California's Water Problems: Why a Comprehensive Solution Makes Sense

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California's Sacramento-San Joaquin Delta faces a very uncertain future. Policymakers and stakeholders in the state are actively negotiating how to improve the health of the Delta ecosystem while protecting agricultural and urban water supplies. Using a bargaining-theoretic framework, we argue that failing to include above-ground storage and conveyance expenditures in the negotiations may distort the apparent trade-offs between other options.

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Water use, water-related infrastructure, and methods of increasing the efficiency of water use are important policy concerns for California. The population is growing, as is the value of its (mostly irrigated) agricultural production, leading to an increased demand for water. Global climate change is projected to reduce the ability of California's existing infrastructure to capture the Sierra Nevada snowmelt, reducing available supplies. Much of California's water supply is routed through the Sacramento-San Joaquin Delta, leaving it vulnerable to saltwater intrusion in case of a major earthquake. Because the Bay-Delta is an environmentally sensitive ecosystem that is home to endangered and threatened species, environmental water uses have become increasingly important.

Early in 2007, Governor Schwarzenegger introduced a $4.5 billion bond measure that provided funds for conservation, underground storage, environmental enhancement in the Bay-Delta and elsewhere, and above-ground storage and conveyance. Gov. Schwarzenegger's initial proposal (carried by Senator Dave Cogdill) was not approved by the legislature for inclusion on the state ballot during the regular legislative session. The legislature met in a special session called by the governor in the fall of 2007 to attempt to pass a bond proposal to put on the February 2008 ballot for voter approval. Democrats and Republicans proposed competing bills but neither passed. In November, Gov. Schwarzenegger called for a joint effort to come up with a consensus proposal to put to the voters. The governor and various interest groups are preparing initiatives for the fall 2008 election through an alternative process, even while negotiations are ongoing. The size of the bond issue, its allocation, and the sharing of the financial burden among California taxpayers and water users are all topics of negotiation.

One of the primary points of disagreement among interest groups regards the future role of additional dams and above-ground water conveyance in California's water system. Since California voters rejected a major water infrastructure project in a 1982 referendum, the Peripheral Canal, proposals for the construction of additional major infrastructure designed to increase water supplies from surface water have been largely absent from the water allocation policy debate. Water allocation issues have been addressed through conservation measures, rationing, and some use of water markets. In the absence of augmented supplies, the reality underlying water policy is that one unit of water consumed by one use is not available for another (apart from reuse). This reality has made it difficult to negotiate changes in water use.

Gov. Schwarzenegger's proposed funding for above-ground storage was strongly opposed by some members of the legislature and many environmental interests. In response to criticism regarding the inclusion of above-ground storage in the bond measure, California Department of Water Resources director Lester Snow responded, "We have everything on the table from groundwater to conservation to waste water recycling." By broadening the set of policies in his initial proposal (the negotiation "issue space"), the governor increased the set of options for allocating water resources among competing uses.

Negotiation participants have commented on the importance of maintaining a broad issue space. The bill's author, Sen. Dave Cogdill, R-Fresno, remarked after the committee's vote, "I am extremely disappointed but not surprised by the Senate Democrats who voted against this critical measure. They are taking issues off the table and opting to address California's water needs using only a half-full toolbox."

Assemblyman John Laird commented, "I really believe it's too important to not come to some sort of an agreement. But if this is about dams, and nothing else, it won't happen. And if this is about water cleanup and conservation and leaving out the Delta, it won't happen. It's going to have to see where there's a place in the middle to give everyone involved the comfort level to move ahead."

Clearly, negotiation participants believe the set of options available will affect the outcome of the negotiations. We construct a very simple bargaining-theoretic framework to examine how Gov. Schwarzenegger's inclusion of funds for new water storage and conveyance infrastructure might influence the negotiation's eventual outcome.

A Bargaining-Theoretic Framework

Many stakeholders are participating in the political process underlying policymakers' debates and proposals. For simplicity, we lump these extraordinarily diverse groups into three categories of interests, each represented as a "player" in the negotiations: environmentalists, taxpayers, and water users, including both agricultural and urban users of water conveyed through the Delta.

For most purposes it would be completely unsatisfactory to group stakeholders so coarsely; here, we simply seek to represent one facet of the bond issue debate. We also note that the players constitute "interests" rather than sets of individuals. In reality, water users pay taxes and are concerned about the environment, to varying degrees. Environmentalists are also taxpayers, and many rely on water conveyed through the Delta.

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In our simplified bargaining framework, we consider three broad classes of issues: a list of categories for which dollar expenditures are earmarked, a scheme for sharing the burden of funding the earmarked expenditures, and an allocation of available water among competing uses. We limit attention to issues involved directly with north-south water transfers.

To construct our list of expenditure items, we draw from proposals put forth in Sacramento by various legislators. We identify three categories: Delta restoration expenditures, new above-ground storage and conveyance infrastructure, and water-use efficiency expenditures, including infrastructure improvement and other conservation measures for agriculture and/or urban users. Delta restoration expenditures improve the health of the Delta ecosystem and enhance the survival of endangered and threatened species. The latter two categories increase water supplies. New infrastructure increases available water. Water-use efficiency expenditures increase effective water, given the amount of available water.

For purposes of discussion we will assume that total expenditures are fixed. Responsibility for funding these expenditures will be allocated between fees paid by water users and the bond issue. The environmentalist is exempted from sharing the financial burden. The allocation of the water available based on the current water system and the negotiated expenditures is also negotiated.

Each of the players wishes to maximize his welfare, or "utility," which is dependent on the outcome of the negotiation. Water users' utility increases with the amount of water allocated to them, and decreases with the fees they pay to use the water. Their allocated water, in turn, increases with expenditures on new infrastructure and water-use efficiency measures.

Environmentalists' utility increases with the health of the Delta ecosystem, which in turn increases with the expenditures devoted to Delta restoration and with the water allocated for in-stream uses in the Delta. Environmentalists' utility decreases with the construction of new storage and conveyance infrastructure, due to the negative impacts on local ecosystems.

Taxpayers' utility decreases as the size of the bond issue increases. Taxpayers' utility increases as the water allocated to users increases because an increased user allocation increases economic activity. It increases as the health of the Delta ecosystem increases, and decreases as expenditures on new storage and conveyance increase, because better environmental quality is a public good.

Obviously, even in this very simple framework there are a number of conflicting interests. The user wishes to maximize the increase in water supply per dollar expended regardless of how the supply is generated. The environmentalist dislikes new infrastructure that may affect wilderness areas, and thus prefers water-use efficiency measures. The taxpayer and user's interest conflict directly regarding who should pay. The taxpayer is concerned to some extent with the

water allocated to both of the other players, while each of them is concerned only with his own water allocation. This means that the taxpayer will place a higher priority on increasing the supply of effective water through water-use efficiency expenditures, infrastructure expenditures, or both.

Implications

In this context, what are the implications of excluding above-ground storage and conveyance from the set of issues considered in the negotiation? There are two possible cases. In the first case, above-ground storage and conveyance always have a higher marginal cost per unit of increased supply than water-use efficiency measures. However, if the negotiated share of the cost paid by the user differs across expenditure categories, then above-ground storage and conveyance may emerge as part of the negotiated solution.

A player cares about how much he pays. He cares about what others pay only to the extent that it affects other dimensions of the negotiated solution. If, on the other hand, the negotiated share is the same for both types, then because the user cares about his supply and not about storage or increased use efficiency *per se*, and because the environmentalist is negatively affected by dams, above-ground storage and conveyance expenditures will not emerge in the negotiated solution.

In the second case, the cheapest way of obtaining an increase in supply involves a mix of both expenditure types. Thus, excluding one type of expenditure increases the cost of increasing supply. The implications of such an increase are two-fold. First, the scope for increasing the user's utility through the negotiation is reduced. Second, the scope for increasing the environmentalist's utility through the negotiation is reduced. Because the marginal cost of increasing total supply is higher, even if the environmentalist got to choose how every dollar was spent, the utility he would achieve by his preferred combination of in-stream flows and Delta restoration expenditures would be lower. Given that he must negotiate with a user and a taxpayer, both of whom wish to see increased supplies for the user, the higher marginal cost makes it more expensive to obtain an additional dollar for Delta restoration. Effectively, increasing the cost of one of the variables players care about means that a given amount of money has less potential for improving total welfare. The solution of a negotiation that excludes the possibility of expenditures on above-ground storage and conveyance will have less scope for improving social welfare than the solution of a negotiation that includes this possibility.

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What's included in the issue space plays a critical role in determining the success of the process, and the nature of the negotiated outcome. While sometimes the contribution of economics to policy debates is summarized as "everything has a price," bargaining theory demonstrates that the more accurate statement is "every negotiated variable has a value, and every relevant variable should be negotiated." If a relevant issue is excluded from the negotiation, the relative prices of other items may be distorted. Regardless of whether or not money for above-ground storage and conveyance is included in a state water bond proposal, introducing the option into the debate can only increase negotiators' flexibility. However, whether or not this flexibility will result in a more socially desirable solution will depend on whether there is a difference between who pays for different types of supply-enhancing expenditures. If there is a difference, then a player's decision will be distorted by the difference between the relative costs of the two types for him as compared to the relative costs of the two types for society as a whole.

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For additional information, the authors recommend:

Goldmacher, S. (2007) "Laird Talks Water in Q & A." Capital Alert, *Sacramento Bee*. Available at www.sacbee.con/1066/story/392067.html.

Lucas, G. (2007) "Sacramento: Senate Panel's Dems Vote Down Water Bond over Proposed Reservoirs." *San Francisco Chronicle*. April 25. Available at www.sfgate.com/cgibin/article.cgi?f=/c/c2007/04/25/BAG4QPEU3O1.DTL&hw=Lucas+water+GOP&sn=002&sc=881.