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COST GAINS AND CO₂ REDUCTION IN GREENHOUSE HEATING BY AIR TO WATER HEATPUMP LATVIA DURING 2ND HALF OF 2021.

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Use of air to water heatpump (AWHP) to reduce CO₂ emissions from greenhouse heating were investigated by calculating the running costs of AWHP and natural gas boilers. Real climatic conditions and heating regimes of SIA Rītausma industrial greenhouse production facility in south east of Latvia were used for the calculations. COP of commercially available Hitachi 10kw heating power air-to water heatpump and the Nordpool day-ahead Latvia electricity prices were used. AWHP COP was adjusted to the actual outdoor temperature by using the third-degree polynomial fitted to the COP declared by the producers at 4 standard temperatures: -7,2,7,12 C. The cost of gas heating was calculated from the actual price of natural gas delivered to the facility and the actual gas boiler which has a 0,94 COP.

Results. 2nd half of 2021 was extraordinary in terms of hikes in both electricity and natural gas prices. For most of the time AWHP economically outperformed gas heating by a large margin. During periods of very high electricity prices and low temperatures the gas was much better option economically. During the time period studied the AWHP had economic advantages from August to November 2021 and gas heating was better during most of December 2021. By adding heatpumps to the existing gas heating system and running a hybrid system it proved possible to lower heating costs at least twice as compared to the existing cost of heating by natural gas alone. Addition of heatpumps to existing gas heating allows for at least 2-to-3-fold reduction of CO₂ emissions and a significant reduction of the heating costs. Phase transition materials like paraffins with phase transition T 50-60 C were found to be the most efficient storage media for the heat generated by AWHP in order to benefit from low electricity night prices at Nordpool.

Summary. Calculations using theoretical performance of heatpumps and market price for electricity and gas in Latvia during 2nd half of 2021 show that it is possible to achieve 2-to-3-fold reduction in CO₂ emissions and simultaneously significantly decrease the heating costs by adding air to water heatpump to existing gas heating for a greenhouse in Latvia.

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