Chapter 1
Power System Planning Process

ABSTRACT

This chapter aims at providing the basic background and foundation to the whole power system planning process covered in this book. It helps in setting the stage for a clearer and better understanding of the ensuing chapters. This is needed in the case of all readers, but it is especially important for readers who are not from the power industry such as regulators, policy makers, or legislators. Moreover, the planning process itself is also introduced in this chapter. This is particularly helpful for practicing engineers and other readers who might not be familiar with such issues. Finally, power system planning is introduced in this chapter to emphasize specific functions used in this context, especially those that are different than general planning functions.

INTRODUCTION

This chapter is intended to be an introduction to power system planning, which is the title of the book. This chapter will give a broad idea about power systems and the components comprising them. It will also present the various planning functions in general and the specific issues used in planning of power systems. We believe that for novice readers this will be a good introductory chapter, however, for readers who have experience with power systems, Chapter 1 can be skipped. It is understood that this chapter provides a broad definition of the components of the power system as well as the planning process.

Readers familiar and knowledgeable in power systems can catch the general flow and inter-linkages of the various functions of the planning process. On the other hand, unfamiliar readers can refer to Figure 1. This figure shows the inter-relation between the book chapters resulting in better, simpler and clearer flow of information and better understanding.

As can be seen from Figure 1, the whole power system planning can be divided into three phases; 1) preparation, 2) assessment and evaluation, and 3) implementation. Chapter 2 presents the major factors that affect and influence the future of power industry. These factors constitute constraints and determinants that affect the three phases almost equally since they are responsible for shaping and changing the future of power systems. The rest of the book chapters fall in one of the three phases, starting with the power system planning process.
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planning criteria that are presented in Chapter 3, which is followed by presenting the load research in Chapter 4. Both chapters constitute the preparation stage for the power system planning process. Chapter 4 is considered as the input for Chapter 6 (energy efficiency), Chapter 7 (demand side management), and Chapter 5 (load forecasting). It should be clear that both Chapters 3 and 4 feed Chapter 5 that represents the backbone for any planning process. In this chapter, load forecasting is presented. This function opens the door to the reader to investigate ways to meet the expected loads by means of renewable energy generation (Chapter 8), or through the system expansion (Chapter 9), or by means of interconnection (Chapter 10). Any or all of these choices can be selected and integrated through integrated resource planning (Chapter 11). Such integration takes into consideration both supply and demand alternatives. Financial factors (Chapter 12) will affect the final selection for the system expansion alternatives and will lead to defining the appropriate tariff (Chapter 13) and electricity pricing. This results in achieving the objectives of supply continuity and economy. Finally, the planning process as a whole is only possible when proper tools are used (Chapter 14) which are used throughout the whole planning process.

We recommend that readers who are familiar with power system components and power system planning issues are advised to start reading chapter 3 directly unless they are willing to browse through the remainder of this chapter.

POWER SYSTEM COMPOSITION

The power system is divided into three main components: 1) generation, 2) transmission and interconnection, and 3) distribution. This division is based on assets or equipment, and not necessarily on ownership of such assets. The three components are somewhat different in the way of operation and management. While the generation component is concerned with the issue of power supply and delivery to the network, the transmission component is directly involved in transferring power from generators to distribution companies. In addition to this the transmission component is in charge of the exchange of power from other power systems through system interconnections.

In fact it is in many models responsible for the