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Hardware-in-the-loop test for a parabolic trough collector plant in the meat industry

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Abstract

The paper presents the concept, implementation and results of the hardware-in-the-loop test bench (HiL) established for a medium-scale parabolic trough collector system under construction. The 122.4m² plant heats the make-up water of a fossil-fired steam boiler in a meat factory in Austria. The test bench consists of a plant model implemented in a Real-Time machine, which is electrically connected to the plant control hardware (PLC) through several I/O terminals. Within the test bench, it is possible to run different test cycles and emulate critical operation scenarios like collector loop overheating. The control strategy of the solar plant can be checked with minimal risk. The test bench also enables to improve the control ability to cope with weather and sensor disturbances. A suitable fault detection strategy is prepared, which minimizes the risk of component damage and enhances the plant availability.

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Keywords: parabolic trough collectors; Hardware-in-the-loop test; process heat

1. Introduction

Within the European FP7 Project InSun, which started in April 2012 and ended in September 2015, two solar plants for industrial processes in two different countries are installed and monitored in detail. The main goal of InSun is to demonstrate the reliability and quality of large-scale solar thermal systems using three technologies of collectors for the generation of heat used in different industrial processes.

One of these demonstration plants is located in Austria and it is providing heat for the manufacture of meat products in the factory Berger. The 2013 installed 1067m² large flat plate collector system is extended by a 122.4m² parabolic trough collector field to increase the temperature of the make-up water up to 98°C and to efficiently assist

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the steam boiler (Fig. 1, Fig. 2). Steam is used in wet and dry meat treatment processes as well as for disinfection and defreezing.

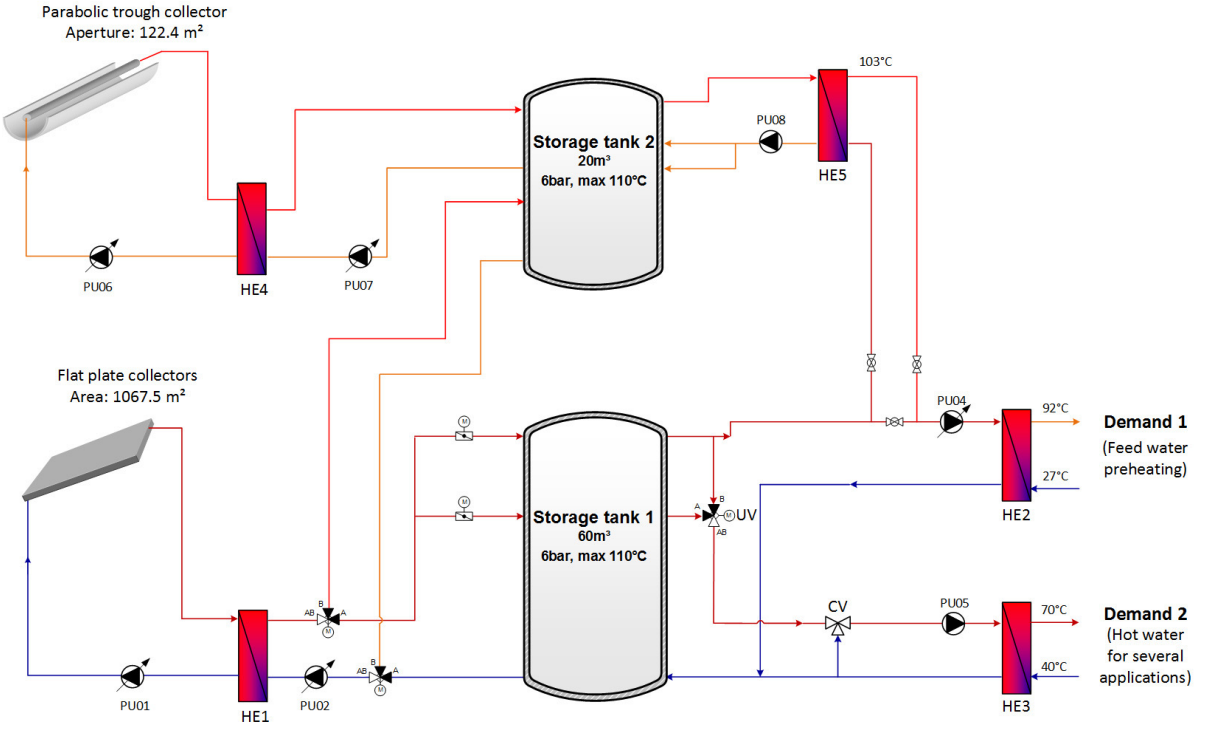

Fig. 1 The plant scheme

Fig. 2 The plant under construction. Left: the collector field, right: the 20m³ tank