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**Erasmus+ program Partnership for Digital Education
Readiness “Smart School in restoration and construction
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O2 Virtual Learning Materials

HEAT PUMP



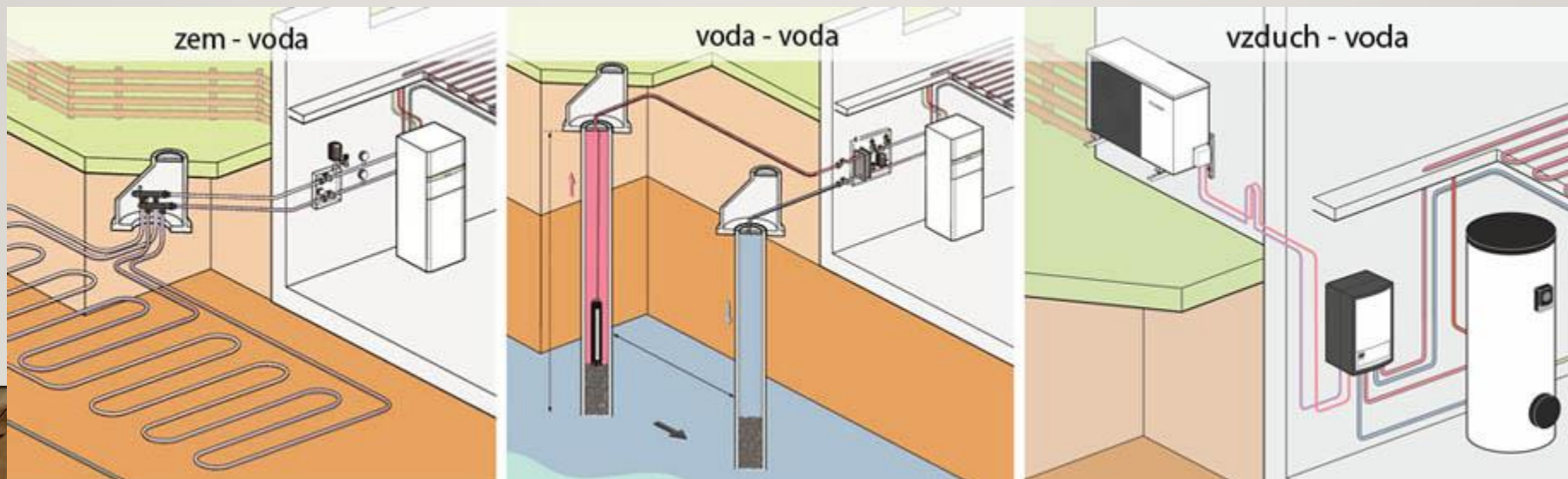
PRACTICAL EDUCATION

We give classes in this topic for the students of:

- 3693 K – technician of energetic appliances of buildings,
- 3678 H - plumber,
- 3658 K – mechanic of building and installation technologies,

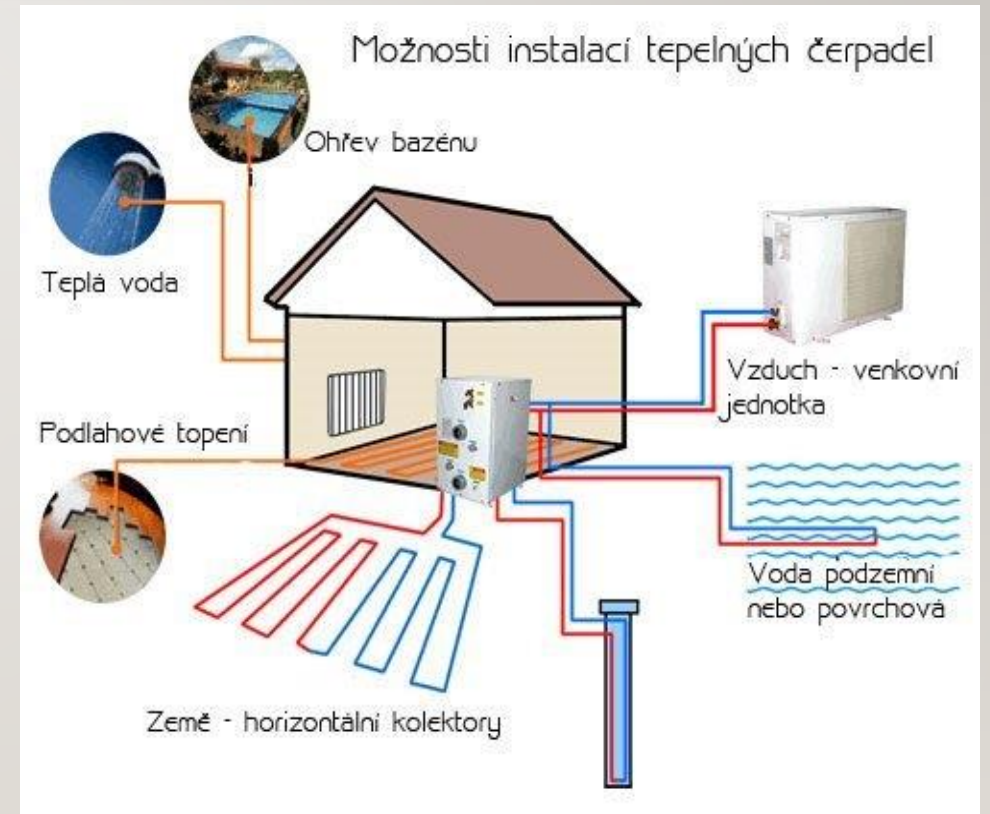
CHARAKTERISTIC

- Heat pump takes energy from the exterior and uses it for the house.
- Environmentally friendly.
- Heats in winter and cools in summer.
- Economical with the least maintenance.



FUNCTIONS OF HEAT PUMPS:

- heats in winter
- prepares hot water all the year
- cools the interior in summer
- heats the water in the pool
- uses unusable energy of the low heat from surroundings – water, air, earth

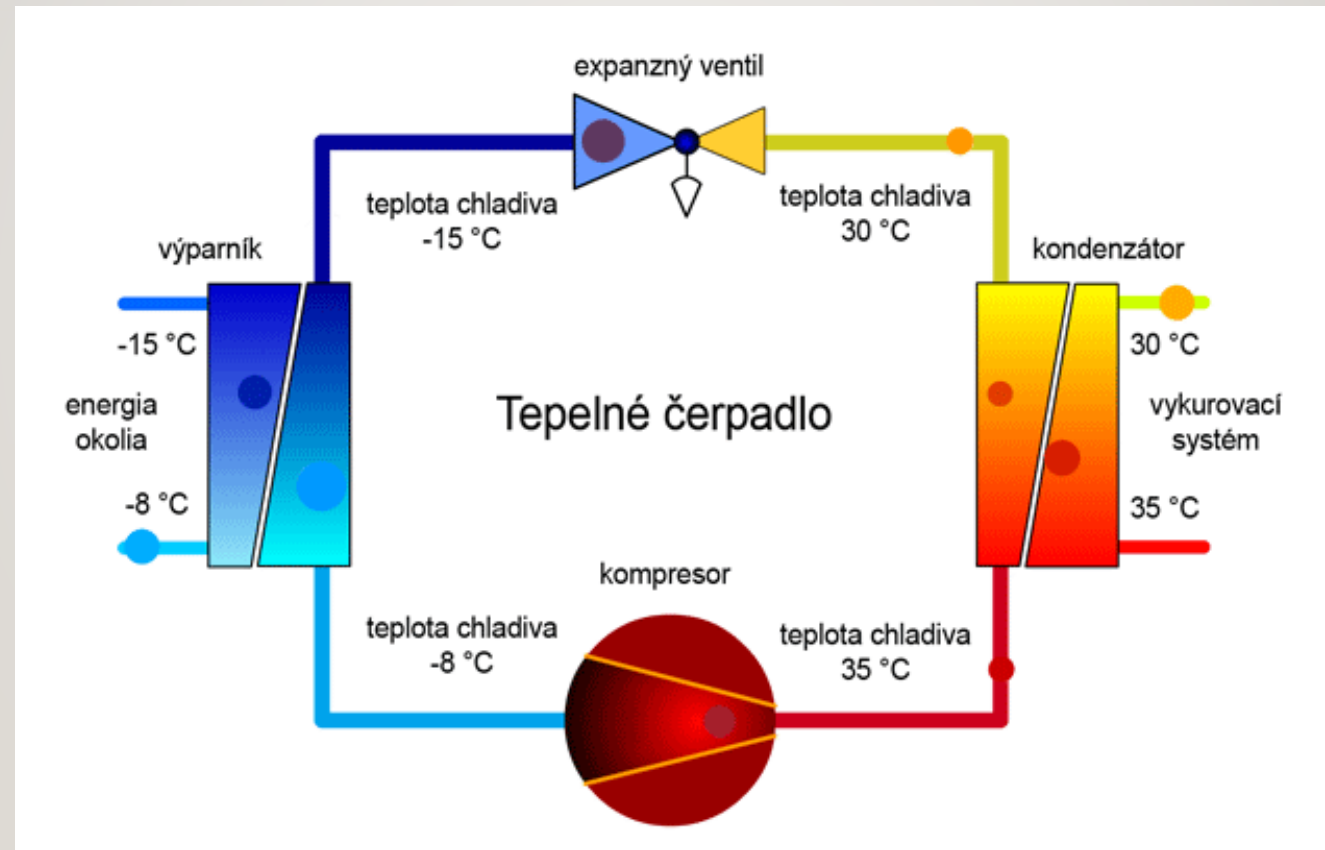


HISTORY

- Slovak Aurel Stodola was the designer of the first heat pump in the world.
- His heat pump from 1928 still works in Switzerland and heats the town hall in Geneva by taking heat from the lake water.



PRINCIPLE OF OPERATION



The heat pump, or cooling circuit, has 4 parts :

- Evaporator
- Compressor
- Condenser
- Throttle valve

TYPES OF HEAT PUMPS

- Air – water



- Air – air

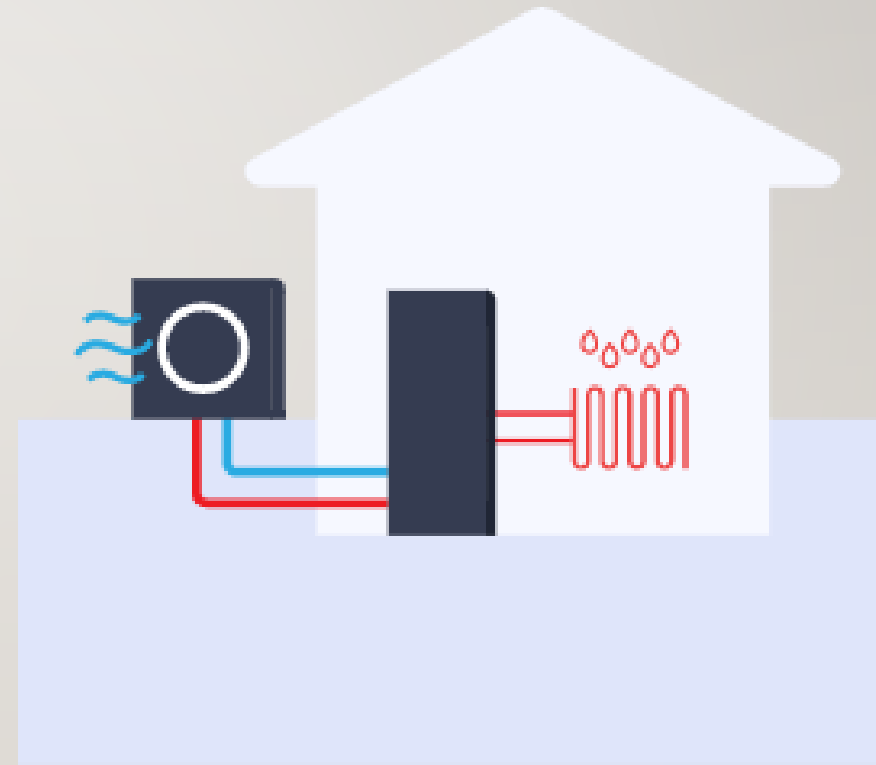
- Earth – water

- Water – water



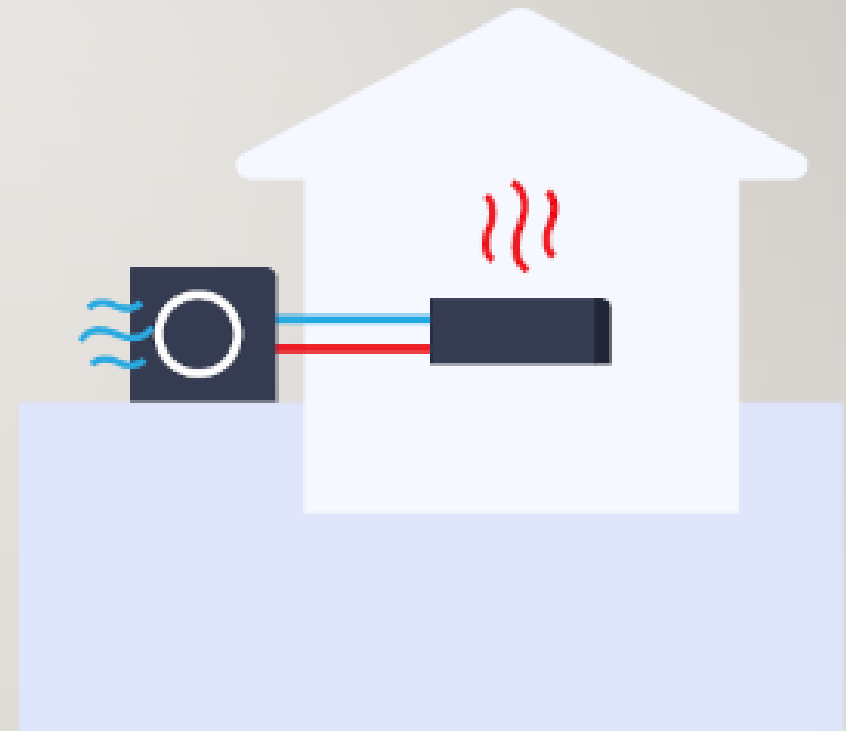
AIR - WATER

- The most widespread type.
- Takes heat from the outside air.
- Then uses it to heat water in the heating system or in the hot water tank.
- Suitable for family houses whose land is not a sufficient for a heat pump with a surface collector.



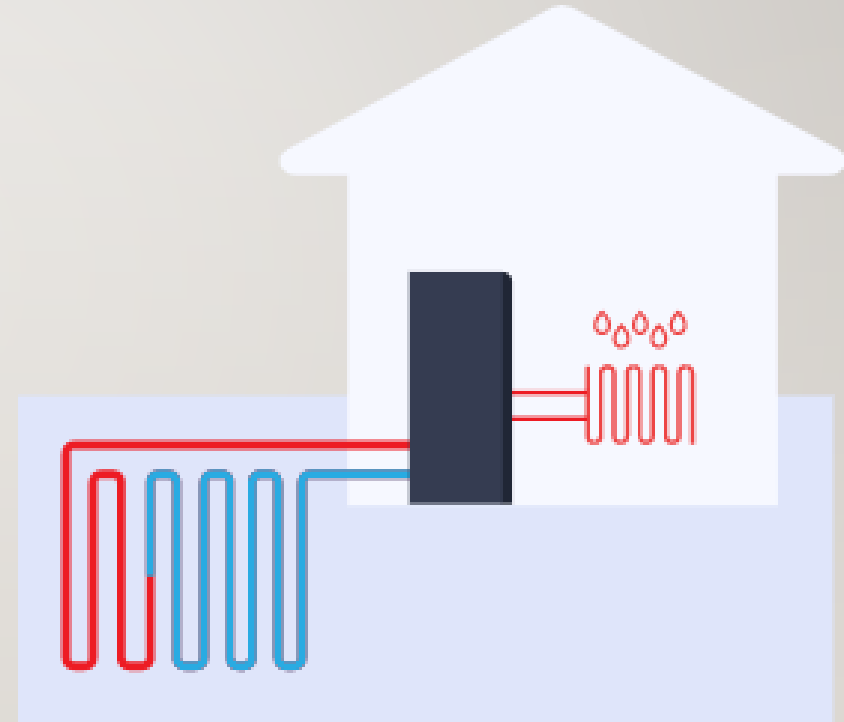
AIR - AIR

- Principle of classic conditioning.
- It can also work in reverse for heating purposes.
- Suitable for older houses.
- Very affordable.
- Its operation doesn't require the construction of a water heating system.



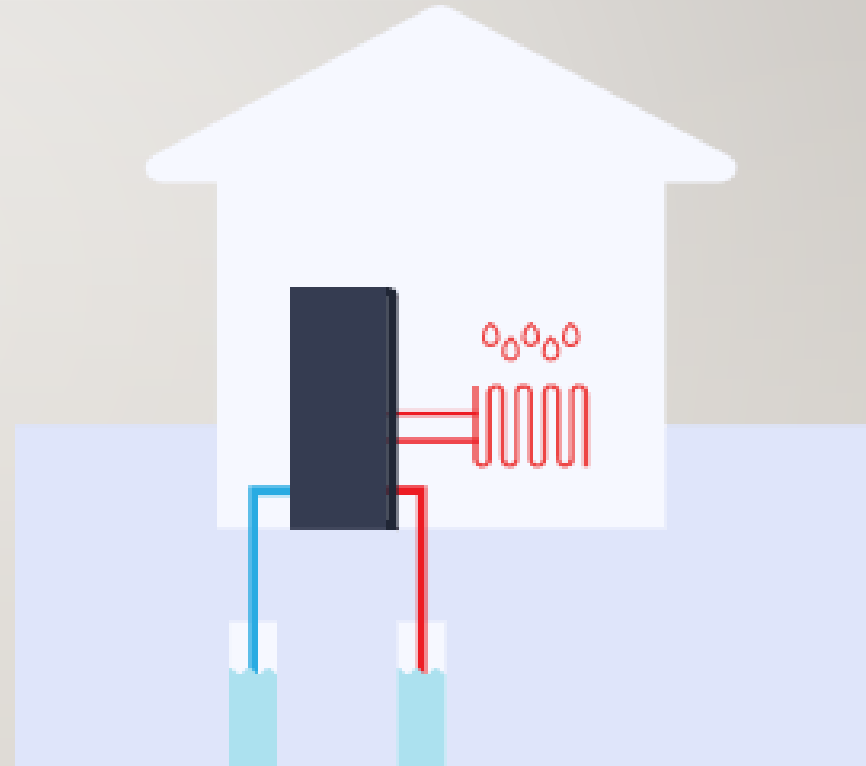
EARTH - WATER

- Receives heat from the ground in a hole or from the garden, where plastic hoses filled with antifreeze are stored.
- Saves electricity by up to 30% compared to air heat pump.
- Suitable in places where the average winter temperature drops below 3°C.



WATER - WATER

- Receives heat from a water well or a thermal well.
- Water is pumped from the garden well to the heat exchanger and after cooling it returns to the ground.
- It has the highest heating factors.
- Can be used for reusing waste heat in technological areas.



COEFFICIENT OF PERFORMANCE

- Heat pump consumes electrical energy, but it receives approximately 3 to 5 times more thermal energy.
- If we supply 1 kW in the form of electrical energy, we get 5 kW of heat – the performance number of the heat pump is 5.
- **COP** shows the ratio between the energy input and the energy obtained for heating.
- The COP is influenced by the current input of the CH, the output temperature and the temperature of the environment from which we take energy.

OPERATING MODES OF HEAT PUMPS


- **Monovalen** – the heat pump is the only source of heating heat in the building. It is suitable for all low-temperature heating systems with a supply temperature of up to 55 °C.
- **Monoenergetic** – it supports additional electric heating. It is necessary for air-water heat pumps to achieve sufficient heating performance at low outdoor temperatures. The temperature range when operating is about of -7 °C.
- **Bivalent alternative** – it supplies total heating heat up to a certain set outside temperature (e.g. 0 °C). When the temperature drops below this value, the heat pump will turn off and the heating will be provided by the second heat source.
- **Bivalent parallel** – produces the necessary heat up to a certain outside temperature. At lower temperatures the second heat source is also switched on. If the outside temperature falls below the second limit value, the heat pump will be switched off and the second heat source will ensure the complete supply of heat.

COMPARISON OF HEAT PUMPS TYPES

AIR – WATER

- + for homes with smaller land and heating renovations
- + the best selling type
- + heating and cooling at a reasonable price
- + installation on the façade and in the technical room
- + no need for a large land or a deep well
- noisier when installed outdoors in winter
- not economical

AIR – AIR

- + great for winter gardens and maintaining a constant temperature, e.g. on cottage
 - + low initial investment
 - + maintain a constant temperature (for winter garden or cottage)
 - + part of the air conditioning – it did not radiate heat, but it blows
 - it dries eyes, give a feeling of a draught
 - noisy in heating mode
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POROVNANIE DRUHOV TEPELNÝCH ČERPADIEL

EARTH-WATER

- + FOR NEW BUILDINGS AND HOMES WITH LARGER LAND
- + The most economical and efficient type
- + Indoor installations with and long service life
- + Silent heating
- + Ideal for new houses
- more demanding primary source installation
- for larger land or deep well

WATER-WATER

- + for houses with access to water, e.g. from a well, river, etc.
- + draws energy from a well, pond, lake, etc.
- the least used type of heat pump
- it needs a certain minimum flow rate with a constant temperature
- difficult installation of primary source



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Thank you for your attention

