Chapter 14

Information Technology in Power System Planning and Operation under Deregulated Markets: Case Studies and Lessons Learnt

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ABSTRACT

Power systems have grown recently in size and complexity to unprecedented levels. This means that planning and operation of power systems can not be made possible without the aid of information technology tools and instruments. Even small systems need such aid because of the complexity factor. On the other hand, new trends have recently emerged to solve the problems arising from increased size of power systems. These trends are related to the market structure, legal, and business issues. Other trends also cover technological developments, and environmental issues. Moreover, power systems have special characteristics and features that are not duplicated in other infrastructures. All these issues confirm the need for special information technology tools and instruments which aid in planning and operation of power systems.

INTRODUCTION

This chapter aims at introducing the new emerging trends and critical factors which have shaped and continue to influence decisions of power system planners and operators. Some of these are technical issues while others are economic and financial. Legal issues are also of great concern in modern power system business. Moreover, some issues are related to the institutional setup of the electricity companies, the regulatory bodies and government. The interaction of the four thrusts; namely, technical, economic/financial, legal, and institutional introduce another layer of complexity in the planning and operation of power systems.

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This chapter will hopefully shed some light on all these issues and how they affect the processes of decision making and conducting business in the electricity sector. It will introduce new terminologies, discuss new procedures and tools, and present the philosophy underlying the changes and trends which lie ahead.

There are so many issues that nowadays influence and shape the functions of a power system. These issues have emerged from the trends which have evolved due to the deregulation strategies adopted by almost all power utilities. The model of a comprehensive monopolistic utility is almost a fact of the past; although in few countries it is still in place. Presently there is the vertical model which distributes the country into geographical regions and gives a concession to one utility to serve one particular region or area. Then there is the functional model which separates generation from transmission from distribution and gives each one to one or more companies. In between the two models there are several variants. These variants depend on the ownership of the power utilities. For example generation and distribution are privatized while transmission is kept as a government entity. In others generation is kept with government while transmission and distribution are privatized.

In almost all cases, government is moving away from controlling the power system and more into regulatory roles and duties. These regulatory roles include tariff setting, licensing, power quality issues, and more. The relationship between the regulatory body, which does not by default represent government per se, and the power companies could be a complex one as the criteria used involves customer satisfaction, companies’ profitability in addition to quality of the power delivered.

In certain aspects these ownership models have created competition and a drive for better quality. Therefore, new technologies and procedures have been tried and put into use. Moreover, customer satisfaction has become an important factor in the electricity business to the extent that in certain cases customers dictate their preferences as to green power over other environmentally polluting sources.

All these new trends have created new functions and duties for the power system planners and operators. On one hand better tools have been developed to improve the planning aspect of the power system including peak load and energy forecasting, risk assessment and reliability enhancement, integrated resource planning, and future expansion and investment planning. On the other hand other tools have been developed for the proper and cost-effective operation of the power system. These include: contingency analysis, economic dispatch with provision for tie lines control and power exchange, demand side management, reliability and availability monitoring, optimum power flows and loss reduction, interruption management and power restoration, and billing and payments follow up.

The interconnection with other systems also imposes other criteria and therefore requires new tools and methodologies for better operation and control. Moreover, the economic and financial aspects of power system planning and operation have taken more roles. For example, the issues of power purchase agreements (PPA), independent power producers (IPP), take or pay options, public private participation (PPP), etc. are important issues that take due place in power system decision making. The same also applies to the legal issues such as the various agreement forms which are needed to forge the business relationship between the parties. Finally the institutional aspects which are a direct reflection of the ownership model adopted play an important role in dictating the functions of the various entities. On top of all the issues mentioned the environment dimension is strongly present. It has technical, economic, financial, legal and institutional complications which must be properly addressed by the electricity sector entities.

In face of these new trends and technologies the educational institutions responsible for graduating engineers and other professionals who will work in entities of the electricity sector must adapt
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