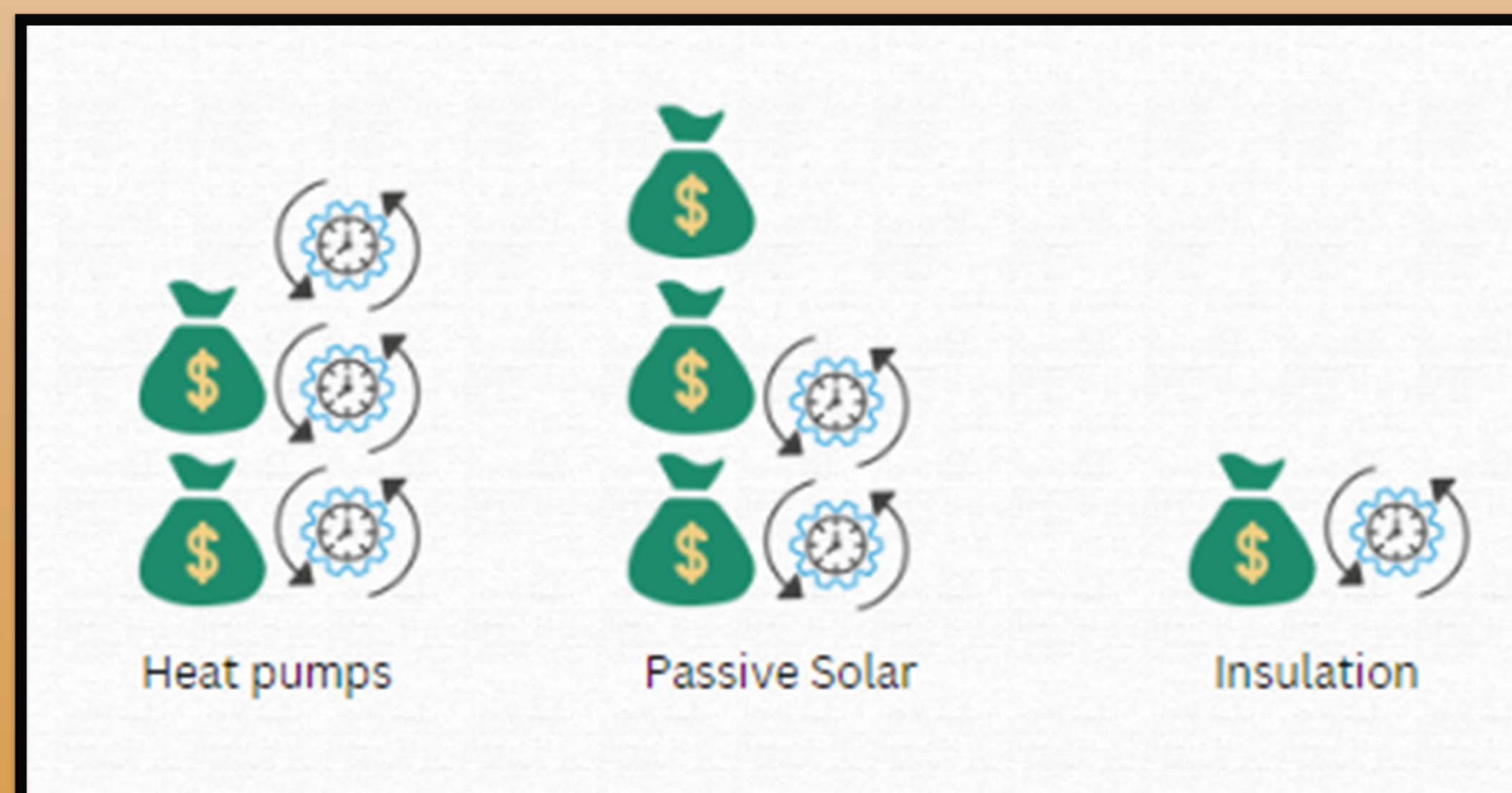


Figure 2. Efficiency and cost comparison.

## Further information:

Hawken, Paul. *Regeneration Ending the Climate Crisis in One Generation*. Penguin Books, 2021.  
Ahmad, Mukhtar. *Operation and Control of Renewable Energy Systems*. Newark, UK: John Wiley & Sons, Incorporated, 2017.

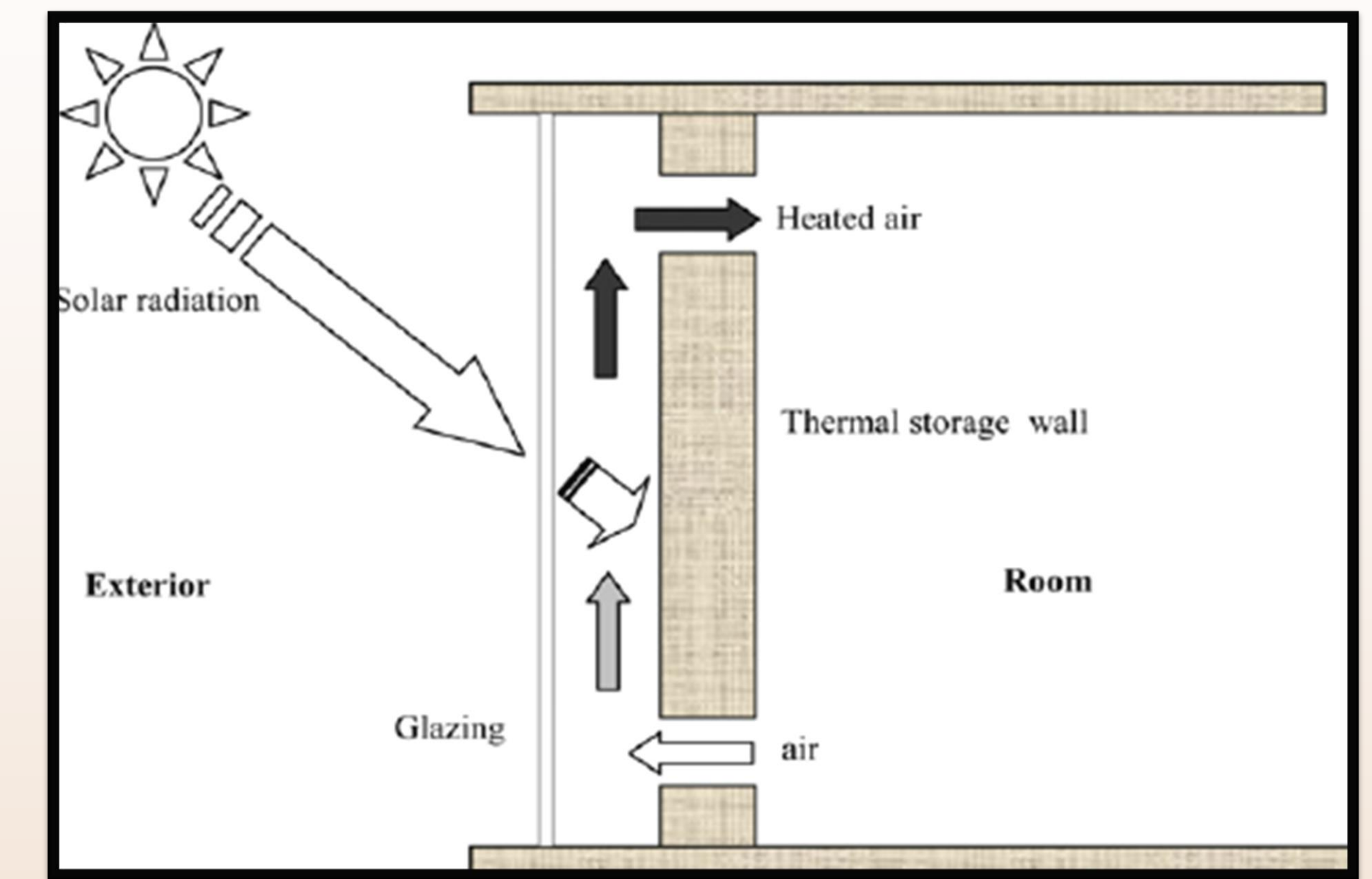


Figure 3. Diagram of Trombe Wall

## Results:

Changing to sustainable heating and cooling needs to come from the consumer. To help homeowners achieve their goals of more efficient heating and cooling, and greener sources of heat government support are needed. Interviewees suggest there is a low demand for heat pump units. There are two reasons for this, first is cost, and second is trust in the systems. Regarding cost, it is the upfront cost to install or purchase units. The operating cost is lower, and the longer the system lasts, then the more money will be saved, it is an investment as much as it is a climate crisis solution. Passive solar was described as the most expensive, the variation in building materials and design by case-by-case scenarios makes passive solar difficult to calculate the cost. Improving insulation within the home is an upgrade that can vary in cost and efficiency. With insulation improvements being the cheapest solution, it is also the most achievable. What the homeowner can afford is a primary component to decide which aspect or aspects can be implemented. Based on interviews, sales of heating systems are not favored for or against sustainability, so remaining neutral and giving the buyers the facts for them to make their own decision. Experts recommend GSHP in new homes, this allows the owners to bare the upfront costs by adding it to the mortgage. For existing buildings upgrading traditional systems to ASHP will provide higher efficiency, both environmentally and financially.