Scott's Biomass Fuel Project

Lake Tahoe Basin Management Unit, Placer County and Placer County Air Pollution Control District

June 2014

Executive Summary

Background-Master Stewardship Agreement

The Scott's Biomass Fuel Project (Scotts Project) was a collaborative project between the U.S. Forest Service (USFS), Lake Tahoe Basin Management Unit (LTBMU) and Placer County (County) that was carried out under the provisions of a Supplemental Project Agreement (SPA) signed on June 6, 2013. The SPA was tiered to the existing Master Stewardship Agreement (MSA) between LTMBU and the County entitled "Tahoe Basin Biomass Agreement" (May 3, 2011). The SPA stated: "This Stewardship Supplemental Project Agreement (SPA) is hereby entered into by and between the County of Placer, hereinafter referred to as "Partner" and the USDA Forest Service, Lake Tahoe Basin Management Unit, hereinafter referred to as "The Forest Service," as specified under the provisions of Master Stewardship Agreement #11-SA-11051900-006. The primary purpose of the master agreement is to reduce the number of acres of fuels burned annually on NFS (National Forest System) lands within the Lake Tahoe Basin through removal of biomass as an alternative to burning activity fuels. This Landing Biomass Fuels Project is a collaborative effort between the U.S. Forest Service and Placer County, to utilize biomass as an alternative to pile burning. The goal of this project was to implement hazardous fuels reduction treatments where large piles of slash and cull logs have been yarded to landings (landing piles) in conjunction with fuels reduction projects and left for burning. This project processed landing pile biomass generated from fuels treatments and removed it from the site, eliminating the need to do follow up prescribed fire treatments."

Background-Project Objectives

Forest management projects designed to reduce wildfire hazard, improve forest health, and increase protection of communities and forest resources create excess woody

biomass in the form of brush, limbs, tops, and small trees that have no commercial value for traditional wood products. This excess biomass is normally piled and burned on-site. The cost to collect, remove, process, and transport woody biomass is higher than its value as fuel or other wood products. Although burning is carried out only when air quality considerations and prescription parameters for factors such as fuel moisture, air temperature and wind speed can be met, such burning still produces more emissions than if the biomass is burned under controlled conditions in a biomass energy facility.

Several other constraints exist that limit the ability to utilize mechanical equipment. These include, but are not limited to, slopes greater than 30%, sensitive areas such as stream courses, and areas with wildlife or heritage concerns. Additionally, The Lake Tahoe Basin is a fire dependent ecosystem where thinning, fuel reduction and biomass removal are initial steps in restoring fire to the ecosystem. Subsequent treatments including understory burns still need to occur to complete the full suite of fire restoration treatments.

Both the U.S. Forest Service and the County have an interest in finding ways to decrease the amount of open burning of excess biomass that results from forest management and hazard reduction projects. And both are interested in finding ways to promote, and increase the economic feasibility of utilization of such excess biomass for renewable energy production. This project provided the framework for the two partners to work together in furthering those interests.

Project Description

The Scott's Project involved utilizing for energy the excess biomass from several LTBMU forest management projects. Specifically, the biomass was from harvest units in the Christmas, Meow, Sierra and Aspen Community Restoration Projects, all of which were located near the south shore of Lake Tahoe, south and west of the City of South Lake Tahoe, California. All work on the Scott’s project was carried out through a contract with the CTL Forest Management, Inc. (contractor).

The objectives of the Christmas, Meow and Sierra projects were to thin the forest and reduce fuel loads to improve forest health and reduce fire hazard to nearby communities. The Aspen Community Restoration project was designed to restore landscape diversity by removing encroaching conifer trees to encourage the regrowth of aspen trees in areas where aspen had once been the dominant tree component. These projects were designed to facilitate biomass removal and utilization from units accessible to mechanical equipment.

In accordance with project design and contract requirements, excess biomass from 413 acres of harvest units was piled at landing areas. A chipper operated at landing areas where biomass was transferred to the chipper by a large grapple loader. The chipped biomass was loaded directly into chip trucks and transported to the Buena Vista biomass energy facility in Ione, California, approximately 98 miles from the Scott’s Project area. Buena Vista was the closest biomass to energy facility to the project that was willing to

accept and pay for the biomass material. Due to market fluctuations, several local plants have closed, and the value of biomass can vary greatly. Trucks required approximately 6.25 hours to make the round trip from the project area to the biomass facility and back.

Figure 1: Equipment Used to Process and Transport Biomass

Equipment	**Vendor / Model / Year**	**Engine**
Chipper	Peterson/4310/2011	Caterpillar C18, 765 HP, D-rated
Grapple Loader	John Deere/200CLC/2006	John Deere, 6068HT059, 2006, 140 HP
Chip Trucks	Kenworth/T800/2014	ISX, 500 HP

Figure 2: Typical Chipping Operation

In addition to processing and transporting the biomass, the contractor was required to abate dust on project roads by occasional watering. And, the contractor was required to decommission a temporary access road by scarifying with a bulldozer.

The Buena Vista facility is required to have ongoing monitoring of air emissions from combustion of biomass material. The Placer County Air Pollution Control District (PCAPCD) was able to access this monitoring information to determine estimated emissions produced from the Scott's biomass. This was combined with data from Buena Vista that shows typical electrical energy generation for a given amount of biomass to indicate how much energy was generated from Scotts Project biomass.

The PCAPCD also has data showing typical emissions from open burning of given amounts of piled biomass. This data was used to estimate the emissions that would have occurred from open burning the piles in the Scott's Project. Calculations were then made to compare emissions from open burning versus utilization at the Buena Vista facility.

Figure 3: Typical Open Burning of Excess Biomass Pile

The project was financed with funds from the LTBMU, Placer County and the Placer County Air Pollution Control District via their Clean Air Grant program.

Project Results

Biomass Utilized for Energy Generation

The project chipped and transported 4,094 green tons (GT) or 2,866 bone dry tons (BDT) of biomass to the Buena Vista biomass energy facility—biomass that would have otherwise been open burned. At the Buena Vista facility, the chips were burned under controlled conditions to heat a boiler, creating steam that powered a turbine generator to produce electricity. Approximately 3,630 Megawatt hours of electricity were generated; enough to support about 450 households for a year.

Figure 4: Buena Vista Biomass Energy Facility

Air Quality Impacts of the Project and Performance of the Biomass-Energy Recovery Boiler

Emissions modeling based on research studies together with accurate accounting of the tonnage of biomass delivered to the Buena Vista biomass energy facility indicate that utilization of the excess biomass from the Scott's project for energy production versus the alternative of open burning resulted in significant air emissions reductions as shown in Table 1.

Table 1: Comparison of Emissions—Open Burning Vs. Biomass Facility

Project emissions		NOx	PM	VOC	CO	CO2	CH4	CO2e
No project								
Open pile burn	metric tons	7.41	16.06	12.35	155.61	4528	7.41	4683
Electricity grid	metric tons	0.29	0.09	0.04	0.5	1396	0	1396
Biomass project								
Chip truck	metric tons	0.62	0.04	0.02	1.5	55	0.03	56
Water truck	metric tons	0.00	0.00	0.00	0.0	0.4	0.00	0.4
Grinder	metric tons	0.28	0.20	0.01	0.4	48	0.03	49
Excavator	metric tons	0.15	0.00	0.01	0.1	9	0.01	9
Biomass boiler	metric tons	1.83	0.25	0.08	0.0	4513	0.21	4518
Reductions	metric tons	4.82	15.64	12.27	154.1	1297	7.13	1447
	%	68	97	99	99	22	96	24

Explanation of Table 1 Information:

The “No Project” portion of Table 1 shows emissions that would have occurred if the biomass in this project had been open burned (“Open pile burn” row in the table) and the emissions that would have resulted from use of fossil fuels needed to generate an equivalent amount of energy (“Electricity grid” row in the table).

The “Biomass Project” portion of Table 1 shows the emissions that were actually produced from all aspects of the project. This includes the processing of the biomass (“Loader” and “Chipper” rows in the table), transport of the biomass to the Buena Vista energy facility (“Chip truck” row in the table), use of a water truck to abate road dust (“Water truck” row in the table) and the actual production of energy at the Buena Vista energy facility (“Biomass boiler” row in the table). The “Reductions” rows in the table show the metric tons of reduction in emissions resulting from utilization of the biomass for energy production in lieu of open burning and the percentage of total reduction for each specific emission.

The columns in the table show emissions for NOx (nitrogen oxide), PM (particulate matter--shows the weight of particulates that are less than 2.5 microns in diameter), VOC (volatile organic compounds, not including methane), CO (carbon monoxide), CO2 (carbon dioxide), CH4 (methane), and CO2e (carbon dioxide equivalent). CO2e indicates the total weight of CO2 and the CO2-equivalent weight of CH4, methane, which has a global warming potential factor 21 times that of carbon dioxide by weight.

Significance of Emissions Reductions:

The bottom of table 1 shows reductions in emissions, some of which have more significance than the amounts might seem to indicate.

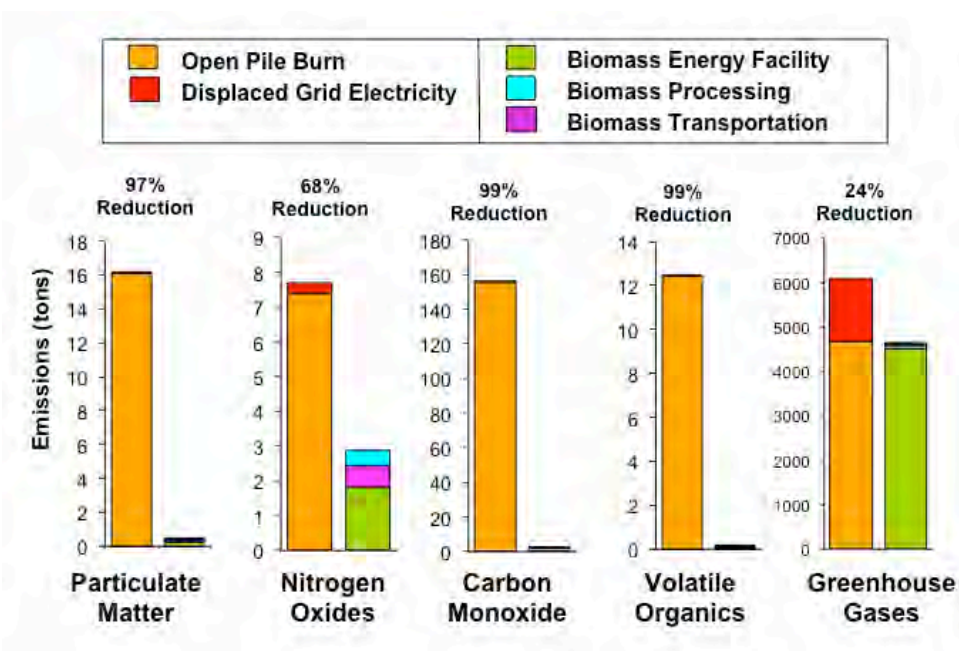
The reduction in PM is significant in terms of reducing particulates that have a tangible documented effect on respiratory-related illness. But the PM reduction may be even more significant in relation to global climate change impact. Preliminary data shows that 10-30% of PM falls in the category of "black carbon" that research indicates has approximately 900 times the climate change impact of CO_2.

The reduction in CH4 emissions seems small in terms of tonnage. But as mentioned above, research has shown that methane has 21 times the effect of CO_2 on climate change, so this reduction is important.

The reduction in CO_2 a major compound connected to climate change also seems small in terms of percentage. This is primarily due to the fact that burning biomass in an energy facility produces basically the same amount of CO_2 emissions as open burning. However, the significance of the reduction is increased by the fact that biomass is a renewable energy source that is considered by most experts as "carbon-neutral" because the carbon that is released when biomass is burned was originally sequestered from the atmosphere by the tree that produced the biomass. This is in contrast to the combustion of fossil fuels that are not renewable and not carbon-neutral, resulting in their CO_2 emissions being more impactful.

In summary, the reduction in emissions from use of biomass for energy production in lieu of open burning is very significant in terms of air quality improvements, reduction in potential human health impacts and climate change influence—and beyond what some of the amounts might individually imply.

Figure 5: Graph, Comparison of Metric Tons of Emissions
Open Burning Vs. Energy Facility



Economics of Woody Biomass Material Collection, Processing and Transport

The cost for CTL, Inc. to process and transport the biomass was $94,717. This included dust abatement work, restoration of the temporary road and all miscellaneous work such as moving equipment to and from the project. CTL received a total of $114,640 in payments for the biomass that was delivered to the Buena Vista energy facility. The total cost of utilizing the biomass from the Scott's Project was a total of these two amounts, $209,357, or $73.05 per BDT. This cost is higher than would normally be expected and is primarily due to the very long haul distance for the chips.

The high cost of utilization of the biomass was offset by savings from not having to reduce the fuels (biomass) with prescribed burning. Completing fuel hazard reduction projects in the Lake Tahoe basin area is much more expensive than similar projects in other forested areas due to regulatory and operational factors like constrained airsheds and proximity to neighborhoods. . These factors result in higher costs of permitting and cost of the actual burning and post-burning activities; e.g., additional equipment use to ensure sufficient burning of large piles, additional crew and equipment time when any holdover smoldering occurs, and additional coordination with a multitude of partner agencies in the Lake Tahoe basin area. There is also an increase in public relations work in the Lake Tahoe basin for all burning activities. This includes such things as individual contacts with nearby homeowners prior to burning and additional media contacts before, during and after prescribed fire projects. LTBMU staff estimate that Scott's Project burning costs would have been approximately $150,000 and ancillary costs for planning, burn preparation, air and water board permits, monitoring during and after the burning, additional equipment work to lessen the smoldering time of burning large landing piles, and regular patrols of the burn areas to ensure no problems occur—would have been approximately $20,000. The total of these two amounts, $170,000, or $59.32 per BDT represents the total amount of savings that occurred from utilizing the biomass on the Scott's Project for energy in lieu of open burning. Overall, the Scott's Project provided an estimated net cost of $39,357 or $13.73 per BDT.

The Scott's Project is not representative of all areas in the Lake Tahoe basin, but in areas feasible for use of mechanized equipment, it appears that utilization of biomass in lieu of open burning can be a beneficial alternative with reasonable costs. Decrease in the overall cost of such utilization seems likely if more biomass facilities such as the one proposed for Cabin Creek, are constructed because having facilities closer to potential biomass sources reduces transportation costs. In addition, the presence of additional facilities will increase the demand for excess biomass. This will make utilization of excess biomass more feasible and facilitate contractors' ability to make investments in equipment that can increase efficiency and associated cost reductions.

Figure 6: Economic Summary for Scott's Project

	Total	Per BDT
Contract Cost	$94,717	$33.05
Biomass Receipts, Buena Vista	$114,640	$40.00
Total: Cost to Utilize Biomass	$209,357	$73.05
Deductions/Savings		
Avoided Burning Cost	$150,000	$52.33
Avoided Planning, Burn Prep, Permitting, Patrolling & Monitoring Costs	$20,000	$6.98
Total Savings From Utilizing Biomass	$170,000	$59.32
Net Project Cost For Utilizing Biomass	$39,357	$13.73

Summary

The Scott's Project was one of a series of projects, including the Crag and Rubicon projects, facilitated by Placer County in cooperation with the LTBMU. These projects were intended to explore biomass utilization techniques and find ways to increase utilization feasibility. The projects have provided valuable information on the economics and emissions effects of utilizing biomass for energy production in lieu of open burning. This information will inform planning of future forest management and hazard reduction projects and future considerations for development of biomass energy facilities. The projects have also helped improve the process for cooperative funding of biomass processing and transportation for utilization in biomass energy facilities. This is particularly pertinent and important for the proposed biomass energy facility at Cabin Creek given that the Lake Tahoe Basin will be a major source of its biomass feedstock.

The economics of the Scott's project were reasonable when considering only direct dollar outcomes. However, there were also very positive benefits in the form of emissions reductions that cannot be accurately monetized at present. And supporting biomass utilization projects helps provide continuity of employment for companies that are essential for future biomass utilization success in an industry that has experienced less overall stability in recent years. Again, this is important for the proposed Cabin Creek biomass facility that will be dependent on a secure infrastructure to provide a long-term supply of biomass.

In the longer-term, developing economically-feasible utilization of excess biomass will benefit forest management and hazardous fuels reduction programs and projects designed to protect and enhance forests and important forest resources like watersheds, wildlife habitat, forest health and recreation. These projects result in the reduction of wildfire effects while facilitating the restoration of prescribed fire into these fire-dependent

ecosystems. Success of projects like Scott's and the information they provide is important for developing information used to improve future forest management and protection of forests and communities.

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