Chapter 7
Mining Smart Meter Data:
Opportunities and Challenges

Ayushi Tandon
Indian Institute of Management Ahmedabad, India

ABSTRACT

Metering side of electricity distribution system has been one of the prime focus of industry and academia both. The most recent advancement in this field is installation of smart meters. The installation of smart meters enables collection of massive amounts of data regarding electricity generation and consumption. The analysis of this data could help generate actionable insights for the supply side and provide the consumers demand management-related inputs. The problem addressed in this chapter is to identify suitable data mining algorithm for applications like: estimating the demand and supply of electricity, user and use profiling of commercial, and industrial customers, and variables suitable for these purposes. This chapter, on the basis of rigorous literature review, presents a taxonomy of smart meter data mining. It includes the summary of application of smart meter data analytics, characteristics of dataset used, and smart meter business globally. This chapter could help researchers identify potential research opportunities, and practitioners can use it for planning and designing a smart electricity system.

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INTRODUCTION

Electricity is vital utility as it supports many critical activities and services in human life. Electric power system consists of generation, transmission and distribution networks. The majority of electricity generation at present is centralized operation relying on non-renewable energy sources like coal, natural gas and nuclear. Electricity supply as an industry is highly capital intensive and suffers heavily due to demand-supply mismatch and transmission losses. In the recent decade application of Information and Communication Technology (ICT) in the power Industry has given rise to a new smart grid and smart metering infrastructure. Attempts are being made to enhance energy efficiencies and increase the reliability of electricity generation, transmission, and distribution systems by implementing network intelligence, empowering customers and enabling grid flexibility with smart devices deployments.

The evolution from the first known electricity meter, patented by Samuel Gardiner in 1872, towards a distributed electricity grid model able to manage numerous generation and storage devices in efficient and decentralized manner(Uribe-Pérez, Hernández, de la Vega, & Angulo, 2016). The metering side of the distribution system has been the focus, and the most recent advancement is the installation of *Smart Meters.* During 90's in the developed economies, automated meter reading (AMR) systems were introduced in the distribution networks moving away from electrochemical meters (Farhangi, 2010). Recently the AMR systems are being replaced with smart metering infrastructure (SMI), with two-way communication capabilities. These smart meters can digitally send meter reading to suppliers and also provide consumption and pricing related feedback to the user. This bidirectional communication ability of smart meters enables collection of the massive amount of data regarding the electricity generation and consumption. One of the biggest challenges in smart metering is the gathering and analysis of this 1.9 Terabytes of data per user/year. But, this also presents the most significant opportunity since analysis of this data could help generate actionable insights for supply side and provide the consumers demand management related inputs to the consumer. This opportunity if realized could enable countries to achieve the 20/20/20 European Sustainability Objectives of 20% reduction in energy consumption and, greenhouse gas emissions while 20% increase in renewables uses by 2020. According to the recent Benchmarking Report by the European Commission, the European Union has set the target to achieve 72% coverage of households with smart meters by 2020. In May 2017, Bangladesh Power Development Board (less developed country) launched smart meter service in the capital city, realizing the potential of this technology.