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 for regional Texas Water Development Board (TWDB) identified water-augmenting projects.

Key Messages

- Changing cooling in South Central Texas decreases water use but it also reduces electrical generation amount, increases operating costs and incurs capital costs.
- Estimated average annualized cost per acre-foot of water saved from retrofitting existing plants to dry cooling is about $4,000 per acre foot with a range spanning from $900 to $8,200.
- When building new electrical generating plants with dry as opposed to recirculating cooling we found the average cost of water saved is $3,500 per acre foot.
- A benefit from using dry cooling is that water reliability would not be a risk.
- Implementation of cost effective retrofits would likely involve cost sharing with those using the saved water as these increase costs borne by generators and reduce revenues.
- Climate change will likely increase water use in turn increasing retrofit water savings while lowering saved water costs.

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Backup Details are 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 Unpublished Manuscript, Texas A&M University, College Station, Texas

The retrofits considered here involve use of an induced draft dry cooling tower system. This reduces water use but also involves: a) expensive capital investments (~$3 million); b) increased operation and maintenance (O&M) costs; and c) decreased electrical generation levels.

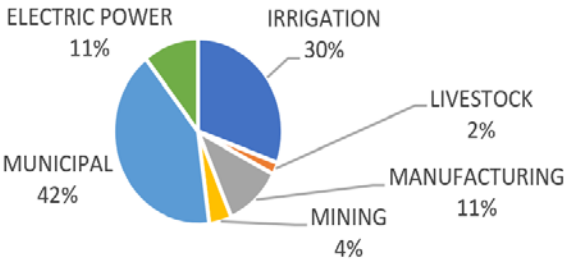

Figure 1 Relative shares of water diversions

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

To compute the cost of water saved by the retrofit, we divide the annualized retrofit cost by the amount of change in consumptive water use savings. We did this using Department of Energy data available on 26 South Central Texas 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 saved and the amount of water saved for regional retrofits of 26 possible plants. Data for estimated water cost and quantity for developing possible regional water plan projects are also included. We find the water savings costs through retrofits are generally higher than those under most of the possible water projects. The lowest cost alternatives arise for retrofits at cogeneration facilities and for building new, smaller plants with dry cooling.

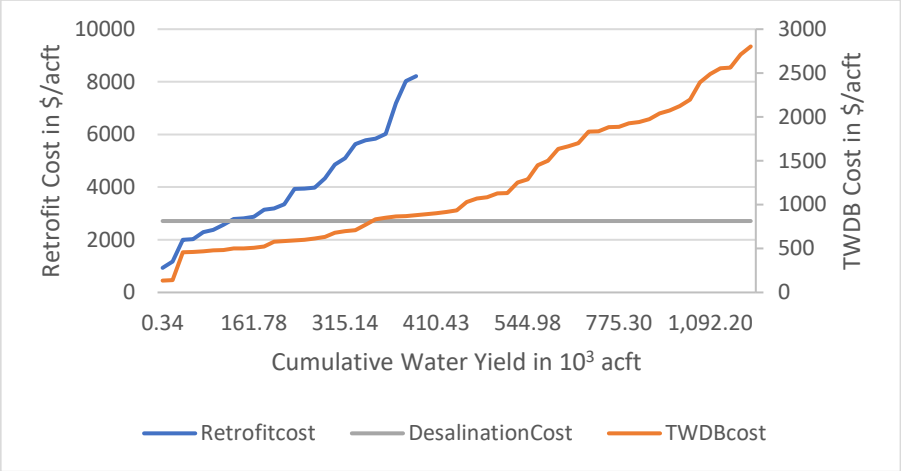

Figure 3 Retrofit costs and quantities of water versus TWDB project costs and quantities

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 retrofit generated saved water cost by 10-15%.