California's water saving brings bonus effects

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Water-saving measures in California have also led to substantial reductions in greenhouse gas (GHG) emissions and electricity consumption in the state.

That is the conclusion of new research from the University of California, Davis, published today in the journal *Environmental Research Letters*.

Measures to cut water use by 25 per cent across California were implemented in 2015, following a four-year drought in the state that caused the fallowing of 542,000 acres of land, total economic costs of $2.74 billion, and the loss of approximately 21,000 jobs.

The UC Davis researchers found that, while the 25 per cent target had not quite been reached over the one-year period - with 524,000 million gallons of water saved - the measures' impact had positive knock-on effects for other environmental objectives.

In California, the water and energy utility sectors are closely interdependent. The energy used by the conveyance systems that move water from the wetter North to the drier and more heavily populated South - combined with utility energy use for treatment and distribution, end-user water consumption for heating, and additional pumping and treatment - accounts for 19 per cent of total electricity demand and 32 per cent of total non-power plant natural gas demand state-wide.

Lead author Dr Edward Spang, from UC Davis, said: "Due to this close interdependence, we estimated that the decrease in water usage translated into a significant electricity saving of 1,830 gigawatt hours (GWh). Interestingly, those savings were around 11 percent greater than those achieved by investor-owned electricity utilities' efficiency programs over the same period.

"In turn, we calculated that the GHG emissions saved as a direct result of the reduction in electricity consumption are also significant - in the region of 524,000 metric tons of carbon dioxide equivalent (CO_2e). That is the equivalent of taking 111,000 cars off the road for a year."

To estimate the water, energy, and GHG savings achieved for the duration of the urban water conservation order, the researchers collected and consolidated a range of publicly available data. They sequentially

estimated total water savings for each water agency reporting to the California State Water Resources Control Board; the associated energy savings, via spatially resolved estimates of the energy intensity of water supplies by hydrologic region; and finally, the linked GHG emissions reduction, using the emissions factor for the California electricity mix (including both in-state generation and imports).

Finally, they compared of the cost of securing these savings through water conservation to the costs of existing programs that specifically target electricity or GHG savings.

Co-author Professor Frank Loge said: "The scale of these integrated water-energy-GHG savings, achieved over such a short period, is remarkable. Even more interesting is that the cost of achieving these savings through water conservation was competitive with existing programs that specifically target electricity or GHG reductions.

"Our results provide strong support for including direct water conservation in the portfolio of program and technology options for reducing energy consumption and GHG emissions. It's particularly pertinent given that our analysis was based only on pursuing the individual goals of either electricity savings or greenhouse gas reductions, and not the combined benefits of water, electricity, and GHG savings."

He added: "Taking these three benefits into consideration together would substantially increase the cost-effectiveness of water-focused conservation programs across all scenarios of varying program and technology persistence. There is a strong incentive for water and energy utilities to form partnerships, and identify opportunities to secure these combined resource savings benefits at a shared cost. There would also be a benefit in the associated regulatory agencies supporting these partnerships through aligned policy measures, and targeted funding

initiatives."

More information: Edward S Spang et al, The estimated impact of California's urban water conservation mandate on electricity consumption and greenhouse gas emissions, *Environmental Research Letters* (2018). DOI: 10.1088/1748-9326/aa9b89

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