

“It’s the water, stupid!” Nuclear Power won’t work in Global Warming World

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An oft-repeated jibe against renewable energy sources like wind and solar power by (usually) smug nuclear power proponents is, “What are you going to do when the sun don’t shine and the wind don’t blow?”

For the umpteenth time since 1988, our organization has been forced to meet this mindless taunt with the starkly real rejoinder: “And what are YOU going to do when the rivers don’t flow?” For, just like in Illinois in 1988, 2005, and 2006; and throughout Europe several years this century, France -- the much heralded nuclear exemplar -- is again facing a river water crisis that is forcing the shutdown of one-third of its entire nuclear power fleet.

Due to the current serious drought (think: “*transient global warming conditions*”), maintenance issues, and a worker strike, 80% nuclear-reliant France is now *importing* electricity from England to meet power demand. One report indicates that “20GW (gigawatts) of France’s total nuclear generating capacity of 63GW was out of service,”¹ *exactly* when needed the most.

The reasons are easily understood. Fourteen of France’s 19 nuclear generating stations are sited on rivers. Reactors discharge heated water into these confined water systems, relying on that age-old deficient axiom that “the solution to (thermal) pollution is dilution.” Unfortunately for the French, during severe droughts, the rivers possess neither sufficient water volumes nor flow-rates to sufficiently dissipate the ever-growing heat build-up. Continuing operation would result in cooking the river biosystems locally and downstream.

Regulations exist in France (and elsewhere) preventing this. Powerplants are required to curtail operation or shut down completely when discharge water exceeds such a heat threshold -- inconveniently, when demand for electricity is peaking.

The power output of reactors continuing to operate is also lessened during periods of drought due to higher river water temperatures. A Union of Concerned Scientists paper notes that, with higher ambient water temperatures in rivers and lakes, “...the effectiveness of the condenser in converting steam back into water decreases. As a result, steam is not “pulled” through the turbine as swiftly and less electricity is “cranked” out.”²

To be fair this condition applies to any steam-cycle electricity generator, whether powered by coal, nuclear or gas. But to be equally fair, this point should be held pointblank in mind when considering new sources of electricity in a difficult to model but seemingly immanent climate-disrupted world. Wherever drought becomes the norm, the steam-cycle for power generation will compete head on with more basic human needs and uses for water. And in an agricultural state like Illinois -- which already uses over 80% of its surface waters for power generation³ -- expanding reliance on the steam-cycle becomes a liability.

Before Illinoisans indulge in too much smirking and *schadenfreude* over France’s predicament, it’s worth noting that 1.) reactor shutdowns already happened in Illinois in 1988, and almost again in 2005-06; and 2.) 100% of Exelon’s Illinois reactors are river-dependent.

So -- what lessons can be learned from these unfortunate experiences? Well, some in the Illinois legislature think -- this is a great time to *build more* nuclear reactors! The last two Illinois legislative sessions saw proposals to repeal what is known as the “Illinois nuclear construction moratorium”⁴

The legendary American conscience and humorist Will Rogers once quipped that some people learn by reading; others by being told. And some -- just have to pee on the electric fence for themselves. It seems to us that those advocating construction of new nuclear reactors in a climate unstable world --

where water will be THE ultimate constraining resource, and where we have ample historic evidence that reactors are less-efficient, vulnerable, or outright inoperable under expected severe

drought conditions, and finally, where viable energy alternatives exist -- would fall in that third category. Which would not necessarily be such a bad thing -- if they didn't require that we all hold hands with them. ■

¹ "France imports UK electricity as plants shut," The Times , July 3, 2009, http://business.timesonline.co.uk/tol/business/industry_sectors/utilities/article6626811.ece

² "Nuclear Heat," Issues Brief, Union of Concerned Scientists, 2006. www.ucsusa.org

³ "Drought may give a taste of the future," Kelly Kennedy, *Chicago Tribune*, July 7, 2005; and private phone conversation with Dr. Derek Winstanley, (then) Illinois State Water Survey, July 8, 2005.

⁴ Or, more accurately, Sec. 8-406.c of the Public Utilities Act, preventing the construction of new reactors in Illinois until such time as the federal government has a demonstrated and operating facility for the permanent disposal of high-level radioactive wastes (spent-fuel) by the reactors.

Nuclear Power's Poor Performance under Global Warming-Like Conditions

Location	Dates	Incident
Illinois, USA	June 1- Aug. 31, 1988	Severe drought, exceedingly high temperatures, low river volumes and flow rates force (then) Commonwealth Edison's Dresden and Quad Cities reactors to reduce power to 30% or shut completely in some cases. USEPA thermal discharge standards had been reached and exceeded by the reactor discharge water. Nearly 100 reactor-days of operation were thusly curtailed -- precisely at a time when ComEd needed the power to meet repeated peak demands. <i>Source: NRC daily reactor reports, 1988</i>
Western Europe	Summer of 2003	France, Spain, Germany and other European nations are hit with extraordinary heat wave and drought -- ultimately killing over 30,000. France, Germany and Spain are confronted with the dilemma of allowing reactors to exceed design standards and thermal discharge regulations to maintain power for cooling -- or shutting the reactors. Spain shuts theirs down; France and Germany allow some of theirs to exceed standards and thermal discharge regulations, while shutting others. In France local firefighters are actually called out to hose down overheating reactor containments (at Fessenheim). In the course of the summer the French nuclear reactors at Blayais on the Gironde River estuary are alone allowed to exceed thermal discharge limits 50 times. <i>Source: Inter Press Service, July 11, 2005</i>
Illinois,	summer of 2005-2006	During serious drought USEPA and state officials consider closing several Illinois reactors coming close to exceeding thermal discharge standards. A break in the weather and needed rains prevent EPA intervention. <i>Source: NEIS phone conversations with IL State Water Survey personnel</i>
Illinois, Minnesota	July 29 -- Aug. 2, 2006	Prairie Island MN (1,137 megawatts) compelled to reduce its output by as much as 54%. Quad Cities Reactors, near Cordova, IL, Dresden Nuclear Plant, near Morris, IL, and the Monticello Nuclear Plant, in Monticello, MN, reported that they had cut power production to moderate water discharge temperatures (<i>Source: Nuclear Regulatory Commission 2006</i>)
Donald C. Cook reactors, Bridgeman, MI	July 30, 2006	Donald C. Cook reactors were manually shut down during severe heat wave; internal containment building temperatures exceeded regulatory limit of 120° F. for over 8 hours, and the temperature could not be reduced. <i>Source: NRC Event Number: 42739, 2006</i>
Tennessee, Alabama, Georgia, SE United States	Aug. 5-12, 2008	Tennessee Valley Authority lost one-third of its nuclear capacity due to the serious SE drought conditions. All 3 Browns Ferry reactors were idled to prevent overheating of the Tennessee River. <i>Source: Chattanooga Times/Free Press</i>
France	July, 2009	"20GW (gigawatts) of France's total nuclear generating capacity of 63GW was out of service" due to reaching thermal discharge limits for French rivers. <i>Source: The Times, July 3, 2009</i>
TVA, TN, AL, GA -- USA	July-Aug. 2011	TVA reduced power at Browns Ferry Nuclear Plant to stay within the discharge permit issued by the state of Alabama. At one point, all three units were reduced to a power level of about 50 percent. "Our water temperature forecasting model predicted a period of high river temperature during this time, prompting the decision to reduce power at Browns Ferry to avoid exceeding the 90°F downstream temperature limit set by the permit." (<i>Source: Paul Hopping, Operations Evaluation staff in TVA's River Scheduling organization.</i>)

