



Chapter 3

Decision–Making Support on Energy Management in District Heating


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ABSTRACT

The chapter focuses on implementation of Industry 4.0 in energy management of a district heating system. The present objectives for implementation of digital technologies in district heating are analyzed. The barriers for sustainable and flexible district heating systems and challenges to overcome them are discussed. The objectives of energy management in district heating are presented. The realization of energy management stages in district heating tackling the digitalization challenge are presented. The

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chapter explores approaches and techniques to information support of decision making in energy management under conditions of uncertainty. The chapter describes the decision support system “HeatCAM” as a tool of energy management in district heating. This system will provide real-time monitoring and making decisions on regulation of heat consumption modes of the building on the consumer side in the condition of uncertainty.

INTRODUCTION

The heating sector which makes up more than 50% of the whole energy demand is currently under transformation because of Industry 4.0 implementation (Recommendations for implementing the strategic initiative INDUSTRIE 4.0, 2013; Reducing your ICT energy costs, 2015). The main objective of the transition to District energy 4.0 is energy performance increasing. Digital technologies are aimed to make the whole energy system and, in particular, district heating system smarter, more efficient, and reliable and to boost the integration of more renewables into the system.

The impact of usage IoT devices in District Heating 4.0 such as intelligent sensors and smart meters lays in acquisition the large data amounts of monitored heat consumption and changes in external factors affecting the needs in heat energy that may be used for decision support on heat energy demand regulation.

Making decisions on the management of the heating system is carried out in the condition of uncertainty. In relation to demand side energy management the timely regulation of the heat energy demand for heating buildings eliminates the excess of the heat consumption due to the fluctuations in temperature of the environment and individual heat energy needs for each building. The implementation of decision support system (DSS) based on machine learning approaches on data processing in the management of district heating system can improve the efficiency of such decisions.

The Chapter will focus on determination the approaches of increasing district heating energy performance. The decision support models and tools for smart energy management in district heating will be analyzed. The DSS for making decision support in regulation of district heating on the consumer side will be presented. This system will provide the real-time monitoring and making decisions on regulation of heat consumption modes of the building on the consumer side in the condition of uncertainty.

DISTRICT ENERGY 4.0 CONCEPT AND ITS IMPLEMENTATION

District heating (DH) plays a significant role in the supply of low-carbon heating and hot tap water all over the world. DH technology is most common in the countries with cold climate where the heat demand is large. It is particularly widespread in North, Central and Eastern Europe. In such countries as Iceland, Finland and Sweden the high amount of residential consumers are connected to DH system. In cities like Copenhagen, Helsinki, Warsaw, Vilnius, Riga as much as 90% of residential heat demands are satisfied by DH.

The DH system is a complex technological and socio-economic system, with heat generated in a central source and supplied for commercial and residential consumers to support comfort indoor air temperature in heated rooms. The consumers of the heat energy from the district heating systems in cit-

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