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A review on Heat Pumps implementation in Lithuania in compliance with the National Energy Strategy and EU policy

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ABSTRACT

The article provides a review on Heat Pumps (HPs) implementation in Lithuania in compliance with the National Energy Strategy and European policy and encompasses the period 2005–2013 after the Lithuanian integration into the EU.

Lithuania has limited quantity of indigenous energy resources and is dependent on the import of natural gas, petroleum and hard coal. Up to 2009, Lithuania's energy dependence on the imports of fuel and energy was about 50–62%. At the end of 2009, after the decommissioning of the Lithuanian Ignalina Nuclear Power Plant (INPP), energy dependence on the imports of energy resources increased remarkably to approximately 80–82% and considerably exceeded the EU average 53–54%. The share of indigenous and renewable energy sources (RES) in gross inland fuel and energy consumption in Lithuania increased from 11.2% (RES 8.7%) in 2005 to 21.4% (RES 17.6%) in 2013. About 48% of such energy sources were transformed in Combined Heat and Power (CHP) and heat plants, 38% belonged to households and 14% – to industry and other sectors.

In the article, the HPs implementation in Lithuania and European countries was overviewed. The analysis of HPs promotion in Lithuania was carried out. HP related legislation in Lithuanian and Europe was shown. Regulations on HPs installation and usage of refrigerants were disclosed. Aims and tasks of Lithuanian Heat Pump Association were indicated. The dissemination and manufacture of perspective HPs were investigated. Lithuanian HPs market characteristics and technological trends were reviewed. HPs technical segmentation in Lithuania and categories by heat collector, output (kW) and hot water production were analyzed. HPs market shares by company's brand name were compared. Best practices – representative implementation of HPs in Lithuanian Grand Spa sanatorium were presented. Market outlook, sensitivities and expectations until 2020 were assessed. Techno-economical characteristics of HPs implementation and energy-saving potential were defined.

Contents

Abbreviations: CHP, Combined Heat and Power; COP, coefficient of performance; EC, European Commission; EHPA, European Heat Pump Association; EU, European Union; GHG, greenhouse gases; GSHPs, Ground Source Heat Pumps; GWP, global warming potential; HP, Heat Pump; INPP, Ignalina Nuclear Power Plant; JSC, Joint Stock Company; toe, tons of oil equivalents; LEI, Lithuanian Energy Institute; LTL, Lithuanian Litas (1 LTL=0.2896€); NPP, Nuclear Power Plant; ODP, ozone depletion potential; RES, renewable energy sources; SPF, Seasonal Performance Factor

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1. Introduction

The article provides a review on Heat Pumps (HPs) implementation in Lithuania in compliance with the National Energy Strategy and European policy and encompasses the period 2005–2013 after the Lithuanian integration into the European Union.

The *aim of the article* was to make a comprehensive analysis of Heat Pumps implementation in Lithuania for the period 2005–2013, their market development and comparison of results with the achievements of European countries.

Heat Pumps (HPs) are a part of the environmentally friendly technologies using renewable energy. HPs are devices transferring renewable energy from air water and ground to buildings or industrial applications by reversing the natural flow of heat so that it flows from a lower to a higher useful temperature. Heat Pumps are quoted in the European Directives on the use of renewable energy sources (RES), on the Energy Performance of Buildings (EPBD) and on Energy related products (ErP) [1,2]. *Operation principle of HPs* is shown in Fig. 1.

A Heat Pump is a device that can provide heating, cooling and sanitary hot water for residential, commercial and industrial applications. It transforms the energy from the air, ground and water to useful heat. This transformation is done via the refrigerant cycle.

Take a look of Ground Source Heat Pump operation principle.

1.1. Evaporation

A Heat Pump always has an outdoor heat source and an indoor outlet. Outdoor sources can be ambient air, exhaust air, ground-rock, groundwater, water, etc. The energy from these sources is infinite and hence renewable. This energy makes up about 75% of the energy that is delivered by Heat Pump.

The fluid present in the pipes, buried in the ground, absorbs the heat from the ground. The ground has a stable temperature of around 10–12 °C throughout the year. This temperature is enough to heat the refrigerant because it has a very low boiling point. This means that it only needs a very low temperature to heat up. The heat exchanger, the evaporator, uses the thermal energy from the outdoor source to boil the refrigerant (the liquid in the Heat Pump) and turns it into a gaseous state.

1.2. Compression

Then the refrigerant arrives at the heart of a Heat Pump: the compressor. The compressor compresses the refrigerant, which is in gaseous state, to a high pressure, that by consequence increases its temperature.

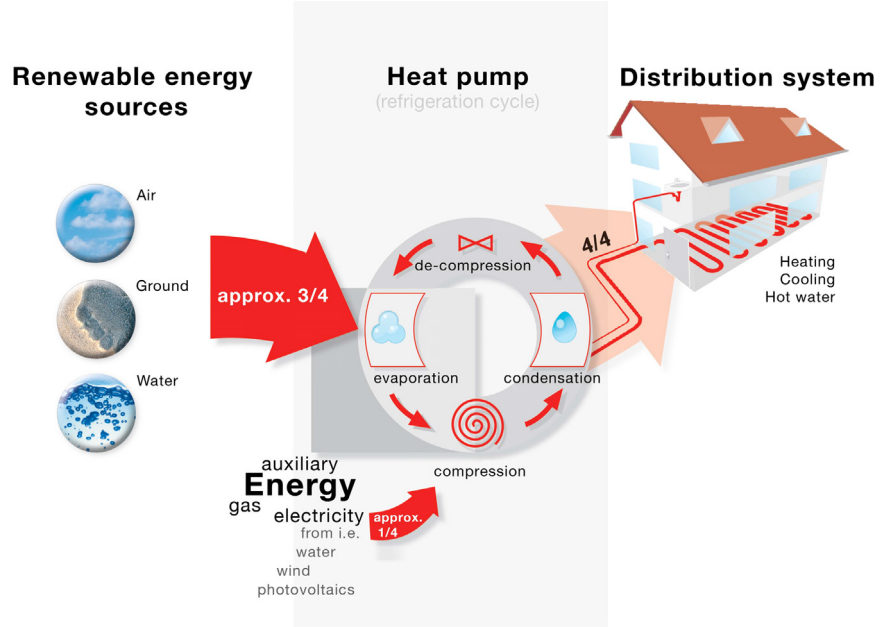

Fig. 1. Operation principle of a Heat Pump (*Source: EHPA/Alpha Innotec*).