Chapter 22
Issues and Technologies of Effective Energy Management

Edward T. Chen
University of Massachusetts – Lowell, USA

ABSTRACT

The purpose of this chapter is to discuss critical issues and the role technology plays in today's energy sectors. Specific emphasis is placed on security, mobile dispatch solutions, and the so-called "Smart Grid." The industry continues to grow in both size and complexity, creating a multitude of challenges for companies as they struggle to keep the lights on. The utility business has traditionally lagged behind other sectors in the adoption and implementation of new technologies. However, mounting economic, environmental, social, and political pressures have thrust this once lumbering dinosaur out into the spotlight. Energy companies must look to innovative technology solutions to help them keep pace with our growing society. The chapter also touches upon how these issues create meaningful educational and employment opportunities.

INTRODUCTION

The utility industry has historically been slow to adapt to new technologies and business paradigms. However, mounting economic, environmental, social, and political pressures have thrust this lumbering dinosaur into the spotlight. The utility industry has witnessed a rapid increase in the rate of change in both technology and business practices. Energy companies need to find innovative technology solutions that provide better service to their customers while minimizing the impact on the environment and keeping costs under control (Chao, 2011; Kirschen & Strbac, 2004).

Organizations will need to invest in adequate infrastructure to support mobile workforce management and remote operation of the power grid. Furthermore, the fallout from the 9/11 terrorist attacks, Enron scandal, and major blackout events have created a sea of regulatory legislation that must be navigated if a company hopes to survive

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in today's difficult business environment. Technology is poised to take a lead role in these efforts and competent. Qualified personnel will be needed to manage critical projects using smart technologies (Lui, Stirling, & Marcy, 2010).

This chapter examines existing issues, technologies, and business strategies as they relate to the energy industry and identify areas where potential problems exist. Examples will include both successful projects as well as those, which failed to live up to expectations. This chapter looks at several topics in an effort to provide the reader with an understanding of the state of the industry as it relates to technology and what the future holds.

It is a very dynamic time for the energy industry. Companies are scrambling to keep pace with changes in regulations and technology. Cost will become a major issue and additional funding will be needed (Chao, 2011; Kirschen & Strbac, 2004). Who ultimately pays for a smarter, more reliable power system is a hot debate. The increased interconnection of parties and availability of information requires solutions that are viable, consistent, and securely managed.

ENERGY INDUSTRY OVERVIEW

Electricity. It is amazing how something so seemingly simple can become so ingrained into our daily lives. Light bulbs, computers, smart phones, home appliances, and most recently consumer vehicles would all cease to function without the controlled flow of electrons. In order to fully appreciate the current state of this critical industry and predict its future direction, we must start at the beginning.

Society's first recordable encounters with electricity occurred about 2,600 years ago during the era of the ancient Greeks (Warkentin, 1998). In fact, interestingly enough the words electron and magnet are both subsequently of Greek origin. Given the primitive technology of the time, the Greeks were limited in their discoveries to the observation of simple concepts like static electricity and the effects of magnetism. However, from these humble beginnings came a series of powerful experiments conducted by some of humanity's greatest scientific minds. Pioneers such as Maxwell, Faraday, and Volta helped to lay the groundwork for the industrial revolution and the eventual birth of the electric industry.

While there have been many contributors over the years, there are two in particular whose work cannot be ignored. Thomas Edison and George Westinghouse sought to bring electricity to the masses with their respective companies, eventually coming into conflict over what would be called "the war of currents." In 1882, Edison had established a direct current (DC) system to serve neighborhood incandescent lighting facilities. Centered in Manhattan, the Pearl Street Station became the first Investor Owned Utility (IOU) in the United States. Westinghouse on the other hand, had begun developing Alternating Current (AC) technology, boasting its superiority for transmitting power over longer distances to that of Edison's system. The two sides then engaged in a lengthy battle of propaganda and smear campaigns, attempting to win support from a largely uneducated populace. AC power eventually emerged as the dominant technology and has been used extensively in the construction and operation of the Bulk Electric System (BES).

The conclusion of the war of currents led to a blossoming of small utility companies primarily focused on serving local loads. After a period, it became clear that by interconnecting with their neighbors, these companies gained access to increased energy capacity and improved reliability. At present in the United States, there are five main types of power utilities participating in this widespread interconnection: Investor Owned (IOU's), Federally Owned, Publicly Owned, Cooperatively Owned, and the Independent Power Producers (IPPs). Each entity is unique in structure and function, yet they all must work together to keep the lights on and businesses running strong.