

**Rocky Mountain Restoration Initiative (RMRI)
 July 21, 2020, 2:00 PM - 4:00 PM
 RMRI Biomass Utilization Subcommittee
 Meeting Summary - FINAL**

ATTENDANCE

Participants: Nate Beckman, Angela Boag, Mo Bookwalter, Ben Cohen, Ken Curtis, Patt Dorsey, Cindy Dozier, Samantha Lichtin, Mike McHugh, Helena Murray, Mike Preston, Tim Reader, Kelle Reynolds, David Rightley, Ellen Roberts, Travis Smith, Garrett Stephens, Kirby Self, Larry Swan, Peter Thompson, Nathan Van Schaik, Kendric Wait, and Laura Wolf

Facilitation: Molly Pitts and Samuel Wallace

ACTION ITEMS

Molly Pitts and Samuel Wallace	<ul style="list-style-type: none"> • Distribute the PowerPoint slides from the presenters to the Biomass Utilization Subcommittee. • Develop slides to update RMRI partners on the activities of the Biomass Utilization Subcommittee during the July 22 full RMRI meeting.
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SPEAKER PRESENTATIONS

The purpose of today’s meeting is to share information and lessons learned related to biomass power generation. Several speakers have been invited to discuss their experiences with biomass power generation.

Bioenergy Status, Trends, and Potential Impacts for Restoration Forestry: A California Perspective, Larry Swan, US Forest Service (USFS) Region 5 Wood and Biomass Utilization Program Leader

- The purpose of this presentation is to provide a background on what California is doing to promote forest biomass utilization and biomass energy to accomplish fuels reduction and forest restoration goals at a landscape scale. California has several examples of companies and industries that have attempted to use bioenergy; not all of the examples have been successful in their ventures.
- There are four broad biomass energy markets: thermal, electricity, cogeneration, and liquid and gaseous fuels. Thermal bioenergy markets are mostly related to commercial and residential heating and hot water. Thermal bioenergy can also be used for air conditioning as well, but the market for air conditioning using thermal bioenergy has not emerged yet.
- There are three biomass energy pathways to use biomass material: thermo-chemical, biological, and physical. Within the thermo-chemical pathway, there are three ways to use biomass: combustion, gasification, and pyrolysis. Each method for using biomass in the thermo-chemical pathway requires a different amount of air, with combustion requiring excess air, gasification requiring a partial vacuum, and pyrolysis requiring a complete vacuum. Combustion, gasification, and pyrolysis also require different amounts of heat. Combustion will emit heat up to 300°C, gasification requires temperatures of 700°C, and pyrolysis requires temperatures up to 590°C.
- The end-product of the biological pathway is ethanol. The physical pathway uses hydrolysis techniques to treat biomass to become usable fuel substitutes.
- The status of California’s wood products industry infrastructure has weakened over time. Currently, there are 25 sawmills, two veneer plants, two post and pole facilities, one board

plant, and one whole log shavings mill in the state. California does not have any pulp and paper mills, so they need to find other ways to use wood processing residues.

- There are currently 24 biomass energy power plants in California. About 14 of those facilities are standalone facilities and produce electricity. The other ten facilities are cogeneration plants that power kilns in sawmills.
- The biomass power plants produce about 20 megawatts (MW) each on average. To produce 20 MW, each plant needs about 160,000 bone dry tons (bdt) of fuel per year. Delivering this amount of fuel requires about 12,800 truckloads of material per year. If one acre produces approximately 12.5 bdt from a thin-from below prescription, then the power plant can theoretically treat 12,000 to 13,000 acres per year, assuming that the power plant only takes biomass from forest treatments. A power plant that produces 20 MW of power is roughly equivalent to a sawmill that produces 50 million board feet per year in terms of how much bdt of forest biomass they require.
- In the 1990s and 1980s, around 60-70 biomass power plants were constructed. When those power plants lost their power purchasing agreements (PPAs), many had to shut down. The power plants that remained open relied on agriculture and urban biomass rather than forest biomass for their facilities.
- The state and federal vegetation management goals include treating ½ million acres per year on USFS lands and another ½ million acres per year on state and private lands, for a total of one million acres. Treating one million acres would produce around 12 million bdt per year. The infrastructure does not exist to process all that material. Assuming that 25% of the material will be burned in prescribed fires, another 25% will be piled and burned, and another 25% will be masticated and left in place, that means 25% of the material will need to be removed. That amount of material is equivalent to around 3 million bdt per year that will be available for use by the biomass industry.
- Over the past seven years, the California Legislature has passed many bills that have affected the biomass industry. In 2006, the California Legislature passed legislation that created a cap and trade program for greenhouse gas emissions.
- In 2012, the California Legislature established the Biomass Market Adjusting Tariff program (BioMAT). The BioMAT program directs public utilities to purchase energy from small biomass power plants that do not generate more than 5 MW until they reach 50 MW of biomass power. A 5 MW biomass power plant will require about 40,000 bdt/year. The legislation that established BioMAT requires that 80% of the feedstock of biomass power plants enrolled in the program come from forest biomass. None of the facilities that will participate in the BioMAT program have been built yet, but there are seven facilities in development.
- In 2016, the Biomass Renewable Auction Mechanism (BioRAM) program was established by the California Legislature to direct public utilities to buy energy from existing, larger biomass power plants that produce 20 MW on average. The BioRAM program was established as some of these larger plants were going to lose their PPAs. Currently, seven facilities have BioRAM PPAs. These plants are using a mixture of processing residuals, which is cheaper than wood, and forest biomass to produce their electricity. These plants are impacting land management practices.
- There are significant incentives to develop biomass energy in California. The first incentive is the California Low-Carbon Fuel Standard (LCFS). The LCFS is based on a system of cap-and-trade in which credits from low-carbon fuels can be purchased to offset emissions from traditional petroleum fuels. Other incentive programs include the federal Renewable Fuel Standard (RFS) and federal section 45Q.

- In the 1990s, there was a lot of interest in the gas and liquid cellulosic biofuels industry, but the industry lost momentum. There is now a renewed interest in the cellulosic biofuel industry. Currently, California has five ethanol refineries. The corn for those plants come from the Midwest.
- There are some recent cautionary lessons about the cellulosic biofuel industry. For example, a cellulosic biofuel plant in Mississippi failed after receiving more than \$800 million in investments from several significant investors, including Microsoft and Sun Microsystems.
- There is currently a cellulosic biofuels plant being built in Oregon. The capital expenditures for this plant will be over \$300 million. The plant should be operational by Quarter 1 of 2021. The plant will use forest biomass, primarily from non-federal lands, because fuel from federal lands does not qualify for Renewable Identification Numbers (RIN) credits.
- Fulcrum Bioenergy is an example of a cellulosic biofuel company, headquartered in California, that is constructing a cellulosic biofuel plant in Nevada. The Fulcrum Bioenergy plant is producing pyrolysis oil and should be the next operational plant after the Oregon plant to produce cellulosic biofuels.
- There is a growing interest in hydrogen fuels. Hydrogen is produced from a variety of fuels and methods. The production of hydrogen is classified based on the technologies and fuels from which they come. Two types of hydrogen fuels are valued for their potential to serve as credits under California's LCFS program. The first is hydrogen fuel that is produced using renewable and nuclear energy. The second is hydrogen fuel that comes from natural gas or coal, where the carbon byproduct of these processes is captured and stored. Hydrogen fuel created from biomass material can qualify for LCFS credits as well if the carbon byproduct from these processes is captured and stored. When the hydrogen from these processes is used as fuel, they qualify for credits under California's LCFS program, which makes them valuable in the market. Colorado has the geologic foundation to sequester the carbon byproducts that are produced as a result of creating hydrogen fuel.
- From an outside perspective, there are opportunities for Colorado to develop its biomass energy industry. One of Colorado's greatest assets is the creative minds and previous experience that Colorado companies have.
- Biofuels produced in Colorado can qualify for the California LCFS program so long as the biofuels produced in Colorado are used as transportation fuels and are consumed in California. Colorado also has the geology to sequester carbon byproducts from the production of biofuels, which will increase the value of the LCFS credit on the California marketplace.
- The biomass energy industry in Colorado has to coexist with the traditional logging industry. A strong logging industry is essential to cut trees and transport them to a power plant.
- Forest biomass as a feedstock is going to be more expensive than urban and agricultural waste. There will need to be incentives, like California's BioMAT or BioRAM program, to incentivize public utilities to purchase biomass energy and encourage investment. These policies and incentives need to incorporate the value of indirect, non-monetized benefits of biomass energy (e.g., reducing wildfire impacts, improving water quality, etc.).

Clarifying Questions

Meeting participants asked several clarifying questions about Larry Swan's presentation. Questions are indicated in italics with corresponding answers in plain text.

When public utilities were directed to purchase energy from biomass power plants that use forest biomass, did that raise utility rates?

With the state incentives in place, the utility rates increased only by pennies. This marginal increase in the utility rates was in part due to the large size of the ratepayer base.

In Colorado, public utilities are thinking about how to meet the last 20% of their zero-carbon production goals. Could biomass power be a potential avenue to approach the last 20% of the zero-carbon production goals?

It is worth a conversation. Laura Wolf, the Region 2 Wood Innovation Coordinator, could provide more information on this topic.

Where do the conversations to promote biomass energy need to start? With policymakers, the timber industry, the energy industry?

It is important to identify the different interests and groups at the beginning of the process. Some people are interested in net-zero emissions, others are interested in industry development, and others are interested in watershed restoration. In California, several groups came together to support the BioMAT program. Additionally, some of the push towards biomass energy in California arose from a drought emergency that helped motivate California legislators to pass legislation.

Growing Markets for Sustainable Biomass, Peter Thompson, Biomass Thermal Energy Council (BTEC) Deputy Director

- The BTEC is a trade association that advances the sustainable use of wood and agricultural biomass for clean, efficient heat and combined heat and power to meet America's energy needs and strengthen local communities. They have three focus areas: policy and government affairs, technical and regulatory affairs (i.e., technical projects to incorporate bioheating into codes and standards), and education and outreach to the public and congressional leaders.
- Renewable energies make up 11% of the United States' energy consumption. Biomass energy is the largest component of the renewable energy portfolio, representing around 43%. The BTEC's primary interest is in the gasification and combustion pathways of utilizing biomass energy; most members of BTEC utilize direct combustion for heating personal, industrial, and public buildings.
- A critical aspect of promoting bioenergy is the message that not all carbon is equal in the energy sector. Fossil fuels release carbon dioxide directly into the atmosphere from sources that would otherwise be stored. Forest biomass, on the other hand, is a natural component of the carbon cycle. The Environmental Protection Agency (EPA) is currently evaluating a rule to define energy derived from forest biomass as carbon neutral.
- Even as the United States population has grown, the number of forested acres in the United States has remained stable. Forest growth outpaces tree removal in the United States.
- In the southeastern and northeastern United States, wood represents the primary feedstock for renewable energies. A big difference between biomass sources in the western and eastern United States is that in the eastern United States, wood primarily comes from private lands. In contrast, in the West, wood primarily comes from public lands.
- There are several development pressures and land-use changes facing forests. Development is encroaching into natural forest land. One of the biggest challenges facing forests is that there is a lack of financial returns from forests. There need to be market incentives for forest products, or the land will be at risk of being converted to another land use.
- Forest management issues include a lack of funding and increasing threats from insects, diseases, and wildfire.

- Energy markets are rapidly shifting. Natural gas is cheap, and sustainable wood fuels cannot compete with it. Transportation costs associated with forest biomass energy are also very high. On average, the forest biomass has to travel 50 to 75 miles to the closest facilities.
- The issues related to development pressures, forest management, and energy markets are all exacerbated by climate change.
- The stakes related to proper forest management are high. The 2018 Camp Fire in California had a death toll of 85 people and burned over 150,000 acres.
- Thinning treatments are successful at protecting homes from fire. There has to be an economical use for the trees that are being removed to incentivize treatment.
- The biomass market begins with procuring feedstock. The feedstock then goes to sawmills or fiber mills for fuel processing. The processed fuels are then distributed to the fuel handlers. From there, the fuels go to boilers or residential stoves to heat homes, commercial spaces, and sometimes industrial processes.
- The website (www.wood2energy.org) provides information on the location of existing timber industry companies. The map includes information on pellet companies, sawmills, and cogeneration facilities, among others.
- Several sectors use woody biomass for energy, including the residential, commercial/industrial, biomass power plants, export products, and emerging technologies (e.g., gasification, torrefied wood, biocrude, and biodiesel) sectors. The southeastern United States has a strong export market to European companies that buy much of the biomass.
- There are three primary sources for forest biomass energy feedstock. The primary source is logging and wood residues from harvesting operations and hazardous fuel extractions. The secondary source includes wood processing residues from primary and secondary wood processing mills and pulping liquors. The tertiary source for feedstock is from urban wood residues. Urban wood residues are only usable as biomass energy if they have been treated properly.
- Approximately 12.5 million residences in the United States use biomass as their primary or secondary source for space heating. Approximately 3.5 million residences heat their space using primarily biomass. There are over 11,000 commercial and industrial boilers and over 500 biomass cogeneration plants in the United States. Biomass made up 5% of the primary energy use in the United States in 2017.
- Biomass heat at the residential scale relies on stoves, boilers, and furnaces to burn cordwood and pellets. Biomass at the commercial scale can heat office buildings, hospitals, shopping malls, and apartment complexes. Commercial biomass heating system relies on pellets for smaller systems and wood chips for larger systems. Industrial-scale heating requires more than 5 million British thermal units (MMBTU). Industrial-scale biomass processes often produce a combination of heat and power.
- Thermal biomass energy establishes markets for low-value wood. As paper mills close across the country, forest biomass needs another market to re-establish its value. One potential market is energy. Forest biomass energy markets allow private landowners to profit from forest management while reducing the wildfire threat. On public lands, forest biomass energy markets reduce hazardous fuel loads and lower fire suppression costs. The wood energy industry also provides jobs and economic development opportunities in rural communities. Private forests support over 2.4 million rural jobs. Additionally, 75% of the funding that is invested in thermal biomass energy stays in the local economy.
- There are three barriers for the biothermal energy industry. One key barrier is that the equipment is expensive, so there are high capital costs associated with developing a facility. The subsidies and tax credits for biomass energy facilities are low, but there is proposed legislation to increase the investment tax credit for biomass energy facilities. The second

key barrier is that low-value wood markets must be economically viable for the industry to sustain itself. Lastly, there needs to be more comprehensive carbon intensity accounting and pricing for all energy options, including biomass fuels.

- Several policy solutions are pending in Congress. The Biomass Thermal Utilization Act extends investment tax credits for installing residential and commercial heating systems. The Wood Heaters Emissions Reductions Act provides funding to replace old wood heating systems to align with the EPA's performance standards.
- The 21st Century Conservation Corps for Our Health and Our Jobs Act provides funding for corps crews to implement forest treatments. This legislation will not likely be passed before the end of this congressional session. It will likely be brought up during the next congressional session, depending on the results of the election.
- The EPA is analyzing the lifecycle of greenhouse gas emissions of wood pellets and wood chips for thermal applications. The EPA is also evaluating the electric pathway under its Renewable Fuel Standard program and may expand that program to include thermal biomass energy.
- The Community Wood, Energy and Innovation Program provides \$25 million to install wood energy systems and innovative wood products facilities.
- The Bioenergy Program for Advanced Biofuels provides funding to fuel producers, including those who produce wood pellets and other biomass fuels.

Clarifying Questions

Meeting participants asked several clarifying questions about Peter Thompson's presentation. Questions are indicated in italics with corresponding answers in plain text.

Are there any organizations that have a summary of state woody biomass policies?

The BTEC website (www.biomassthermal.org) has a database on state policies on wood energy. The database can be found under the "Policy Issues" tab on the website. The database is not entirely up-to-date at this time.

Can the trees that are killed by beetles and disease still be used in the biomass market?

Yes, they can still be turned into a fuel source. The wood residue from those trees can be pelletized.

What is the first step for establishing a bioenergy facility?

- One of the largest barriers to establishing a bioenergy facility is the high capital cost for equipment. There needs to be a policy mechanism to reduce these capital costs to make bioenergy competitive with other energy sources. Once bioenergy becomes competitive, then local areas can determine what energy source best fits their needs. It would also be helpful to become familiar with Colorado's Renewable Portfolio Standards to understand Colorado's incentive structure.
- [Peter Thompson provided additional comments on this question via email after the presentation.] It is critical for end-users to commit to installing biomass heating equipment. In the case of wood energy for heating, the end-users would potentially be hospitals, schools/universities, municipalities (for individual facilities or a district heating network for multiple buildings), and residences. It would also be useful to hear from a project developer in the field on how to bring together the right people in the region to establish a facility.

How can the BTEC help support the biothermal energy industry in Colorado?

BTEC has connections to larger companies in Colorado, including Lignetics, which is one of the largest domestic pellet producers in the United States. BTEC can connect the RMRI Biomass Utilization Subcommittee with companies and industry representatives from across the country to see what solutions may be possible in Colorado.

Where in Colorado are the best potential sources for biomass?

There are multiple potential feedstock streams for biomass energy. One feedstock includes the woody biomass from forests. Another feedstock includes manure from meat facilities and solid waste, which can supply anaerobic digesters. It is also possible to recycle plastics and paper waste for hydrogen production.

Considering that some utilities, like Colorado Springs Utilities, are implementing forest restoration projects, where is the highest potential source for feedstock?

Other information sources in Colorado may be more knowledgeable about the best opportunities in Colorado for feedstock. For residential heating applications, the best place to start would be to contact a pellet mill in Colorado.

Gypsum Biomass Power Plant, Kendric Wait, West Range Forest Products General Manager and former CEO of Evergreen Clean Energy Corporation

- Kendric Wait was one of the original power plant developers for the Gypsum biomass power plant. He worked on the project from 2010 to 2013. The Gypsum biomass power plant was sold to a New York private equity firm in 2018.
- Kendric Wait is still involved with the operations of the Gypsum biomass power plant. He currently owns West Range Forest Products, the company that provides fuels to the power plant.
- The forest biomass that goes to the power plant comes from the White River National Forest, Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands (PSICC), Arapaho and Roosevelt National Forests and Pawnee National Grasslands (ARP), some private land, and the Bureau of Land Management. They deliver around 4,000 to 6,000 semi-truck loads of forest biomass per year, which is around 85,000 bdt per year.
- There are three key components to developing a biomass power plant and about two dozen smaller items that could end a project if they do not come together. The three key components are a PPA with a utility, a fuel source, and the proper transmission infrastructure. The transmission infrastructure is critical to send electricity to the purchasing utility. Once those three key components together, the next steps are to address smaller issues, like water, planning and zoning, and siting the facility.
- The Gypsum power plant is located in Eagle County. In Gypsum, there was only one parcel that was zoned industrial, and the plant owners bought it. In high-elevation communities, real estate can be very expensive. Some people did not want industrial facilities when the investors purchased the industrial-zoned property.
- Establishing a biomass power plant begins when ratepayers and a utility company decide that they are willing to buy more expensive power to accomplish another public goal, such as forest treatments.
- The Gypsum biomass power plant's story began in 2008 when Holy Cross Energy voted to pay up to a 5% higher rate to add biomass power and some additional renewable energy power to their energy portfolio to meet community renewable energy goals. The Gypsum

biomass plant increased the utility rates by 2%. The plant also produces 6% of the Holy Cross Energy's electricity needs.

- Securing the wood supply for a biomass power plant can be tricky. The USFS and US Department of Agriculture (USDA) want to get wood out of the forest, but they have limited budgets and resources. As developers, any proposal for a biomass energy facility has to be crafted to meet the budgets and restraints of the USFS. For example, the Gypsum biomass plant currently produces 13 MW gross energy and 12 MW net energy. The USFS would not have been able to support a 30-MW plant if the developers had suggested building a plant of that size.
- The woody biomass supply that land managers offer does not always align with the amount of security that a bank needs to finance a multi-million dollar plant. A stable 20-year supply is needed to encourage financial investment. The USFS does not offer 20-year fuel contracts, so it requires some collaboration to bridge the supply gaps.
- The PPA between the Gypsum biomass power plant and Holy Cross Energy goes until 2034. Federal managers like the long-term nature of this PPA because they know that the woody material coming off of 1,000 to 1,500 treatment acres every year will have a stable outlet. Having this stable outlet for the woody biomass allows the White River National Forest to engage in long-term planning to treat in the wildland-urban interface (WUI), critical watersheds, and infrastructure corridors.
- The woody biomass on Colorado forests is not only low-value material, but much of it has a negative value, meaning it costs money to remove the woody biomass from the forest. Many stakeholders rely on fire resilient forests (insurance agencies, multi-million residential neighborhoods, ski resorts, sawmills, water providers, etc.). It becomes challenging to bring them all together to contribute financially to forest management costs.
- The solution to making woody biomass more valuable is through legislation and incentive structures. It is expensive to develop a biomass power facility without tax credits, other types of subsidies, and subsidized logging. A more expensive biomass power plant means that there will be a higher increase in power rates. Tax credits and long-term stewardship contracts can incrementally drive down any increases in power rates by making it less expensive to develop a facility. The Colorado Public Utilities Commission's primary interest is getting low power rates to the consumers. They do not want to buy more expensive power unless they are required to do so, as they were in California.
- Biomass power is competing with solar and wind energy, which are both cheap energy sources.
- The power plant developer and the supplier have to be involved in the discussions about where to site a biomass power facility. They also need to identify where there are opportunities for a 20-year supply of woody biomass feedstock. Lastly, they also have to identify who is purchasing the power and where there is existing energy infrastructure.

Clarifying Questions

Meeting participants asked several clarifying questions about the Gypsum biomass power plant. Questions are indicated in italics with corresponding answers in plain text.

What are the annual consumptive water needs for the Gypsum biomass power plant, and were there any challenges with securing a long-term water supply?

Securing the long-term water supply for the power plant was one of the relatively easier issues to resolve. The Gypsum biomass power plant is located on the Eagle River from which they get their water supply. Their annual water consumption is about 240 acre-feet per year, and the annual cost of water is anywhere from \$10,000 to \$60,000 per year.

What are the potential issues for establishing a biomass power plant in the Denver Metro Area?

- The biggest issue is whether there is an entity that is going to be willing to buy the power. There is not any legislation that currently requires Xcel Energy or any other utility to buy biomass power. If there is legislation, the utilities will buy it.
- The second biggest issue is that Denver is a non-attainment area under the Clean Air Act. It would be difficult to acquire the needed emission permits for a power plant in a non-attainment area.
- The third issue is that it is better to build a biomass power plant near the source of the woody biomass supply. Transporting woody biomass from the mountains to Denver would be expensive. There is potential to source urban wood waste from Denver to serve as a supplemental feedstock, but the urban wood waste from Denver is dirty. The dirt would interfere with any power plant's traditional combustion system.

With the air regulations in Denver, is it completely infeasible for a cogeneration plant to be located on the west side of Denver?

Establishing a new source of air pollution in a non-attainment area will be a significant hurdle. There would need to be more research completed on the Colorado Department of Public Health and Environment's regulations to know whether it is possible or not.

What was the public's response to the construction and operations of the Gypsum biomass power plant?

- There will always be people who do not like the construction of a new power plant. There are some legitimate concerns from the public about having truckloads of woody biomass come through town. It is important to find alternative transportation routes to minimize the impact of the facility. It is also important to make sure the facility does not hurt the local viewsheds.
- Over the past ten years, the public has been supportive of the facility. Some of the logging has occurred in areas where there are serious fire concerns, and people in those areas have been very supportive of the project. The logging and forest treatments that have occurred as a result of the Gypsum biomass power plant has protected communities from wildfires.

Is there any potential to downsize a facility and produce energy behind the meter and engage in a net metering system to boost the price of the unit?

A large industrial outfit, such as a sawmill or pellet mill, could produce energy behind the meter. The rate received from net metering is not nearly large enough to pay for the investment in a biomass power plant facility. Legislation would be needed to increase the net metering rate to make it a viable option.

What is the process for getting woody biomass from the forest to the biomass power plant?

- West Range Forest Products has a task order in its 10-year stewardship contract with the White River National Forest. They try to deliver the wood to the power plant as dry as possible. When they cut green timber, they bunch the trees and let them sit on the ground to allow for the pine needles to suck out the moisture. They then drag the trees, mostly small-diameter junk wood, to the hauling truck and grind the trees directly into the back of the truck. The truck can then haul around 20 to 22 bdt. This material goes directly to the power plant for storage or combustion.

- When West Range Forest Products cuts larger trees that can be used as sawlogs, those trees go to the sawmills. They do haul the woody residue waste from the sawmills back to the power plant as well.

How much of their feedstock is composed of waste from the sawmills?

It varies. This year, about 30% of the feedstock is going to be composed of sawmill waste. In the past, the waste from the sawmills has made up to 50% of the feedstock. The mix fluctuates based on pricing as ultimately, West Range Forest Products is charged with delivering the lowest cost fuel as possible to the power plant.

Is it possible to store whole logs on the Gypsum power plant property?

It is possible to store whole logs on-site, but it is not economical. Transporting whole logs to the power plant adds another step of having to grind the logs once they arrive, and it is more expensive to operate a chipper for whole logs at the plant. The logging trucks can also haul more material when it is grounded than when it is whole. They do keep some prepared fuel on-site in storage in the winter when it is not possible to log.

Has the Gypsum biomass power plant ever had trouble getting supply?

Not yet, but it is something that is on their minds. Their long-term stewardship contract with the USFS expires in a couple of years.

What is the furthest travel distance for the materials to reach the biomass power plant?

Material is hauled out of Saratoga, Wyoming.

Forest Resilience Bond, Zach Knight, Blue Forest Conservation Co-Founder and CEO

- Blue Forest Conservation develops forest resilience bonds, a public-private partnership financing mechanism that accelerates the pace and scale of treatments on public lands. In the forest resilience bond structure, the beneficiaries (e.g., USFS, flood control districts, private businesses) of a forest treatment pay for the work completed based on the benefits received.
- Blue Forest Conservation is currently in the process of interviewing equity investors, lenders, land managers, and non-governmental organizations (NGOs) that are collaboratively planning projects that are involved with biomass facilities.
- One of the largest challenges for biomass power facilities is securing a stable supply of woody biomass. The USFS cannot always guarantee that they will deliver a defined quantity of woody biomass at a defined time in the future. It is possible to acquire 20-year PPA, but it is challenging to get a supply contract to match that timeline.
- Lenders want a guaranteed supply to match their loans and equity investments. In the forest resilience bond, Blue Forest Conservation and partners find lenders to make loans to partners who have the capacity to implement projects (e.g., National Forest Foundation (NFF), National Wild Turkey Federation (NWTFF), Mule Deer Foundation, etc.). These partners then enter into cooperative agreements with the USFS to complete work. The lenders then issue the loan so that these partners can begin work on the project immediately. In a forest resilience bond project, the fact that partners have a funding source to complete work immediately creates more certainty around a steady supply of woody biomass for biomass facilities.
- It is helpful for the partners to have an offtake contract for the woody biomass set up in advance of the project to lower the cost of treatments.

- Biomass facilities need to be subsidized the way wastewater facilities are subsidized. Financing projects and funding them completely upfront allows partners to guarantee the supply of woody biomass for the life of the project. Since the contract term limit for stewardship contracts has been extended to 20 years, it is becoming possible to guarantee a woody biomass supply over a longer period.
- A long-term stewardship contract between the USFS and a forest restoration crew is a good option for a bioenergy facility that has its own forest restoration crew. For bioenergy facilities that do not have their own crews, working with an entity that has a cooperative agreement with the USFS is an option to secure a supply of woody biomass.

Clarifying Questions

Meeting participants asked several clarifying questions about the forest resilience bond. Questions are indicated in italics with corresponding answers in plain text.

What is the first step to connect a foundation to the USFS so that they can begin to provide feedstock to a biomass power facility in development?

- There are two options for delivering feedstock to a biomass power facility. One way is to have independent bioenergy facilities that do not have a contract with a forest crew bid on truckloads of chips from the projects. The other option is to build a partnership between the project implementors and a biomass facility that can serve as the offtaker. Many groups, like the NWTF, have master stewardship contracts with the USFS at the regional level but sometimes directly with a National Forest. Blue Forest Conservation is still trying to solve how to connect standalone biomass power plant facilities with the project implementors.
- The best option so far for biomass power facilities has been for biomass power facilities with forest restoration crews to directly enter into stewardship contracts with the National Forest.
- One goal of delivering feedstock to a biomass power facility is to not leave any piles on the ground.

What is the demand for forest treatments in Colorado, and how does that demand align with existing power plant facilities and energy infrastructure?

- There is a broad need for ecologically-based forest restoration work across Colorado and the West. Every National Forest implements forest treatments. Some National Forests are bigger producers of woody biomass than others.
- The amount of woody biomass production that is possible on a National Forest depends on staff capacity and the number of existing National Environmental Policy Act (NEPA)-cleared acres. The number of NEPA-cleared acres is a big factor for treatments. Having a large number of NEPA-cleared acres at a landscape level can provide more certainty around access to biomass.
- Funding is a big barrier too. There is always a need for pre-commercial thinning, but how much work is accomplished depends on funding.
- For some National Forests, their dead trees are deteriorating. It is more difficult to harvest wood and utilize the biomass as the trees deteriorate.
- Before RMRI, the San Juan National Forest already had a wood products industry that could accept the material from treatments. The RMRI-Southwest Colorado (RMRI-SW) project is a good opportunity to develop a biomass facility because of the availability of woody biomass.
- There are opportunities for woody biomass production in the ARP and PSICC National Forests as well. There is a lot of wood in the WUI on both federal and non-federal lands, and

the Upper South Plate Partnership has identified key places for treatments. There are many drivers along the Front Range to utilize biomass more effectively.

- Every region has its own cast of challenges and opportunities. RMRI is a new approach to gather those who are passionate about communities, creating jobs, and protecting water, recreation, and wildlife habitat. It will take a community effort to develop new and innovative approaches to develop opportunities for biomass utilization. Communities will have to choose to subsidize getting low-value material out of the forests as they did in Eagle County when they chose to fund the Gypsum biomass power plant.

The NWTF has a master stewardship agreement with USFS Region 2 and with some of the National Forests in Colorado. Is there something the NWTF should be thinking about to help provide a constant supply of wood for a biomass facility?

- There will never be enough USFS money alone to support an entire project, and other traditional sources of funding, like grants, can be ineffective at funding projects if they rely on providing funding through reimbursements. A reimbursement payment method is a problem when groups do not have the money up front to pay for implementation, which means they either have to take out a loan or delay payments to the contractor.
- The forest resilience bond process begins by engaging local partners, from water agencies, to power line operators, to flood control districts. Once the partners have been connected, they complete an economic analysis with the World Resources Institute. They then bring partners together to pool resources and develop a funding plan.
- There needs to be financial flexibility to get multiple contractors on the ground at once to complete work. Having upfront funding also creates the opportunity to hire small businesses that often cannot afford to wait for payments until after the work is completed.
- If there is a funding plan to provide upfront funding for treatment implementation, the NWTF as an implementation partner can guarantee the supply coming off of their treatments for biomass power facilities.

Some of the speakers have discussed the challenge of having piles in the forest build up over time. One challenge with the Southwest Colorado Environmental Impact Fund is the cost of transporting material taken out of the forest to facilities. RMRI-SW partners are looking at several options, including establishing woody biomass feedstock yards or constructing facilities closer to where the work will be implemented. What are the economics of burning piles versus removing the piled material out of the forest?

The Gypsum biomass power plant has collected and ground already existing piles in the past on hundreds of acres. The burn piles are not the best fuel because it is dirty, but the quality is still acceptable. It is often cheaper to burn piles rather than collect them, but with the right budget, it is not difficult to remove piles.

NEXT STEPS

- The Biomass Utilization Subcommittee will meet to go over their takeaways from this discussion. Molly Pitts and Samuel Wallace will send out the PowerPoints from the presenters to the Biomass Utilization Subcommittee.
- Molly Pitts and Samuel Wallace will develop slides to update RMRI partners on the activities of the Biomass utilization Subcommittee during the July 22 full RMRI meeting.