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The Lack of Long-term Feedstock Supply Impedes Capital Investment in California's Wood Utilization Opportunities

It is a well-known fact wood product businesses and bioenergy facilities require a reliable and predicable feedstock supply to sustain operations long term. Many have heard that without an agreement to *guarantee* enough reliable feedstock to sustain business operations long term, a wood-based business model is deemed too high of a risk to leverage the financing needed for project completion. However, there is little documentation in California that confirms the extent to which biomass-based businesses are limited by a lack of access to stable feedstock supply contracts.

Despite an excessive amount of dead trees, brush and small diameter wood that needs to be removed from California's forests, existing and proposed wood waste utilization projects face a close to insurmountable challenge when it comes to demonstrating sufficient and long-term access to woody feedstock sources. There are several reasons why a feedstock agreement can be jeopardized: (1) volatile markets, (2) declining USFS budgets and staffing capacity, (3) the low value of biomass and high transportation costs, and (4) administrative challenges of contract management. All these factors lead to the vexing reality that while feedstock agreements are a necessary component to securing a financial package for new wood product businesses, they are difficult to obtain. Without a minimum contract term of ten years, many lenders and investors deem wood products and bioenergy projects too risky.

This paper will cover the issues above and discuss two case studies--the Tule Creek Forest Products and the Loyalton Biomass Facility--to understand the prominent factors that led to the collapse of their feedstock arrangements and subsequent business closure. Additionally, we will discuss what feedstock factors the Loyalton Biomass Facility believes will help the facility succeed under new ownership. This paper complements these stories with testimonials from other project developers and financial professionals that are experiencing similar barriers. Several other projects will also be mentioned. Ultimately, the evidence supports the assertion that the lack of a reliable feedstock supply chain is a significant barrier for the utilization of biomass residuals in California.

Factors that Impact Feedstock Agreements

Feedstock Factor One: Price Volatility and Landowner Insecurity

Determining the market value of a timber stand is a complex undertaking and can result in a highly variable average price each year [1]. While there are many factors that impact the price of each forest stand, there are two primary external factors that must be considered before bringing sawlogs and excess biomass to market: demand and supply. Demand can be impacted by the housing market, paper and packaging, export, and wood bioenergy industries. As certain trends in the market move up or down to demand a certain class of species, the value of timber fluctuates with demand. Likewise, if there is an abundance of timber supply for sale in a region, it can dramatically impact the ability to sell lumber at a stable price. If mills are having difficulty procuring feedstock supply, they will pay a higher price for it. In

[1] Forest2Market. Accessed 11/24/20

California, for example, the timber market has been saturated by salvage logging from wildfires, resulting in processing facilities rejecting new material and requiring small landowners to forego forest projects until they reopen.

It should also be noted that due to the lack of value excess biomass retains, biomass is a product dependent on the feasibility of sawlog projects. A project is implemented for its sawlog value and the projected return on the harvest given the concurrent market price. Without a favorable price on timber value, biomass removal projects typically exceed the costs used in a proforma. There are various methods of handling excess biomass through a timber sale, however, and market conditions have regularly discouraged the sale of biomass leaving contractors with no other option than to leave them in large piles in the forests. Because sawlog value is highly sensitive to a variety of market conditions, this impacts the prices of woody residual biomass and influences the decision of a timber landowner to operate. This can make any long-term agreement to procure feedstock a challenge.

The Camptonville Community Partnership (CCP) is currently developing a forest-based 5 MW bioenergy facility in Yuba County. CCP is finding a lack of interest in entering into any feedstock agreement due to the concern of private small timber companies and associated businesses to price fluctuation. These companies and the forestry professionals that often broker wood also point to continued wildfires further exacerbating price fluctuation, lack of workforce, transportation costs, and insurance deficiencies.

> *"Because of the uncertainty of where a forestry professional might be working 1 or 10 years down the road, many operators are unwilling to sign any length of contract – the feedstock is so low value and their operating costs are so high that they can't afford to commit to providing feedstock if there's a chance they'll be working too far away to make the haul financially feasible."* [2]

The Beck Group's *California Assessment of Wood Business Innovation Opportunities and Markets (CAWBIOM)* substantiates the volatile nature of prices in developing sawmill byproducts, veneer, and wood chips markets in California[3].

A Case Study: Tule Creek Forest Products

In 2014, The Watershed Research and Training Center, located in Trinity County, leveraged their diverse experience in wood product research and development from roundwood manufacturing to small-diameter sawmilling, and found what they believed to be the foundational business model that could support diversification and growth of multi-product wood products campus: bundled commercial firewood[4]. They conducted fuel supply studies, workforce capacity and market assessments to anticipate any potential issues. Because commercial firewood was an established market, there was no projected concern with market appetite and the business would only require about 200 truckloads of feedstock per year[5]. Called Tule Creek Forest Products (TCFP), The Watershed Center had a strong

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[2] Allison Thompson, Project Manager for South Yuba River Citizens League on the Camptonville Forest Biomass Business Center in Yuba County. Personal Communication. 10/1/2020

[3] The Beck Group (2015)

[4] Nick Goulette (2018) Fire Adapted Communities Learning Network. Accessed 10/25/20

[5] In comparison a 5 MW facility can anticipate 23 truckloads per day, totaling well over 8,000 truckloads a year. Numbers taken from Camptonville Community Partnership Forest Biomass Facility Conditional Use Permit staff report - https://www.yuba.org/CUP2019-0002%20-%20Staff%20Report%20Package.pdf

management team, a pre-permitted old mill site and targeted financing for equipment and cash to operate within the first year. The critical failure, it turned out, was that the feedstock projections and contracts fell short of wood supply needs.

There were two main factors that undermined the business model. First, a significant wildfire season in 2015 (TCFP's first year in operation) incentivized logging contractors and operators to prioritize salvage sawtimber instead of the less-profitable firewood feedstock within their region. A second blow to contracting capacity occurred in 2017 when a softwood lumber imports trade war with Canada ensued. This coincided with increased demand from new home and commercial construction, raising lumber and sawlog prices, thus decreasing their ability to procure firewood feedstock from private timberlands. Even when Tule Creek had an operating business and equipment in place, and had established consistent pricing and receiving systems, there was lack of interest from private landowners, contractors and brokers to continue supplying wood due to increased sawlog pricing and demand Increasing scarcity of capacity across the feedstock supply chain, from loggers to truckers, focused energy on sawlog harvest, leaving firewood feedstock (e.g. cull logs, hardwood, tops) stranded either within stands or on landings, perceived as an unnecessary cost with not enough ancillary value (e.g. for fuels/fire hazard reduction, or for site preparation) to justify utilizing capacity that could otherwise be purposed to sawlog harvest and delivery. With nowhere else to go, the project turned to the US Forest Service, which had many competing priorities and unfortunately could not be relied on as a feedstock supplier. Ultimately, after their third year of operation, Tule Creek Forest Products closed.

The Tule Creek business model was well developed to succeed. As with any business model, gaining net-positive profits is crucial. According to the "Economic contribution of California's Forestry and Forest-Products Sectors" published by UC Agriculture and Natural Resources in 2017, stumpage[6] price per board foot (MBF) rose and fell by over $150 per MBF from 2015 to 2017[7]. When compared against the harvest levels for those years, returns fluctuated from approximately $345 million in 2015 to $1.47 billion in 2016 only to return to about $400 million in 2017[8]. This volatility, as well as a lack of contract capacity with local private and federal landowners led to the demise of the business.

> *"Tule Creek didn't need a lot of wood. We thought we could buy our fuel supply from season to season without many contracts. However, on the back of the 2008 stock market crash, workforce capacity fell and the sawlog market influenced contractor behavior. No one could have anticipated the huge price fluctuation and the way landowners would have behaved when we first started."* [9]

The Watershed Center did hold a supply agreement contract with Sierra Pacific Industries to receive the otherwise non-merchantable treetops and cull trees from their harvests over a 10-year period. However, the contract did not require a consistent wood price over the 10-year period and had no binging provisions. While this theoretically might have sustained the project, the Center believed that if

[6] Stumpage price is used to define the value of timber before harvest and is a key aspect of an operators cost-benefit analysis.

[7] University of California Agriculture and Natural Resources Cooperative Extension (2020)

[8] Numbers are estimates and may not reflect actual numbers. Please see Figure 2 "Historical California harvest levels and implied average stumpage price" in the UC Cooperative ANR Extension publication.

[9] Nick Goulette. Personal Interview 11/16/20

the contract were any more specific or binding, SPI would have had much less interest in signing[10]. This situation is even more concerning for a small business or a non-industrial timber landowner.

> *"With small-diameter wood products, feedstock contracts can operate as another risk factor instead of a profit factor. The wood markets could be different in a few years' time, so to guarantee any specific wood supply would be risky. Strong contracts that can hold up in court are intimidating to small scale timber landowners who don't have the wherewithal to go to court."* [11]

The Tule Creek project provides a cautionary tale in wood products business model development, and the role of volatility in the markets, constraints in logging and hauling capacity, and landowner insecurity should be taken seriously.

Feedstock Factor Two: Declining US Forest Service Budgets and Staffing

For Tule Creek, Sierra Pacific Industries comprised the bulk of the contracted fuel supply for business operations. The Watershed Center also anticipated procuring the additional fuel supply from National Forest System lands through the USFS' competitive bidding process based on the large biomass estimates coming from their fuel availability study. After their contract with SPI fell through though, they had to rely much more on the USFS fuel supply. Yet, when their region experienced an intense wildfire season, Forest Service programmatic priorities shifted the expected sales from cull logs and treetops Tule Creek hoped to use for their operations[12].

As discussed in a previous paper prepared for the Forest Management Task Force, the "Forest Service Feedstock Collaboration On-Ramp Document", US Forest Service (USFS) Region 5 repeatedly encounters three issues to achieving more forest health projects: uncertain discretionary budget, high staff turnover, and limited ability to perform timely and efficient NEPA review[13].

> *"The USFS staff for managing the forest is getting smaller and smaller as the staff to manage fire is increasing. Ranger Districts have difficulty getting their own NEPA done in a timely manner and now need assistance from other District Offices on the Forest. Because of this we see less and less projects being developed and implemented. Hence, there is less opportunity for feedstock to be purchased with the declining capacity to develop and manage forest health projects."* [14]

The USFS recognizes these barriers and are actively collaborating with State partners to achieve more forest health projects. In August 2020, the USFS entered into an Agreement with Gov. Newsom on a shared long-term strategy to manage forests and rangeland which includes a commitment from the USFS to match California's 500,000-acre forest treatment goal per year[15]. This builds on the last 15 to 20 years the USFS has recognized the role partnerships and collaboration play in achieving large landscape stewardship goals. Through various agreements and contracting tools, the USFS have relied more on

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[10] Ibid.

[11] Ibid.

[12] Nick Goulette. Personal Interview 11/16/20

[13] CLERE Inc. (2020)

[14] Todd Sloat. Personal Interview 11/25/2020.

[15] Press Release (2020) Office of the Governor.

local partners to perform the contract oversight, hire operators and implement projects, thereby giving their partners the contracting power to enter into feedstock agreements.

Often, biomass projects see their National Forest as a pivotal opportunity to obtain long-term feedstock supply yet encounter a similar situation as the Watershed Center encountered with their National Forest balancing a number of priorities. The Mariposa Biomass Project (MBP) is experiencing the same issues with their National Forest's hiring process and staff resources to complete NEPA.

> *"When [the Forest Service has a] budget and approval to hire, the federal process is difficult, and few people can or want to apply. That includes archeologists and others for NEPA work. As far as a feedstock agreement, our local forest district is having trouble getting agreements and SPAs[16] in place… There is a difficulty putting together the large landscape projects that would fuel feedstock contracts because they don't have in-house staff to do NEPA and restrictions on hiring outside consultants not to mention limited resources. Plus, they get hit every year with huge fires that eat up time and resources and take focus from planning and treatments."* [17]

The MBP has two letters of intent in hand that describe a possible 5-year commitment with private contractors who are hired to perform high hazard tree removal on private property or along power lines as designated by PG&E[18]. They continue to seek further contracts in order to attract financing but are hesitant to rely on wood from federal lands.[19]

Feedstock Factor Three: Value of Biomass and High Transportation Costs

The Sierra Institute's Paper, *Paying for Forest Health: Improving the Economics of Forest Restoration and Biomass Power in California,* states that operational costs regularly exceed market values of biomass[20]. This results in a profit-deficit business model necessitating the financial support from state-directed market incentives and grant programs. A number of landmark policies and programs like SB 859 BioRAM or SB 1122 BioMAT have been established to help overcome the economics of expanding small diameter woody biomass removal projects. However, these state programs, as well as grant programs such as the CEC's EPIC program and the Forest Service's WIG programs, have not yet taken projects over the finish line. For this reason, wood-based businesses are continually pressured to seek innovative investment opportunities to support their project from public and private sources.

> *"I doubt there is an instance where anyone is doing anything with biomass on federal lands, or in a community, where the project is not relying on multiple grants -federal*

[16] Supplemental Project Agreements (SPAs) define specific project outcomes for contractors to achieve on USFS land and are considered legally binding. SPAs are tiered off Stewardship Agreements which are not considering legally binding relationships.

[17] Melinda Barrett, Program Manager Mariposa Resource Conservation District. Personal Communication 11/19/20

[18] Steve Smallcombe, Chief Technical Officer for MBP. Personal Communication October 2020

[19] TorBjorn Millang, Project Developer on MBP. Personal Communication. October 2020

[20] Sierra Institute for Community and Environment (2020)

grants, state grants, or others - to help them support their effort. Without government support it does not happen." [21]

Even when there is government support, there is considerable skepticism about the promise of a wood products business being successfully established.

"Operators and private landowners are very hesitant to enter contracts before [a biomass] plant is built or is even under construction – the process has been so lengthy that they don't believe the plant will actually happen, and even though we wouldn't hold them to the contract if the plant wasn't built, they still can't afford to be planning on it long term if there's a chance it won't happen." [22]

A Case Study: Loyalton Biomass Facility

The Loyalton Biomass Facility has had a long history in the Sierra Nevada, being originally built as a sawmill and bioenergy facility, before closing in 2010. In 2018, the Loyalton Biomass Facility was reopened after being purchased by American Renewable Power with support from their partners, Sierra Business Council. The facility has a nameplate capacity of 18 MW, uses a steam turbine and processes about 165,000 BDT per year. The facility was a beacon for revitalizing the town of Loyalton in Sierra County by creating 21 direct full-time jobs and over 120 indirect jobs throughout the County. At full capacity, the facility has the potential to receive wood from over 12,000 treated acres per year[23]. Procuring a feedstock agreement within a financially feasible radius of the facility proved to be very difficult. The low value of the biomass and the high transportation costs led to local landowners only offering small volume contracts. This meant that Loyalton required many contracts to maintain operations. The facility needed to manage 20 to 30 contracts per year based on the typical contract length lasting for 2-3 years[24]. Due to the seasonal nature of forest operations in the snow-dominant region, Loyalton had to quickly acquire enough contracts and stockpile 80,000 BDT on their lumberyard in order to maintain operations through the winter (which can last from four to six months).

Loyalton participated in the BioRAM program to win a favorable price on high hazard fuel supply, but the transportation costs and difficulty of procurement made it hard to rely on the supply volume. Transportation costs are a well-researched and understood barrier to operation with prices for biomass removal fluctuating around $50 per BDT[25]. Often this limits a bioenergy facility's abilities to procure feedstock beyond a 30-50-mile sphere. In Loyalton's case, it was not economically viable to source their material beyond 30 miles[26].

For Loyalton to offset costs of feedstock procurement, the facility participated in the BioRAM program, which offered a financial incentive for biomass facilities to accept High Hazard Fuels (HHZ) from mortality-stricken stands throughout the Sierra Nevada. Yet, due to the way BioRAM was structured off of tier 1 and tier 2 priority stands, the projects that occurred within their 30-mile radius of financially

[21] Becker, D. et al. (2011)
[22] Allison Thompson. Personal Communication. 10/1/2020
[23] Sierra Business Council (2019)
[24] Steve Frisch, President of SBC. Personal Interview. 11/06/20
[25] Tubbesing, C.L. (2020), California Biomass Collaborative (2015), Mason, Bruce and Girard, The Beck Group (2019), Lawrence Livermore National Laboratory (2020), Spatial Informatics Group (2016)
[26] Steve Frisch, President of SBC. Personal Interview. 11/06/20

feasible procurement went to other facilities[27]. This left Loyalton to source HHZ from hard-to-reach regions.

With all these factors combined, the Loyalton Biomass Facility shuttered in early 2020 due to their inability to maintain the volume of feedstock needed.

Recently, the Loyalton Biomass Facility has been purchased by Sierra Valley Enterprises, owned and operated by Jeff Holland of CLT Forest Management. Sierra Business Council is excited to see a forester take over facility operations for his in-depth knowledge of the contracting landscape and local connections. The facility has already secured a contract to accept the biomass from the Town of Paradise Camp Fire which will satisfy operations for the next three years[28]. There is hope that this particular project may overcome feedstock barriers and bring economic prosperity and fire reduction.

Feedstock Factor Four: Multiple Short Term Contracts Management and Other Administrative Challenges

For a bioenergy operation, there are multiple types of contracting purposes and entities. There are procurement contracts with utilities to purchase the electricity and establish long-term demand for the product. Then, on the supply side, there are feedstock contracts with private landowners and federal partners. Both can be drastically different in performance and commitment. In this sense, the hiring and contracting process to perform work on federal land is considered complex and confusing[29], adding another layer of contracting expertise necessary to facilitate wood business contract management.

While there is no shortage of biomass fuel potential through forest health projects, small private commercial timber sales, and fuel thinning, feedstock contracts to perform work are short term and must be stacked in order to have a consistent supply. As demonstrated with the Loyalton facility, the larger the facility, the more contracts will be needed such that the facility is not vulnerable to one contract failing and thereby jeopardizing operational capacity.

> *"Typically, [agricultural feedstock contracts are] 1-3 years, with (biomass) operations usually requiring 10-20 contracts minimum."* [30]

In order for Loyalton to achieve 30 contracts per year they diversified their fuel supply ownership and type. A majority came from federal land, and about 20% came from private landowners working through the local fire safe council[31]. Additionally, Loyalton accepted green waste from landfills and wood pallets from the Tesla factory near Reno, Nevada. As discussed earlier, the ability for businesses to contract with non-federal partners like private landowners can be difficult. The need to manage so many contracts manifested as a significant administrative barrier.[32]

Navigating the complexity of contracting with the USFS adds another layer of contracting expertise to facilitate a successful wood business. The USFS offers dozens of programs and authorities that can

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[27] Ibid.
[28] Ibid.
[29] Sierra Institute for Community and Environment (2018)
[30] Tad Mason, Chief Executive Officer for TSS Consultants. Personal Communication 10/08/20
[31] Steve Frisch, President of SBC. Personal Interview. 11/06/20
[32] Ibid.

enable intergovernmental collaboration and public-private partnerships to implement forest projects on National Forests. However, the application of such collaborative tools and authorities is not consistent statewide, and there is often confusion on which tool is best for a partner's project[33]. Despite the various benefits that can emerge from federal agreements, utilizing these multi-tiered collaboration tools requires intimate knowledge of the programs and an understanding of nuanced legal definitions. The USFS is actively working to address this issue and has dedicated staff and resources to expanding technical assistance for professionals. However, even when a partner is able to enter into an agreement with the USFS, feedstock contracts built off those USFS agreements and contracts are hard to obtain.

> *"We cannot directly contract with the USFS, because small non-profits do not have the capacity to take on entire timber sales, which is needed when dealing with USFS lands, so for access to USFS feedstock, we have to look at contracting with timber operators who are likely to win USFS bids. This presents multiple barriers. One of them is that by looking so long term, no one knows who will actually be operating the USFS sales..."* [34]

Finally, a contract manager must also be able to enter into and maintain procurement contracts with the utilities. For bioenergy projects, understanding how to comply with BioRAM or BioMAT programs is a complicated matter. Both programs require specific feedstock use, with associated oversight by the state, which can pose challenges to small businesses and community groups. Handling verification, reports, and audits adds to the administrative challenge posed to bioenergy contract managers.

When considering the types of contracts that must be acquired from private and federal landowners and the procurement contracts to be secured from electricity purchasers or other wood product buyers, it is always amazing to hear successful projects. One in particular is located in Shasta County. The Hat Creek Bioenergy facility is currently proceeding to financial close and will likely begin construction for their 3MW facility by 2021 due to relationships with an experienced site developer and a feedstock supply manager with extensive connections and experience. Companies and organizations that manage feedstock supply for a region, like Licensed Timber Operators (LTO), have access to projects that have numerous timber sales and occasional subsidized feedstock sources (e.g. grants), which will keep feedstock prices manageable.

> *"For forest biomass projects like Hat Creek Bioenergy, it is critical that a reliable and consistent feedstock supply and a stable price can be obtained. Without this, projects can't move past the feasibility phase. We could not have proceeded to the next phase of the project without Todd's experience and connections in the region."* [35]

At this time, only those projects with deep experience and connections in the current biomass and wood industry can leverage relationships and anticipate implementation projects over a long period of time. In most cases the high cost for low return is too great to maintain a reliable marketplace.

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[33] Sierra Institute for Community and Environment (2018)

[34] Allison Thompson. Personal Communication. 10/1/2020

[35] Matt Summers, Chief Technical Officer for West Biofuels, EPC and technology provider for Hat Creek Bioenergy. Personal Communication. 11/05/20

Putting it all together: Attracting Capital

> *"The first conventional wisdom [of woody biomass utilization] is that a guaranteed supply of biomass is needed before loggers and manufacturers will make capital investments in infrastructure and equipment"* [36]

With any business plan, having a reliable and predictable supply chain is essential to business success. Therefore, the ability to secure a feedstock agreement can be a determining factor on whether the business can succeed. The various factors described above make it increasingly difficult to provide the foundation for the new wood product businesses to attract capital. Most private landowners cannot assume risk when entering into feedstock contracts, and the federal landowners are bogged down by complicated contracting requirements and a lack of staff. Meanwhile, lenders and investors believe there is too much risk in investing in a project without a feedstock contract.

For Loyalton, securing enough feedstock contracts to maintain their operations through the winter was a deciding factor on their ability to stay open. Through their partnership with SBC, Loyalton intended to offset difficulties in financing and forest economics by inviting new businesses to use the combined heat and power (CHP) produced from Loyalton to operate their smaller wood product businesses. However, the widely popular concept of establishing a wood product campus on-site was, again, limited to the logistics of feedstock availability in the region.

> *"In order to have the pricing to pencil out, [Loyalton] would lend their land to subsidize the chipping operation to a wood products campus. But before any companies joined, they asked about the feedstock supply analysis that guarantees a 10-year supply of material to ensure a return on my investment. Especially when the feedstock is coming from federal land. All the investors want a certain return to even consider to co-locate in the business campus. Capital is not patient."*[37]

In a report developed by the Center for Force Majeure on the market opportunities to introduce Sierra Nevada Sustainable Forest Material (SNSFM) into engineered wood product development, participants reported reliable feedstock supply contracts being one of the biggest barriers to catalyzing the market. For one of the survey companies, the report states:

> *"it is 'impossible' to secure a 20-year supply contract for SNSFM. Without such a contract, capital investment in a facility is extremely challenging to secure, and business planning is also very difficult…I can't build the plant if I have to pay it off in six months because I can't contract more than six months in supply."* [38]

From a technology supplier standpoint, West Biofuels further substantiates the conundrum of needing to build a facility before the feedstock agreements are in place. Before West Biofuels enters into a contract to begin building or manufacturing the expensive custom parts for facility construction, the

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[36] Becker, D. et al (2011) p 209

[37] Steve Frisch, President of SBC. Personal Interview. 11/06/20

[38] Lupien, S. (2019)

financial plan needs to be finalized. With the financial plan impinged on the prior availability and commitment of feedstock that will be guaranteed years from the time of signing, the amount of risk assumed by all entities can be troubling.

> *"There are investors and banks willing to finance a BioMAT project, but a major hurdle is proving that feedstock is secured. Feedstock can make up half of the operating costs of these facilities and there is zero energy production and zero revenue if the facility runs out! Any forest management program that wants to feature a BioMAT/bioenergy component should be structured to provide this consistent supply over a long-time horizon."*[39]

David Wilkinson with Rural Community Assistance Corp elaborated on the aspects of risk that are perceived by a lender in the wood product industry. Ultimately, obtaining a feedstock agreement and securing the needed financing to launch a wood product business are in a constant gridlock over the same perceived risks.

> *"There's market risk if the start-up business is introducing wood-based products into developing markets (eg. biochar, hydrogen fuel). There's technological risk with gasification systems producing renewable energy; and a certain amount of feedstock supply-chain risk (fuel and labor cost fluctuations) and long-term stable prices for feedstock."*[40]

Conclusion

Securing a reliable, long-term feedstock agreement is a necessary component to a wood product or bioenergy business plan. Without which, a project can be deemed too high of a risk to the financial industry. Volatile market prices were a significant barrier, as seen with The Watershed Center's Tule Creek Forest Products which failed in 2017. Lack of staffing at the USFS to complete NEPA and finish planning efforts can also play a role in preventing success of these projects. Low biomass value, transportation costs and the amount of feedstock agreements necessary were determining factors with Loyalton's closure in early 2020, exemplifying how heavy administrative burden can impede project success. Projects must include an experienced contracting manager to facilitate the many short-term contracts and multitude of other administrative burdens that can be critical to a successful business. Moving forward, perhaps the Hat Creek Bioenergy facility in Shasta, and Loyalton Biomass facility's new ownership will be examples of successful feedstock procurement.

[39] Matt Summers. Personal Communication. 11/05/20

[40] David Wilkinson, Loan Officer for the Biomass Utilization Fund for the RCAC. Personal Communication 10/21/20

> *"Supply and pricing need to be dialed in if you want to make major change for these forests, and make it possible for companies to utilize these materials over and over again versus doing one-off projects here and there."* [41]

With the many factors that can impact the ability to obtain a feedstock contract, there are options for new approaches for the management of forest biomass. The need for innovative new thinking around these old standing problems is dire, as we face the oncoming challenges of climate change and associated catastrophic wildfire. New thinking must be applied, and serious financial and political commitment must be made to move the needle on these issues.

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