

## **Impact of Water Conservation on Electricity Consumption in the City of Davis**

Kathy Yip

### **Abstract**

In 2015, California confronted its fourth year of drought, facing a 48% deficit (2,835,000 million gallons) in surface water resources below baseline conditions (Howitt et al. 2015). In response to the water deficit, the Governor of California began mandating water conservation. The state of California was required to have a 25% reduction in urban water consumption relative to 2013 baseline levels, which was approximately 2,140,000 million gallons. Urban water agencies were required to report their monthly progress towards this goal to the SWRCB in response to the mandate (Brown et al. 2015). This project estimates the amount of water conserved in the City of Davis as well as the resulting electricity savings in the water year of 2015-2016. For the City of Davis, the water saving goals was 27% reduction in urban water consumption relative to the 2013 baseline levels. The data was being retrieved from the 'H2Open' website. From the result, it shows that the City of Davis succeeded in saving 1,098 million gallons of water, corresponding to a 27.3% decrease relative to the e2013 baseline over the mandate period. The resulting electricity saving from the reduction in water consumption was 895MWh. Based on the result, it has shown that the City of Davis was able to meet the state-wide mandate goal (25% reduction in urban water consumption).

## **Introduction**

In 2015, the Governor of California mandated a 25% reduction in urban water consumption relative to 2013 baseline levels in response to the deficit in surface water resources due to drought. Urban water suppliers were required to report their monthly progress towards the urban water conservation goal as well as the urban water consumption. Since the water sector has a close relationship with electricity and energy consumption, the main focus of this project is to evaluate whether electricity consumption has a direct relationship to water consumption as well as the comparison between electricity consumption and amount of water conserved in 2013 and 2015.

## **Objective**

The main objective of this project is to compare the urban water consumption in 2013 and 2015 of the City of Davis as well as the electricity saving as a result of the mandate. The deliverable for this project would be a chart showing the monthly water production in the 2013 and 2015 by analysing the data as well as the total resulting electricity savings. A percentage of water reduction will also be calculated to see if the City of Davis met the state-wide goal of a 25% reduction in urban water consumption relative to 2013 baseline levels.

## **Data Sources**

Centre for Water-Energy Efficiency. (2016). "California H<sub>2</sub>Open"  
<<https://cwee.shinyapps.io/greengov/>> (April, 2021).

Howitt, R., Medellín-Azuara, J., MacEwan, D., Lund, J. R., & Sumner, D. (2014). Economic analysis of the 2014 drought for California agriculture. University of California, Davis, CA: Center for Watershed Sciences.

Mitchell, David, et al. Fiscal and Economic Impact Analysis. 2016, p. 27.

Spang, E. S., Holguin, A. J., and Loge, F. J. (2018). "The estimated impact of California's urban water conservation mandate on electricity consumption and greenhouse gas emissions." *Environmental Research Letters*, 13(1), 014016.

SWRCB. “Water Conservation and Production Reports“

<[https://www.waterboards.ca.gov/water\\_issues/programs/conservation\\_portal/conservation\\_reporting.html](https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/conservation_reporting.html)> (April, 2021).

### Methods and Assumption

- Download the urban water systems monthly consumption data reported to the CA State Water Resource Control Boards for the duration of the Governor’s urban water conservation Executive Order B-29-15 (June 2015 – May 2016).
- Compare the mandate period data to the baseline time period (2013)
- Make columns plot to compare the water consumption data in 2013 and 2015
- Calculate the total amount of water conserved as well as the percent of reduction
- Calculate the electricity savings based on the percent of reduction in water consumption.
- The cost of water conservation to water suppliers is estimated to be \$75/acre-foot based on a recent SWRCD report (Mitchell et al. 2016)

### Calculation/Results

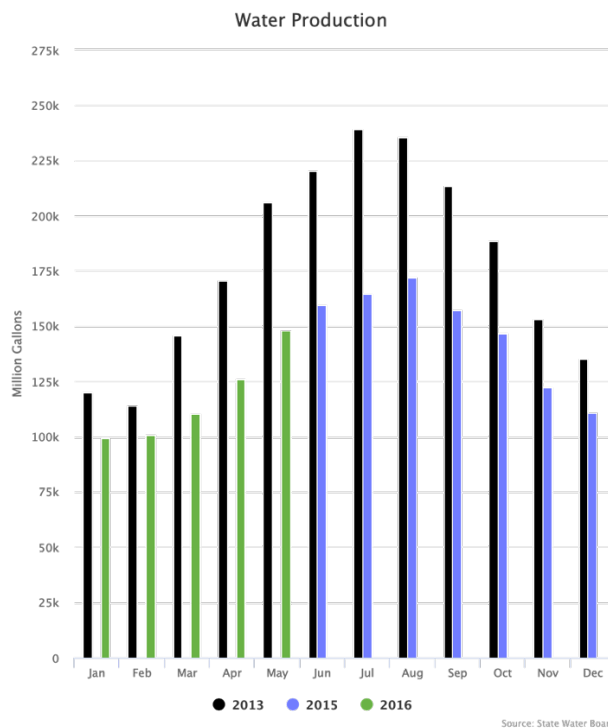
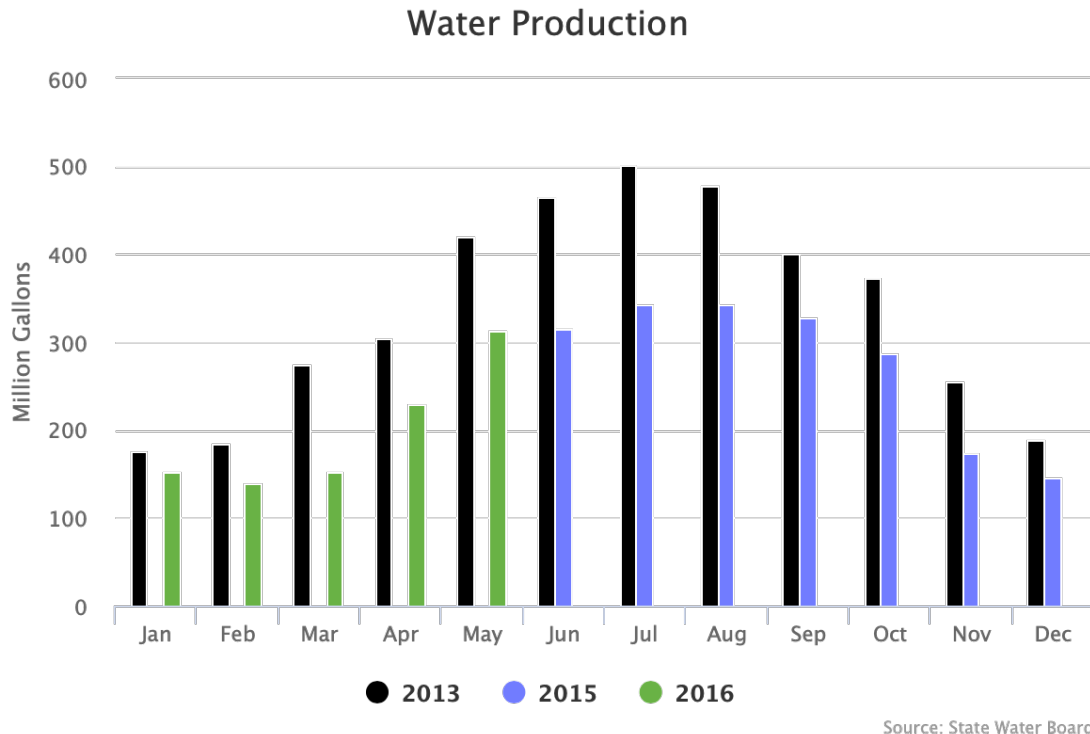


Figure 1 Water Consumption in California in 2013 and 2015-2016



*Figure 2 Water Consumption in the City of Davis in 2013 and 2015-2016*

From the data analysed, it shows that the water saving of the individual urban water supplier ranged from 0% to 53.5% relative to the 2013 baseline time period. At the state-wide level, a total saving of 24.5% was achieved, which was lower than the 25% reduction goal (*Figure 1*). A total of 524, 000 million gallons of water was saved throughout the period of the mandate, with a greater quantity of savings occurring in the summer months relative to the winter months.

For the City of Davis, a water saving of 27.3% was achieved, meeting the state-wide goal of a 25% reduction and the county goal of a 27% reduction (*Figure 2*). A total of 1,097 million gallons of water was saved throughout the period of the mandate. Similar to the state of California, a greater quantity of saving occurred in the summer months.

Since the total electricity savings are calculated directly from water savings, the significant reduction of water consumption during the mandate resulted in electricity savings as well. For the state of California, the total estimated electricity savings associated with the observed state-wide water conservation was 1,830 GWh while for the City of Davis, the total estimated electricity savings associated with the water conservation was 859 MWh.

## **Conclusions**

From the analysis conducted, it shows that the state-wide urban water conservation mandate was a success. Roughly, 24.5% of water was being conserved state-wide during the mandate and 27.3% of water was saved in the City of Davis. In the spring of 2015, more than 93% of California experienced severe drought. This mandate was able to conserve water in response to the water deficit. Given the relationship between water systems and energy use, a significant amount of electricity was also conserved due to the reduction in water consumption over the mandate period. As a result of the electricity saving, there was also a reduction in greenhouse gases (GHG) emission. For the state of California, a 524,000 million gallons of water saving has resulted in 521,000 metric tonnes of carbon dioxide equivalents. For comparison, the total electricity savings linked to water conservation are approximately 11% greater than the savings achieved by the investor-owned electricity utilities' efficiency programs for roughly the same time period (Holguin et al. 2017).

## **Recommendation/Limitations** (one paragraph)

For this model, the water-energy-GHG savings are limited to California. It would be important to include observable data for each county for a better prediction model since the locations, scales, and population of each county would have a significant impact on the water-energy-GHG savings model prediction. The level of development of each location, such as the implementation of renewable energy facilities would be a great factor of the prediction model as well. Therefore, having a specific model to calculate the water-energy-GHG savings for each county could better predict and estimate the linkage between energy savings, GHG emission and water consumption.

## References

Centre for Water-Energy Efficiency. (2016). "California H<sub>2</sub>Open"  
<<https://cwee.shinyapps.io/greengov/>> (April, 2021).

Howitt, R., Medellín-Azuara, J., MacEwan, D., Lund, J. R., & Sumner, D. (2014). Economic analysis of the 2014 drought for California agriculture. University of California, Davis, CA: Center for Watershed Sciences.

Howitt, Richard, et al. Economic Analysis of the 2014 Drought For. p. 28.

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