Overview of Power System Planning

Texts:
- Power System Planning, Robert Sullivan, McGraw Hill
- The Economics of Power System Reliability and Planning, M. Munasinghe, (World Bank Publication, Johns Hopkins Univ Press))
- Electricity Economics and Planning, T. W. Berrie, IEE Press

*Without data and without a good plan you are just sitting in the dark.*
(darwinmag.com)

Power systems must be planned. There are several overarching steps that must be followed:

1) Load Forecasting
   - How much electrical load must be served
   - Where will the loads be located.
   - How much will the load peak, how much of the load is weather sensitive.

2) Generation Planning
   - How much generation must be present.
   - How much reserve generation must be available. What is the minimum generation reserve that must be present to guarantee reliable generation supply.
   - What is the acceptable level of generation reliability. (i.e. what is the probability that generation will not be able to supply load on any given hour of the year).
   - Where should new generation be sited?

3) Generation Cost Analysis
   - What are the best generation sources that will deliver adequate generation reliability at minimum cost.

4) Transmission System Planning –
   - Security Analysis – will the transmission system deliver all the electrical energy demanded by the loads when one or even two components are out.
Transmission Reliability Analysis – how reliable is the transmission system? What is the probability that the transmission system cannot deliver the electric energy to the loads.

Generation reliability and its relationship to transmission system design. How much will a given transmission line enhance the generation reliability?

How many tiers of voltage should there be between the generators and the loads?

Should transmission be designed to serve the “common carrier” service requirements of an open marketplace, or should it be designed to serve loads from local generators.

How do you design the “optimal” transmission plan. What makes it optimal (cost, reliability, aesthetics, reserve for future growth, etc.)

5) Financial Analysis

How will the generation and transmission purchases and construction be financed?

Will the customer loads and the prices for energy guarantee sufficient revenues to meet the financial obligations.

6) Power System Reliability (reliability that takes into account the interaction of generation, transmission, distribution and loads)

How reliable should power delivery be? Can we place a cost on outages for residential, business, and industrial customers.

Can we design a power system to an optimal “cost effective” system?

Some additional things one ought to think about:

1. Where does the data necessary to perform these analyses come from?
2. What are the objectives of the organization doing the planning?
3. What has changed under the new rules of power system deregulation?