# REDUCE ENERGY CONSUMPTION?

SERIES ON SUSTAINABILITY **2 of 6**

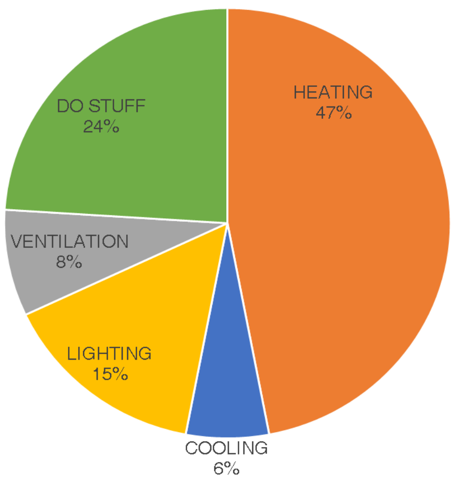
## WHAT ARE THE BIGGEST DRIVERS OF ENERGY USE?

**BUILDING USE ENERGY.** In fact, roughly 40% of all energy consumed, 70% of all electricity consumed, and a third of all CO2 emissions in the United States come from the built environment. This makes the building sector the largest individual contributor to greenhouse gas emissions.

Five reasons why buildings use energy:

1. **HEAT** – Provide occupant comfort
2. **COOL** – Provide occupant comfort
3. **VENTILATE** – Provide fresh air to occupants
4. **LIGHT** – Illuminate spaces so occupants can see
5. **"DO STUFF"** – Everything else that consumes energy in a building, such as industrial processes, computer plug loads, cooking food, or heating a pool.

In Minnesota, energy used in a commercial building will typically fall into one of these five categories:




**Energy usage is a function of what you are asking the building to do (or the building type) and what climactic conditions exist at the site.**

| Building Type | |
|---|---|
| Food Service - Fast Food | Higher average energy consumption per square foot |
| Healthcare - Hospital Inpatient | |
| Public Assembly - Library | |
| Office - 100,000 sf or greater | |
| Public Assembly - Entertainment/culture | |
| Lodging - Hotel/Motel | |
| Office - 10,000 sf - 100,000 sf | |
| Healthcare - Clinic | |
| Bank/Financial Institution | |
| Education - K-12 School | |
| Office - 10,000 sf | |
| Religious worship | |
| Residential - Single Family Detached | Lower average energy consumption per square foot |

### SO, WHAT CAN WE DO TO REDUCE ENERGY CONSUMPTION?

At a high Level, the following strategies can be employed to reduce energy consumption for each desired outcome:

**1. HEATING**

- More insulation
- Higher heating efficiencies (Thermal Efficiency, COP, HSPF)
- Fewer windows first, then lower window U-Value*
- Reduced ventilation through controls or through providing the minimum code required amount

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# WHAT CAN WE DO TO REDUCE ENERGY CONSUMPTION?

**2. COOLING**

- Economizers**
- Higher cooling efficiencies (EER, SEER, IPLV, IEER)
- Lower SHGC or U-Value Glazing*

**3. VENTILATION**

- Demand control using occupancy sensors or CO2 controls**
- Heat Recovery of outside air**
- Not providing excess ventilation air***

**4. LIGHTING**

- Lower lighting power density which can be achieved through higher efficiency luminaire/ lamps or lower lighting levels
- Good use of daylighting and automatic controls

**5. DO STUFF**

- EnergyStar appliances wherever applicable
- Do stuff in isolated environments (e.g. data centers with hot/cold aisles, air compressors in separate rooms)
- Reclaim excess heat from process equipment
- Occupancy sensor controls of receptacle plug loads

* *Lower window U-value improves building energy performance for both heating and cooling. However, lower SHGC (Solar Heat Gain Coefficient) or SC (Shading Coefficient) reduces cooling energy but increases heating energy because you're getting less heat gain from the sun into the building through glazing. In MN, it's often the best energy outcome to have the maximum SHGC that is allowed by code because our buildings are heating dominated, the energy cost impact may be different than the energy use impact.*

** *As with all strategies, implementation of these items is critical and often done incorrectly. If they aren't set up correctly, they can significantly increase energy use and energy costs. Utilizing a commissioning provider can ensure these systems work as intended.*

*** *In terms of Indoor Air Quality (IAQ), providing excess ventilation air is a common strategy to improve human health. It's important to note that ANY TIME we increase minimum ventilation air quantity, there is a trade off with higher energy usage and energy costs.*

**ENERGY USE VS. ENERGY COST:**

Energy use and energy cost are not interchangeable, and it's important to be specific about which metric we're talking about. This is most important when choosing between electricity and gas. We make this choice as designers primarily when considering heating, water heating, and appliances.

**Unit Conversion:** 1 Therm = 29 kWh
**MN 2020 Prices:** 1 Therm of gas = $0.818 / 1 kWh of electricity = $0.1003 / 1 Therm of electricity = $2.91

When comparing for heating or water heating, gas-fired equipment has an efficiency of 80% - 96%; electric resistance has an efficiency of 100%. Including efficiencies, electric resistance heat is 2.8 - 3.3 times more expensive to operate than gas heat in Minnesota in 2020.

Heat pumps are more complicated because the heating efficiency varies depending on the outdoor air temperature. At low outdoor air temperatures, the heat pump stops working and backup heat is needed (generally electric resistance heat at temperatures below 5° F, depending on the equipment). So even though heat pumps have efficiencies of 2.5 - 3.5 COP (250% - 350%), they also cost more to operate in Minnesota in 2020 by 1.3 to 2.0 times. In more moderate climates, the air-source heat pump may actually cost less to operate depending on utility rates.

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