Practice Brief

January 2020

Changes in Electrical Generator Cooling Systems

Are They a Cost Effective Source of Saving Water?

Electrical generators use substantial water for cooling in South Central Texas (see figure 1). There are possible water saving actions via retrofitting existing cooling systems or when constructing new facilities. However, these can be expensive propositions. Here we estimate the costs per acre-foot of water that arise from such conversions. We also compare them to the range of estimated costs in regional Texas Water Development Board (TWDB) identified water-augmenting projects.

Key Messages

- Changing cooling decreases electrical generation amount and increases operating costs plus incurs capital costs.
- We find the estimate of average annualized cost per acre-foot of water saved from retrofitting existing plants to be $4,041/acft with a range spanning from $934/acft to $8,215/acft.
- When building new electrical generating plants with dry as opposed to recirculating cooling we found the average cost of water saved is $3,527/acft.
- Dry cooling would remove water scarcity as a risk and the increased reliability would be a benefit to electrical generators.
- Implementation of cost-effective retrofits would likely involve cost sharing with those using the saved water.
- Climate change will likely increase water use and in turn increases water savings from changing cooling while decreasing the costs of the saved water.

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Details can be found in:
Yingqian Yang, Bruce A. McCarl (2019). Changes in Electrical Generator Cooling Systems Are They a Cost Effective Source of Water? Unpublished Manuscript, Texas A&M University, College Station, Texas

Here we consider retrofitting an induced draft cooling tower system with dry cooling. Such conversions involve: a) expensive capital investments (3 million); b) increased operation and maintenance (O&M) costs; and c) decreased electrical generation levels along with reduced water use.

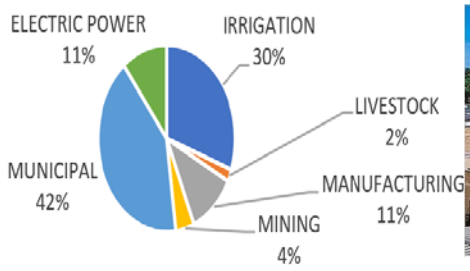

Figure 1 Relative shares of water diversions

Figure 2 a) Induced draft cooling tower b) Dry cooling tower

To compute the cost of water saved when retrofitting cooling systems, we divide the annualized retrofit cost by the amount of change in consumptive water use savings adjusting diversions for return flow. We did this for Department of Energy data available on 26 power plants and for 15 new potential plants. Consumptive water use was estimated based on state of Texas data.

Figure 3 present schedules of cost per acre foot of water and the amount of water saved for regional retrofits of 26 possible plants. Data for regional TWDB project water cost and quantity are also included. We find the water savings costs through retrofits are generally higher than those under most of the TWDB water development possibilities. The lowest cost alternatives arise for retrofits at cogeneration facilities and building new, smaller plants with dry cooling.

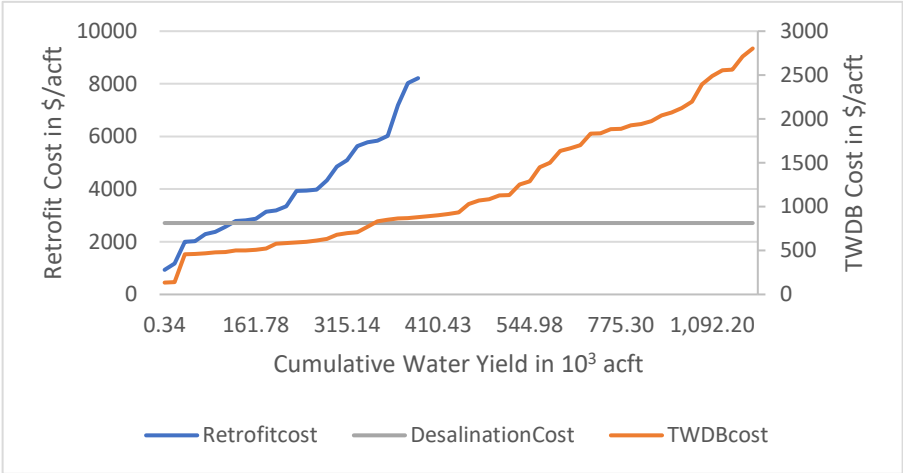

Figure 3 Retrofit costs and quantities of water versus TWDB project costs and quantities

Given the lost generation and increased operation and investment cost for this to be implemented it would appear to be necessary for those gaining from any water savings to help pay for the altered investment and operating cost.

We also considered how projected climate change would influence the cost of changing cooling and found it would reduce the water cost by 10-15%.