Some Problems with Hydroelectric Power

Originally, designers thought the building of a dam and hydroelectric plant was benign. However, we have come to realize the situation is more complex. Dams flood valleys and canyons. The existing river ecosystem is replaced with a lake ecosystem, wiping out the river and valley species and replacing them with, in many cases, species not native to the region. Salmon serve as the most well known example. Each year in order to spawn they made their way upriver from the ocean to the small streams that form the headwaters of larger rivers. Along the way they navigated rapids and even small waterfalls. But they were blocked when large dams were built. They were unable to spawn. So fish ladders were built—artificial rapids they could climb to get past the dam. Then it was discovered that reservoirs caused habitat to silt-up, destroying the clean, rocky bottom required for successful spawning. When spawning was successful, many fry did not survive the trip downstream to the ocean, getting sucked-in and pureed by the turbines of the generating stations. The species became threatened. Today, some dams are even being dismantled in efforts to save the Salmon, an important world food source.[i]

In some cases, the flooded river ecosystem is precious or unique; the reservoir makes it easy for people to access the area (on boats), but it can destroy much of the original scenic value. For instance, Lake Powell, the reservoir behind the Glen Canyon Dam, flooded one of America's greatest scenic treasures, equal in some people's estimate to the beauty of the Grand Canyon.[ii] In another example, the Hetch-Hetchy Valley in Yosemite National Park was thought by many to be the equal to Yosemite Valley, its famous sister. But in 1923 it was dammed to provide water and electricity for San Francisco.[iii]

Other problems sometimes ensue. The reservoir behind the Three Gorges Dam in China has made the surrounding mountains unstable. Landslides and erosion threaten the safety of the people, and millions are having to be relocated.[iv] The Aswan High Dam in Egypt cut off the annual Nile River floods, depriving the lower Nile Valley of sediment. Controlling the destruction caused by the floods was wonderful. However, sediment was deposited on the land during floods; it kept farmland fertilized and prevented subsidence in the Nile River Delta. Now, the productivity of the land is declining, requiring farmers to substitute expensive fertilizers, which do not seem to fully correct the fertility decline. The delta (the cities of Alexandria and Port Said are there) is now sinking into the Mediterranean. In addition, the dam created a reservoir in a desert (Lake Nasser) with such a large surface area that evaporation has seriously reduced the flow of the Nile.[v] Finally, the silt carried by rivers collects in reservoirs, eventually filling the reservoir. In many cases, it will take a hundred or more years. But what happens then?

Today, hydroelectric plants are being built on much smaller streams with smaller heads. They channel the stream through the power plant without creating a large reservoir. This design is called *run of the river*. It still requires construction of a dam and alteration of the river valley ecosystem, but on a much smaller and less destructive scale. However, the flow of a river varies with precipitation levels. Large reservoirs can be used to even-out a river's flow. But this cannot be done with run of the river. With these schemes, the amount of power varies with the flow of the river. As we have seen in other white papers, this presents a challenge for electrical grid management.

[i] *Salmon*. Wikipedia. Retrieved online 12/14/2007 at http://en.wikipedia.org/wiki/Salmon. See also the many sources and books for further reading cited at the end of the Wikipedia article.
[ii] For example, see the website of the Glen Canyon Institute, http://www.glencanyon.org.
[iii] *Hetch Hetchy Valley*. Wikipedia. Retrieved online 12/16/2007 at http://en.wikipedia.org/wiki/Hetch_Hetchy.
[iv] Weijian, Chen. (2007). *Commentary: The tragedy of the Three Gorges Dam*. Retrieved online 12/10/2007 at http://www.upiasiaonline.com/Economics/2007/12/05/commentary_the_tragedy_of_the_three_gorges_dam/3564.
[v] El-Sayed, Sayed, and van Kijken, Gert. *The southeastern Mediterranean ecosystem revisted: Thirty years after the construction of the Aswan High Dam*. Retrieved online 12/10/2007 at http://www-ocean.tamu.edu/Quarterdeck/QD3.1/Elsayed/elsayed.html.