Date Submitted

Jan 20, 2012

Option Name

Thermoelectric Power Plant Transition and Demand-Side Management

Description

Thermoelectric power plant consumptive demand can be significantly reduced and/or eliminated through aggressive demand side management and a transition to more water-efficient power supplies (e.g., wind, solar PV, and combined cycle gas facilities).

Location

Thermoelectric power plants and related energy demands consume water in every basin state; the largest power plants and water demands are located in rural areas (e.g., Four Corners region, western Wyoming, and rural Utah).

Quantity & Timing

Thermoelectric power plants generally have a permitted life of 40 to 50 years. Many of the largest plants in the basin were built in the 1960's, 70's, and 80's. Table 1 lists fourteen plants in the basin that collectively consumed nearly 167,000 AF of water from the Colorado River or its tributaries. Several of these plants may be retired before 2015 (e.g., Arizona Public Service has proposed to retire Four Corners units 1 – 3), and many, if not all, will likely be retired long before 2060. Table 1 is not comprehensive; for example, Arizona's Palo Verde Nuclear Station consumes 60,000 – 70,000 AF/yr of recycled wastewater but is not included.

A typical, wet-cooled, conventional coal plant in the Southwest consumes approximately 541 gallons/MWh of electricity generated; a wet-cooled combined cycle gas plant consumes 180 gallons/MWh, or 67% less.[1] Wind, solar PV, and energy efficiency measures use no water (see chart at end). The minimum quantity of water available for this strategy is a 67% reduction of 2015 energy demands, which assumes all existing coal plants are replaced with efficient, combined cycle gas plants. The maximum quantity of water available for this strategy is the near elimination of all water demands for energy in 2060, which assumes existing plants are replaced with wind, solar PV, energy efficiency, *or* dry cooled power plants and new energy demands are met with water efficient resources such as dry cooled gas or solar plants – as has been the trend in recent years in much of the Southwest (all recently-built gas plants in Nevada, for example, have adopted dry cooling).

[1] Data sources cited in Western Resource Advocates and Environmental Defense Fund. 2010. *Protecting the Lifeline of the West: How Climate and Clean Energy Policies Can Safeguard Water*. Boulder, CO.

Table 1. Major Thermoelectric Power Plants in the Colorado River Basin. Source: U.S. Energy Information Administration, 2005.

State	Plant	Water Consumption, 2005 (AF/yr)	Cooling Water Source	Plant Inservice Year
AZ	Navajo	26,274	Lake Powell	1974 - 1976
WY	Jim Bridger	25,333	Green River	1974 - 1979
NM	Four Corners	24,826	San Juan River	1963 - 1970
NM	San Juan	19,977	San Juan River	1973 - 1982
UT	Hunter	18,746	Cottonwood Creek	1978 - 1983
CO	Craig	14,331	Yampa River	1979 - 1984
UT	Huntington	12,377	Huntington Creek	1974 - 1977
UT	Bonanza	7,672	Green River	1986
WY	Naughton	6,080	Hams Fork River	1963 - 1971
UT	Carbon	3,112	Price River	1954 - 1957
CO	Hayden	2,823	Yampa River	1965 - 1974
AZ	South Point Energy	1,954	Colorado River	2001
AZ	Desert Basin	1,614	CAP Canal Water	2001
CO	Nucla	1,592	San Miguel River	1991
Total		**166,712**		

Technical Feasibility

Electric utilities retire thermoelectric power plants on a regular basis; utilities around the region are choosing to retire older, inefficient facilities in favor of newer, more efficient combined cycle gas plants, water-efficient renewables, and demand side management because of the price of natural gas, the cost of potential air regulations, and other factors.[2]

Costs

Variable, but as little as $0. The costs are zero if electric utilities retire plants in order to meet clean air requirements (unrelated to the water issues) or as plants reach their design lifespan. If utilities accelerate retirement of power plants because of the water savings, the costs would depend on the extent to which retirement is accelerated. The costs would primarily be borne by electric utilities, their shareholders, and customers; the economic benefits (of increased water supplies) could potentially be borne by the same customers, however.

Permitting

Likely would involve approvals from state public utility commissions, in addition to a transfer of water rights from electric utilities to other entities.

Legal/Public Policy Considerations

Plant retirements will have important public policy benefits for human health and the environment, particularly in the regions adjacent to plants. They could also have important socioeconomic impacts or

[2] For example, in 2010, Colorado's legislature, PUC, stakeholders, and Xcel Energy decided to retire 900 MW of coal-fired capacity in the Denver-Metro region and replace it with natural gas and other resources.

benefits on communities adjacent to plants that provide workers and/or receive tax benefits. The impact/benefits would depend on whether retired plants are replaced with alternative resources on-site or in a distant location.

Implementation Risk/Uncertainty

Little to no risk or uncertainty.

Reliability

Reliable.

Water Quality

The "new" water would have a quality comparable to the original source.

Energy Needs

No foreseen energy needs to deliver water from the site of the retired power plant to alternative users; however, electric utilities would likely have to develop new sources of energy generation to replace retired supplies.

Hydroelectric Energy Generation

No impacts.

Recreation

Recreation and tourism could be improved in national parks and areas where air quality is impacted by existing thermoelectric pollution.

Environment

Strategy may create benefits for air quality, human health and the environment, particularly adjacent to the region's largest thermoelectric coal units.

Socioeconomics

See: Legal/Public Policy Considerations

Other Information

The water intensity of electricity generation varies, depending on the fuel source, conversion technology, and cooling technology. The following graph illustrates the typical water intensity of conventional power plants in the Southwest, emerging technologies, and renewable sources of energy.[3]

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[3] Western Resource Advocates and Environmental Defense Fund. 2010. *Protecting the Lifeline of the West: How Climate and Clean Energy Policies Can Safeguard Water*. Boulder, CO.

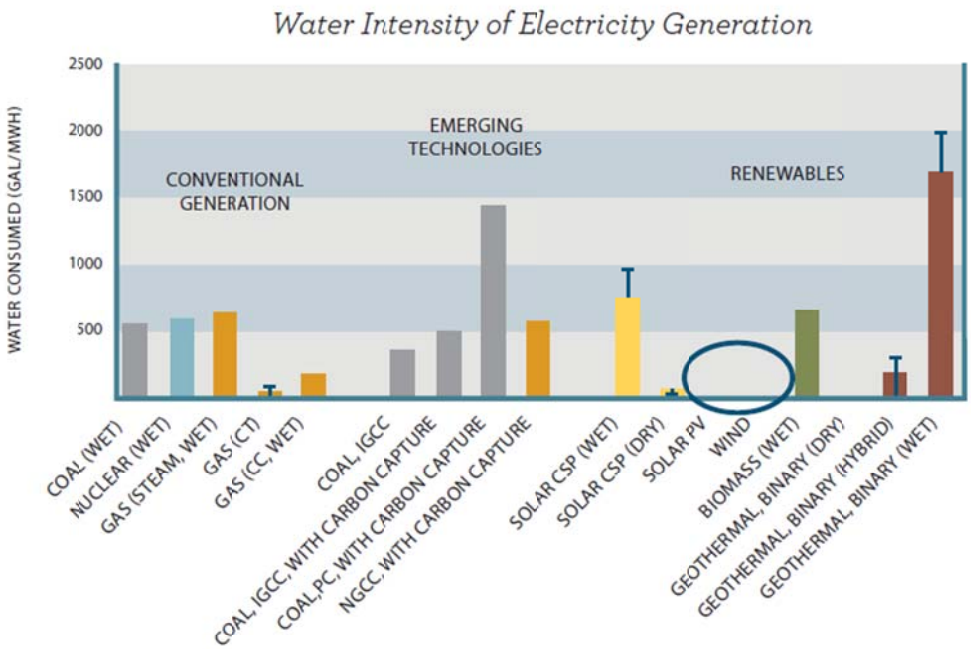

Figure ES-1. Water use for electricity generation varies substantially. Importantly, renewables like wind and solar photovoltaics (PV) use virtually no water. Water use for geothermal plants can range substantially, but most geothermal plants in the Interior West use negligible amounts of freshwater, as they usually rely on water high in salts or other minerals for cooling.

WRA would be happy to assist USBR in matching the power plants listed in Table 1 to the appropriate demand node in the CRSS model.