

Warsaw, 1st March 2021

Maksymilian Kočański, M.Sc.  
Author

Abstract of PhD thesis

**„Big Data Analytics in Building Energy Management Systems within Smart Grids”**

Two-way communication between actors of energy systems, automated control algorithms, and active involvement of consumers are among the key benefits expected from Smart Grids (SG). Many engineering tasks have to be completed to achieve these advantages, including rolling out of Smart Metering (SM) systems, ensuring semantic interoperability between stakeholders, systems, and devices, in particular in Building Energy Management Systems (BEMS), as well as implementing behaviour change programmes with measurable impacts. Acquiring knowledge from unprecedented amounts of data collected during the implementation of these tasks is becoming increasingly complex and requires utilisation of novel approaches in Big Data Analytics (BDA). Using a mixed research methodology, combining both qualitative and quantitative methods, the thesis addresses two aspects of these problems, providing a scientific contribution to the big data-driven development of SG. First, based on examples from Poland and Germany, it provides a comprehensive Technology Innovation System analysis of SM as an important element of SG and a prerequisite for acquiring data for BDA tools. Second, it showcases how the application of original BDA tools for time series classification and regression can allow for achieving results that are not achievable by the currently used methods of implementing engineering tasks in BEMS within SG. The tools are validated in two experimental settings that included time series collected over 12 months from an example of information-intensive BEMS comprising over 5,100 data points (case study in Germany) and time series collected over 29 months from SMs installed at over 1,600 households participating in a behaviour change programme aimed at electricity savings (case study in Poland). The outputs of the thesis are recommendations for improvement of public and private policy instruments as well as two novel BDA tools, demonstrated in R and MATLAB environments. They can be used by various stakeholders of SG – public and private policy makers, BEMS operators, as well as managers of energy conservation campaigns addressing households.

**Key words:** Big Data, Smart Grids, Smart Metering



Signature of PhD candidate