



# A systematic literature review on electricity management systems



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## ABSTRACT

Many countries in the world and most importantly Pakistan is suffering from severe electricity crisis. Information Technology (IT) is being used in every field of the life and we may apply IT to overcome electricity crisis. A large number of papers are presented by different researchers on electricity management. The key motivation of this systematic literature review is to study, analyze and explore the status of different solutions presented for management of electricity throughout the world and determine requirements for the development of a new electricity management system. We apply standard systematic review method with the manual search of three digital libraries. Out of 74 primary studies, 27 studies are software contributions, 13 studies are hardware solutions, 18 studies represent the theoretical work and 16 studies contribute proposed ideas. The quality of the contributions is fair as 74 articles out of 209 were selected as candidate studies after manual peer review. Currently, the solutions presented by different researchers are limited in scope. Many researchers are working on tool contributions, but most of them are only providing solutions for specific regions and communities. There is a need to develop a generic Electricity Management System (EMS) that should be customizable and can be used as generic solution.

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## 1. Introduction

Many countries in the world are currently facing overwhelming and lingering problem of energy crisis [1–4] which upset not only the daily life of people but it also has severe impact on socio-economic growth of any country. According to UN commission report released in December 2003, 1.3 billion people in the world are living without electricity. World electricity demand is projected to be double between 2000 and 2030, growing at an annual rate of 2.4% [8]. The difference of demand and supply require short term and long term policies by the Governments of different countries to solve this problem [5]. The generation of electricity through different sources, effective monitoring of electricity and Corporate Social Responsibility practices can reduce the gap of demand and supply. Electricity losses are also one of the main reasons of the electricity crisis. Software systems can be used to identify loss and theft of the electricity.

Electricity management systems are the applications for management and optimization of electricity to minimize problems of electricity crisis. Software systems for electricity management can be very helpful to overcome electricity crisis. In the recent years, this area of research has attracted the much attention of the researchers throughout the world. Growing interest in the field of electricity management systems is proving that there is a need to develop electricity management systems that can be used globally. Most research in this field is limited primarily because researchers just proposed different ideas, but they did not provide complete solutions that may be applied on real problems. Few researchers presented software solutions for electricity management but these solutions are limited in scope.

The objective of this Systematic Literature Review (SLR) is to study, analyze and investigate that what type of research is conducted in this field? What are the problems with existing solutions and more specifically what has been the output from the research community that might help to develop new electricity management systems that can effectively manage electricity? The foremost objective of this systematic review is to inspect the recent research work and present the most significant and motivating input that will help in developing energy management systems and might be valuable for the practitioners working in this field. This review also attempts to discover which methods and tools have been applied to develop and implement different energy management systems. The SLR is structured as follows:

We present our research methodology in Section 2. Section 3 represents the results and we discuss our results and research questions. In Section 4, we discuss limitations of our study and Section 5 depicts the conclusions of our systematic literature review.

## 2. Research method

This section describes the methodology adopted for the systematic literature review. To complete the systematic review, the literature review was selected as the research technique since exploring the contributions that have already been made in this field helped a lot to find out the answers of research questions. The literature review is a contribution that is intended to assemble the appropriate work in the specific field.

Our systematic literature review on electricity management systems is based on guidelines provided by Kitchenham [6,7]. It is generally applied research method for gathering requirements for a new research. The SLR research technique provides a generally characterized process for distinguishing, assessing, and translating all accessible evidences important to answer research questions [6]. This standard review methodology is selected to answer different research questions.

### 2.1. Research questions

The key motivation of this systematic literature review is to gather, analyze and explore existing methods presented for electricity management all over the world. We summarize and use information obtained through this review for development of an electricity management system as a second step. This review also attempts to discover which methods and tools have been applied to develop different electricity management systems. To acquire this objective, we formed a set of research questions to be addressed through this SLR. Research questions and motivation behind each research question is presented in Table 1. In the process of exploring answers to research questions, this exploration will highlight the shortcomings of existing research and software systems that have been developed. The following questions are formulated as a basis for discovering, exploring, and discussing the available literature.

- RQ1. Which type of research is conducted on Electricity Management Systems since year 2000?
- RQ2. What are the current Electricity Management Systems?
- RQ3. Who is leading the research in the field of Electricity Management Systems?
- RQ4. What are the limitations of current research solutions?

With the RQ1, a question may arise that why we started our research work from the year 2000? Due to the exploratory nature of the study, we only included contributions from 2000 and onward, otherwise it will be out of scope of the study. However

**Table 1**  
Research questions and motivation behind them.

Research question #	Motivation behind the research questions
RQ1	This question helps us to understand what type of research has been carried out in this area of study in last 14 years.
RQ2	To get an idea what type of electricity management systems are currently being used by the different, electricity management companies and other producers/consumers which are using electricity management systems to manage electricity.
RQ3	RQ3 helps us to find the group of people which are leading the research in this field, so that we can study their practices, which will help us in developing a new system.
RQ4	RQ4 helps us to realize limitations of current research

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