Chapter 12: Renewable Energy

This chapter provides a synthesis of renewable energy indicators, issues, and opportunities, and how they relate to sustainable output of forest and rangeland products and ecosystem services.

**SUMMARY**

Based on current trends (12.1), meeting the Governor’s Renewables Portfolio Standard (RPS) mandate (SB350) that utilities procure 50% of their electricity from renewables by 2030 will require a continuing major expansion of solar and wind energy production. Where additional facilities are located, and how they are configured and maintained, will determine the level and type of impacts on forest and range operations and ecosystems [1, 2].

Public policies can affect the balance of large solar and wind facilities versus small-scale use for homes and businesses, and whether large projects are sited on leased public lands or private lands with lower ecological values (e.g. marginal agricultural lands).

Current trends (12.2) also suggest that biomass energy will not be a significant contributor to renewable energy expansion. Biomass has become less competitive, due to declining natural gas prices, and decreasing production costs and higher public financial incentives for solar and wind [3,4], leading to a decline in the number of biomass facilities and total megawatts produced (12.2). As of April 2017, there were 21 industrial biomass facilities operating in California, with at least 15 idle due primarily to uneconomic power purchase agreements. However, at least 9 small biomass plants [5] are in various stages of development because of SB1122 (2012), known as Bioenergy Market Adjusting Tariff (BioMAT). BioMAT rules provide procurement support for plants that supply 3 MW or less to the grid, using at least 80% feedstock from sustainable forest management, fire threat reduction, or defensible space clearance activities. If the maximum 50 MW capacity from small plants is ever realized, the total will only be equivalent to a single large biomass plant. However, the smaller facilities could be important in rural areas to improve forest health, reduce fire risk, and support rural economies.

Biomass energy has been an important factor for maintaining healthy forests, reducing fire risk, supporting rural economies, and reducing greenhouse gas and black carbon emissions [6]. The future of forest biomass in the energy sector depends in part on federal and state policy and legislation that considers the non-monetary benefits of biomass power, continued technological improvements to improve cost competitiveness versus other energy sources, and emerging potential uses such as advanced biofuels [7] (e.g. renewable diesel) that could be part of the state’s Low Carbon Fuel Standard program [8].
KEY FINDINGS

12.1 Indicator: Contribution of Renewable Energy Sources to California Electricity Generation

California appears to be on schedule to meet 2020 RPS targets, mainly due to increases in the contributions of wind and solar. Over the recent period 2010-2015, the contribution to state total system power from wind power has increased 78%, and solar has increased over 1700%.

Based on current trends, meeting RPS targets in the longer term will require a continued major expansion of wind and solar energy. Where additional facilities are located, and how they are configured and maintained, will determine the level and type of impacts on forest and range operations and ecosystems.

12.2 Indicator: Contribution of Forest Biomass to California Electricity Generation

There is a downward trend for electricity generation (17% decline) as well as number of facilities that primarily utilize forest biomass (24 to 17) over the 2001-2015 period.
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DISCUSSION

California’s Renewables Portfolio Standard (RPS), established in 2002 under Senate Bill 1078, requires all electricity retailers in the state to procure a portion of retail sales from renewable energy sources. California’s RPS establishes increasingly progressive renewable energy targets for the state’s load serving entities, requiring both retail sellers and local publicly owned utilities to increase their procurement of eligible renewable energy resources to 50% of retail sales by 2030 (SB350).

To meet the mandate of 50% by 2030, California will need to continue its current trajectory of increasing reliance on renewable energy (Figure 12.1) (12.1). If current trends continue, most of the increase will come from a continued expansion of both solar and wind power (Figure 12.2) (12.1).

The Solutions Project [9] has charted one possible future course for meeting the state’s electricity demand using 100% renewable sources by 2050 [10]. Under this scenario, new solar plants would need to occupy an additional 900,000 acres of land. A rough estimate that one-third of this expansion would be required to get from the current 25% level to the 50% RPS target translates to about 300,000 acres, a significant portion of which would likely occur on rangelands, especially in the desert. The numbers are of course estimates, but clearly underscore the importance of proper siting of facilities to minimize impacts.

Solar

A 2015 study shows that utility scale solar energy projects (over 1 MW) occupy just over 110,000 acres of rangeland in California [11]. This includes about 27,000 acres of leased Bureau of Land Management (BLM) desert land with operational or under construction solar projects [12]. This represents a complete land use conversion with associated impacts on alternative uses and ecosystem values, along with the additional impact of added human infrastructure associated with the site [13]. For these reasons, these projects are often opposed by environmental groups, despite their general support for solar to reduce carbon emissions.

Conversely, there are cases where these groups have supported large projects on previously disturbed
private lands with low ecosystem values [14]. Proper site selection and use of private lands can lower costs and delays due to government regulations. However, investors have driven up prices for suitable sites for new projects on private lands [15].

The Desert Renewable Energy Conservation Plan (DRECP) is a collaborative planning process with a goal to identify appropriate locations (Development Focus Areas) for renewable energy development, while providing for conservation of resources across 22.5 million acres of the Mojave and Sonoran deserts in California [16]. In these areas, projects benefit from a streamlined permitting process and simplified mitigation measures. Phase I of the DRECP covering 10.8 million acres of public lands managed by the BLM was approved by the Secretary of the Interior in September, 2016. The lands specifically identified for renewable energy development by the plan have the potential to generate up to 27,000 megawatts of renewable energy (solar, wind, and geothermal) – enough to power over eight million homes. Phase I of the DRECP also set aside millions of acres for conservation and outdoor recreation.

Government policies such as the current 30% federal tax credit, energy pricing policies from the California Public Utilities Commission, and other incentives available under various state and local programs in California are critical for the future of solar in California, and for the relative contributions of rooftop versus large solar projects [17].

**Wind**

Large scale wind farms currently exist on about 27,000 acres of leased BLM lands [12, 18]. There are also numerous testing sites on BLM lands that could be developed in the future in Lassen, Lake, Kern, San Bernardino, and Imperial counties. In California, wind farms have also been developed on state-owned lands [19], tribal lands [20], city-owned lands [21], private farms and ranches [22], and even on industrial timberland [23]. On private lands, the Union of Concerned Scientists estimates that landowners with good wind resources can increase the economic yield of their land by 30-100%, while continuing current ranch or farm operations [24].

There are numerous environmental concerns over the expansion of wind farms [1], including mortality of birds and bats directly related to turbines. The U.S. Fish and Wildlife Service published Land-Based Wind Energy Guidelines [25] in 2012 in an effort to reduce bird and bat mortality rates. In California, efforts to replace older technology and microsite the replacement turbines should reduce mortality rates significantly. For example, Vasco Wind Energy Center replaced its 432 small turbines with 34 new turbines resulting in tripled energy production and a 70% reduction in avian mortality [26].

**Biomass**

Forest biomass energy production has been promoted as a way to improve forest health, reduce wildfire risk, reduce greenhouse gas emissions and black carbon [6], and supply continuous base-load power to the grid (unlike wind and solar). The Placer County Air Pollution Control District (PCAPCD) has developed a protocol [27] for quantifying the implications of forest biomass utilization that has been adopted by the California Air Pollution Control Officers’ Association as part of their Greenhouse Gas Credit Exchange program [6]. Research sponsored by PCAPCD has quantified the benefits of forest biomass utilization for greenhouse gas reduction as well as air quality, when compared to the “business as usual” process of open pile burning residues from forest operations [28, 29]. Numerous studies in California provide additional evidence for the various benefits of forest biomass utilization for energy production [30, 31].
Biomass plants can also provide much needed employment opportunities in rural communities, and are often an important component of integrated wood processing facilities [32]. Providing an efficient way to dispose of residuals can be essential for economic viability of the entire facility.

On the other hand, emissions from using biomass to generate electricity can contribute to the formation of ozone and particulate matter in the Central Valley, which already exceeds air quality standards [33]. Forest biomass resources must also be shipped relatively long distances by truck, causing additional air quality emissions. The Energy Commission plans to begin a study in 2017 on the net atmospheric greenhouse gas emissions from forest biomass utilization for bioenergy, considering land use effects and other factors.

The number of biomass facilities in the state that utilize forest biomass (including residues from wood processing operations) has been declining, from 24 in 2001 to 14 in 2015, with a corresponding decline of about 17% in net electricity generation (Figure 12.3) (12.2). There may be additional facilities (some of which rely on forest biomass) idled in 2020 when their power purchase agreements are set to expire [3]. Biomass power has become less competitive due to declining production costs and higher public financial incentives for solar and wind, and lower natural gas prices [3, 4].

Recent actions to support biomass energy may change the current trend line:

- **SB1122 (2012)** established a feed-in tariff to new bioenergy facilities that are 3 MW and less. This program, called the Bioenergy Market Adjusting Tariff or BioMAT program, tasks the three largest Investor-Owned Utilities (IOUs) to procure their share of 250 MW of bioenergy, with 50 MW allocated to facilities that use forest material from sustainable forest management activities.

- **AB1923 (2016)** adjusted the BioMAT size limits to allow electric generators to have a nameplate capacity of 5 MW while maintaining the export limit of 3 MW.

- **SB859 (2016)** requires that electrical corporations and the larger local publicly owned utilities purchase their proportionate share of 125 megawatts of electricity from existing bioenergy facilities that use fuel from High Hazard Zones in California.

In support of the Governor’s Emergency Proclamation [34] to address public safety and property from falling dead trees and wildfire, the Public Utilities Commission issued decision E-4770 (March, 2016) requiring investor-owned utilities to purchase at least 50 MW of generating capacity collectively from biomass.
generation facilities that use minimum prescribed levels of feedstock from High Hazard Zones and to use the Renewable Auction Mechanism (RAM) solicitation procedures to procure the contracts.

Recent large fire and tree mortality events in the state demonstrate the importance of maintaining healthy forests, and California’s biomass plants have played an important role in facilitating forest treatments to improve resiliency and reduce fire and pest risk. Studies have shown the various benefits including greenhouse gas reduction for more active harvest and prescribed burning regimes that could improve forest health and reduce fire risk [35, 36].

Figure 12.4 shows the location of operational biomass plants that primarily utilize forest biomass in relation to conifer forestlands in the state, including BioMAT plants in various stages of development. For a significant portion of conifer forestland, transport costs preclude biomass energy being a viable option for disposal of unmerchantable material from treatments. If treatments are performed, pile-and-burn or leaving materials on site are the most likely options.

Biomass energy could also be an important component of an integrated strategy to address the current tree mortality crisis, and for restoring areas damaged by large wildfires [37]. The Tree Mortality Task Force [38] has identified priority areas for treatment to address public safety and forest health. Without sufficient biomass energy capacity, strategies to treat these priority areas and effectively dispose of the resulting material become far more difficult.

The future of forest biomass in the energy sector depends in part on federal and state policy and legislation that considers the non-monetary benefits of biomass power, continued technological improvements to improve competitiveness versus other energy sources, and emerging potential uses such as advanced biofuels [7] (e.g. renewable diesel) that could be part of the state’s Low Carbon Fuel Standard program [8]. The federal Biomass Research and Development (R&D) Board [39] has promoted the “Billion Ton Bioeconomy Vision” [40]. Part of the Vision is “…to rapidly expand emerging biofuels and bioproducts industries, targeting a potential 30% penetration of biomass carbon into the U.S. transportation market by 2030 in a sustainable and cost-effective manner to create jobs, reduce greenhouse gas impacts, and enhance national security.” It remains to be seen what the role of forest biomass will be in this larger overall strategy.

Opportunities

Opportunities to reduce the demand for energy production from forest and rangelands include:

- Continue to develop and support policies and programs that increase energy conservation. This includes numerous opportunities provided in the Assessment chapter related to urban forests (Chapter 3).
• Continue to develop and support policies and programs that facilitate small-scale renewable energy for homeowners, businesses, and public agencies.

Opportunities to minimize impacts from new renewable energy projects include:

• Consider the full range of impacts on forest and rangeland economic and ecosystem services when siting new renewable energy facilities, and where possible consider siting options on marginal agricultural lands or within developed areas.

• Continue to support research that improves the efficiency of renewable energy facilities, requiring less acreage per unit of energy produced.

• Continue to support research and implementation of improved technology that reduces the impact of renewable energy production on important ecosystem services.

Opportunities specific to energy production from forest biomass include:

• Continue to support research to fully account for and better quantify both the positive and negative aspects of energy production from forest biomass.

• Continue to develop and support policies that recognize the potential of forest biomass energy projects to improve forest health, reduce fire threat, contribute to rural economies, and provide other benefits.

• Explore opportunities for forest biomass to contribute towards the state’s Low Carbon Fuel Standard program.
Indicator: Contribution of Renewable Energy Sources to California Electricity Generation

Which Montreal Protocol Criteria does the indicator evaluate?
MPC6: Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies.

Why is the indicator important?
Increased use of renewable energy sources reduces our carbon emissions and reliance on fossil fuels, and provides various economic benefits. However, renewable energy does represent a significant new demand on our forest and rangelands that can have a negative impact on other ecosystem services.

Are there known targets or policy goals?
A series of legislation and executive orders, most recently SB350 (2015), sets Renewables Portfolio Standards (RPS) targets for the percent contribution of eligible renewable energy resources to electricity generated and sold to retail customers per year at 33% by 2020 and 50% by 2030.

What does the indicator show?

Key Findings:
- California appears to be on schedule to meet 2020 RPS targets, mainly due to increases in the contributions of wind and solar. Over the recent period 2010-2015, the contribution to state total system power from wind power has increased 78%, and solar has increased over 1700%.
- Based on current trends, meeting RPS targets in the longer term will require a continued major expansion of wind and solar energy. Where additional facilities are located, and how they are configured and maintained, will determine the level and type of impacts on forest and range operations and ecosystems.

Data Sources and Quality

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<th>Data Theme</th>
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<td>Total Electricity System Power</td>
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![Graph showing electricity generation from forest biomass]

**Key Findings:**
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References


3. Mohan, G., Solar is in, biomass energy is out—and farmers are struggling to dispose of woody waste, in Los Angeles Times. 2015.


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32. Benda, D., Burney biomass plant gives notice it will shut down, in Redding Record Searchlight. 2016.


34. Executive Department, S.o.C., Proclamation of a State Emergency. 2015.


