1 **HIGH-PRESSURE STEAM** is routed from the wood-CHP boiler to the turbine.

2 **TURBINE BLADES** spin at nearly 100 revolutions per second. Steam acting on the turbine blades creates mechanical energy in the **TURBINE**.

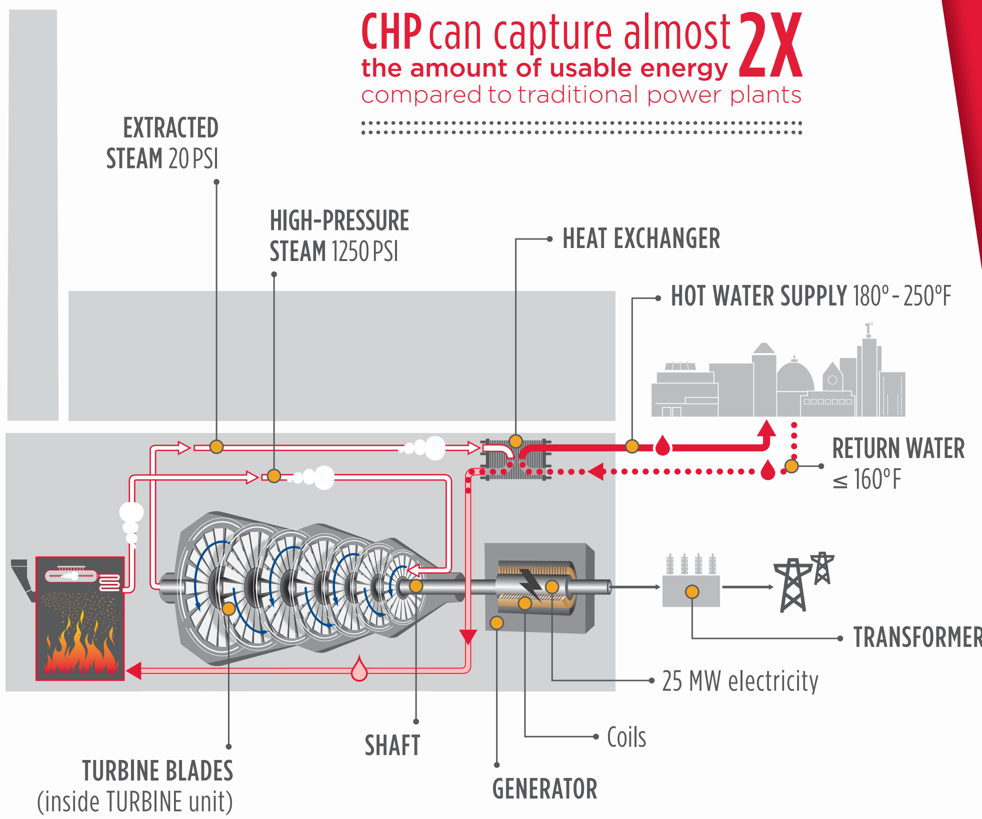
3 The mechanical energy output from the turbine drives the **SHAFT** that connects the turbine and the **GENERATOR**. As the shaft spins, it rotates coils within magnets inside the generator, converting mechanical energy to electricity.

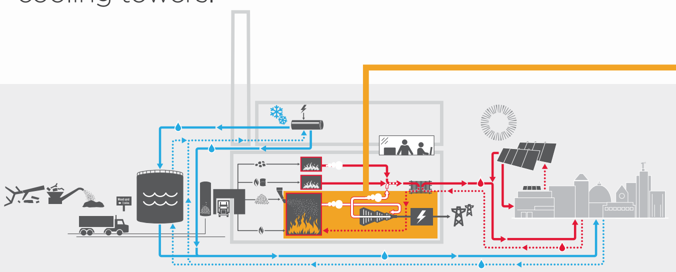
4 The **GENERATOR** produces electricity at 13.8 Kv, which is sent to a transformer in a substation at a nearby power plant to increase voltage to 115 kV, matching voltage on the transmission system (the grid). Some of the electricity is used for plant operations at various voltages (4160 and 480 volts) via **TRANSFORMERS**, switchgear, and circuit breakers in the plant.

5 This production of electricity by the turbine-generator reduces the **HIGH-PRESSURE STEAM** to **EXTRACTED STEAM**, which is exported to a **HEAT EXCHANGER** to transfer the energy to the District Energy **HOT WATER SUPPLY**.

6 Low-pressure steam that cannot be utilized for heating and cooling must be cooled and the heat released through cooling towers.

CHP can capture almost 2X the amount of usable energy compared to traditional power plants





CHP-turbine room

1 Biomass **(WOOD CHIPS)** moves through a conveyor that drops the wood chips down into five **METERING BINS**.

2 The **METERING BINS** control the flow of **WOOD CHIPS** into the **BOILER**, to optimize combustion conditions. **NATURAL GAS** is injected to increase the combustion temperature and stability.

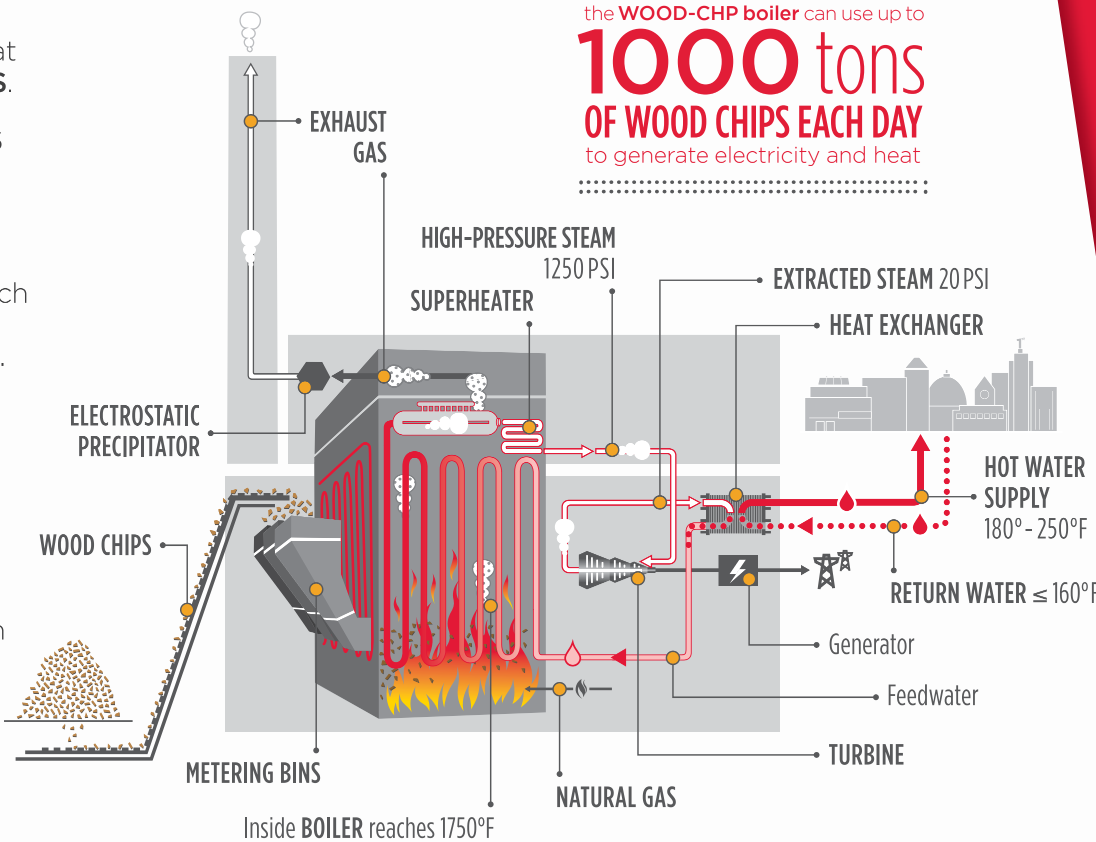
3 The boiler walls are lined with pipes filled with water, which absorb the heat from the combustion and raise the temperature of the water to **HIGH-PRESSURE STEAM**. High-pressure steam traverses the **SUPERHEATER**, which prepares the steam to be sent to the **TURBINE**.

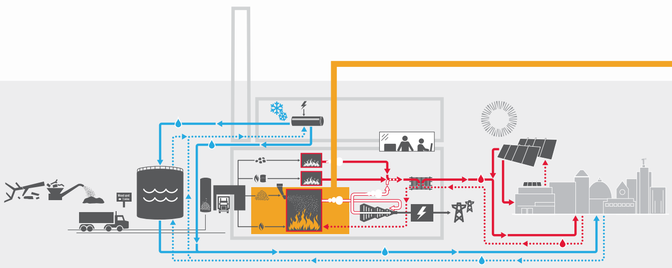
4 **EXTRACTED STEAM** captured from the electricity generation process is used to heat water for the District Energy **HOT WATER SUPPLY**.

5 The combustion of the **WOOD CHIPS** and **NATURAL GAS** creates combustion gases **(EXHAUST GAS)**, which pass from the boiler through an **ELECTROSTATIC PRECIPITATOR**, which removes particulate before exhaust gas is released through the stack.

6 Ash remaining from the combustion is beneficially reused whenever possible, primarily for agriculture purposes.

the **WOOD-CHP boiler** can use up to
1000 tons
OF WOOD CHIPS EACH DAY
to generate electricity and heat





wood-CHP boiler

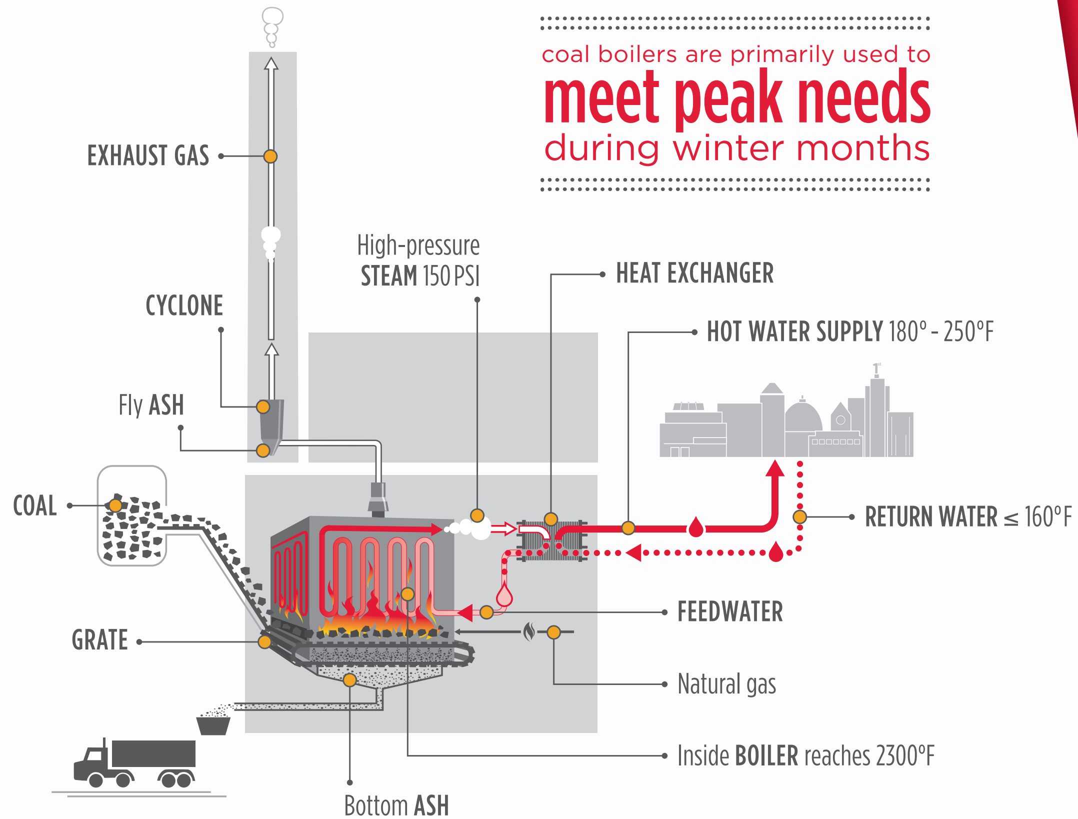
1 **COAL** is dispatched onto a flat **GRATE**, to allow combustion air to contact the coal. The grate moves the coal into the boiler for combustion at ~2300°F.

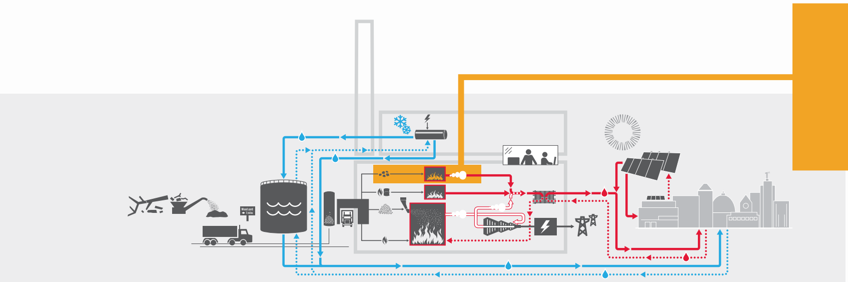
2 The boiler walls are lined with pipes filled with water, which absorbs the heat from the combustion and raise the temperature of the **FEEDWATER** to **STEAM**.

3 The **STEAM** from this process travels to a **HEAT EXCHANGER** to transfer the energy to the District Energy **HOT WATER SUPPLY.** Once heat is removed from the steam through the heat exchanger, it is condensed to water which is returned to the **BOILER** as **FEEDWATER** and cycled back through the pipes in the boiler walls.

4 As the **COAL** burns, it produces **EXHAUST GAS** and **ASH**. The gases and lighter ash (fly ash) are filtered through a **CYCLONE** before final release from the stack as exhaust gas. The heavier ash (bottom ash) is collected at the bottom of the boiler and removed.

coal boilers are primarily used to
meet peak needs
during winter months





coal-natural gas boilers

natural gas-oil boilers

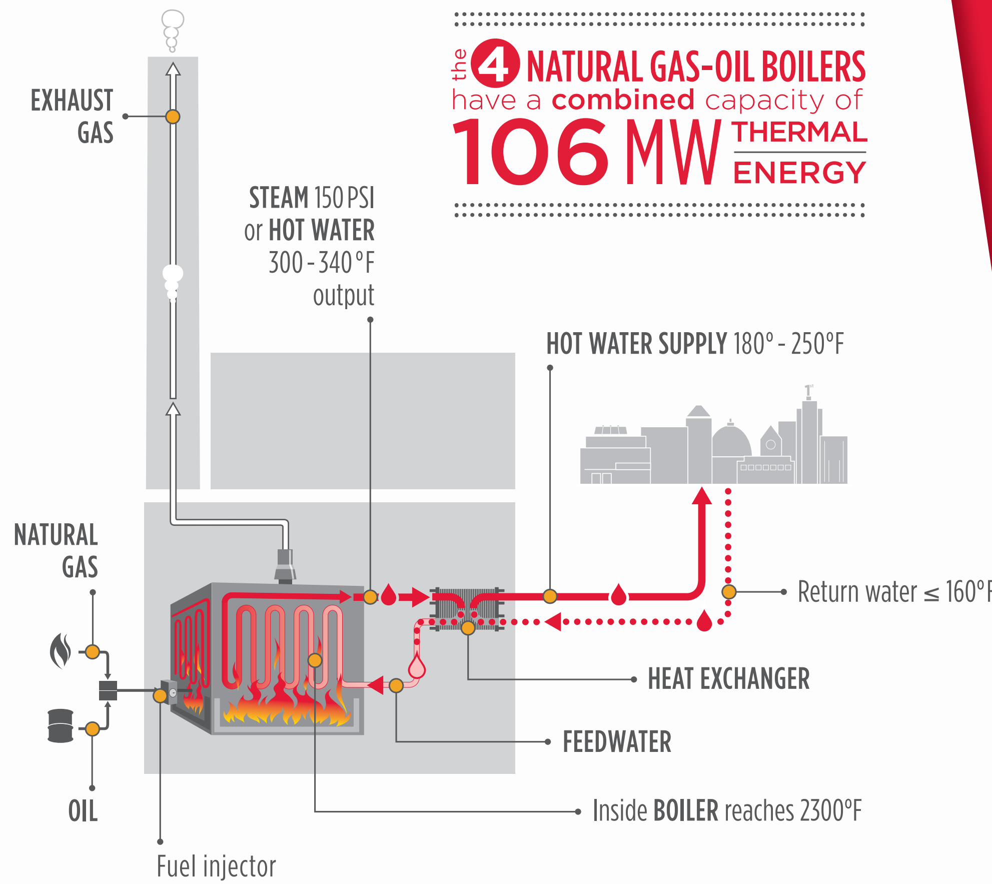
1 **NATURAL GAS** is injected into the boiler under pressure, where it is ignited. Natural gas is continually added to sustain the fire and temperature (~2100 - 2400°F). The boilers primarily run on natural gas, with the option of **OIL** when natural gas is not readily available.

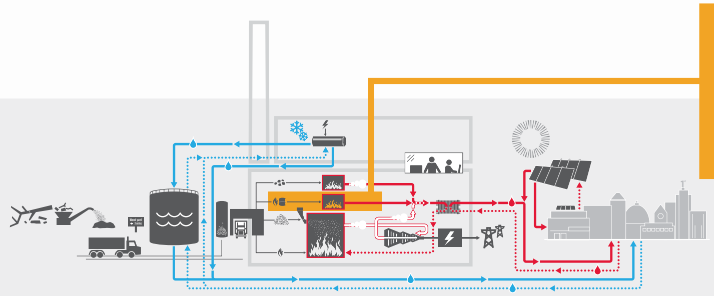
2 The boiler walls are lined with pipes filled with water, which absorbs the heat from the combustion and raise the temperature of the **FEEDWATER** to **STEAM**. Two of the boilers export **STEAM**. Two of the boilers export **HOT WATER**.

3 When steam is exported from a boiler, it uses a heat exchanger to transfer the energy to the District Energy **HOT WATER SUPPLY**. When hot water is exported, it can heat the hot water supply directly.

4 Once heat is removed from the **STEAM** through the **HEAT EXCHANGER**, it is condensed to water which is returned to the **BOILER** as **FEEDWATER** and cycled back through the pipes in the boiler walls.

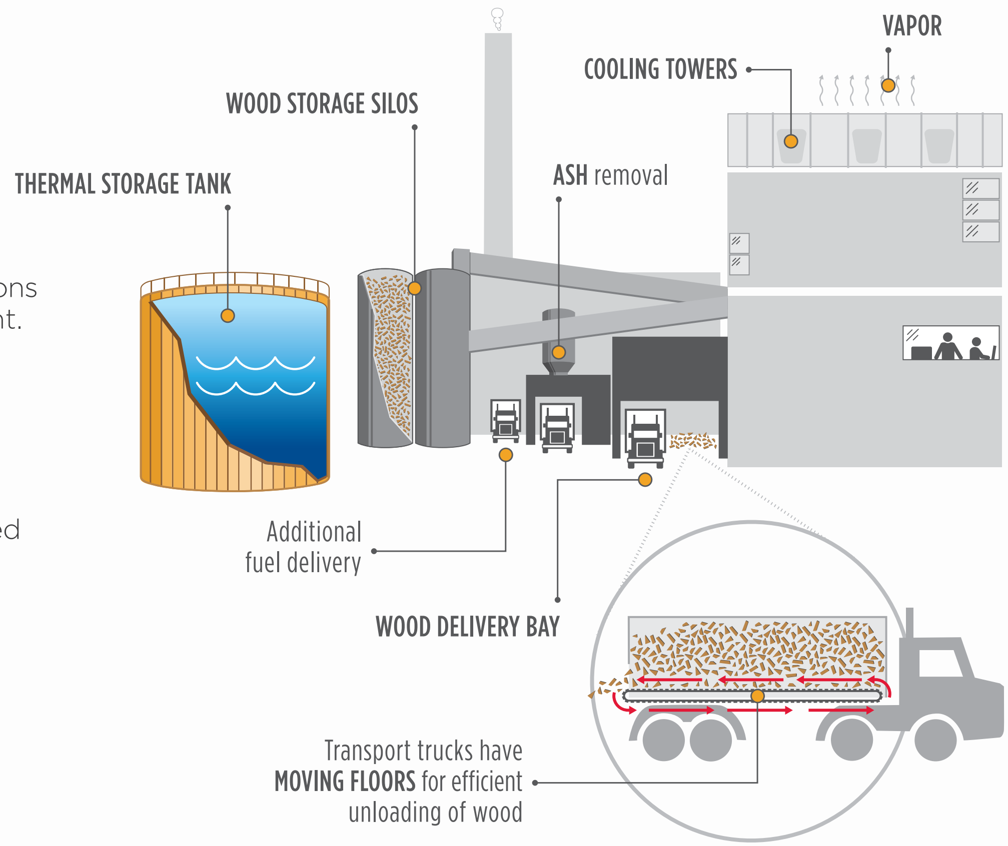
the 4 NATURAL GAS-OIL BOILERS have a **combined** capacity of **106 MW THERMAL ENERGY**

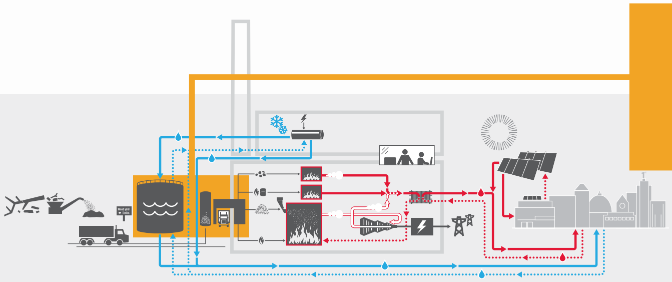




UP TO **45 truckloads** OR **1,000 tons**
of biomass wood chip fuel
is delivered to the plant each day

- The **WOOD STORAGE SILOS** hold more than 600 tons of wood fuel, the amount the plant burns overnight.
- The **THERMAL STORAGE TANK** is 72 feet high by 80 feet in diameter and stores 2.5 million gallons of water. It is 1 of 2 tanks used in the system.
- The **WOOD DELIVERY BAY** allows 2 trucks to simultaneously unload. Delivery trailers are equipped with **MOVING FLOORS** for efficient unloading. A series of conveyor belts moves the wood fuel from the delivery bay to the storage silos.
- Wood **ASH** is removed from the system, trucked to other locations, and either used in landfill cover or for agricultural land applications.
- **COOLING TOWERS** are used to reduce the heat of steam to condense the steam to a liquid before releasing it to the atmosphere as **VAPOR**.





delivery and storage area

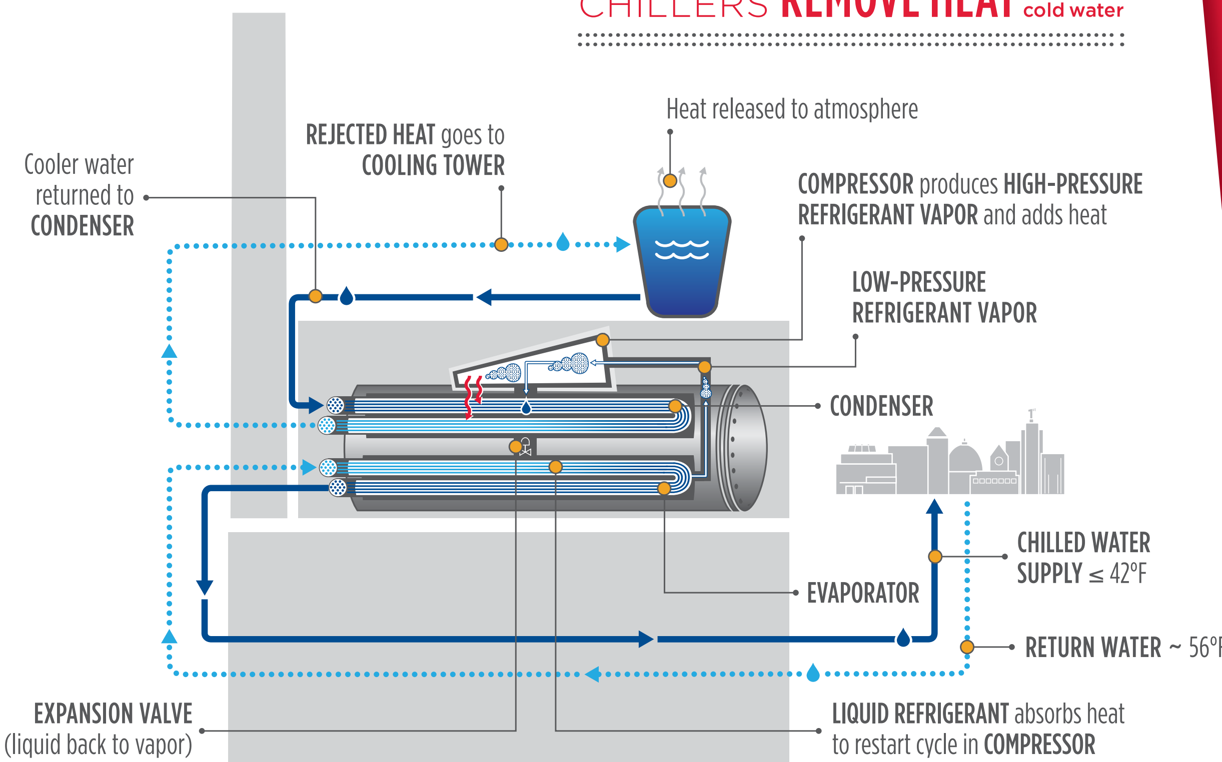
1. The **COMPRESSOR** takes **LOW-PRESSURE REFRIGERANT VAPOR** from the **EVAPORATOR** and pressurizes it, producing **HIGH-PRESSURE REFRIGERANT VAPOR** and heat.

2. The heat from the **HIGH-PRESSURE REFRIGERANT VAPOR** is transferred to a separate water loop in the **CONDENSER** and **REJECTED HEAT** is released to the atmosphere by the **COOLING TOWER**.

3. The high-pressure refrigerant is now cool and in liquid form. This liquid refrigerant is passed through the **EXPANSION VALVE** into the **EVAPORATOR** becoming a cold vapor.

4. The low-pressure, cold, **VAPOR REFRIGERANT** is then used to cool the **RETURN WATER** coming back from customers at ~56°F to produce ≤42°F **CHILLED WATER SUPPLY** for customers to use to cool their buildings. Vapor refrigerant absorbs this heat and returns to the compressor to restart the chilling cycle.

COLD is the absence of heat
CHILLERS **REMOVE HEAT** TO PRODUCE **cold water**



chiller process