

## Energy and Agriculture

Energy is once again at the forefront of agricultural issues in California. Three interconnected concerns dominate the discussion of agricultural energy. First, a spike in oil and other energy prices has highlighted once again the costs of energy-connected agricultural inputs such as fertilizer, electricity and fuels for trucks and tractors. Second, agriculture is a producer of feedstock for bioenergy. Both increased energy prices and government policy have again stimulated interest in bioenergy as a substitute for fossil fuels. Third, environmental concerns related to both regional air quality and global climate change has encouraged investigation of alternative energy sources as well as policies to change the energy relationships in the California economy and globally.

Government energy policy is only partly under the purview of the U.S. Department of Energy. The U.S. Environmental Protection Agency (USEPA) and the U.S. Department of Agriculture (USDA) also have strong energy-related policy mandates. USDA has major biofuels programs and the recent Farm Bill adjusted biofuels subsidy rates and trade policy. USEPA has responsibility for determining regulations that reduce the negative environmental impacts of energy production and use and EPA regulations related to biofuels and climate change are among the most important current policy issues. The Energy Act of December 2007 set mandates for use of biofuels including both from conventional feedstock (corn) and from as yet uncommercialized cellulosic technologies, but EPA was charged with deciding which fuels meet the “renewable” fuels standards required for fuels to qualify for the mandates.

In California, the California Energy Commission is the lead agency for energy policy. The California Public Utilities Commission regulates privately owned electric and natural gas companies that generate power. The California Department of Conservation oversees the operations of oil, natural gas and geothermal wells to enforce environmental regulations and ensure public safety. Finally, the California Air Resources Board (CARB) is responsible for setting standards for energy sources that meet California’s low carbon fuel standards.

In 2006, California introduced major legislation on renewable energy. According to Senate Bill 107, electric utilities must increase the share of electricity they provide from renewable sources to 20 percent by 2010. Governor Schwarzenegger expanded on this legislation by signing executive order S-14-08, which requires California utilities to increase this share to 33 percent by 2020. A.B. 32, the Global Warming Solutions Act of 2006, requires that greenhouse gas emissions be reduced to 1990 levels by 2020. CARB has primary responsibility for implementing the A.B. 32 scoping plan, which includes a cap-and-trade system, which will likely raise costs for energy intensive industries, but also provide opportunities for industries, such as agriculture that may be in a position to green house gas emission credits.

Today, California meets about 73 percent of its electricity demand through in-state production, with the remainder met by imports from neighboring states. California sources meet 13 percent of natural gas demand and almost 40 percent of crude oil demand (CEC 2009). Natural gas supplies about 46.5 percent of all electricity generated

in 2008 followed by 15.5 percent from coal, 15 percent from nuclear facilities about 9.5 percent from large hydroelectric dams. About 13.5 percent of electricity comes from other renewable sources, including geothermal (about 5 percent), small hydroelectric facilities (3.5 percent), wind power (2.5 percent), biomass (2.2 percent) and solar power (0.3 percent) (CEC 2009). Electricity usage by the agricultural sector is primarily for pumping water (>70 percent of usage).

Between 1990 and 2007, electricity consumption in California rose at an annual average rate of 1.28 percent, far less than the rate of growth in the economy. Electricity use in agriculture, (primarily for irrigation pumping) was 13 percent higher in 2007 than in 1990. In 1990, the agricultural sector accounted for 9 percent of total power usage. This share fell to 6 percent in 1995 before rising to reach 8 percent in 2007 (compared to about one percent of the total economy of the state).

As elsewhere, costs in California agriculture rise with rising oil prices and other energy prices. In agriculture, indirect energy use, including upstream utilization from inputs such as fertilizers, pesticides and water pumps and downstream use for processing, and distribution, exceeds on-farm use for fuel and makes farms particularly vulnerable to price spikes (Roland-Holst and Zilberman 2006). The share of energy costs in producers' total operating costs depends on the product. For example, fuel and fertilizer costs are about 38.75 percent of total operating costs per acre for corn (Britten et al. 2004), but only about 1.43 percent for strawberries (Molinar et al. 2004).

With rising input costs, agriculture will adapt to less energy intensive methods of irrigation, product drying and fertilizer use. Off the farm, the industry will shift to less energy demanding modes of input and product distribution. In some cases, such as compared to developing countries with more labor-intensive methods, California agriculture has higher energy cost-shares than competitors. But, in other cases the climate and other environmental factors allow California agriculture to have lower energy intensities, such as field production versus greenhouse technology for vegetable production. The comparative advantage of California agriculture will shift with higher energy costs and one major factor is the cost of energy inputs here relative to costs among competitors. These relative costs are largely related to infrastructure and environmental policy.

Of agricultural industries, cattle production is the most susceptible to rising energy prices because oil and gas costs make up a relatively large share of total costs. The large share of energy costs is due to the cattle industry's demand for hay and dependence on truck transport. In addition, the livestock industry is vulnerable to policies that shift crop resources from animal feed production to energy feedstock. Crops such as vegetables and nursery products are less vulnerable, since energy comprises a smaller share of their total costs. For example, Roland-Holst and Zilberman (2006) estimate a total energy cost-price pass through of 5 percent for cattle but only 2.8 percent for most vegetables and 0.6 for nursery products.

While agricultural feedstock can be used to generate bio energy, controversy exists regarding the environmental benefits of commercially feasible biofuels in the United

States, which use corn that could otherwise feed people or livestock. Cellulosic biofuels that use crop feedstock are not yet commercially feasible and it seems unlikely that California, with only 10 million acres of cropland and most of it suited for high-revenue crops, will have a comparative advantage in supplying much of the this feedstock in the case that the technology does become commercial. Agricultural waste-to-energy sources that use crop residue or cattle methane emissions have been used on a limited scale for decades, but have not yet become economic without substantial subsidy. Nonetheless, Federal mandates and California Executive Order S-06-06, if implemented as written, will continue to stimulate agricultural feedstock for bioenergy.

– University of California Agricultural Issues Center, July 2009

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