California Society of American Foresters

The Social Benefits of a Robust Woody Biomass Energy Sector in California

A Position of The California Society of American Foresters

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Position

Much of California's forestland supports unnaturally dense stands of small, highly flammable trees that are unmerchantable for lumber production. Restoring healthy resilience to the state's forests and reducing currently unacceptable risks of catastrophic wildfire will require extensive thinning of smaller trees from overcrowded stands. The enormous and rapidly growing social costs of catastrophic wildfires make government subsidies to directly enable extensive precommercial thinning a sound investment in many situations. However, a more economically efficient solution to restoring forest resilience is to develop robust markets for low-value forest biomass generated as a by-product of forest restoration activities. Although the woody biomass energy sector has been operating in California for about 40 years, it faces both ongoing and cyclical financial challenges that have frequently caused biomass energy plants to close or curtail operations, thereby reducing opportunities for economic utilization of traditionally unmerchantable trees. Given the billions of dollars spent each year on wildfire suppression and the billions of dollars of wildfire-related costs imposed annually on residents through loss and disruption of life, destruction of property, uncontrolled carbon emissions, and smoke-related health effects, increased strategic state and federal support for the state's woody biomass energy sector represents an efficient and necessary approach to address our wildfire emergency.

Issues

Extensive forest thinning and related hazardous fuel treatments are needed to reduce risks of catastrophic wildfires. By creating market demand for small trees, the woody biomass energy sector enables economic harvesting of small trees that would otherwise be economically infeasible to manage. The economics of woody biomass energy production are daunting mainly because of the high cost to collect and process small trees and transport wood chips to biomass facilities, especially when electricity prices are low due to low fossil fuel prices, or in comparison to wind or solar energy, which require no feedstock inputs. The number and production capacity of biomass energy facilities in operation and the areas of the state supplying wood chips to biomass facilities have declined substantially over the past 25 years. Currently 22 commercial-scale biomass energy facilities with combined capacity of 550 megawatts (MW) operate in California, compared to more than 50 operating facilities with combined capacity of approximately 900 MW in 1995.

Depending on levels of subsidy, the economically feasible distance for hauling wood chips to biomass facilities ranges from 30-50 miles. State and federal subsidies for the biomass energy industry have historically fluctuated based on shifting political and fiscal priorities, creating uncertainty that discourages investment in new and existing biomass energy facilities. Expansion of biomass energy capacity such that facilities were located at an average distance of 60 miles from each other throughout the state's forest regions would reduce catastrophic wildfire risks, improve air quality, reduce greenhouse gas emissions, and stimulate the economies of the state's socioeconomically disadvantaged rural regions.

Background

California has been a world leader in converting biomass to electricity since the industry emerged around 1980. The four primary fuel sources for the state's biomass industry are mill residues (e.g., sawdust), agricultural waste (e.g., nutshells and orchard removals), urban wood waste, and forest residues. Forest residues include slash (i.e., tops and limbs of felled trees) and cull logs, as well as

small trees resulting from thinnings. During the industry's first 20 years, most of its fuel consisted of mill residues, the least costly of the four main sources. Forest residues, which are the highest-cost source, accounted for an estimated 13% of the state's total biomass fuel supply in 2005 (Morris 2008), but since then have increased to approximately 35% with the closure of facilities that operated primarily on agricultural and urban wood wastes (Mason pers. comm.)

The state's biomass energy sector has always relied on subsidies or favorable regulations, such as the Renewable Portfolio Standard, which mandates that a share of the state's energy be produced from renewable sources. Recent subsidy programs include the California Public Utilities Commission's Bioenergy Renewable Auction Mechanism, which provides that qualifying facilities receive above-market prices for power generated from specified hazardous fuel treatments, and the non-profit organization My Sierra Woods's Forest Biomass Transportation Incentive, which supplements payments to landowners for biomass delivered from locations more than 30 miles from a biomass facility.

Market and Social Benefits

The biomass energy sector provides market benefits from sales of electricity, and social benefits, which are not compensated by revenues from market transactions. The main social benefits of biomass energy are avoided use of fossil fuels, which avoids greenhouse gas emissions, and the avoidance of alternative biomass disposal methods (e.g., piling and burning or burning in a wildfire), which also emit greenhouse gases and can impair air quality. Another important type of social benefit associated with biomass energy is the economic stimulus it provides to the communities where biomass facilities are sited, and to the communities that supply the woods workers who collect, process, and transport fuel to facilities. Closely related to these economic benefits are the improved socioeconomic well-being of families and enhanced community capacity associated with the construction and operation of local manufacturing facilities from, for example, an increased local property tax base.

Most biomass sourced from forests would otherwise either be open-burned in piles or left in the woods to decompose or burn in a wildfire. Burning wood at a

biomass facility using controlled combustion technologies greatly decreases its air emissions (e.g., particulate matter, methane, and volatile organic compounds) relative to open burning or wildfire. For example, a recent Placer County study found that burning biomass in a power plant reduced by 96% emissions of both highly toxic particulates and the potent greenhouse gas methane relative to open burning (Springsteen et al. 2011). Such reduced emissions are significant, tangible benefits of the biomass energy sector (Morris 2000). As the social costs of catastrophic wildfires increase, the social benefits of using hazardous fuels for biomass energy increase. The social benefits of biomass energy production are several times larger than the market benefits. (Morris 2000)

A recent comprehensive life-cycle assessment of biomass energy production in California found that treating 18 percent of a 2.7 million-acre northern California forest landscape per decade over a 40-year timeframe would reduce greenhouse gas emissions from the landscape by 65% and reduced wildfire property damages and suppression costs by $306 million (all monetary values are expressed in 2018 dollars), or $98 per acre throughout the forest landscape. This treatment level would result in a 22% reduction in overall acres burned, and a 42% reduction in acres burned at lethal severity. (Nechodom 2010)

Each delivered bone-dry ton (BDT) of biomass generates roughly 1 megawatt-hour (MWh) of power (Shelly 2007). Although the spot wholesale price of electric power in California fluctuates radically, most biomass facilities have long-term price contracts (power purchase agreements) with purchasers that average approximately $90 per MWh (Mason pers. comm.). Thinning a typical acre produces on the order of 20 BDT of biomass. Thus the average market value from thinning an acre and converting the resulting biomass to energy is approximately $1,800. Collecting, processing, and transporting a BDT approximately 40 miles costs an estimated $68, or $1,360 per acre. Adding in costs of generating electricity, including operations and maintenance and debt service, typically drives the overall operation's net revenues negative, which is why the industry requires subsidies or other economic support.

Carbon Footprint

Forests have great potential to sequester carbon. However, depending on its growth and the disturbances it incurs, a unit of forest can, on net, either sequester or emit carbon during a specified period. The U.S. Environmental Protection Agency declared forest biomass to be carbon neutral in 2018. However, whether forest biomass is in fact carbon neutral is controversial. On the one hand, biomass is qualitatively different from fossil fuels, the burning of which has been the primary driver of historic increases in atmospheric carbon. In contrast, prior to the industrial age, carbon cycled between the biosphere (sequestered carbon) and the atmosphere (emitted carbon) continually for millennia with no measurable change in atmospheric carbon levels. On the other hand, biomass energy is also qualitatively different from other forms of renewable energy (e.g., solar and wind) in that it generates copious carbon emissions, which drive climate change.

There is consensus, however, that producing energy from small trees with no alternative economic use, from harvests designed to release larger trees and enhance stand diversity, from land permanently maintained in forest cover, and delivered to an efficient biomass facility with modern emission controls reduces that energy's carbon footprint and increases its social benefits.

Socioeconomic Benefits

A 2008 study of the forest biomass industry in Mississippi found that a large-scale biomass energy facility generated 5.9 direct (i.e., within the industry) jobs in the logging industry and 2.8 direct jobs in the power-generation industry per MW of plant capacity. As the directly-affected logging and power-generation businesses buy inputs and their workers spend their incomes, these 8.7 direct jobs would result in a total of 23.4 jobs and $770,000 in annual employee compensation per MW throughout the regional economy. (Perez-Verdin et al. 2008)

Powerlines have become an important focus of wildfire policy in recent years, as electrical equipment failures have become a dominant source of catastrophic wildfires (Cal Fire 2015). In addition to being a frequent cause of wildfires,

powerlines represent critical infrastructure that could be better protected by removing adjacent vegetation and converting it to biomass energy.

For rural communities that have lost substantial employment, population, and capacity to serve their residents due in part to historic declines in timber harvesting and forest products manufacturing, the enhanced economic stability and social well-being from creation of hundreds of family-wage, permanent, skilled local jobs in the biomass energy sector, as well as hundreds of additional service-sector jobs in supporting enterprises, would be substantial and potentially transformative. Providing in-woods and manufacturing jobs for working-class people whose share of state income has declined for decades would help reverse California's increasing income and wealth inequality.

Capacity Deficit

At its peak in the mid-1990s, the California biomass industry comprised approximately 50 facilities with a combined installed capacity of approximately 900 MW (Morris 2000). As of 2018, plant closures and idlings had reduced that capacity to 560 MW at 22 operating industrial-scale facilities. About half of these facilities are located in the Central Valley fueled primarily by agricultural by-products or urban wood waste, and half are located in forested areas fueled in significant part by forest residues. This limited capacity leaves much of California's 33 million acres of forestland unserved by the biomass market. For example, commercial-scale biomass facilities currently operate in only six (Humboldt, Lassen, Placer, Plumas, Shasta, and Siskiyou) of the state's 19 northernmost counties (University of California Division of Agricultural and Life Sciences 2019).

Another way of analyzing California's biomass capacity deficit is by comparing demand for forest biomass relative to the supply that would be forthcoming if the state met its goals for treating forestland to prevent catastrophic wildfires. Fueling each MW of biomass energy capacity consumes roughly 8,000 BDT per year. Assuming 35% of the state's biomass energy capacity (190 MW) is fueled by forest residues, existing capacity would consume approximately 1.5 million BDT of forest biomass annually. This demand could be satisfied by annually thinning

about 75,000 acres. However, this amount of thinning would achieve less than 8% of the state and federal governments' respective goals of treating 500,000 acres of non-federal land (Jacobson 2019) and 500,000 acres of federal land annually (USDA Forest Service, Pacific Southwest Region 2019). Thinning 1 million acres of forest annually would generate sufficient biomass to fuel approximately 2,500 MW, far more than the industry's current capacity. The potential to reach or even approach these goals would be improved by strategically expanding the state's biomass energy capacity.

A recent feasibility study for a proposed woody biomass plant in Arizona estimated the capital costs to build the facility at $3.53 million per MW for a 20-MW facility and $3.08 million per MW for a 40-MW facility (TSS Consultants and Precision Energy Services 2018). Subsidies to support utilization of woody biomass for energy have almost always taken the form of payments to the facility owner to offset operating costs, or payments to landowners to offset biomass processing costs, as opposed to direct investment in production capacity.

Conclusion

S.B. 901, enacted in 2018, authorizes $200 million per year for five years from the state's Greenhouse Gas Reduction Fund for wildfire prevention, primarily in the form of hazardous fuel reduction projects. This source is additional to several existing federal and state funding sources for such projects. A portion of these funds could be allocated to offset the costs of forest biomass procurement. Alternatively, the state could establish a renewable energy production tax credit to offset biomass power production costs. Either approach would stimulate investment in new and existing biomass energy facilities and expand demand for forest residues from treatments designed to restore badly needed resilience to California's forests.

The 2018 Camp Fire in Butte County was the deadliest and costliest wildfire in state history, with damages estimated at $16.5 billion (Reyes-Velarde 2019). The strategy for reducing occurrences of similarly devastating fires must be based on a comprehensive program to reduce hazardous fuels near forest communities and increase fire resilience throughout California's forestlands. Increasing subsidies

for woody biomass energy production would effectively monetize its social benefits, which in turn would promote biomass energy capacity expansion and enhance opportunities to help reach the state's fire hazard reduction goals.

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