Capacity and Energy

Electricity has three important properties:

1. Electricity must be produced at the same instant in time, and in the same amount, that it is consumed by customers. Since electricity cannot be stored like other energy sources such as coal, oil, natural gas, etc., *when* electricity is generated has a large effect on its value to customers and the price utilities are willing to pay for it. Electricity generated during off-peak times (middle of the night and weekends) is worth less because customers use less electricity at those times. Conversely, electricity generated during on-peak times (middle of the day and middle of summer) is worth more because customers use more electricity at those times.
2. Electricity supply is considered an essential service and regulated by the Federal government and by state and local governments. Local utilities generally operate under an "obligation to serve". If there is electric load in their service territories, the utility is basically treated as a monopoly and required to have enough power-generating capability to meet anticipated demand.
3. Electricity has become a necessity in the developed world; a reliable supply is needed at all times.

Electrical Supply

There are two critical, interconnected, yet different, components of electrical generation and consumption – capacity and energy.

Capacity

Capacity is the capability of suppliers to produce a good or service. In the electricity market, capacity is the physical amount of generation that a utility company has available to serve customer demand. This physical amount of generation is usually measured in kilowatts (kW) or megawatts (MW) and represents the total amount of power that a utility is capable of generating/producing.

Capacity reflects the amount of generated power available at any point in time, but usually represents an electric utility's annual peak demand. An electric utility with an obligation to serve must maintain a level of available generating capacity sufficient to meet the peak demand of its customers during the hottest summer days and the coldest winter nights – and still have some generating capacity in reserve.

Energy

Energy is the amount of electricity, which is produced by the generating capacity of an electric utility, that customers consume over time. Energy is measured in kilowatthours or megawatthours. Energy is the product of capacity and time.

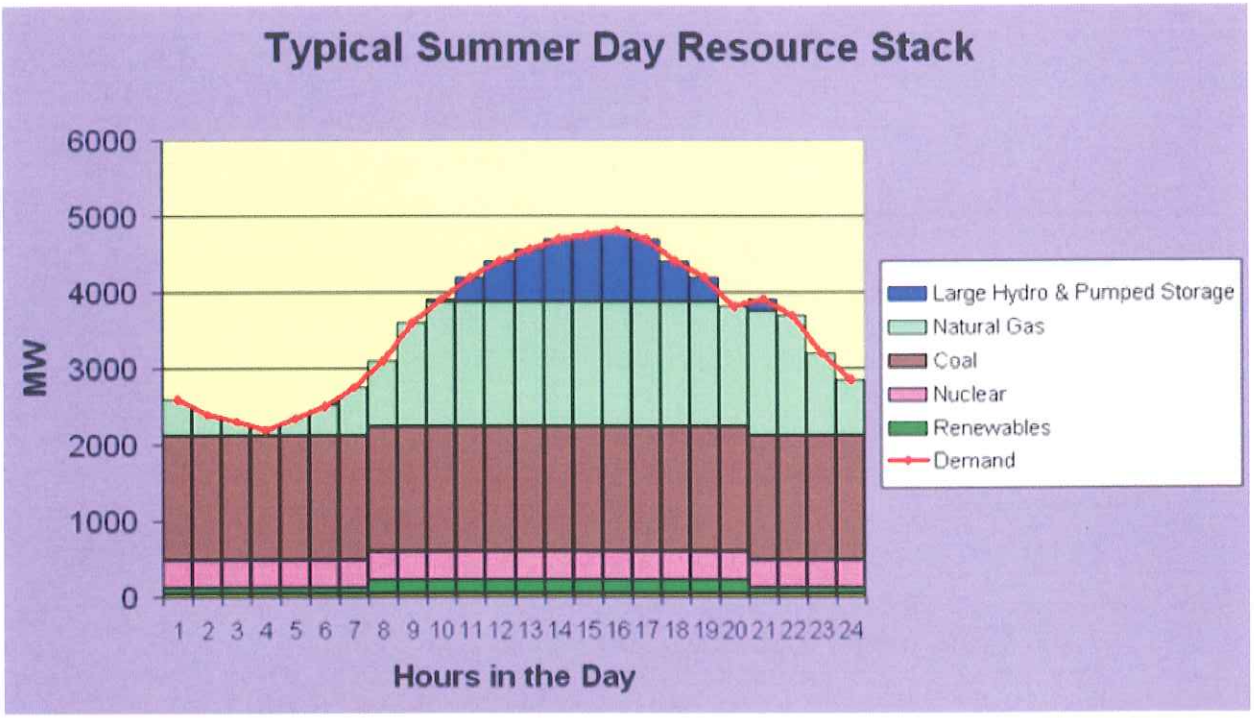
Electrical Demand

Electrical generation must vary instantaneously second to second, minute to minute, hour to hour, etc. as customers turn on and off lights and other electrical devices, since state-regulated electrical utilities are required to meet this demand. Unlike theater auditoriums, where, once all of the seats are sold and anyone else who wants to see a performance is turned away, utilities are required to meet customer load/anticipated demand – at all times.

Supply and Demand

Figure 1 illustrates both demand and how electrical demand, for a typical summer day, is met. Demand shifts over time and is illustrated by the red line. A typical utility would have powerplants operating 24 hours a day to meet part of this demand (called the base load). In this illustration, the coal and nuclear plants are used for this purpose. They are not able to "quick start" to meet changing loads, and are less flexible than other types of generating resources. The utility also has the capacity to bring additional powerplants on line to meet increased demand, as required, during the daytime. In Figure 1, these are a natural gas unit and large hydropower plants.

Figure 1



Why Capacity Is Important

A 10-kW light bulb that burns for 10 hours will consume 100 kilowatthours of electricity. A 100-kW light bulb left on for 1 hour will consume the same 100 kilowatthours of electricity. The 10-kW light bulb only requires 10 kW of capacity while the 100-kW light bulb requires 100 kW of capacity. Both light bulbs consumed the same amount of electrical energy (100 kilowatthours),

but one light bulb requires 10 times the amount of capacity of the other light bulb. If these were the only two demands (or loads) of an electric utility, this utility would need to have at least 110 kW of generating capacity available at any given time to ensure that both bulbs could be lit at once.

Federal, state, and local reliability requirements and regulations require that utilities maintain sufficient capacity available and are ready to meet potential demand, regardless of whether or not the customers turn on any electrical devices and actually consume electricity.

Glen Canyon Dam and the Provision of Capacity

Electrical power generated at Glen Canyon Dam (GCD) is integrated with several other powerplants on the Colorado River and sold as electrical energy and capacity. Western determines the amount of electrical capacity it can contractually obligate. This determination is made on a periodic basis and changes with hydrological conditions and when operating parameters change.

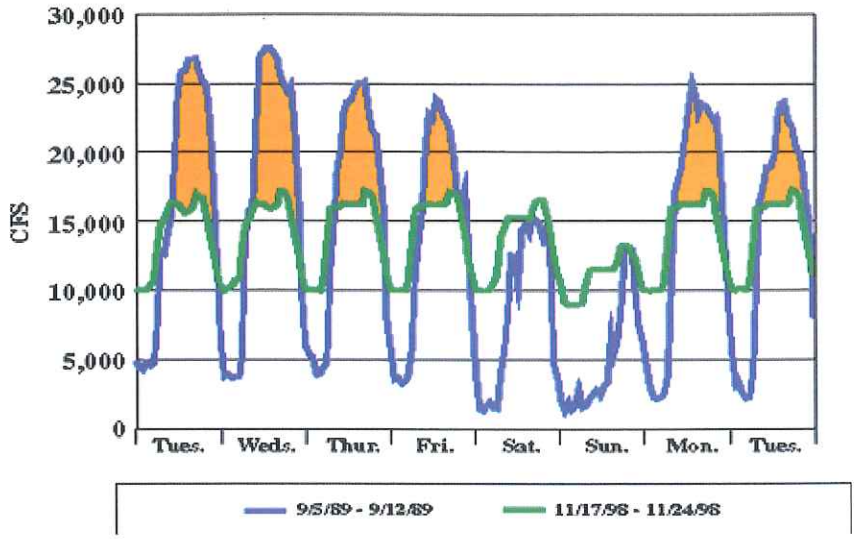
In 1997, the Department of the Interior issued a new set of operating rules for GCD after completing an environmental impact statement in 1995. Figure 2 shows GCD hydrographs for 2 weeks: one before and one after the change in the operating rules. These are two historical weeks chosen for comparison purposes. They both have approximately the same volume of release.

Both produce approximately the same amount of electrical energy. Although cubic feet per second, not megawatthours are measured on the vertical axis, in Figure 2, the area under the curves can be used to represent the electrical energy generated. However, the change in the pattern of electrical generation produces significantly less electrical capacity. The yellow "fill" represents a reduction in operational capacity.

After this change in operational rules, Western did not change its contractual obligation for electrical energy, but did reduce the amount of capacity obligated under contract. This capacity had to be replaced by the Glen Canyon electrical customers even though they did not need to use these new generators to produce additional energy.

Figure 2

Lost Capacity



From time to time, economic studies related to GCD operations will fail to consider the place of electrical capacity in the market and how changes in GCD operations can change the marketable capacity available at GCD. Colorado River Storage Project power customers, all not-for-profit entities, who hold long-term contracts for Federal power from GCD, are potentially financially and operationally impacted by this type of change.