Steam Venting at a Nuclear Power Plant

As the demand for freshwater grows and supplies dwindle, should water use become a major factor in choosing new sources of electric power? That is a question addressed recently in a hearing sponsored by a subcommittee of the U.S. House Committee on Science and Technology.

The United States Geological Survey says that 48 percent of freshwater withdrawals nationwide are for electric power production. Water is needed to make steam in most thermal power plants, and for cooling. Water is also an important factor in the production of fuels such as coal, oil, and natural gas. While almost all of this water usage is "non-consumptive" (it is not absorbed by vegetation, for instance), this enormous source of demand reduces stream flows, lowers groundwater tables, and diverts water from other uses. The testimony delivered before the subcommittee by U.S. Department of Energy Undersecretary Dr. Krisitina M. Johnson describes the dependence various power production options have on the availability of water.

Here is one of the big problems: power sources that save water are not always the same ones that reduce carbon emissions. The results are mixed. On a gallons-per-megawatt-hour basis, low-carbon nuclear power is the worst offender. Conventional coal comes in a close second.

Water Use by Plant Type (7-9-09 Testimony of Bryan Hannegan)

Natural gas is somewhat better, but solar thermal and biofuels can be almost as water-intensive as conventional coal. Solar photovoltaics and wind have minimal water requirements. And what about coal power with carbon sequestration (not shown on the chart)? Both Dr. Johnson and Energy Power Research Institute Vice President Bryan J. Hannegan told Congress that carbon sequestration makes coal far and away the worst offender – the water intensity can become double that of a conventional coal plant, needing almost twice as much water as a nuclear power plant, more than twice as much as any other generating option.

The Department of Energy is addressing this issue by promoting energy effiiciency, funding research and development into more water-efficient approaches, and looking at existing options (such as closed-loop parabolic solar concentrators) that required comparatively less water. But all of this is occurring within a broader context. Dr. Johnson says, "In general, water is only one of many factors such as materials inputs, energy production and

consumption, emissions, and others that must be considered in the lifecycle construction, operation, and decommissioning of energy technologies. Consequently, water-related technology R&D is best done as part of the broader R&D effort to improve performance, lower costs, and reduce environmental impacts, including water, of energy supply and end-use technologies." The simple fact that the current Department of Energy looks at these matters in terms of lifecycle impacts is reason for hope.