

When Subsidies Work and When They Don't: Food vs. Power**

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Summary

California's system of water rights implicitly subsidizes agricultural production by pricing water for farms at far below market levels. State policies directly subsidize solar electricity consumption by providing rebates and other forms of support for solar cells installation. While both food and electricity are household staples, these two subsidies are completely different in terms of the cost-benefit analysis because water is a truly limited resource, while solar energy is not.

Current realities

Water is provided for agricultural use at such a low price, it may as well be free. Farmers, however, are unable to sell their supplies under normal circumstances. This perverse incentive means that water has no implicit value to them outside of growing crops. Water subsidies have limited incentives for more water-efficient irrigation systems and less water-intensive crop choices. The resulting overuse of this scarce resource has harmed the environment, intensified the effects of the drought, and left urban water users with massive emergency cuts that will ultimately cost billions in lost consumption.

In California, water is largely allocated on the basis of riparian water rights, where water is assigned to parcels of land on the basis of a historical claim. Water-rights holders can use their allocation, but cannot sell it to other users. Consequently, there are no transactional "opportunity costs" attached to using the water, beyond those of actually moving it to where it is needed. Most of these rights were allocated when the state was largely agrarian. Agricultural interests still control and use 80% of the state's developed water, even though their operations make up less than 2% of the state's economy. Water prices are extremely low for areas with heavy agricultural output — basically only pump costs that as less than \$50 per acre-foot, compared to over \$1,000 an acre-foot for water agencies in the Los Angeles area. Even in times of scarcity, such as now, prices run well below \$150 per acre-foot.

In theory, California agricultural subsidies help keep the price of food low and help "feed the nation." Subsidies also may encourage crop diversity. But the costs of water subsidies are also clear: in response to receiving "cheap" water, the California agricultural sector has grown very water-intensive crops (e.g., alfalfa and hay) in highly arid areas. Data from the agricultural census shows the value of alfalfa is \$250 per acre-foot of water consumed. Compare this to the \$200,000 of economic output per acre-foot of water used in urban areas. Farmers use roughly 4.5 acre-feet of water per acre of the crop. Much of the alfalfa California farmers produce is not even used to feed the nation; rather it is shipped to China to feed dairy cows. By comparison, lettuce, much of which is used for local food, uses just 1.5 acre-feet of water per acre and has a value of over \$4,500 per acre-foot of water consumed.

There has been little incentive to invest in water-saving irrigation techniques. The agricultural sector's consistently higher-than-necessary water consumption has had environmental impacts. By using such large amounts of water, the agricultural sector has substantially raised costs for urban and industrial users that today represent the vast majority of the state's economy. These higher costs come from the restricted supply that reduces consumption below an optimal level and forces some urban areas to invest in expensive technologies (e.g., desalination or dual systems for gray water). California's agricultural water subsidies make it harder to fill reservoirs in times of plenty, leading to excessive groundwater consumption in times of shortages and triggering various "emergency" efforts to sharply reduce short-run consumption that could have been avoided with better conservation in good times.

Solar energy subsidies offer an interesting contrast to water subsidies. Solar energy consumers receive an explicit subsidy to invest in solar cells. Yet most studies today show that solar is far more expensive than other forms of energy production, even if the current cost of greenhouse gases are included. As such, subsidies are implicitly shifting consumption to a high-cost economic source. There are reasons to support solar subsidies, however. By increasing production in the short run, we push the technology much faster down the learning curve, making it more likely solar power can become truly cheaper than other forms of energy. Subsidizing solar cell purchases incentivizes companies to produce ever better cells at cheaper prices in a competitive environment. It also shifts the system from a centralized to a noncentralized model, which has the additional benefit of reduced system capacity.

Scientific opportunities and challenges

Changing California's current water policy provides both an opportunity and a challenge. As the California climate changes such that conservation becomes increasingly important, state leaders have an opportunity to reform outdated contracts entitling farms to senior water rights and to ensure that water pricing is more fair and promotes efficient use. State leaders also have an opportunity to open water markets that will encourage the sale of water from agricultural sources where water is cheap to consumers in areas where water is comparatively expensive. This will discourage wasteful consumption, such as farming low-value, high-water-use crops, while at the same time reducing the risk of water shortages in some parts of the state. This, in turn, would help to stabilize agricultural output levels and, in the long run, could be better for farmers, by encouraging production of crops that have more consistent yields each year.

The politics behind water use in California make policy changes difficult. There is little motivation to change the status quo, apart from dry spells that lead to mandated conservation measures. The process of setting up a robust water market is a steep challenge. It certainly will be difficult to initially allocate water to those who currently do not have set supplies, as well as to public agencies, local or nonlocal. These types of issues are partly to blame for slowing the development of water markets in California. The benefits of water markets, however, are substantial. Not only would they help to provide a more stable supply of water for many urban and agricultural water agencies, they could also be expanded to environmental agencies. For instance, rather than trying to balance competing interests for water from the Bay Delta in Northern California through top-down rules, these interests would have a clear market price to pay for the supply of water. The State of California could maintain a fixed level of water for streams in the Delta through payments to Delta or Central Valley farmers or urban water agencies. Farmers seeking extra water from Delta streams might pay a tiered price to do so. Prices motivate incentives for urban, agricultural, or environmental agencies alike.

On the power side, investment in solar energy provides an increasingly greater opportunity to provide cheap, clean energy that will require fewer subsidies over time. One of the biggest hindrances in transitioning to solar power is its unaffordability relative to sources such as natural gas. Solar subsidies have helped to narrow the gap in price significantly, but if natural gas remains cheaper than solar, there will be much less of an incentive to switch. Yet, subsidies to consumers who buy solar panels or producers who invest in solar energy development reduce solar energy costs by increasing returns to scale. Lower production costs decrease prices, leading to greater demand, which boosts production further. As production grows and efficiencies reduce production cost over time, the per-unit price drops, bringing the price of solar energy closer to the price of other energy sources. Local solar energy subsidies produce benefits well beyond local borders. In less-affluent countries, low-cost solar energy can generate power without large centralized energy systems. Photovoltaic panels would be sufficient in themselves to power homes and businesses. More attention is being given to solar because it is clean and abundant. Solar power subsidies can help hasten the transition from natural gas or coal toward solar.

However, energy storage remains a challenge to increasing solar energy production. The efficiency of solar panels has improved substantially in a short time, but much of the energy produced by the panels is lost in the storage process. When solar production is weaker — in evening hours, for instance —the “base load” of energy still has to come from more traditional sources such as natural gas, coal or nuclear power. Fortunately, as solar energy has become more popular, research and development into energy storage has increased significantly, helping energy storage to (slowly) catch up to improvements in solar energy production.

Policy issues

- California’s water policies are long outdated and need to be substantially cut back. They serve as implicit subsidies for the state’s agricultural sector but do not support lower food prices in the way that more direct subsidies, like tax incentives or wage rebates, would. Low water prices encourage production of low-value, high-water-use crops like alfalfa and lead to waste of a scarce resource.
- The development of water markets should be encouraged and facilitated. “Use it or lose it” water contracts encourage wasteful consumption, while water markets would allow transfers from agriculture to urban agencies. Water prices for urban users are higher because outdated water contracts for agriculture misallocate a scarce resource. These contracts also force more efficient water users (i.e., urban consumers) to make steep cutbacks when water levels are low. Alternatively, demand for water in urban areas is inelastic, so if water prices were more equitable between urban and agricultural water agencies, such that the price of water decreased for urban consumers, the demand for water in urban areas would not increase that much. Lower water prices for urban consumers would not lead to a shortage.
- Solar power should continue to be explicitly subsidized through state and federal policy. These solar subsidies generate very positive outcomes and should be encouraged or even expanded by the State of California. Solar subsidies such as tax credits for large-scale solar producers or credits for residential or commercial solar panels encourage new production, which leads to increasing returns to scale. As investment in and production of solar technology has grown, efficiency has increased, such that solar power is getting closer to meeting the cost, *without subsidies*, of other energy sources like coal or natural gas. Unlike subsidized water, subsidized solar power generates mostly positive externalities. Subsidizing the purchase of solar cells may work better than directly subsidizing primary solar research at universities, as the profit model encourages multiple paths to efficient outcomes in a rapid environment. But constant monitoring is needed to make sure such efforts pay off.
- The State of California needs to reduce pollution through clean energy production. Solar energy production is capable of supplying much of California’s energy demand. In addition, solar subsidies spur investment in solar infrastructure, which generates output, jobs, and spending. Subsidies also support California’s economic growth. Some of the largest builders of solar energy systems, such as SolarCity, Rosendin Electric, and Sungevity, are headquartered in California.

References

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*** A policy position paper prepared for presentation at the conference on Sustainability Challenges: Coping with Less Water and Energy, convened by the Institute on Science for Global Policy (ISGP), on June 5, 2015, in Whittier, California, U.S.*