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Testimony of Dr. Peter H. Gleick[1]
Before the United States Senate
Committee on Energy and Natural Resources

On the Energy and Water Integration Act of 2009

March 10, 2009

Mr. Chairman, Senators: thank you for inviting me to offer comments on the critical connections between energy and water in the United States. Water use and energy use are closely linked: Energy production uses and pollutes water; water use requires significant amounts of energy. Moreover, the reality of climate change affects national policies in both areas.

Limits to the availability of both energy and water are beginning to affect the other, and these limits have direct implications for US economic and security interests. Yet energy and water issues are rarely integrated in policy. Considering them together offers substantial economic and environmental benefits and I support the effort to do this in the Energy and Water Integration Act of 2009.

International and Domestic Water and Energy Challenges

As we enter the 21st century, pressures on both our national water and energy resources are growing. Some recent headlines from around the nation tell the story:

Drought Could Force Nuke-Plant Shutdowns
The Associated Press, January 2008
Sinking Water and Rising Tensions
EnergyBiz Insider, December 2007
Stricter Standards Apply to Coal Plant, Judge Rules; Activists Want Cooling Towers for Oak Creek
Milwaukee Journal Sentinel, November 2007
Journal-Constitution Opposes Coal-Based Plant, Citing Water Shortage
The Atlanta Journal-Constitution, October 2007
Maryland County denies cooling water to proposed power plant
E-Water News Weekly, October 2007
Water woes loom as thirsty generators face climate change.
Greenwire, September 2007

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Other nations are also feeling the challenges of energy and water problem: The Mayor of London recently rejected plans for a desalination plant on the grounds that it would require too much energy. A new desalination plant in Perth, West Australia, was build under the condition that new, renewable energy systems also be built in order to minimize its greenhouse gas contributions. A major wind farm was built to supply part of that plant's energy demand. The energy bill to operate the British water company, Thames Water, amounted to 17% of their total operating costs in 2007 and those costs are rising. Nuclear power plants in France were derated during drought because of temperature limits in rivers to protect ecosystems.

The Nation's Energy System Requires Water

Water is used in every phase of the energy cycle, as shown in Figure 1. A substantial fraction – nearly 40% -- of the nation's water withdrawals are used in the generation phase to cool power plants and produce energy. This is the largest single withdrawal of water in the United States. While most cooling water is not "consumed," this level of water use is putting more and more pressure on regional supplies, and it may not be possible to satisfy all of the expected water needs of newly proposed powerplants. In arid and semi-arid regions, power-plant water demand can be a substantial fraction of limited regional supplies.

Far more water is required for nuclear and fossil-fuel energy systems than for most renewable energy systems, depending on cooling system type (see Figure 2). Moreover, some new fossil-fuel sources require substantial amounts of water during mining and processing, or contaminate large volumes of water making it unavailable for use for other purposes. These differences must be taken into account in national energy policy decisions.

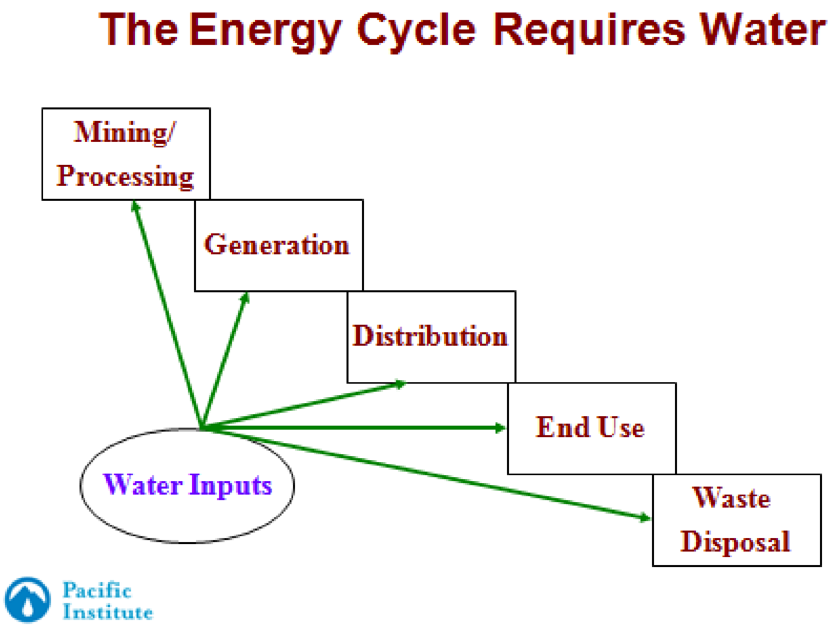

Figure 1. Water is an input to every part of the energy cycle.

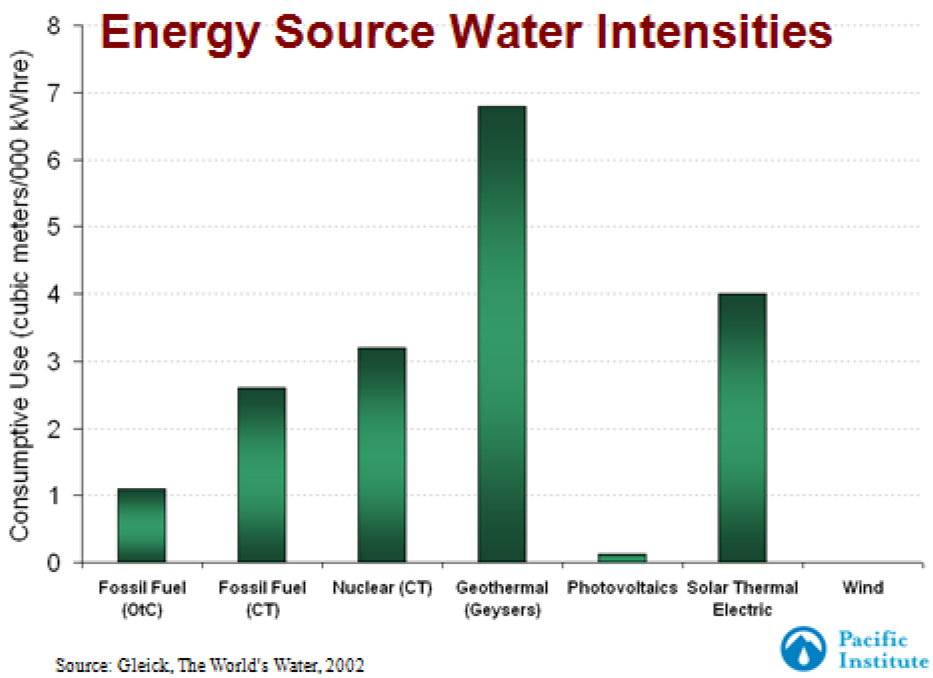

Figure 2. Different energy systems require different amounts of water. This figure shows consumptive use of water in cubic meters per thousand kilowatt-hours of electricity generated for a range of different energy systems.

The Nation's Water System Requires Energy

Capturing, treating, moving, distributing, and using water also require energy. Figure 3 shows the energy inputs for different phases of our water systems. To give you an idea for how substantial some of these energy demands can be, the single largest user of energy in the State of California is the State Water Project (SWP), which moves water from the mountains in the northern part of the state to the coastal cities in the south. The SWP uses an average of 5 billion $kWhr_e$ per year. In order to pump 1 acre-foot of water (326,000 gallons) through the state system to Los Angeles requires an average of 3,000 $kWhr_e$ of electricity. Figure 4 provides a pie chart breaking down the total energy required for water use in San Diego, showing the substantial amount of energy to move water to the region, and the even larger amount of energy to use water. Most of this energy goes to provide hot water, and substantial energy savings are possible by reducing hot water use. This startling assessment of the energy costs of water use can also be seen in the following estimate: Running the hot-water faucet for five minutes uses as much energy as burning a 60W incandescent light bulb for 14 hours.

The growing understanding of these connections is beginning to lead to new state and national policies. California is beginning to regulate greenhouse gas emissions, including emissions from water utilities. The California Energy Commission recently calculated that 95% of the energy savings of proposed energy-efficiency programs could be saved at 58% of the cost through water-efficiency programs instead and this is leading to a rethinking of funding priorities for energy efficiency.

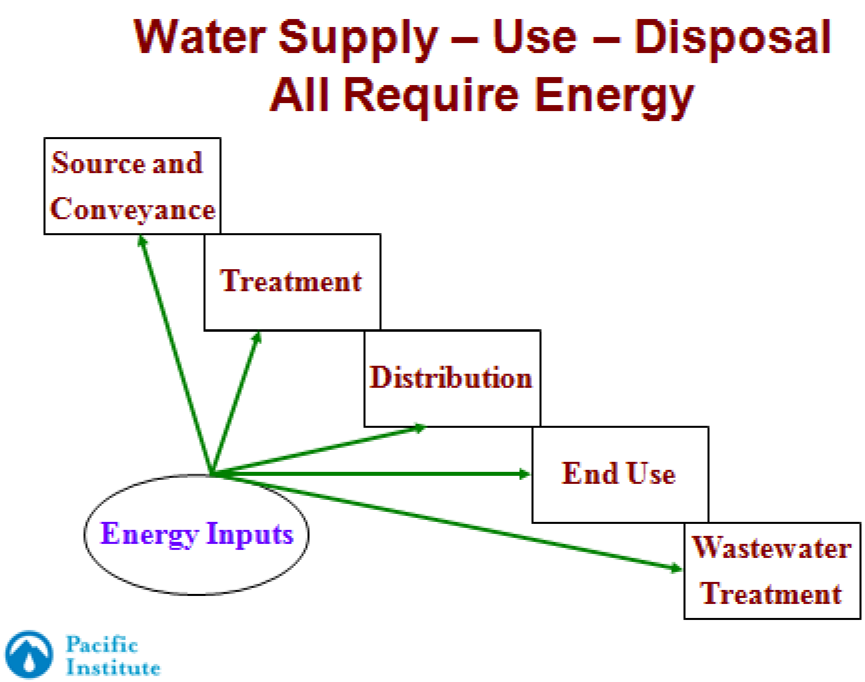

Figure 3: Energy is required for each phase of water delivery, treatment, and use.

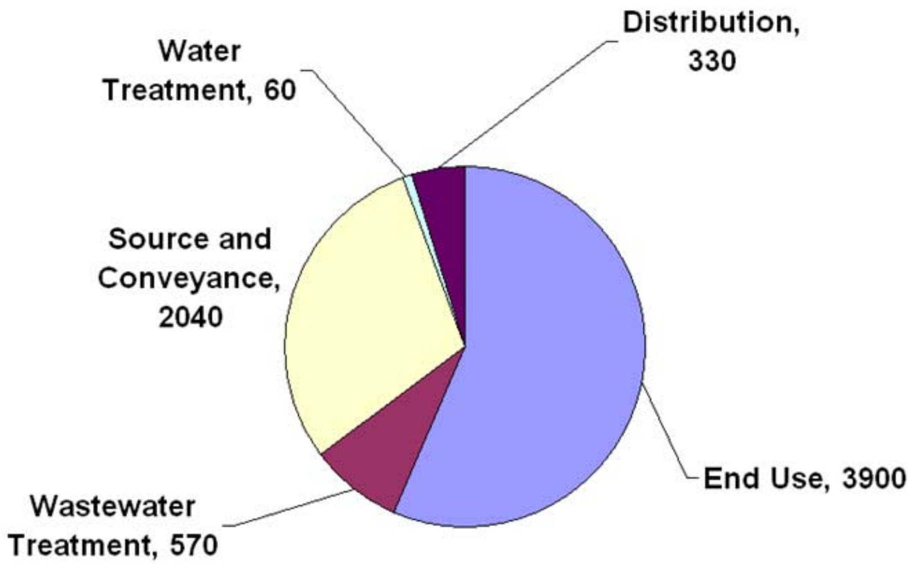

Figure 4. This figure shows the energy in kWhrs to provide, treat, and use an acre-foot (326,000 gallons) of water in San Diego, California. Note the large amount required for the end use. Source: Pacific Institute, "Energy Down the Drain," Oakland, California, 2004.

Water and Energy Efficiency Should be Linked: Clothes Washers

Year	Energy Use kWhr per Load	Energy Use per Household (kWhr/year)
1980 to 1990	3.9	1,540
1990 to 1998	3.0	1,190
Water-Efficient Washers	1.6	630

Source: Pacific Institute, 2004

Pacific Institute

Table 1: The energy efficiency of washing machines has increased in recent years, and new machines also save significant amounts of water. Source: Pacific Institute, 2004. "Energy Down the Drain." Oakland, California.

Another indication of the links between energy and water use can be seen in Table 1, which shows how improvements in the efficiency of washing machines has led to a substantial reduction in energy use per load, and per household. New washing machines can cut energy demands by over 60% compared to earlier models, and they also save substantial amounts of water.

As noted by the California Air Resources Board:

> "Water is one of the few sectors in California's economy where the same policies can serve both preventative and adaptive global climate change goals. Making more efficient use of water will reduce our demands on water resources and shrink the energy consumption associated with water conveyance, pumping, heating and treatment. California water policies can therefore help the State to adapt to the effects of climate change while also minimizing GHG emissions."
>
> California Air Resources Board (February 11, 2008), "Technologies and Policies to Consider for Reducing Greenhouse Gas Emissions in California."

Specific Comments for Changes in the "Energy and Water Integration Act of 2009"

Finally, I'd like to offer specific comments on the proposed bill. I commend the sponsoring Senators for proposing this bill, and these suggestions for corrections or modifications are modest. As my preceding testimony should make obvious, I strongly support the need to both analyze the links between water and energy and to develop national policies that can minimize the unnecessary use of both resources.

Section 5(c)(2)C should read "…to reduce the volume and cost of desalination concentrated wastes and to dispose of those wastes in an environmentally sound manner;"

Section 6 should generally refer to water-related energy "use" rather than "consumption."

Section 6. The amended text of Section 205 of the Department of Energy Organization Act should include a call to both collect and disseminate information on energy use as follows:

"(1) IN GENERAL. – Not less than once during each 3-year period, to aid in the understanding and reduction of the quantity of energy used in association with the use of water, the Administrator shall conduct an assessment under which the Administrator shall collect and disseminate information on energy use in various sectors of the economy that are associated with the acquisition, treatment, delivery, and use of water."

Section 6. In the "Required Sectors" section, the following should be added after "(D) domestic purposes."

"The assessment described in paragraph (1) shall also contain an analysis of the potential to reduce energy use through improvements in water-use efficiency."

Conclusions and Recommendations

Water and energy are tightly linked, but these links are poorly understood and rarely used in policy.

- Decision makers and corporations should better integrate energy issues into water policy *and* water issues into energy policy.

The failure to link these issues will *inevitably* lead to disruptions in the supply of both water and power.

Water efficiency efforts can save substantial water (and energy) at lower cost, and faster, than new "supply."

- Water efficiency should be given a higher priority by resource planners.
- Implement water efficiency programs at all levels designed to capture multiple benefits.

The climate implications of both water and energy policy are significant.

- There are large opportunities for fast, cost-effective reductions in emissions.

National policies can help address both water and energy challenges. In particular,

- Phase out irrigation, energy, and crop subsidies that promote wasteful use of water and energy.
- Pursue smart labeling of water efficient appliances that also save energy.
- Pursue new appliance standards.
- Promote research and development for traditional energy sources that reduce water withdrawals and consumption.
- Promote research and development for renewable energy sources that use little to no water.
- Use alternative water sources such as reclaimed or saline water for power plant cooling.
- Encourage biofuels development that uses little water or discourage water-intensive biofuels.

I congratulate you for considering this vital issue and for helping to raise national attention on the need to re-evaluate and re-focus efforts on sustainably managing both our precious freshwater and energy resources. Thank you for your attention.

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