US Energy Policies Surprisingly Dependent Upon Water

You may not be aware of it, but a lot of energy production is very reliant upon there being great quantities of water to help in the process. A new report suggests that increasingly scarce water supplies are a major hidden cost of a "business as usual" approach to generating electricity in the US.

The new analysis, "The Hidden Costs of Electricity: Comparing the Hidden Costs of Power Generation Fuels," comes from the Civil Society Institute. It looks at six fuels used to generate electricity – biomass, coal, nuclear, natural gas, solar (photovoltaic and concentrating solar power), and wind (both onshore and offshore). The six fuels were then analysed for their impact on water, climate change, air pollution, land, and other resources, as well as planning, cost risk, subsidies, and tax incentives.

"The government and energy industries are literally flying blind as they plan for continued reliance on coal, natural gas, nuclear power and industrial biomass to meet our energy needs," said Grant Smith, senior energy analyst, Civil Society Institute.

The Diablo nuclear power plant in Avila, CA

"Each of these is water intensive and leads to pollution of water, which is increasingly scarce and in competition for other uses such as agriculture and other commercial uses. The drought intensifies the urgency and the imperative that political leaders in both parties hit the pause button on the

headlong rush to support nuclear power and fossil fuel use."

Examples of the water-related findings in the report include the following:

- Nuclear power has critical cooling requirements that require huge amounts of water. Roughly 62 percent of U.S. nuclear plants have closed-loop cooling systems. Reactors with closed-loop systems withdraw between 700-1,100 gallons of water per megawatt hour (MWh) and lose most of that water to evaporation. Water withdrawals are even higher at open-loop cooled nuclear plants, which need between 25,000-60,000 gallons per MWh. Most of the water is returned, but at a higher temperature and lower quality.

- In addition to fouling streams and drinking water through mining and coal-ash dump sites, coal-fired power relies heavily on closed-loop cooling systems which withdraw between 500 and 600 gallons of water per MWh and lose most of this via evaporation. Withdrawals for open-looped cooled coal-fired power plants are between 20,000-50,000 gallons per MWh. Most of the water is returned, but at a higher temperature and lower quality.

- Under a so-called "Clean Energy Standard," biomass would become a much larger source of U.S. electricity generation; however, biomass also requires vast amounts of water. The report notes that a typical 50 megawatt (MW) biomass plant could withdraw roughly 242 million gallons of water per year and lose most of this. Adding 10 of these plants in a region would use 2.42 billion gallons of water per year. For dedicated energy crops, water use for irrigation can be considerable. One study estimates water use for most crops between 40,000 and 100,000 gallons per MWh, with some crops exceeding this range.

- In 2010, EPA estimated that fracking shale wells can use anywhere from two to 10 million gallons of water per well. The water is often extracted from on-site surface or groundwater supplies. Such huge water withdrawals raise serious concerns about the impacts on ecosystems and drinking water supplies, especially in areas under drought conditions, areas with low seasonal flow, locations with already stressed water supplies, or locations with waters that have sensitive aquatic communities.

- By contrast, wind and solar photovoltaic power requires little water in the electricity generation process. Concentrating solar power requires water for cooling purposes, but new technologies are placing greater emphasis on dry cooling. Solar power plants with dry cooling use only around 80 gallons per MWh – about a tenth of the low-end estimate for nuclear power and one-sixth of the low end estimate for coal-fired power generation.

"In 2005 the Congress mandated a federal water/energy roadmap," Seth Sheldon PhD, CSI lead

water/energy analyst, added. “Nearly eight years later, that roadmap has not been produced and either through bureaucratic inertia or fear of hard political questions, the questions are not even being asked, much less their solutions explored. At a time of significant water scarcity and increasing threats to water quality, we can ill afford to ignore this central question about the future of our energy choices.”

Other water-related data highlighted in the report includes the following:

- The full picture for nuclear power water use may be even more dramatic. Estimates of lifecycle water use for three European reactors range from 2,600 to 6,900 gallons per MWh, not including cooling water use. (This compares with a lifecycle analysis of a parabolic trough solar thermal power plant at 1,240 with wet cooling and just 290 gallons per MWH for dry cooling.) In addition, nuclear wastewater production ranges from 6.3 to 7.4 gallons per MWh.
- Coalbed methane recovery of natural gas depletes ground water: one estimate puts total groundwater removed between 1997 and 2006 at an astounding 172 billion gallons.
- Estimates of the lifecycle water withdrawals from wind projects, including both onshore and offshore projects, range from just 55 to 85 gallons per MWh.

Source: Civil Society Institute
Image Source: Mike Baird on Flickr