Erasmus+

SMART school CONSTRUCTION

Erasmus+ program Partnership for Digital Education Readiness “Smart School in restoration and construction industry” No. 2020-1-LV01-KA226-VET-094520

O2 Virtual Learning Materials

Solar panels

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,

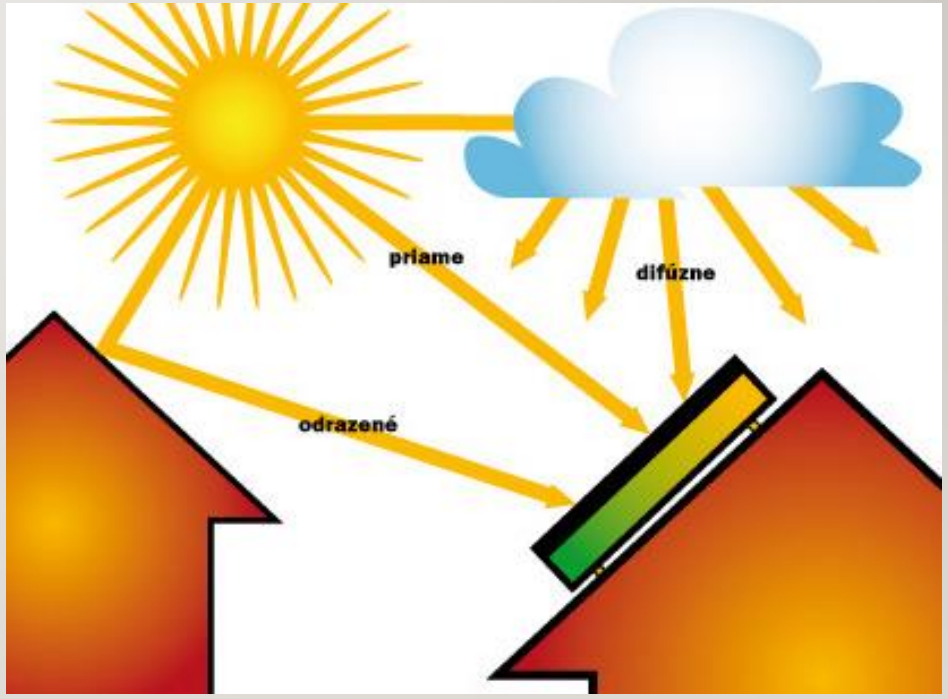
CHARAKTERISTIC

- Change of solar energy into thermal energy.
- Principle of photothermal conversion.
- The absorption surface transforms the solar radiation.

SUN ENERGY

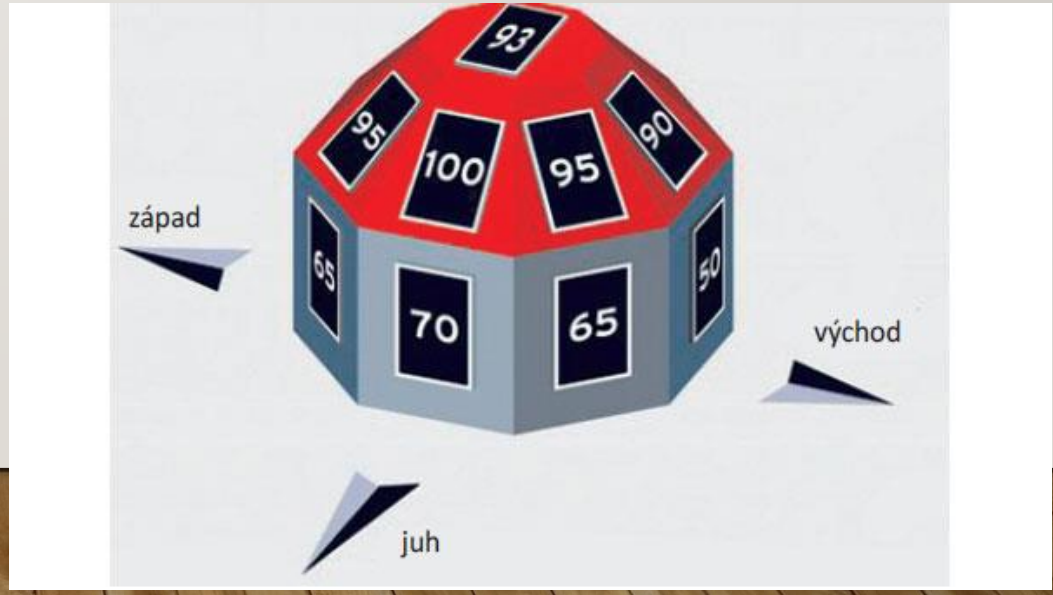
- It falls on the earth in the form of radiation.
- Consists of heat and light energy.
- It spreads in the form

  of electromagnetic waves.

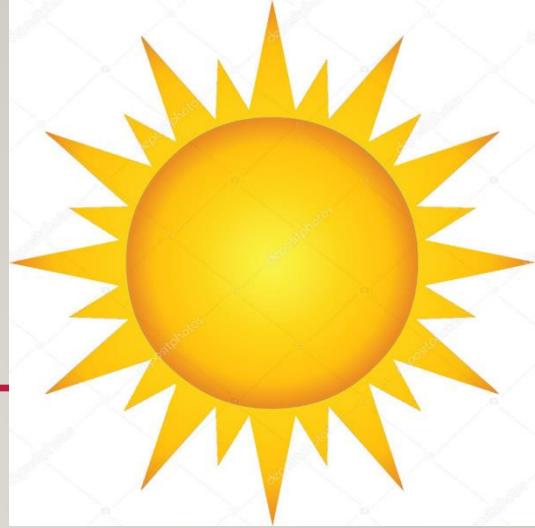


INCLINATION AND ORIENTATION

- South and southwest orientation of the solar panels.
- An angle of inclination for all year operation 30 – 50°.
- Optimal position in winter and summer.



EFFICIENCY OF SOLAR COLLECTORS



- Usually 92-94 %
- Due to heat losses, the actual thermal efficiency is around 80 %.
- The real heat gains depend on the heat losses, the orientation of the collectors, the climatic conditions, the outside temperature, the intensity of solar radiation.
- In fact it is 55 – 65 % of the radiation.

DIMENSIONING OF SOLAR COLLECTORS AND THE SYSTEM

- 1-1.3 m^2 of collector area per person and a boiler with a 75-100 liters per person is recommended for the hot water preparation.
- In summer up to 100 l of water can be heated to a 60 °C using 1 m^2 of collector area, in winter solar connectors can heat water to a 30 - 50 °C.

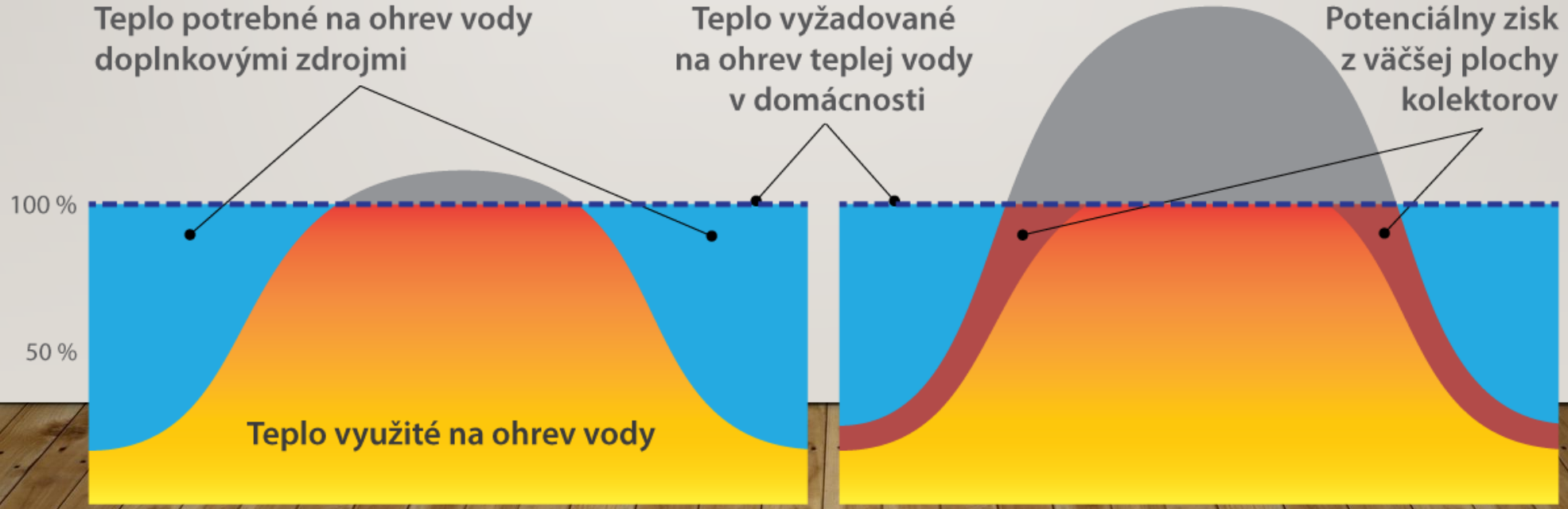
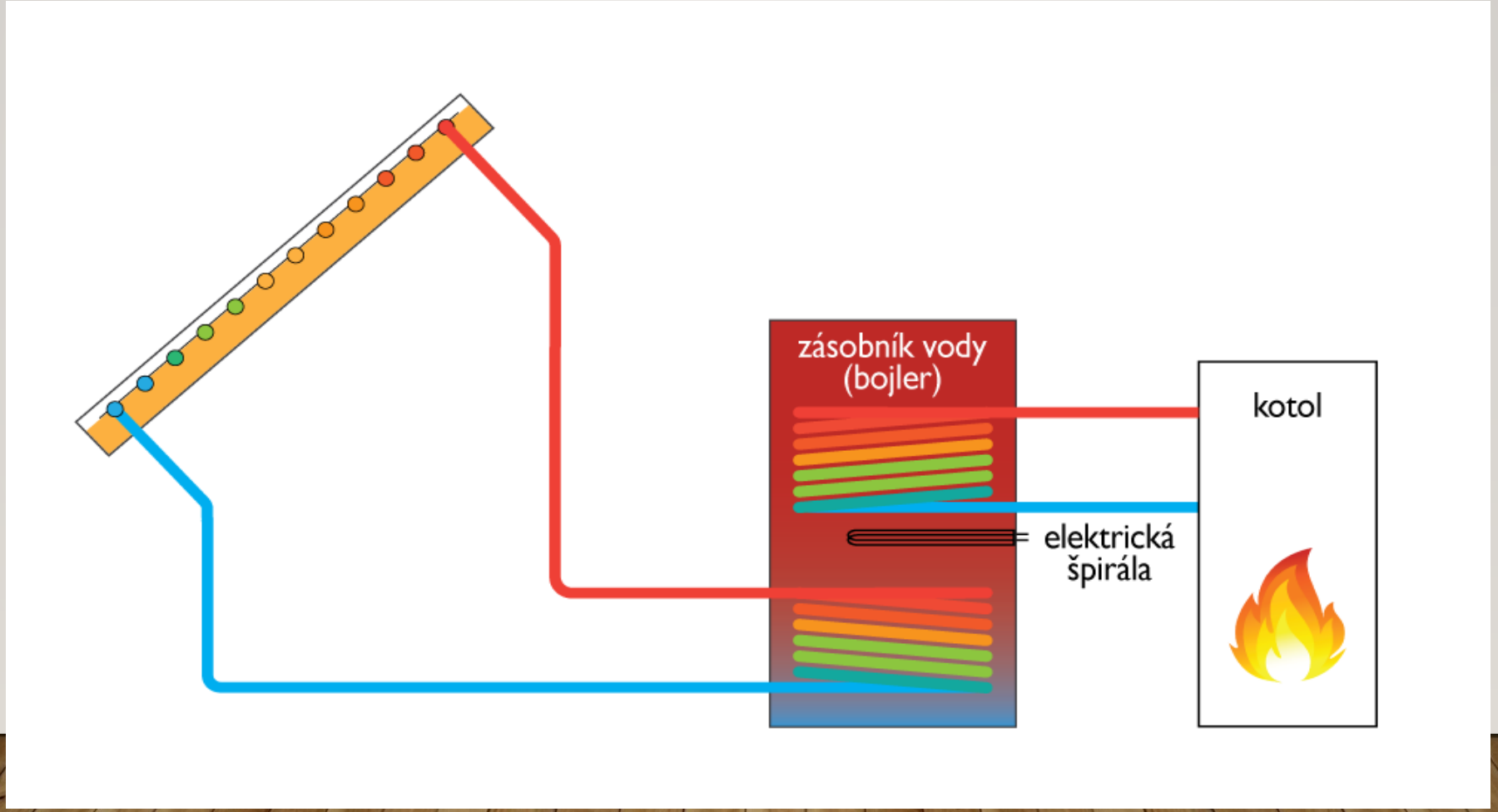


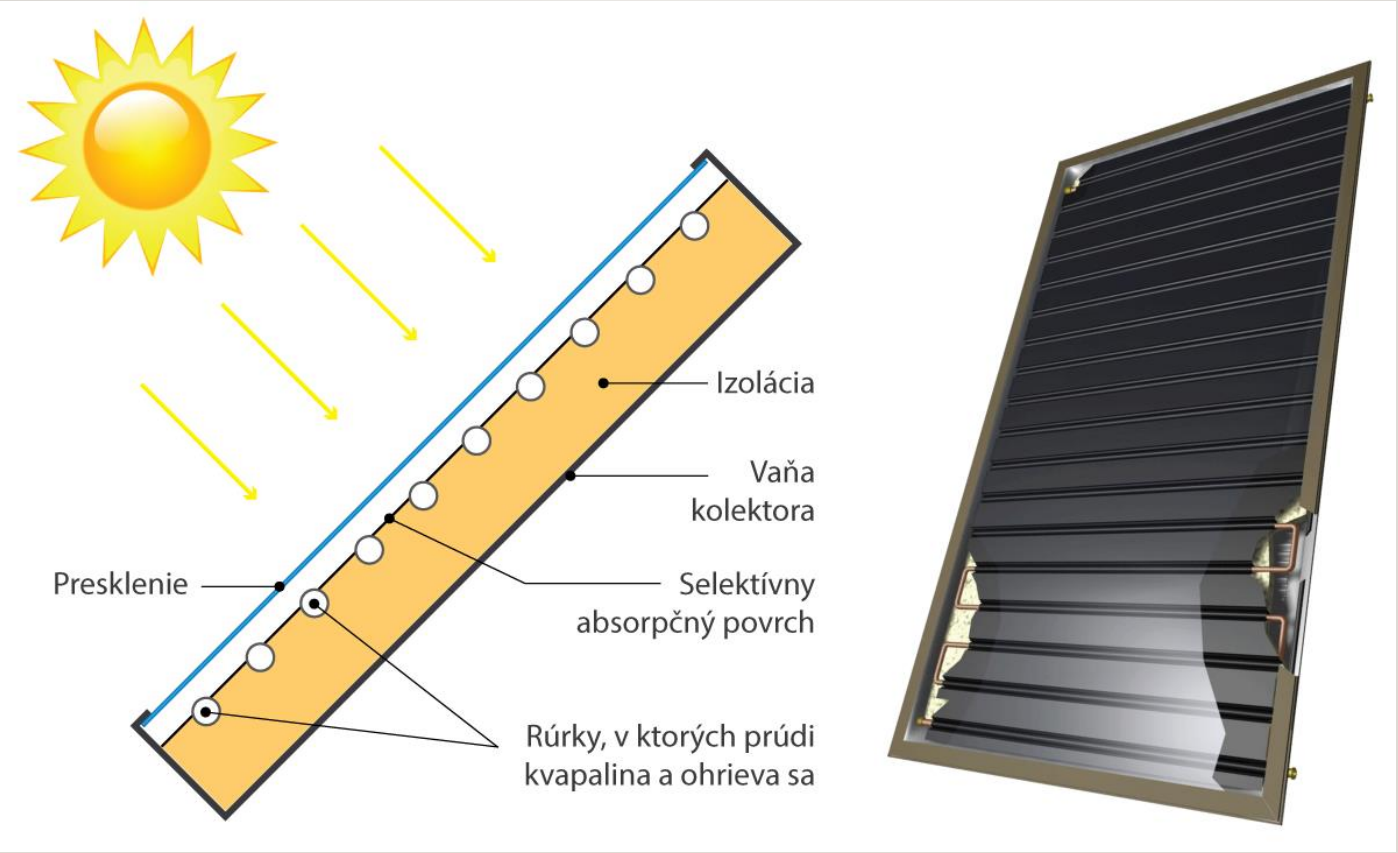
DIAGRAM OF THE SOLAR SYSTEM



FLAT SOLAR COLLECTORS

- The tubular meander is connected to an absorption surface on which a selective absorption layer is applied, which converts up to 95% OF THE SOLAR RADIATION INTO HEAT RADIATION.
- The whole assembly is inserted in the frame and covered from the front with safety solar glass.

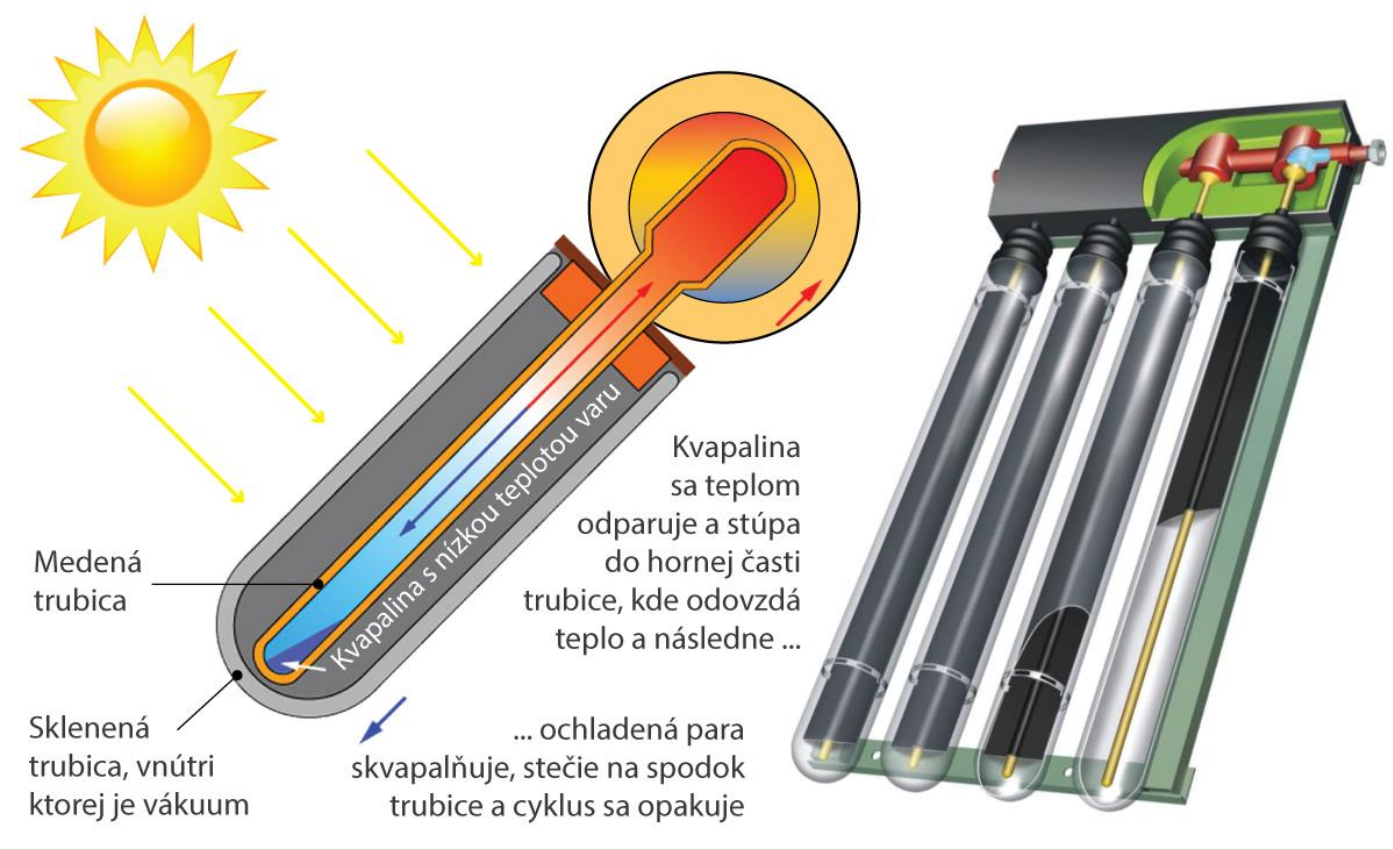
SECTION OF A FLAT SOLAR COLLECTOR



TUBULAR VACUUM SOLAR COLLECTORS

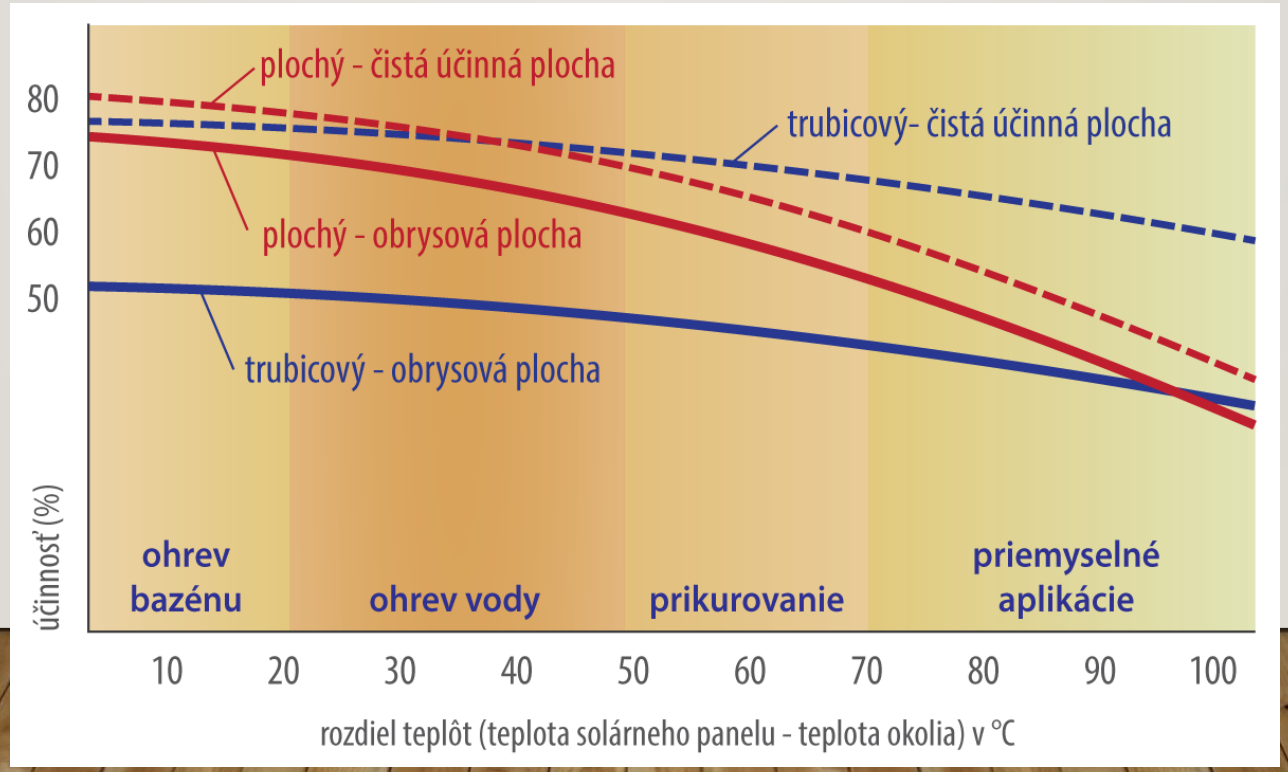
- In tube a copper tube is connected to the absorbent material, in which a liquid with a low boiling point is filled.
- It condenses in the upper part and transfers the heat obtained.
- THE INDIVIDUAL TUBES ARE INSERTED INTO THE COLLECTION PIPE THROUGH WHICH THE LIQUID OF THE SOLAR CIRCUIT FLOWS.
- Insulation is achieved by vacuum in glass tubes, which reduces heat loss by convection (flow).

SECTION OF A TUBULAR VACUUM SOLAR COLLECTOR



COMPARISON OF COLLECTORS TYPES

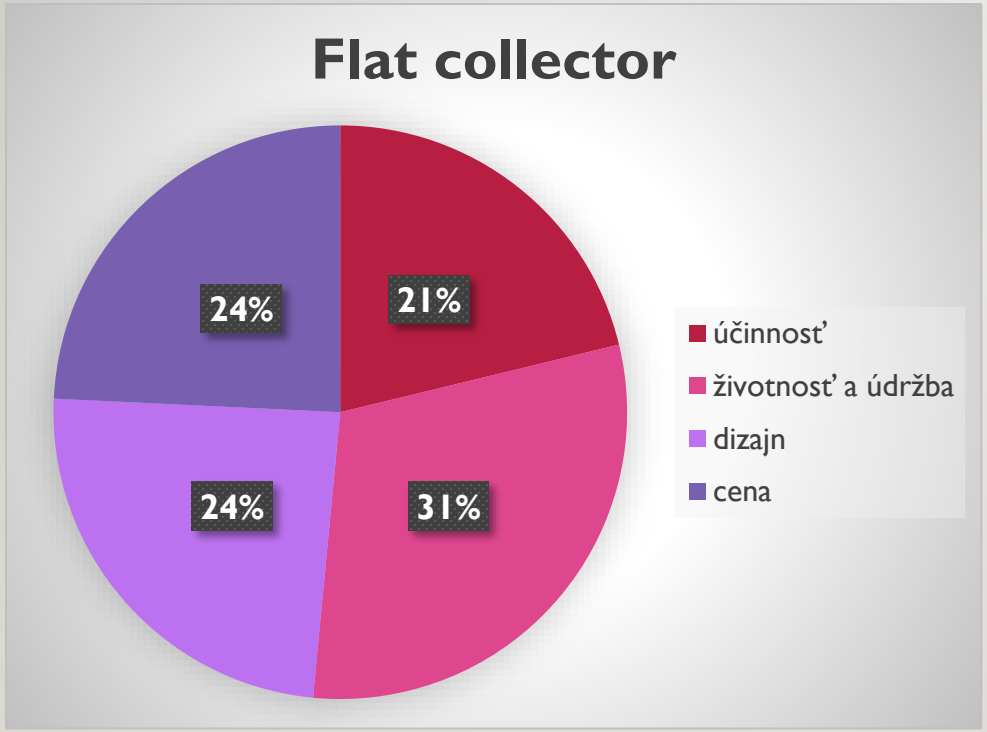
- The theoretical efficiency of the collectors – the surface on which the solar radiation falls
- The practical use – the efficiency is calculated on the area they occupy on the roof (plan area).

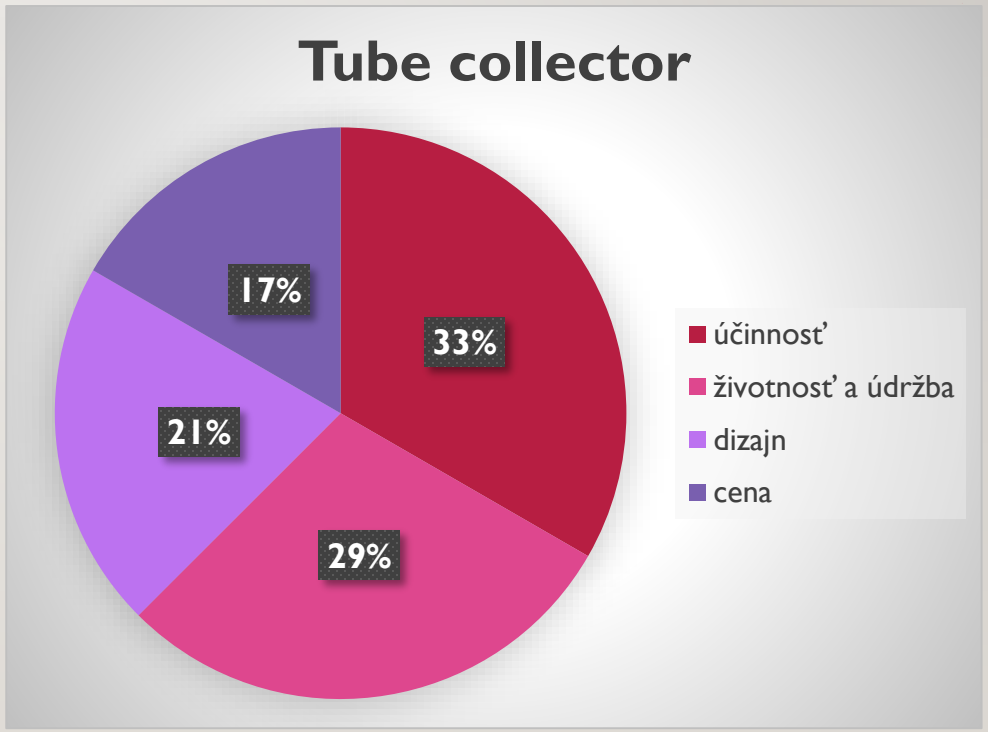


FINANCING

- For the house of 3-5 people the price is around 5,200 eur.
- The greenhouse project – grant with a max. of 1750 eur.

COMPARISON OF FLAT AND TUBULAR COLLECTORS





FINANCIAL RETURN ON SOLAR SYSTEMS

- from 5 – 10 years
- depends on hot water consumption and on the previous method of heating the hot water
- the return is quicker

  for electric spiral energy
- longer return – gas or a heat pump

PRELIMINARY CONSTRUCTION PREPARATION FOR SOLAR PANELS

- Piping from the technical room with the boiler under/to the roof.
- Copper pipes (diameter 18 mm) or stainless steel corrugated pipe (DN 16) with 19 mm insulation. Next to the pipe, stretch the cable for the sensor on 2×0,75 mm^2.
- Do not use Al-PEX, PPR for solar panels, steel is not suitable.
- Do not use PE (Tubolit, Mirelon, etc.) or rubber insulation with resistance up to 105 °C, mineral wool insulation is permissible, but not the most suitable.

- “Virtual material prepared within Erasmus+ program project “Smart School in Restoration and Construction Industry” co-funded by the European Union”

Thank you for your attention

SOŠ STAVEBNÁ
ŽILINA