

HVAC

Description of Mechanical Systems in Buildings that are responsible for Heating, Ventilation, and Air Conditioning. Will dive into control and energy efficiency optimization. Learning about HVAC provides a great foundation for learning more about power plants, industrial processes, construction management, management and maintenance of buildings, automation and control, and decarbonization. I highly recommend being familiar with the basics of HVAC.

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Overview of Temperature Control Systems

Many houses don't have ventilation systems, you have to open your windows, so we'll cover the V of HVAC later. The H and AC are often connected, you might have a house that has a combo unit. And to make things more complicated, you might be using air to both distribute energy and release it.

Lets break down the 3 main parts of an hvac system

- Energy Generation (your boiler and AC unit)
- Energy Distribution (your steam pipes or air ducts)
- Energy Release (your radiators or air vents)

Lets also look at the different types of energy distribution.

- Air
- Water
- Steam
- Refrigerant
- Gas

If you are experienced in commercial HVAC, you might already know you can use multiple methods of distributing energy in a single system. This can be complicated for the novice of HVAC. Lets break down a single system. In fact, it was the first HVAC system, and all it did was heating. It is the steam boiler system.

[image of steam boiler with pipes]

This is as simple as you can get, you boiler water, it floats into the radiators, and goes back down the same pipe. You have no control, but require no electronics. These were run by coal boilers, then upgrades to oil, and now most are natural gas, some in quebec are electric.

We made this smarter by flooding the pipes with water, and using a pump to circulate the water.

[image of system]

This has the advantage of never exposing the pipes to oxygen during operation, and allowing the system to operate at a lower temperature.

Eventually we wanted air conditioning. However, if you cooled down the hot water pipes, water would condense all over them and make mold walls and units. The most common way to cool a space is with an air distribution system.

Lets show what an air conditioner is though, then we can tie it to an air distribution system.

[image of window ac unit]

[image of split system]

[image of chiller]

[image of air distribution system with cooling]

Now that we have air distribution systems explained, we can describe ventilation. All you have to do is add an outside air and exhaust duct. The most common type is an "H Type" ventilation system.

[image of h type]

The great thing here is you can connect any distribution system to it and transfer the energy to the room via air. Or you can use it in combination with in unit heating/cooling like radiators.

The final step here is a quick explanation of temperature controls. The key is tie each controllable item with a single sensor. The easiest example is a hot water radiator. The boiler keeps the water at a constant temperature, lets say 180. Then you just control the valve to change the flow into the radiator. This valve is connected to a thermostat, so it changes the position based on how far the room is from the desired temperature. It works like cruise control on a car!

[image of radiator]

Steam

Everything You need to know about steam

Steam

Types of Steam Systems

You have 1 pipe and 2 pipe steam. Add a diagram!