**Cap and Trade Allowance Revenues for Forestry Sector Areas: A Focus on Bioenergy, Fuels Delivery and Forest Treatments**

**April 23, 2013**

**Introduction**

Almost one-third of California—31 million acres—is forested, providing an extensive opportunity for the capture and storage of carbon in trees. Members of the California forestry sector broadly support the five Forestry Sector greenhouse gas (GHG) reduction activities that are discussed in the AB 32 Climate Change Scoping Plan. They also broadly support the various pathways that the Scoping Plan presents for the utilization of forest-derived biomass for energy production, consistent with California’s Renewables Portfolio Standard. Senate Bill 1122 (Rubio) provides further direction for the development of forest biomass renewable energy production facilities in high fire threat areas. California forestlands of all ownership categories (private and public) provide opportunities for the application of these approaches. Capacity exists among state, federal and local agencies and land managers to implement these approaches. Biomass energy and forest treatment programs have the ability to deliver projects and environmental and economic benefits to disadvantaged rural communities, per the requirements of Senate Bill 535.

The California Air Resources Board released the draft Cap and Trade Proceeds Three Year Investment Plan on April 16. Within the Natural Resources and Waste Diversion Section, Forests and Ecosystem Management is included as an investment area to be considered. This paper provides a more specific investment proposal that could guide a portion of these forest investments. The draft investment plan specifically calls for “including competitive grants or other mechanisms for forest management, restoration, fuel reduction treatments; fire protection and biomass energy production” (p. B-12).

This proposal focuses on the utilization of forest biomass resulting from forest treatment activities, with the primary use being production of renewable energy (electricity and thermal energy).  This investment will directly support implementation of SB 1122 and the 2012 California Bioenergy Action Plan. SB 1122 includes a procurement requirement for large utilities to buy 50 megawatts of biomass bioenergy derived from sustainable forest management in fire threat treatment areas (as designated by CAL FIRE). The specific components of this proposal are separable and scalable, but support and complement each other:

1. Community-scale Biomass Facility Start-up Funding
2. Fuels Delivery Transportation Incentive;
3. Forest Treatments: Management, Restoration, Fuels Reduction Treatments, and Fire Protection.

The 2012 California Bioenergy Action Plan calls for the Resources Agency, Sierra Nevada Conservancy (SNC), California Department of Forestry and Fire Protection (CAL FIRE), California Energy Commission and other agencies to continue working with stakeholders and expanding the forest biomass collaborative to identify and promote small-scale forest biomass projects that reduce fire hazards, restore healthier, more resilient forests, provide renewable energy, and promote rural economic development (Section 1: 1.1)

The Action Plan continues by stating “Biomass energy facilities are essential to achieving forest restoration activities and rural economic development objectives in California’s forested areas.” The Sierra Nevada Conservancy is providing state agency leadership in working with a diverse group of stakeholders and government entities to promote small-scale bioenergy projects that are consistent with forest restoration, economic development, and social equity objectives.

The Sierra Nevada Conservancy is coordinating the Biomass Working Group, a collaborative of agencies, stakeholders and technical experts, to:

* Refine criteria for community-scale biomass energy facilities, identify a few candidate projects, and seek developers and cost-share for deploying and demonstrating commercial and emerging community-scale bioenergy technologies.
* Identify and seek private, state, including public interest energy research and electricity production investment charge, and federal funding for feasibility studies, pilot and demonstration projects, and research to support community-scale biomass utilization projects.

The focus of this investment proposal is to deliver GHG emission reductions through investments in forest restoration and management, and development of community-scale bioenergy facilities. This proposal is outlined in a way that all three components support forest biomass utilization, primarily for distributed electricity generation in rural communities; however, each component can be funded separately. The first section provides funds related directly to the start-up of these small-scale facilities producing 3 MW or less of power. The second component helps offset the prohibitive costs of transporting forest fuels from the woods to the facilities. Finally the third component directly invests in forest restoration and management by funding forest thinning projects which reduce fuels, help prevent catastrophic fire, and increase forest health and resilience. Additionally, these activities will secure the fuel supply for the bioenergy facilities.

These forestry and renewable energy sector activities have the capability of providing significant carbon sequestration and GHG emission reduction benefits. In addition, these activities can be targeted to disadvantaged rural communities and can provide substantial environmental, economic, and social co-benefits. These programs are scalable as more funding resources become available from cap and trade allowance revenues and as program implementation capacity is built. Some of this implementation capacity already exists within state and federal agencies and can be built upon quickly, efficiently, and effectively.

We seek $15 million in year one from Cap-n-Trade Auction Revenues, to be distributed across these three forestry and renewable energy sector activities. In years 2 and 3 of the initial investment plan, we seek $30 and $45 million, respectively. These funds could be administered via grant programs and direct implementation by the Sierra Nevada Conservancy, CAL FIRE, or other appropriate state agencies. Please see each section below for details of each request, including a summary of direct benefits in carbon sequestration, accompanying reductions in GHG emissions, and co-benefits. The potential GHG benefits realized by 2050, as a result of this investment proposal are substantial, with a total sequestration of 8 million metric tons from all three investment areas.

**Investment Proposal Summary**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1. Bioenergy Facilities | 2. Fuel Delivery Transportation Incentive | 3. Forest Treatments | TOTAL |
| Year 1 (FY 2013-14) | $2.45 million | $6.8 million | $5.75 million | $15 million |
| Year 2 (FY 2014-15) | $2.8 million | $5 million | $22.2 million | $30 million |
| Year 3 (FY 2015-16) | $4.2 million | $4 million | $36.8 million | $45 million |
| TOTAL | $9.45 million | $15.8 million | $64.75 million | $90 million |
|  |  |  |  |  |
| Potential Implementing Agencies | SNC | SNC, CAL FIRE | CAL FIRE, SNC, CDFW |  |
| Potential Recipients and Implementing Partners | Community-based groups, biomass energy producers, CA Energy Commission, CAL FIRE | Biomass fuel suppliers, US Forest Service | Fire Safe Councils, local fire districts, CDFW, US Forest Service, private forest landowners |  |

**Greenhouse Gas Benefits (CO2e reductions, annual benefits by investment component, projected through 2050)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1. Bioenergy Facilities | 2. Fuel Delivery Transportation Incentive | 3. Forest Treatments | TOTAL |
| Year 1 (2014) | 0 | 258,400 tons |  | >258,400 tons |
| Year 2 (2015) | 0 | 189,924 tons |  | >189,924 tons |
| Year 3 (2016) | 0\* | 152,000 tons |  | >152,000 tons |
| Year 10 (2023) | 152,000 tons\* | 0 |  | >152,000 tons |
| 2048 | 152,000 tons | 0 | 0.20 million metric tons | >0.35 million metric tons |
| 2049 | 152,000 tons | 0 | 0.76 million metric tons | >0.91 million metric tons |
| 2050 | 152,000 tons | 0 | 1.26 million metric tons | >1.4 million metric tons |
| Total | >4.3 million metric tons | >1.5 million metric tons | >2.2 million metric tons | >8.0 million metric tons |

**\* 5auctionss)tric tonse ($2erop.ucal varies** \*A community-scale bioenergy facility will likely be on-line by 2016, resulting in some GHG benefits. By year 10 (2023), it is assumed that all 50 MW of SB 1122 community-scale forest bioenergy facilities will be operational.

1. **Community-Scale Forest Bioenergy, Start-Up Funding**

Excess forest biomass material removed as a byproduct of forest fuels reduction and forest restoration activities is typically piled and burned (business-as-usual disposal technique). Development of community-scale forest bioenergy projects will provide an alternative opportunity to utilize this excess forest biomass material using technologies (gasification and controlled combustion) that significantly reduce air emissions when compared to business-as-usual pile-and-burn disposal techniques. In addition, community-scale bioenergy facilities will provide family-wage employment for rural communities while producing base-load renewable energy. This business model is consistent with the Governor’s Clean Energy Jobs Plan (development of 12,000 MW of renewable distributed generation by 2020) and SB 1122.

Strategically located community-scale forest bioenergy projects would supplement California’s existing bioenergy infrastructure. These strategically located facilities will provide a biomass utilization option that cannot be met by the existing infrastructure based on location alone. In addition, in the last four years, four of the first generation forest bioenergy generation facilities have closed, representing a loss of almost 50MW of forest bioenergy generation capacity.

The majority of rural communities experience large unemployment rates and at best, low median household incomes. A study by the Political Economy Research Institute at the University of Massachusetts (PERI, 2009) showed substantial job creation benefits from two key components of this proposal: biomass energy production; and the suite of work including reforestation, land and watershed restoration, and sustainable forest management. For every $1 million invested in biomass, PERI calculated the creation of direct, indirect, and induced jobs of 7.4, 5.0, and 4.96, or a total of 17.36 jobs. For the reforestation suite, PERI calculated even more substantial benefits: 17.55 direct, 12.95 indirect, and 9.2 induced, or a total of 39.7 jobs per $1 million investment.

**Opportunity and GHG Benefits**

Like all renewable energy generation that displaces fossil fuels, bioenergy production avoids the production of an equivalent amount of energy from fossil fuels. In addition, forest bioenergy production avoids the biogenic greenhouse-gas emissions produced by other methods for disposing of forest waste such as pile burning and instead replaces them with much lower emissions from energy production using controlled combustion/gasification technologies.

Summarized below are the GHG benefits of deploying SB 1122-compatible community-scale forest bioenergy facilities in strategic locations near high wildfire threat areas within the state:

* At full build-out of 50 MW capacity, the community-based bioenergy facilities will be able to process approximately 400,000 bone dry tons (BDT) of forest biomass per year. Forest treatments (fuels reduction, thinning, etc.) produce about 13 BDT per acre. At capacity, these small bioenergy facilities will result in a market for woody biomass representing over 30,000 acres treated per year. Long-term, those acres will have the capacity to sequester more carbon in larger trees. In the short term, removal of forest biomass to produce energy instead of burning the material in piles will result in direct benefits through reductions in GHG emissions and particulate matter pollutants. Assuming 400,000 BDT processed per year, the annual benefits would include a reduction in GHG emissions of about 152,000 tons CO2e. Other annual benefits include reductions in: particulate matter (2,400 metric tons), NOx (640 metric tons), NMOCs (1880 metric tons), and CO (23,200 metric tons) (Springsteen et al., 2011).
* Forests are the largest source for global carbon storage after the oceans. California forests currently sequester about 30 million metric tons of CO2 annually (CAL FIRE 2010). Wildfire, not forest management, is the dominant influence on forest carbon flux and sequestration today (Stewart et al. 2010). In fire-prone forests of the West, large releases of carbon occur when trees are killed or partially killed by wildfire (Hurtt et al. 2002, Hurteau et al. 2008).
* The preferred method to safely store carbon in forests is to accumulate it in a smaller number of large trees that are resistant to severe fires, rather than in a larger number of small trees that are less fire resistant (e.g., Hurteau and North 2009). Forest management practices have been developed to accomplish this arrangement through thinning and prescribed fire (North et al. 2009). Forest thinning is often the preferred treatment today because many forests stands have accumulated large fuel loads that prevent the safe use of prescribed fire as an initial treatment in particular. Forest bioenergy facilities will be able to provide a ready market for the excess biomass generated by thinning operations, thus helping to at least partially offset the cost of biomass collection, processing and transport.

**Co-Benefits**

Many forests in California are at risk to damage from wildfire, insect outbreaks, disease agents, drought and changing climate because of over-stocked conditions (too many stems per acre). Removing forest biomass as feedstock for bio-energy production can be done in ways that promote healthier, more resilient forests while protecting other resources (e.g., soil and water). eathy foresHHhHealthy forests that benefit from biomass removal provide an array of other societal benefits including:

* Healthy forests reduce the extent of severe fires and dramatically reduce the costs and damages from wildfire. Examples are reduced costs of fire suppression, improved firefighter safety, and reduced damage to property and the environment.
* Healthy forests in the Sierra Nevada range alone help protect the water supply for 25 million Californians. Sediment deposited by runoff after severe fires can require costly clean-up operations for managers of public drinking water facilities as well as managers of hydroelectric and water storage facilities. Carefully managed forests can ameliorate large sediment movements by reducing fire severity and protecting soils.
* Many of the benefits to public health come from added fire protection and reduced air and water pollution. An assessment of a proposed bioenergy facility in Placer County found that the project posed no significant risks to public health and would offer considerable improvements over the traditional method of burning forest waste in piles.
* Healthy forests continuously increase carbon storage in the large trees while making stands more resistant to fires.
* Biomass removal that is conducted to reduce hazardous fuel levels will generally be regarded as beneficial for wildlife as long as abundant key structural components (snags, down logs, hardwoods, etc.) are retained.

* Healthy forests can help avoid serious disruptions to forest recreation. Many rural communities are dependent upon recreational activities as a primary employment opportunity.
* Biomass power facilities mean jobs with comparatively good wages that are needed in many disadvantaged rural forest communities.
* Forest bioenergy facilities provide a reliable source of renewable energy that helps diversify California’s renewable energy portfolio while offering firm reliable power when other intermittent sources such as wind and solar may be off line.

**Proposed Investment**

Investment of cap and trade allowance revenues should target early phase development and deployment of community-scale forest bioenergy technologies consistent with SB 1122.

Currently, there is a limited amount of funding available to project proponents to conduct the preliminary analysis phase, which includes project engineering, design, environmental analysis, and permitting. This work is required before the utility company energy price negotiations can take place, which then establishes the income stream for the project. This preliminary analysis phase must therefore be completed before private financing can be obtained to implement the project.

The cost of completing the preliminary analysis phase is generally between $100,000 and $350,000 (but can be as high as $750,000). In order to achieve 50 MW from forest biomass, approximately $10 million will be needed. The uncertainties of this new industry and the fact that this is an emerging market sector make it virtually impossible to obtain this up-front investment. The costs and income from projects are significant unknowns for investors and lenders to make these up-front investments. Therefore, public funds have been retained to support the current projects under development. The majority of funds have been secured through competitive federal and state grant programs. However, there is limited funding in these programs and they are generally only made available one time per year, which can delay project development.

We recommend a dedicated amount of $ 2 - 4 million annually from cap and trade revenues to support early phase investment in forest bioenergy demonstration projects to establish the industry. Once these demonstration projects are operational, this industry can function like other small-scale renewable energy operations, obtaining working capital for the preliminary analysis costs through investors who have developed confidence in the new industry.

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| --- | --- | --- | --- |
| Fiscal Year | Funds Needed (based on $350,000 per project) | Number of projects | Cumulative MW |
| 1 (2013-14) | 2.45 | 7 | 16 |
| 2 (2014-15) | 2.8 | 8 | 20 |
| 3 (2015-16) | 4.2 | 12 | 14 |
| TOTAL | $9.45m | 27 | 50 |

1. **Fuels Delivery: Forest Biomass Utilization Transportation Incentive**

Because of the relatively low price that energy producers can afford to pay for forest biomass and the relatively high cost of transporting that material from the forest to the energy plant, a transportation incentive may be needed to economically move the material to a plant where it can be utilized, rather than pile burned in the forest. Due in part to the expiration of price floors for biomass power purchase agreements, established in the early 1980s to provide an incentive for development of a biomass power industry, 39 of 62 bioenergy plants closed between the early 1990s and 2012 (see Mayhead, Garreth; U.C. Berkeley, <http://ucce.ucdavis.edu/files/repositoryfiles/ca6601p6-91748.pdf>). Fewer plants equates to longer, more costly average haul distances to transport excess biomass from the forest to a bioenergy plant.

As a specific example, the closure of these facilities has created a very challenging economic situation for timber purchasers on 33 Forest Service contracts with biomass removal specifications. In aggregate, these contracts represent over 680,000 bone-dry tons (BDT) of material that will be too costly to deliver to more distant, currently operational facilities. This volume of material, derived from approximately 53,000 acres of forest treatment, could generate approximately 85 MW of power in one year, enough to sustain about 85,000 homes. If the material is not removed from the woods, it will need to be piled and burned, resulting in increased GHG and particulate emissions. These contracts and resulting forest biomass material represent only a fraction of more than 1 million BDT of forest biomass currently being piled and burned annually because it is not economical to transport to an operating power plant in need of feedstock. Similarly, large quantities of biomass are available from private forest lands.

The cost of bringing the forest biomass to a roadside location can generally be offset by the net revenue of merchantable saw timber removed during the thinning operation. The current delivered price offered for forest biomass to generate heat and power is $40-50 per BDT. In order to breakeven, the biomass fuel supplier must be able to chip, load, transport, and unload the material at these rates. At the low end of this price range, haul distances over 20 miles makes this effort uneconomical. A transportation grant for forest biomass hauled from more than a 20-mile circle around an operating power plant would dramatically change the current condition. The grant program could be administered by the Sierra Nevada Conservancy with payment directly to the fuel suppliers.

**GHG Benefits and Co-Benefits**

Recent studies document the benefits in reducing GHG and other pollutant emissions when woody biomass is used for energy rather than pile burned. Jones and others (2010) showed 38-45% reduction in carbon dioxide (CO2), 59-89% reduction in particulate matter (PM), 97% reduction in methane (CH4, a very powerful GHG), and 40% reduction in carbon monoxide (CO) emissions. They also found that diesel consumption for collecting, grinding, and hauling biomass represented less than 5% of the total bioenergy emissions; in fact, they found that an average of 21 units of bioenergy were produced for each unit of diesel used. Springsteen and others (2011) completed a demonstration project evaluating grinding and hauling 6,096 BDT of mixed conifer forest slash in the Sierra Nevada foothills and found similar emissions reductions: 17% reduction in CO2, 98% reduction in in PM, 54% in NOx, 97% reduction in CH4, 99% reduction in non-methane volatile organic carbons (NMOCs), and 97% reduction in CO emissions. The Stockholm Institute (2010) found even greater benefits related to GHG emission reductions (34%) from biomass energy production instead of being burned in piles. They calculated emissions of 1.84 metric tons CO2e per BDT when biomass is chipped, hauled and converted to power versus 2.77 metric tons CO2e for pile burning and replacement of bioenergy with natural gas.

Using the more conservative value in GHG reduction from Springsteen and others (CO2, 17% reduction), and applying it to the 680,000 BDT described above would result in **immediate direct benefits in GHG reduction of 258,400 tons CO2e** and would include co-benefits in reductions in other emissions of:

* Particulate matter reduction of 4,080 metric tons
* NOx­ reduction of 1,080 metric tons
* NMOCs reduction of 3,196 metric tons
* CO reduction of 39,440 metric tons

Other Co-benefits

* Provide stability for 33 vegetation management contracts with a direct value of $34 million.
* Protect approximately 136 rural jobs connected to these contracts.
* Achieve 53,000 acres of completed fuels reduction treatment.
* Avoid the added fire-risk of forest biomass piles left in the forest until burning crews have favorable weather conditions to burn them.

**Proposed Investment**

Investment of cap and trade allowance revenues should target removal of forest biomass in areas underserved by existing biomass facilities and areas awaiting development and deployment of community-scale forest bioenergy technologies.

* Provide a direct transportation incentive to woody biomass fuel providers who need to transport biomass outside a 20-mile circle to get to an existing bioenergy facility.
* Assumptions: $40-50 paid for delivery of one BDT forest biomass. Chipping/loading costs $30/BDT. Chip van operating cost $90/hour, chip van capacity is 26 green tons or about 13 BDT. Loading/unloading of a truck takes about 1 hour and costs $90, or about $7 per BDT. A transportation distance of approximately 1.5 hours roundtrip would cost $135, or about $10 per BDT. Total cost is $47 per BDT. Haul distances of greater than 1.5 hours round-trip result in a net economic loss to the contractor.
* Calculate the need for funding based on additional haul time above a 1.5-hour round-trip basis and an approximate haul cost of $90/hour; e.g., for a 13 BDT chip van that must travel an *additional* 1.5 hours (3 hours total roundtrip), there is an increased cost of $135, which adds approximately $10 per BDT.
* Request $10 per BDT for immediate help with existing contracts (680,000 BDT). Suggest development of criteria that would allow payments of $5-$15 per BDT dependent on distance to nearest operating bioenergy facility. Total request for year one: $6.8 million. Request reduced amounts in year two ($5 million) and year three ($4 million) as community-based biomass plants begin operation.
* Distribute these funds through a grant program administered by the Sierra Nevada Conservancy or other appropriate state agency.

1. **Forest Treatments: Management, Fuels Treatments, and Reforestation**

Forest treatments reduce or avoid GHG emissions by increasing the rate of carbon capture in larger, more fire-resilient trees; replanting burned sites to restart the sequestration of carbon in trees much more quickly than will typically occur through natural regeneration processes alone, or planting trees in existing forest stands that are under stocked; and reducing the scale and intensity of wildfires and their GHG emissions through fuels reduction treatments. Forest treatment investments can be targeted to those projects that offer the greatest GHG reduction benefits and co-benefits, and that are located in or provide benefits to disadvantaged rural communities.

The April 16 draft Investment Plan identifies forest management, restoration, conservation, and fuels reduction treatments as potential investments under the area of Forests and Ecosystem Management (pp. B-12 to B-13). CAL FIRE and existing CAL FIRE programs are identified as a means of implementation. The SNC and Resource Conservation Districts also may be appropriate implementing agencies. Potential implementation partners include the US Forest Service, private forest landowners, Fire Safe Councils, and local fire districts. All forestlands in the state, (public or private), and their owning or managing entities should be eligible for application of these treatment types and eligible to receive grant funding. For some activity types, CAL FIRE may require additional authority (e.g., through budget trailer bill language) to be able to implement projects on federal lands or to grant to federal entities.

**Opportunity and GHG Benefits**

* The 2010 FRAP Assessment identified that 278,000 acres of non-reserved public forestlands and 253,000 acres of private forestlands need reforestation. The National Forests have an identified reforestation need of over 123,000 acres. Reforestation is estimated to result in the sequestration of 1-7 metric tons CO2e per acre per year.
* The Assessment also identified 7.7 million acres of forestlands (private and public) as high priority landscapes for preventing wildfire threat to ecosystem health. Treating vegetation to prevent or reduce the amount of vegetation burned due to a wildfire can result in less wildfire GHG emissions. Wildfires on private forestlands are estimated to result in average emissions of 1.1 million metric tons CO2e per year.
* The 2010 FRAP Assessment identified 2.6 million acres of non-reserved public and 1.8 million acres of private forestland as needing improvement due to under stocked or over stocked conditions. The National Forests have an identified need of over 266,000 acres of pre-commercial thinning.
* CAL FIRE Unit Fire Plans and Community Wildfire Protection Plans identify hundreds of high priority fuels reduction projects covering tens of thousands of acres. For example, the CAL FIRE Shasta-Trinity Unit 2012 Fire Plan identifies 53 high priority projects totaling over 5,000 acres; the Amador County Community Wildfire Protection Plan identifies 25 primary fuel reduction projects totaling 2,411 acres.
* Treatments are as important for federal lands as for other forest lands. Consider the following regarding National Forest Systems (NFS) Lands in California:
  + Forest Stand Improvement/Thinning - Capable of performing an additional 28,000 acres per year and sequestering an estimated 52 metric tons of carbon dioxide equivalent per acre by 2050[[1]](#footnote-1).

Costs would range from $175 to 300 per acre.

* + Reforestation - Capable of performing an additional 13,000 acres per year and sequestering an additional 61 metric tons of carbon dioxide equivalent per acre by 2050[[2]](#footnote-2).

Costs would range from $700-$850 per acre.

* + Wildfire reduction - Capable of performing an additional 300,000 acres per year sequestering an additional 10 metric tons of carbon dioxide equivalent per acre.[[3]](#footnote-3)

Costs would be $400-500/acre.

* + Programs could be scaled up to achieve these acreages over the next few years.

**Co-Benefits**

* Increased economic development and employment in disadvantaged rural communities and counties.
* Forests more resilient to the effects of climate change (drought, insects, disease, and fire).
* Protection of watersheds, including both water quality and water quantity.
* Reduction in the size, severity, and intensity of fires; reduction in fire suppression costs.
* Reduced air pollution, resulting in improved health conditions and reduced regional haze in both rural and urban communities.
* Protection of landscapes, communities, farms and ranches.
* Protection of critical utility infrastructure (dams, powerhouses, transmission and distribution lines).
* Protection of quality habitat for fish and wildlife.
* Production of sustainable wood products that continue to sequester carbon while in use.
* Production of sustainable, renewable energy from biomass.
* Improved air quality and reduced emissions of GHGs from open-pile burning or decomposition.
* Support and protection of recreational uses that also contribute to rural economic health.

**Proposed Investment**

As outlined above, the opportunities for investing in forest treatments are significant. Treating the 5,000 acres of fuels reduction projects identified in the Shasta-Trinity Unit Fire Plan alone could cost over $5 million, assuming an average treatment cost of $1,000/acre. The Forest Service indicates that, given the funding, they have the capacity to treat about 42,500 acres of fuels this year on the National Forests. At a midpoint cost of $450/acre, this would total over $19 million. Considering these costs and given the scale of the potential treatment areas in general, there is an opportunity (and need) to be highly selective of the projects that will provide the greatest GHG reduction benefits, co-benefits, and benefits to disadvantaged communities. A competitive project selection process that looks at both the full range of these benefits and the costs (e.g., on a cost per ton of CO2 equivalent emissions reduced) will be essential.

Based on the likely level of cap and trade allowance revenue available for this sector, near-term capacities of relevant agencies and landowners to implement programs and projects, and other factors, this Investment Plan proposal requests $64.75 million over a three-year period. The amount of funds requested each year increases to reflect growing capacities to implement projects and anticipated increases in revenues available. Based on an average cost of $450/acre, this investment would equate to nearly 144,000 acres. GHG benefits realized in 2050 are calculated from treatments occurring proportionally to need (e.g., the USFS recognizes a need of 28,000 ac/yr for thinning (4% of acreage in additional capability analysis), 13,000 ac/yr in reforestation (8% of acreage), and 300,000 ac/yr (88% of acreage), with accompanying 2050 benefits of 52, 61, and 10 metric tons per acre, respectively by treatment type.

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| --- | --- | --- | --- |
| Fiscal Year | Forest Treatments | Acres Treated\*\* | 2050 GHG Benefits  (tons, CO2e)\*\*\* |
| Year 1 (FY 2013-14) | $5.75 million | 12,777 | 197,000 |
| Year 2 (FY 2014-15) | $22.2 million | 49,333 | 760,000 |
| Year 3 (FY 2015-16) | $36.8 million | 81,777 | 1,259,000 |
| TOTAL | $64.75 million | 143,887 |  |

\*\* Assumes average cost of $450/acre across treatment types.

\*\*\* Assumes **only** NFS lands treated based on capability acres reported above and shows relative benefits of accelerated treatments (and that treatments occur at rates and proportions described above).

**Conclusion**

This investment proposal requests $15 million in the first year and a total of $90 million over the three-year life of the investment plan. The proposed activities would generate substantial reductions in GHG emissions, would provide benefits to disadvantaged rural communities, and would generate significant environmental, economic, and social co-benefits.

Our proposal consists of three complementary components that provide immediate GHG emissions reduction benefits beginning with the first year of implementation, and substantial cumulative benefits by 2050. Once all of the small bioenergy facilities are operational (50 MW capacity), Component 1 (Community-Scale Forest Bioenergy, Start-up Funding) provides a steady source of GHG emission reductions of about 152,000 tons/year CO2e that will last for the life of the facilities. Cumulatively, this represents over 4.3 million metric tons in GHG reductions by 2050. Component 2 (Fuels Delivery Transportation Incentive), provides immediate up-front benefits by replacing pile burning with energy production, resulting in reductions in GHG emissions of over 1.5 million metric tons in the first three years. Continuation of a modest transportation incentive would result in long-term annual and cumulative benefits similar to Component 1.

Components 1 and 2 provide substantial measurable benefits in GHG emission reductions and they also provide some of the infrastructure needed to increase the pace and scale of forest restoration (Component 3). Forest restoration treatments have the greatest potential for long-term, sustainable GHG emission reduction. *Annual* *benefits* resulting from accelerated forest treatments would exceed 1.26 million metric tons/year by 2050.

The benefits from implementation of all three components include a cumulative reduction in GHG emissions of greater than 8.0 million metric tons of CO2e by 2050, with potential *annual* *benefits* of greater than 1.4 million metric tons per year thereafter.

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1. Carbon benefits based on Forest Vegetation Simulator runs conducted the USFS Regional Silviculturist comparing forest stand carbon values of thinning, fuel removal and subsequent growth to 2050 compared to not thinning and a moderate fire event reducing stand stocking levels through fire caused mortality. [↑](#footnote-ref-1)
2. Carbon benefits based on Forest Vegetation Simulator runs conducted the USFS Regional Silviculturist comparing forest stand carbon values of planting an acre deforested by fire to an acre of natural regeneration following fire and the subsequent growth to 2050. [↑](#footnote-ref-2)
3. Carbon benefits based considered the net difference of stand carbon values from fuels treatment and subsequent wildfire and carbon values from no fuels treatment and subsequent wildfire. Calculations were based on carbon values for Sierran west side conifer stands provided in Forest Ecology and Management 261 (2011) 1115-1120 “High severity wildfire effects on carbon stocks and emissions in fuels treated and untreated forest” by Malcolm P. North and Matthew D. Hurteau. [↑](#footnote-ref-3)