

Wood Biomass Gasification Technology in California



California faces the immense challenge of treating a million acres of forested lands, resulting in millions of tons of forest wood waste that must be managed effectively. This wood waste can either be left to decay, contributing to fire hazards, open pile burned, or processed into useful products like energy. According to a recent study by The Nature Conservancy, the majority of woody biomass waste only has one viable end use, which is energy production. Currently, California has 30 direct-combustion biomass facilities operating with a combined capacity of 540 megawatts, using conventional technology that combusts wood chips in stoker or fluidized bed combustion chambers to produce electricity and heat.

Existing direct combustion facilities face several challenges despite their established technology. Many were developed decades ago with air pollution control systems that, while permitted, are not as advanced as current technologies. These facilities often require long-distance transport of biomass, increasing costs and making operations financially challenging. They are frequently located near disadvantaged communities, raising environmental justice concerns. Additionally, these systems are limited to producing only electricity or heat and generate wood ash byproducts rather than more valuable alternatives.

To address these challenges, the state is focusing on supporting modern small-scale facilities that can mitigate many concerns associated with larger operations. These smaller facilities emit less pollution, require less feedstock, can source fuel locally to minimize transportation impacts, and can be situated in more remote areas reducing air quality impacts on communities. Modern small-scale boilers can also incorporate advanced air pollution control equipment like ceramic catalytic filtration systems, though the higher building costs relative to energy output remain a challenge for profitability.

Beyond direct combustion, gasification and pyrolysis technologies represent next generation pathways for biomass conversion systems. These thermochemical processes convert biomass feedstock into producer gas (biosyngas) under elevated temperatures and limited oxygen conditions. Unlike direct combustion, gasification offers higher electricity conversion efficiency, lower emissions, reduced water requirements, and the ability to produce both liquid and gaseous fuels, including hydrogen and renewable natural gas. These fuels can be used as a source for short- and long-term energy storage and reliability. Additionally, some systems produce biochar, a valuable byproduct that enhances soil productivity and sequesters carbon.

Despite its advantages, gasification projects face technical hurdles including syngas clean-up challenges, stringent feedstock size consistency requirements, need for industry standards, and infrastructure considerations for product distribution. Approximately 90 gasification technology suppliers operate worldwide, with several doing business in California. The state continues exploring these technologies as viable options for processing wood waste while moving away from fossil energy sources.

As California addresses its wood waste challenges in an era of climate change, both small-scale direct combustion facilities with advanced emission controls and gasification facilities offer promising alternative pathways to traditional combustion facilities. Success will require continued policy support through programs like the Department of Conservation's biofuel pilot funding, Cal Fire's biomass utilization grants, and potential new initiatives including tax incentives, insurance opportunities, and increased utilization of wood products by state agencies themselves.