HEAT PUMPS

Milan Kvakovský, Vieroslava Sklenárová, Dušan Medveď

ABSTRACT

Problems of heat pumps are kept under constant review. All from us are aware that energy prices are growing from one year to another. In this context many of us have found themselves the challenge to growing production costs and hot water heating in the house, apartment or other object. Exist a number of solutions but they always depend of suitability of their use in what geographic area and climate zone we live. Experts around the world are for a long time dealing with the idea of alternative solutions to the rational reduction of heat energy. The costs of heating are 15,000 kWh of heat energy for classical house with an area of 200 m^2 of heating space. The next part is the energy needed for cooking, lighting and it is around 3500 kWh. Based on these facts have been developed a number of interesting technologies, such as: solar collectors, low temperature condensing boilers, wood-gas stoves, fireplace heat exchangers etc. However, neither of these technologies used as much energy from renewable natural resources as a heat pump. Technology which receives heat (without combustion) of natural resources is called a heat pump.

1. INTRODUCTION

This device is extremely powerful and yet inexpensive energy and ecologically clean technology based on the physical principle of efficiency to 500%. In proportion to 1 kW of electricity, we get about 5 kW of heat. Today, modern thermal pumps can achieve a higher outlet temperature of heating water (+70 ° C), but it is a big impact on price and durability of the heat pump. It can be said that the basic component of heat pump is compressor. Its quality depends on the overall coefficient of heat pump efficiency, which is the ratio between electric power consumption and heat output of heat pump. Each manufacturer specifies the technical parameters of the heat pump and coefficient of thermal efficiency. That ratio is calculated from a heat value of the primary (natural) resources and the required temperature of heating water. If we need higher temperature of the heating water the compressor must operate with higher pressure coolant, which greatly increases the wear rate and reduces the overall efficiency.

2. PRINCIPE OF OPERATION

As everyone has surely known it is possible to unintentionally transmit heat from the warmer to the colder body. This is possible only when the supply of energy from outside which cooler body heats. Then there is a direct heat exchange. Our goal is to cooled water heated to the desired output temperature. There are several possibilities, the traditional heat through combustion of primary fuels such as gas, wood and so on. The heat pump works completely differently.

There are three fundamental state of matter in solid liquid and gas. If we want to convert water into steam it must be heated to boiling point and then have to deliver large amounts of latent energy for change. In the case of water is approximately similar amount of energy that we consumed in the heating to the temperature of boiling. From which it follows that if we change the fluid in the gas we need power supply. The opposite action is called liquefaction or condensation. Energy consumed in the latent transforming liquid gas to be taken which means cool steam. The evaporator is heat exchanger which is separated by the primary circuit supplying energy from the environment and the

refrigerant circuit, transmit power from outside to the water. Refrigerant is a substance with one essential feature of very low boiling point (Fig. 1).

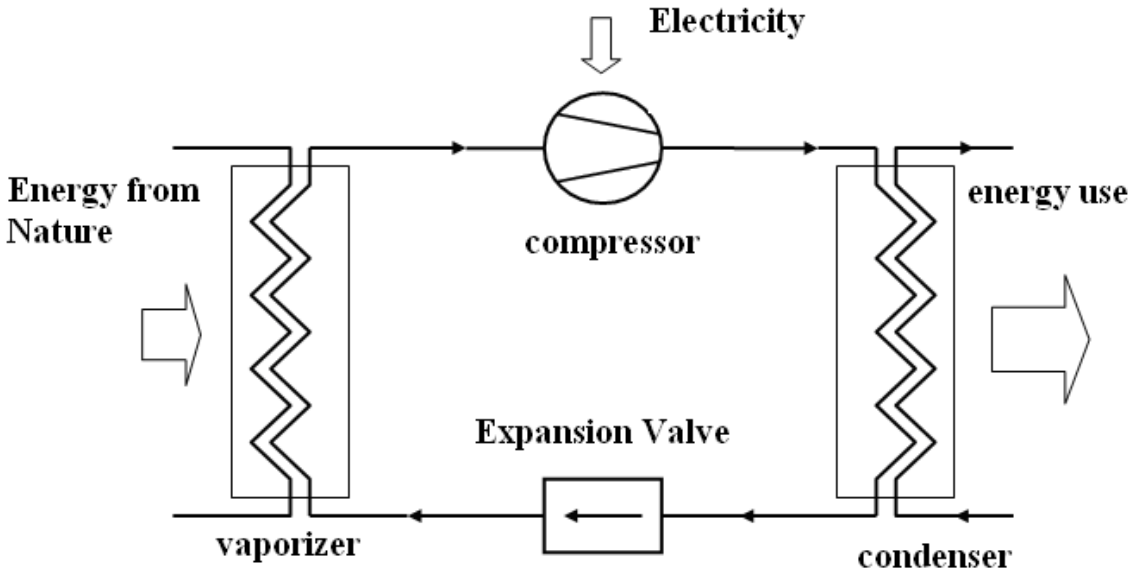

Figure 1 - Principal scheme [1].

The temperature of the refrigerant in the evaporator is lower than the temperature of primary source. There is a heat exchange between refrigerant and the primary source. The original liquid refrigerant begins to boil than the refrigerant receives large amounts of latent heat and cools the primary source. For example when entering the evaporator liquid refrigerant temperature is -15 ° C at the outlet of the evaporator its temperature is about 0 ° C. Its internal energy has increased but the temperature is so low that direct exchange between the heating water and coolant is not possible.

Therefore it is deployed within a compressor. Refrigerant is compressed so that its temperature rises to 100 ° C. The gaseous refrigerant of high temperature and pressure continues to the condenser.

The condenser is heat exchanger separating circuit refrigerant and heating water. The temperature of return water of the heating circuit must be less than the condensation temperature of the refrigerant. At this temperature refrigerant gas and liquid begins handed latent heat which received from the evaporator. It also transmits power received from the compressor. This heated water heating. It is heated with low temperature gradient 55/45 ° C. The gaseous refrigerant at a temperature of 100 ° C comes into the condenser is cooled with return water from the heating circuit to the temperature of condensation. The temperature drops to 45 ° C and the state becomes a liquid.

Refrigerant continues to the expansive or butterfly valve. This is the opposite process in compression. The refrigerant expands and sharply reduces its temperature of 45 ° C to -15 ° C. After passing through the evaporator the heat from primary source is removing. The whole cycle is repeated.

3. BASIC DISTRIBUTION OF HEAT PUMPS

3.1 Heat pump ground - water

The design of heat pumps (ground - water) is nearly identical to the heat pump water - water. The source of low potential energy is the earth from which heat energy is taken by the collector of plastic tubing (Fig. 2). Natural collector can be in terms of structure either a horizontal (flat) or vertical (depth). Horizontal collector has a flat hose stored in trenches in the ground at a depth of about 2 m, i.e. in warm - water depth. Vertical collector is similar but the hoses are stored in deep wells.

In the collector's hoses circulating medium (antifreeze) which removes heat and transmits it to the ground on the primary heat exchanger (evaporator) of heat pump. By flowing through the system hoses natural aquifer medium became again "warm" to the initial temperature and the cycle is repeated. Heat pump that obtained in the potential of low heat in the compressor's circuit further processed to the desired temperature of the heating medium (water) through the heating system (radiators, floor) and heats the house [2].

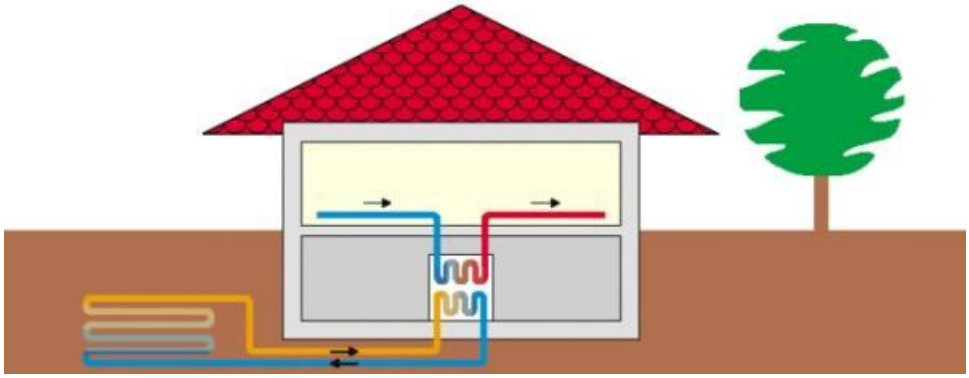

Figure 2 - Operation of heat pump - ground - water [3].

3.2 Heat pump water – water

As the primary source heat pump water - water used mostly groundwaters from digging or drilling wells. Water is pumped through a heat exchanger pump (called an evaporator). This evaporator is taken some of the heat and cooled by water about 4 °C returns to earth by the other wells (Fig. 3). To ensure the proper functioning of the system and avoid the reducing the temperature of the source water (wells) must be wells sufficiently far apart about 15 to 20 m. If this condition is met it is possible that the same water is circulated around without this water lost the temperature. Such a system can be used in the absence of a primary source of yield [2].

Heat pump water - water is installed with success in large river flows of rivers or in areas with a rich source of groundwater.

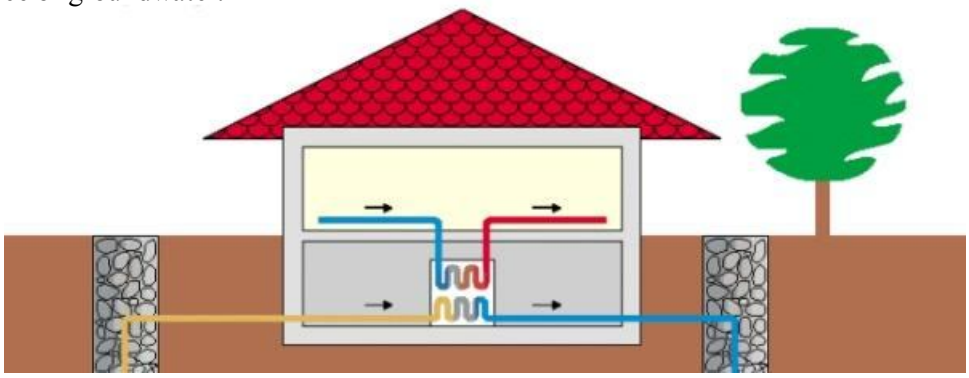

Figure 3 - Operation of heat pump – water - water [3].

3.3 Heat pump air – water

Excellent ratio money - power of heat pump - and especially versatility these are the main advantages of heat pump air - water. Most used the so-called split units - heat pump divided into external and internal unit.

Outdoor unit (evaporator fan) located outside the intake air. Indoor unit located in the house produces water and hot water (Fig. 4).

The heat pump includes automatic the electric boiler that automatically switches at lower temperatures so is the certainty of stable thermal comfort throughout the heating season.

Moreover modern pumps reliable in operation even at very low temperatures up to (-15 °C) [3].

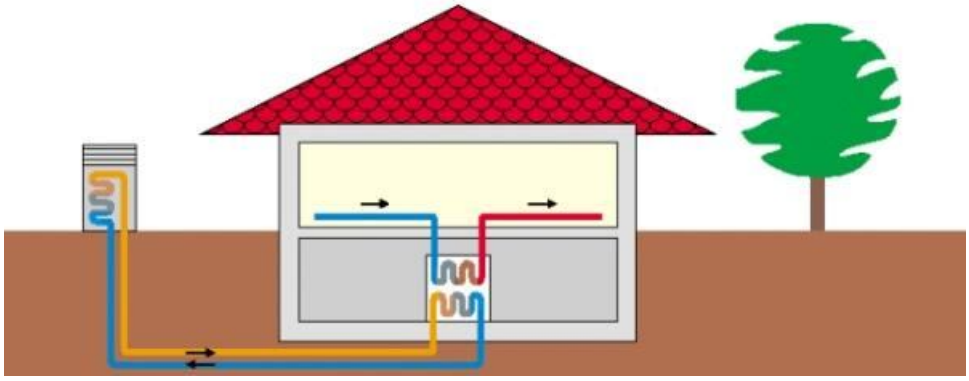

Figure 4 - Operation of heat pump – air - water [3].

4. CONCLUSIONS

The main reason that led me to the selection of this topic was its timeliness. Further development and expansion of the use of heat pumps in municipal and industrial sector not only for the particular research efforts to optimize the energy efficiency of a particular state of the technology and financial support to stimulate the market, allowing a much broader applications the economic competitiveness of these devices to conventional production technologies of heat are generally much cheaper to investors. In this way, promoting the development of the use of this technology in more economically advanced countries of central and northern Europe, which is expected in the near future and 30% share of heat for heat pump heating and heating processes in the municipal sector. Large reserves in the use of heat pumps in the SR in the field of industrial heat pumps High-power view of the enough of waste heat flows mainly from industrial technological processes, which would allow the use of highly energy and cost effective installation.

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Authors:

Ing. Milan Kvakovský
Technical University of Košice
Letná 9
042 01 KOŠICE
Slovak Republic
E-mail: milan.kvakovsky@tuke.sk
Tel: +421 55 602 3560

Ing. Dušan Medveď, PhD.
Technical University of Košice
Letná 9
042 01 KOŠICE
Slovak Republic
E-mail: dusan.medved@tuke.sk
Tel: +421 55 602 3555

Ing. Vieroslava Sklenárová
Technical University of Košice
Letná 9
042 01 KOŠICE
Slovak Republic
E-mail: vieroslava.cackova@tuke.sk
Tel: +421 55 602 3560