

## FINAL REPORT

### **Biomass-to-Energy: Jefferson County's Role in Creating a New Industry for Colorado**



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**Note: Cover photo of treated ponderosa pine stand typical of area in Manitou Experimental Forest, Upper South Platte River drainage, courtesy of Dave Hessel, Colorado State Forest Service, retired.**

## **ABBREVIATIONS AND ACRONYMS**

A37 – Colorado Amendment 37 (requiring the use of renewable energy by certain electric utilities)  
bdt – Bone Dry Tons, or wood with zero percent moisture content  
BLM – Bureau of Land Management  
C & D – Construction and demolition  
CSFS – Colorado State Forest Service  
DOE – United States Department of Energy  
EPA – U.S. Environmental Protection Agency  
EPACT – Energy Policy Act of 2005  
ESCO – Energy Service Company  
FRFTP – Front Range Forest Treatment Partnership  
GIS – Geographic information system  
GT – Green tons, or wood as received with varying levels of moisture  
HFRA – Healthy Forests Restoration Act  
KWh- kilowatt-hour  
MMBtu – Million British Thermal Units  
MW – Megawatt  
OEMC – Office of Energy Management and Conservation  
O&M – Operations and Maintenance  
PTC – Production Tax Credit  
R&D – Research and Development  
RPS – Renewable portfolio standards  
USDA – United States Department of Agriculture  
USFS – United States Forest Service  
UTR – Urban tree residue  
WGA – Western Governors’ Association  
WUI – Wildland Urban Interface

## 1 OVERVIEW

This document provides an update on Jefferson County's effort to support the development of a biomass processing facility in the County. The intent of the facility is to serve as a central site where forest biomass and urban wood waste can be processed, stored and delivered to energy markets. In the 2005 biomass energy feasibility study conducted by the county, it was determined that biomass fuel supply reliability and consistency was a major concern of potential end users. Nobody wants to invest money in new technology unless the fuel supply is guaranteed. By establishing a centralized site, potential supply disruptions to end-users will be reduced. The facility will be owned and operated by a private company. The county will support and facilitate the start-up tasks that lead to the development of the project. The biomass processing site will bring many benefits to Jefferson County, including new capital investment, jobs, and tax revenues.

## 2 PROJECT BACKGROUND AND HISTORY

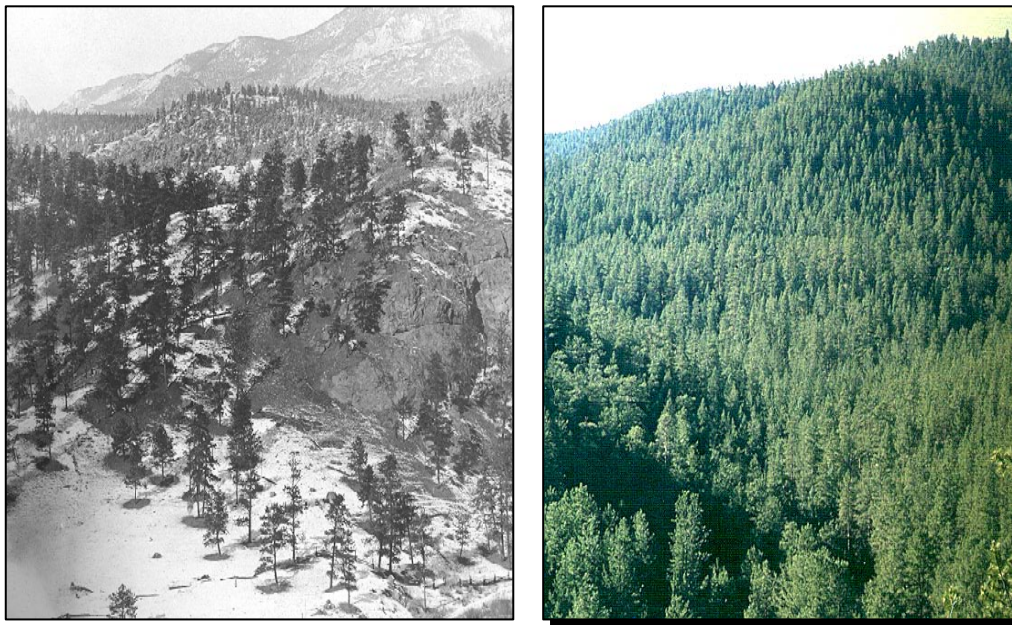
For the past two years, Jefferson County has been working to promote the development of a large-scale biomass processing facility in the county. This document provides an update on the status of that project, and outlines our vision for moving the project to implementation.

***Forest Health.*** Wildland fire has played a significant role in shaping the structure, ecology and regeneration of Colorado's forests. Prior to European settlement, nearly equal mixes of Ponderosa pine, mixed conifers, old growth and open spaces characterized the Front Range's forests. Frequent, low-intensity wildfires were an important part of the ecology, serving to create open park-like spaces for wildlife grazing, removing accumulated debris and dead or dying trees most susceptible to insect attacks, and freeing up soil nutrients and water to allow old growth stands to thrive. The larger diameter trees, with their thick bark and elevated branches were resistant to these low intensity fires. Large scale, stand replacing fires were rare in ponderosa pine forests along the Front Range at elevations below about 7,000 feet.<sup>1</sup>

During the late 1800s, widespread logging along the Colorado Front Range removed many of the larger trees in the region. In 1905, the U.S. Department of Agriculture Forest Service (USFS) was created. The newly formed agency began an aggressive program of absolute fire suppression, not understanding the role of low-intensity, frequent burns in preventing pest infestation, removing accumulated fuels and promoting stand regeneration.

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<sup>1</sup> NPS Rocky Mountain National Park, "Fire frequency and intensity in ponderosa pine forests", December 2005, [http://www.nps.gov/romo/downloads/CDRLC/summaries/ponderosa\\_fire.pdf](http://www.nps.gov/romo/downloads/CDRLC/summaries/ponderosa_fire.pdf)



**Figure 1. The Front Range Forests, Then (late 1800s) and Now (late 1900s)**  
 (Photos from Dr. Merrill Kaufmann, U.S. Forest Service)

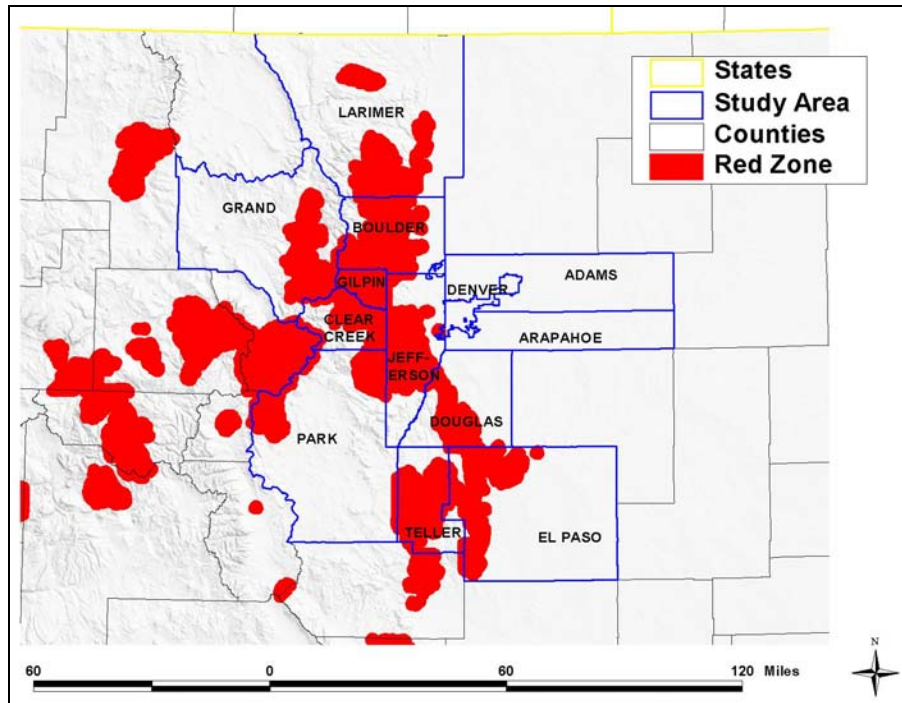
Over the past century, the combination of logging, grazing, fire suppression and climate conditions has produced over-crowded forests with large accumulations of dry fuel (see Figure 1). The over crowded forests are less resilient to forest fire and more susceptible to outbreaks of drought and insect infestations. Densely-packed live trees, downed trees and standing dead and dying trees exasperate the risk of more intense, catastrophic wildfires by serving as ladders for low intensity understory fires to leap to forest crowns. Catastrophic wildfires threaten local communities with loss of life and property, and also cause damage to water quality, wildlife, and the recreational and resource values associated with forestland. The economic losses from the 2002 Hayman Fire are estimated at \$238 million, and still climbing.<sup>2</sup>

***The Wildland Urban Interface.*** In the latter part of the 20<sup>th</sup> century, significant numbers of people and developers began to build homes in the Colorado foothills. A growing proportion of the population in Colorado now lives in the wildland-urban interface (WUI), where wildfire has become an increasing risk for communities. As of 2003, 33% of Jefferson County’s 527,056 inhabitants, or 173,929 residents, resided within the WUI area.<sup>3</sup> The Colorado State Forest Service (CSFS) and USFS undertook a mapping project (the “Red Zone” project) to delineate areas that are at elevated risks of wildfire based on population, housing density, slope, aspect and ground fuels. Figure 2 shows the extent of the Red Zone in Colorado. Across Colorado, the Red Zone contains 6.3 million acres, 470,000 homes and nearly 1,000,000 people.

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<sup>2</sup> Living with Fire: Protecting Communities and Restoring Forests: Findings of the Front Range Fuels Treatment Partnership Roundtable. May 2006. Available on line: <http://www.frftp.org/roundtable/report.pdf>

<sup>3</sup> Toddi Steelman and Devona Bell, Jefferson County, Colorado case study, North Carolina State University Department of Forestry, July 13-19, 2003, [http://www.ncsu.edu/project/wildfire/Colorado/jefferson/jeff\\_reduce.htm](http://www.ncsu.edu/project/wildfire/Colorado/jefferson/jeff_reduce.htm)



**Figure 2. Red Zone Areas in the Front Range of Colorado**

**Forest Treatment.** The risk of catastrophic wildfire presents a challenge for county commissioners, planning and zoning officials and emergency services departments in many communities to mitigate risks to lives and properties and maintain other community services. Forest management efforts, including mechanical thinning and prescribed burning are being implemented throughout Colorado to help reduce fuel levels and mitigate wildfire risks in nearby communities.

In May 2006, the Front Range Fuels Treatment Partnership (FRFTP) Roundtable, a coalition of federal, state and local agencies, environmental groups, universities and insurance groups, released a report documenting the results of a two-year long effort to develop a vision and roadmap for protecting communities from wildfire risks and restoring forest health in 10 Colorado Front Range counties, including Jefferson County.<sup>4</sup> The Roundtable identified nearly 1.5 million forested acres in the Front Range that will require fuels reduction treatments over the next 40 years, at a cost of at least \$15 million per year. This is considerably more than the \$6 million per year presently being spent. The Roundtable also found that increased utilization of the woody residues resulting from thinning would help reduce these costs. Jefferson County has been supportive of this concept for many years.

The large quantities of small trees, brush and slash (biomass) that will result from thinning have little or no commercial value in the forest products industry that has all but vanished from the Front Range of Colorado. Instead, the material is usually cut, piled, and then burned in the open. Concerns over air quality and fears of prescribed burns getting out of control also lead to an increased need to remove biomass from the forest. There are few if any market outlets for the biomass material that is being generated through these efforts. In some cases, creating market

<sup>4</sup> FRFTP Roundtable, May 2006, <http://www.frftp.org/roundtable/report.pdf>

outlets for the material will help reduce management costs for both public land management agencies and private landowners compared with other mechanical thinning treatment options. Biomass energy can support forest ecosystem restoration efforts in the study area and throughout the western U.S. by providing new market outlets and new jobs.

**Renewable Energy.** In his 2006 State of the Union address, President Bush stated, “America is addicted to oil.” With those five simple words, the President focused a growing national dialogue on America’s growing dependence on fossil fuels and foreign oil. As our country moves through the early years of the 21<sup>st</sup> century, there can be little doubt that renewable sources of energy will play an increasingly important role in national security and economic development.

Recent increases in market prices of oil, natural gas, propane, gasoline and coal have created market conditions whereby many utilities, communities, government agencies and individuals are aggressively pursuing the development and implementation of renewable energy technologies. The growing interest in and acceptance of renewable energy, combined with Jefferson County’s forest health conditions, creates a “perfect storm” of opportunity to develop a new bioenergy industry along the Front Range. Biomass is the most versatile of the renewable resources, as it can be used to produce electricity, heat, liquid fuels, intermediate fuels such as pellets, and high value chemicals.

### **3 PHASE I FEASIBILITY STUDY, JANUARY 2005**

In January 2005, Jefferson County completed a detailed feasibility study aimed at evaluating biomass energy options for the County and surrounding region.<sup>5</sup> The study found that there is sufficient biomass generated from both forest and urban sources to support the development of one or more bioenergy facilities in Jefferson County. The study also determined that one of the biggest barriers to increased bioenergy development is the lack of a reliable supply infrastructure to deliver a consistent supply of the biomass that is generated to end users. This presents a “chicken and egg” problem whereby biomass end-users are not willing to invest in new technology without a reliable supply, and biomass fuel processors are not able to gear up to provide that material without the market outlets and consistent sources of raw material.

**Central Biomass Processing Plant.** Based on the results of the feasibility study, Jefferson County has undertaken additional steps during 2006 to move the project to fruition. We have investigated the use of biomass for heating several county-owned facilities, including the jail. Heating the jail with biomass is an excellent opportunity that will be discussed in greater detail a little later in this document. We have also been working over the past year to attract private sector firms to invest in Jefferson County to establish a centralized biomass processing facility. The presence of such a facility will provide potential end users with assurance that there will be a reliable, consistent, local supply of biomass now and into the future.

Jefferson County will not own this facility. Rather, the facility will be owned and operated by a private company. Jefferson County will play a facilitation role in developing the project infrastructure, assisting with outreach to potential end-users (including the general public and environmental groups), supporting legislative actions and policy initiatives aimed at fuel supply

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<sup>5</sup> Final Report: Jefferson County Biomass Facility Feasibility Study. January 2005. Available online at: [http://www.state.co.us/oemc/biomass/reports/Jeffco%20Biomass%20Final%20Report\\_01-21-05.pdf](http://www.state.co.us/oemc/biomass/reports/Jeffco%20Biomass%20Final%20Report_01-21-05.pdf)

and market demand aspects of the project, and providing information to potential biomass energy end-users and feedstock suppliers. Essentially, Jefferson County will be supporting the creation of a new industry for the Front Range, one that offers environmental and economic benefits.

The current concept is that a central site will be established to provide processing and storage capabilities for both forest and urban biomass so that end-users can be assured of a quality, consistent product at a reasonable price. One of the major sources of biomass supply, though not the only source, will be the U.S. Forest Service through an expected landscape-scale stewardship contract to be released during 2006.

***USFS Stewardship Contract.*** During the summer of 2005, the U.S. Forest Service announced plans to investigate the implementation of a large-scale stewardship contract for the Pike-San Isabel and Arapaho-Roosevelt national Forests. Based on public input and comments from interested parties, it appears that the USFS will issue a request for proposals for a stewardship contract in the fall of 2006. Present indications are that the contract will be issued to conduct fuel treatments on about 5,000 acres per year for 10 years. The Forest Service is hoping that the successful bidders will be able to use the contract to obtain investment in equipment that will help reduce the costs of biomass collection. Another outcome is that potential users of biomass will be willing to invest in a bioenergy system if they have a reasonable expectation that a large, stable source of fuel will be available for at least 10 years.

The USFS has issued a similar contract in the Apache-Sitgreaves National Forest in Arizona. The program has been a resounding success in terms of moving biomass out of the forest and into several end-use industries, including wood pellets. The Apache-Sitgreaves stewardship contract serves as a model for other regions of the country, including Colorado.

#### **4 MARKET FOCUS**

The initial focus of the central processing site will be to manufacture three products: wood chips, premium wood pellets and high-ash commercial pellets. It is expected that the products will be used initially in facility heating applications. Longer term, the processed biomass could be used to supply biofuels plants, biomass power generating facilities and co-fired with coal in utility power plants.

***Wood Chips.*** There are two reasons for focusing on the production of chips for bioheating applications. First, with the high prices of natural gas and propane, biomass chips in many cases have become the lowest cost heating fuel option. Wood chip heating systems are being installed throughout the country in public and private facilities for purely economic reasons, although the environmental, social and economic development benefits also play a factor in decision-making. Second, biomass heating with wood chips is considered to be an existing, mature industry, although systems are only now being deployed in the West due to previously low natural gas prices. The technology is considered commercial, there are multiple vendors with hundreds of systems in the field, spare parts are readily available, and the systems are not complicated to operate and maintain. The systems are fully automated, computer controlled and produce minimal emissions. Boulder County installed a wood chip heating system in 2005.

***Residential (Premium) Pellets.*** Wood pellets are uniform in size, low in moisture and ash content, easy to feed into a stove or boiler, and extremely clean burning. Pellets offer



convenience when compared to wood stoves or fireplaces, and cost savings when compared to electric, natural gas and propane systems. Pellet stoves are exempt from the no-burn restrictions that are issued for metro Denver during the winter months. Wood pellet manufacturing is a mature industry experiencing strong growth over the past 10 years. In Colorado, premium pellets are usually sold in 40 or 50 pound bags at retail outlets such as Home Depot, Lowes, Wal-mart and numerous stove and fireplace dealers throughout the state. Premium pellets are made with clean sawdust or ground up, debarked forest biomass and will produce less than 1% ash content.

Jefferson County is an excellent location to establish a pellet manufacturing plant. There are a large number of installed pellet stoves in the Front Range, and with the run-up in natural gas prices, the winter of 2005-2006 saw continued strong sales growth in stoves. Every stove sold equates to a 2-3 ton increase in demand for pellets for every following year. Many stove dealers reported a 2-3 month wait for pellet stoves in Colorado because the manufacturers could not keep up with demand. There was also a shortage of wood pellets in Colorado and much of the country last winter as manufacturers struggled to produce enough pellets to keep up with surging demand in both the U.S. and Europe. Thus, product demand is strong, distribution networks and infrastructure are already in place and retail sales outlets are common. The industry is again projecting pellet shortages during the 2006-2007 heating system as demand outstrips supply.

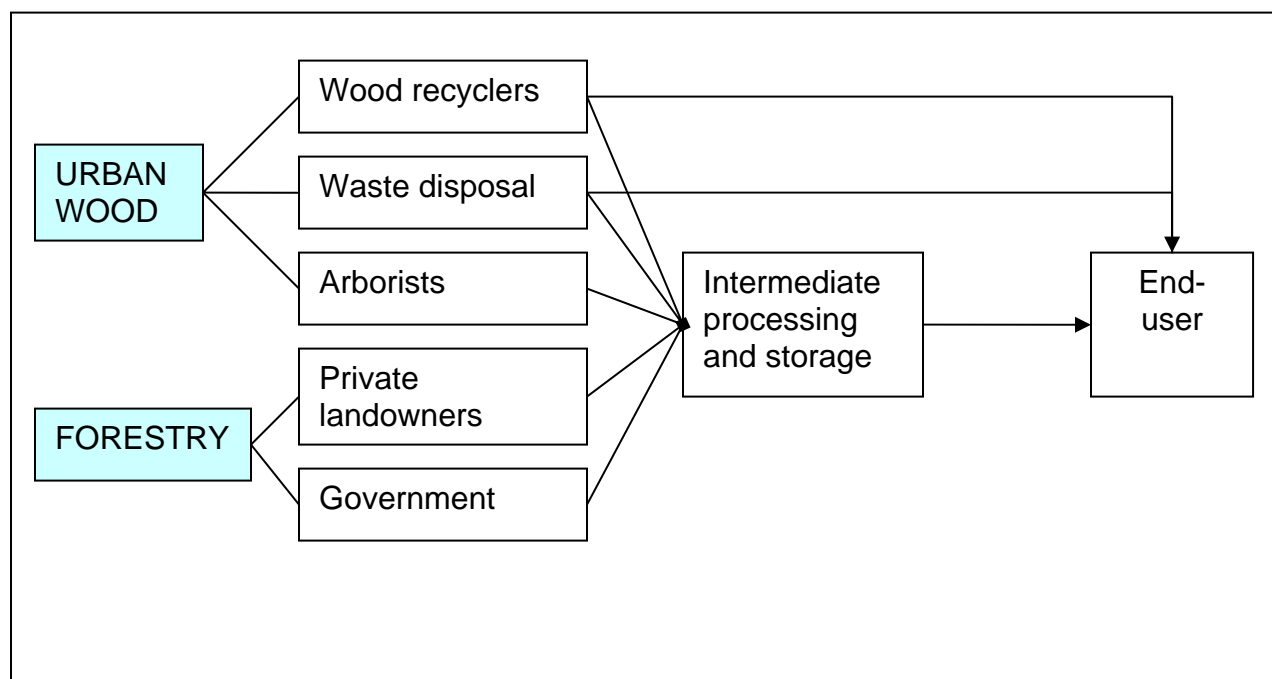
There is not a single pellet manufacturing plant located in Colorado at this time. The nearest producers are in Wyoming, Arizona and South Dakota so every ton of fuel burned in Colorado is imported from another state.

**Commercial Pellets.** A third product to be manufactured is commercial pellets. Commercial pellets are higher in ash content than residential pellets. Commercial pellets are typically manufactured using biomass that is not free of all bark, needles, leaves and twigs. Because these pellets produce a higher ash content, they need special stoves, furnaces or boilers that are designed for a higher ash content fuel. Forest biomass from Front Range forest is expected to be an excellent fuel for making commercial pellets. The target market for commercial pellets is institutional facility heating or process thermal applications. Schools, hospitals, jails, utility power plants, greenhouses and many industrial facilities are key targets. Many European countries are aggressively pursuing the deployment of commercial pellet systems. Presently, industrial scale commercial pellet boilers are manufactured in Europe and imported into the U.S. Commercial pellet systems offer several advantages over wood chip heating systems (see discussion below). The concept would be to supply institutional users with bulk delivery of commercial pellets via truck and pneumatic conveyance to the customer's storage silo.

**Pellets and Chips Comparison.** An initial evaluation of the relative costs associated with either a chip or pellet system was performed for heating the Jefferson County jail. Wood chips are minimally processed to a specified size range (matchbook size), and usually have higher moisture content and lower bulk density than wood pellets. Because of these differences, the chip system requires a much larger fuel storage volume than does a pellet system, and has higher fuel usage, electricity and operations and maintenance (O&M) requirements. By contrast, the wood pellet system has lower initial capital costs but a higher annual fuel cost because of the processing. Both systems are economically favorable when compared to the existing natural gas system and current natural gas prices.

## 5 THE BIOMASS SUPPLY

It is anticipated that biomass supply for the facility will come from two primary sources: forest biomass and clean urban wood waste. Urban biomass suppliers include wood recycling companies, waste disposal companies, arborists and landscapers. Forest biomass suppliers include private landowners, counties and cities, federal agencies (predominantly the U.S. Forest Service) and the contractors that manage their land. Figure 3 provides a general overview of the biomass supply system.



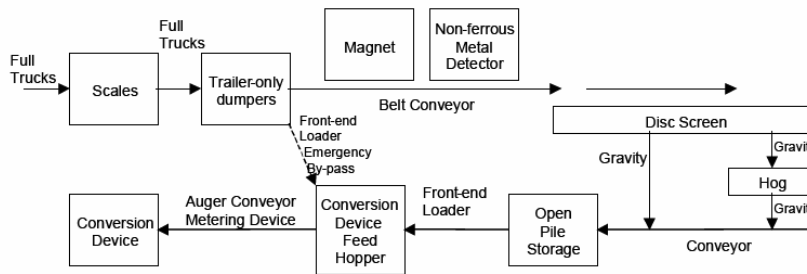
**Figure 3. Sample process diagram for biomass supply**

An important role of the facility will be to coordinate and develop multiple suppliers and supply streams, so that the market does not become too dependent upon one source of biomass feedstock. The biomass supply system must be developed to continue to operate even if one component of the system experiences disruptions or shortages. The ability to address seasonality is another important issue. The demand for wood biomass in heating applications is typically highest in the winter months, whereas much of the forest biomass is produced during the other three seasons. It will be necessary for the processing facility to have on-site storage, for raw materials and/or finished products, and a network of year round suppliers, preferably from multiple sectors of the supply system.

The estimated area requirements for a facility able to produce approximately 60,000 tons of material reliably each year ranges from 5 to 10 acres depending on the configuration of the site. Additional room for future expansion (an estimated 5 to 10 acres more) would be beneficial. The wood storage pile can be highly variable in size depending on the storage method, but would most likely occupy approximately 60 percent of the site. Utility services required include electricity, propane or natural gas, water (for dust and fire suppression, office needs – limited

process water is required for applications under consideration), and wastewater treatment (for vehicle washing and limited process needs).

Figure 4 highlights generalized equipment components for a generic biomass processing facility. The main components include receiving (guard station, scales, truck dumps), processing (magnets, screens and wood hog or chipper), storage (either open pile, below-grade bunker or silo) and a conversion system. The conversion device could be a combined heat and power plant, district heating system, pellet plant or possibly an ethanol plant as that technology matures. The conversion device may be located on-site and an integral part of the process, or off-site. Off-site conversion facilities would require transportation, its own on-site storage, waste treatment and conversion technology.



Source: Phillip C. Badger, Processing Cost Analysis for Biomass Feedstocks, ORNL/TM-2002/199, Oak Ridge, Tennessee: Oak Ridge National Laboratory, October 2002.

**Figure 4. Generalized Process Diagram for Biomass Facility**

The number of trucks entering and leaving this facility per day is heavily dependent on the end use/product and scale of the facility. For a 30,000 ton per year pellet plant, one would expect six to as many as ten incoming trucks. There would be fewer outgoing trucks per day, most likely three to five, shipping the densified pellets to consumers.

## 6 RATIONALE FOR COUNTY SUPPORT

**Public benefits.** A key aim of forest management is to help mitigate the risks of more destructive fires and help reduce the rate of spread of wildfire in strategic areas, with the recognition that wildfire is a natural part of forest ecosystems. Fires will still occur, but the objective will be to reduce the severity and impact of those fires. A growing body of evidence shows that forest thinning can mitigate fire risks, and thinning followed by burning can have significant benefits. Removal of biomass rather than leaving it on-site to be piled and burned or consumed through prescribed burning can have additional benefits. These benefits can include:

- Protection of life, property and infrastructure
- Watershed protection
- Reduced air pollution
- Use of renewable resources

- Rural economic development
- Hedge against volatile fossil fuel prices

Over the past five years there is considerable documentation on the effects of forest fires within the greater Denver metropolitan area.<sup>6</sup>

***Economic Development.*** Economic development is fundamentally about enhancing the factors of productive capacity - land, labor, capital, and technology - of a national, state or local economy. By using its resources and powers to reduce the risks and costs that could prohibit investment, the public sector often has been responsible for setting the stage for employment-generating investment by the private sector.<sup>7</sup> For Jefferson County, there is opportunity to expand the local economy in a number of areas. Recent work conducted by the University of Arizona allows for initial insight into the potential for economic growth associated with forest stewardship initiatives.<sup>8</sup>

Annual monitoring of the economic impacts of the stewardship contract on the Apache-Sitgreaves National Forest in the White Mountain region of Arizona was established as a condition for issuance of the contract. Tentative and initial results suggest considerable “health and safety” as well as economic benefit to the rural community from the stewardship contract. Select important early conclusions include:

- Innovative technologies are clearly in play to support demand for a variety of harvest outputs (clean chips, dirty chips, roundwood, and saw timber) including materials that historically had little or no value.
- Impacts are not always localized. Data on cross-commuting suggest that impacts can be spread over the entire White Mountain region (a large geographic area encompassing many communities).
- The “forestry cluster” is a major employer; firms surveyed employ some 450 full time equivalent employees.
- The “forestry cluster” is an important economic engine that indirectly supports an additional 90 FTEs in the White Mountain region through the multiplier process.
- Despite the fact that Future Forest, LLC is a new player (less than two years old as a corporate entity), it is already an important player. Of the 317.8 FTE who live and work in the White Mountain region, almost 1/3<sup>rd</sup> are employed to harvest and process Future Forest, LLC material – 81 FTE directly and 23 FTE indirectly through the multiplier process.
- Local expenditures by the 13 firms surveyed are substantial; the grand total spent by these firms in the White Mountain region is over \$12 million annually.

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<sup>6</sup> See for example, “Jefferson County Biomass Facility Feasibility Study” prepared by McNeil Technologies for Jefferson County, 2005.

<sup>7</sup> Derived from <http://www.eda.gov/Research/EcoDev.xml>

<sup>8</sup> Gibson, Lay. 2005 WSMP Economic Assessment, conducted for the White Mountain Stewardship Contract Monitoring Board, April 24, 2006.

There are strong parallels between the White Mountain region of Arizona and Jefferson County Colorado. The potential is to retain and enhance existing employers as well as attract new industry to Jefferson County.

**National Leadership.** The Energy Policy Act of 2005 (EPACT) contains a broad array of initiatives and policies aimed at bioenergy development in the U.S.<sup>9</sup>

Additionally, Under Section 210(b), EPACT states that the Secretaries of Agriculture and Interior may make grants to those owning/operating a facility using forest biomass as raw material to produce electric energy, transportation fuels, or other petroleum-based substitutes. Grants may not exceed \$20 per green ton of biomass and may not exceed \$500,000 total. EPACT authorizes \$50 million to be appropriated each year through FY 2016. Funds have never been appropriated for this program.

The Healthy Forests Restoration Act (HFRA) seeks to reduce fuel build-up in the nation's forests and promotes the use of biomass for energy. The USDA has a number of strong programs aimed at supporting biomass energy. To date, and in the future, Jefferson County's efforts will be closely coordinated with a number of federal agencies. Through this project, we will be serving as a model to show how local communities and the private sector can work together to implement national energy policies and ultimately strengthen our local and national energy security.

**State Leadership.** In 2004, Colorado voters passed Amendment 37 (A37), which requires Colorado utilities serving 40,000 meters or more to meet a certain percentage of its electrical demand with renewable energy. Four percent of the renewable power must come from solar generation, and the remainder can come from any eligible resource including wind, small hydro, geothermal and biomass. The definition of biomass under A37 does include forest biomass.

A number of programs of the Colorado Governor's Office of Energy Management and Conservation (OEMC) are actively promoting and supporting biomass energy development in Colorado, and we are working closely with OEMC on the implementation of this project.

Finally, in March 2006, Governor Owens signed SB 06-003 that amends section 20-30-1305 (3), of the Colorado Revised Statutes to include biomass for heat, power or both in the life-cycle cost analysis to be conducted when evaluating the design, construction or renovation of state-owned and state-assisted facilities.

## **7 THE ROLE OF JEFFERSON COUNTY, ACTIONS AND NEXT STEPS**

Jefferson County's role in this project will be to act as a facilitator and coordinator of the multiple partners and stakeholders that must be engaged if the project is to be a success. The primary activities will be:

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<sup>9</sup> For example, see [www.eesi.org/publications/Presentations/2006/NWPPA\\_EPACT\\_3.29.06.pdf](http://www.eesi.org/publications/Presentations/2006/NWPPA_EPACT_3.29.06.pdf)

- Facilitate the development of a public-private partnership with biomass suppliers, processing companies, end-users, public agency stakeholders and others as needed;
- Develop and provide economic development incentives to biomass processing companies;
- Assist with market development efforts aimed at biomass facility heating systems, with primary targets being county-owned buildings as well as public and private sector end-users;
- Support and develop state, federal and local legislative and policy actions that will benefit the project;
- Assist biomass processing facility developers with infrastructure and site development planning and engineering, permitting and rezoning;
- Conduct community outreach and public education on the benefits of the project, including early coordination with environmental groups so as to minimize potential conflicts or concerns; and,
- Conduct an education and outreach campaign to potential biomass suppliers, including government and private landowners, urban wood waste generators, landfill operators, wood recyclers and trucking companies.

Each activity is explained in greater detail below.

***Facilitation and Coordination.*** Since this project is targeted towards developing a processing site in Jefferson County, strong county leadership and coordination will help ensure the success of the project. Development of this new industry for the Front Range will require significant cooperation between the public and private sectors and multiple stakeholders. Although the biomass processing facility will be owned and operated by a private company, a strong partnership with local, state and federal agencies is essential to project success. The underlying driver for this concept is the unhealthy conditions of the Front Range's forests and wildfire risk to the citizens living in our forested communities. A strong public-private partnership is needed to ensure that forest treatment efforts are coordinated across multiple landowners to help ensure a consistent flow of biomass to the site.

***Federal Agencies.*** The U.S. Forest Service is the primary federal entity that Jefferson County needs to coordinate with. With a request for proposal for a stewardship contract likely to hit the street this fall, the County should concentrate on working with the Forest Service to include language in the RFP that will ensure biomass will be required to be removed from the treatment projects that are implemented.

An additional partner is the National Renewable Energy Lab (NREL) in Golden. NREL is presently studying the feasibility of installing a biomass heating system to heat part of its campus. The county can play a role in working with NREL to ensure that biomass fuel for the system is coordinated through the county processing site. NREL is a world leader in conducting and supporting R&D for advanced biomass conversion technologies.

The U.S. Department of Energy (DOE), through the Golden Field Office, is providing additional funding support to the county. DOE technical staff should be kept updated on the project as it

progresses. DOE can also provide insight into the status of federal R&D efforts aimed at commercializing new bioconversion technologies. Down the road, there is the potential for the Jefferson County biomass site to serve as a host site for advanced technology demonstration projects.

**State Agencies.** The state of Colorado has two primary offices that work on biomass energy issues. These are the Colorado State Forest Service (CSFS) and the OEMC. CSFS is a partner to coordinate supply and to provide outreach to private landowners. CSFS, working in conjunction with Colorado State University, has begun a statewide effort to develop a GIS based map to locate planned and on-going forest treatment projects and potential forest biomass availability. The county should work with these entities to ensure that relevant data are made available to the processing facility in a timely manner.

OEMC is supporting several biomass efforts including the mapping/resource assessment mentioned above, assessment of the potential for biomass to be co-fired with coal in utility power plants, and technical support to promote the implementation of biomass heating systems within state and local government facilities. This latter project, implemented through the *Rebuild Colorado* program, seeks to promote financing and installation of biomass heating systems through a partnership with energy service companies (ESCOs). The program will provide feedstock supply assessments, technical and economic analysis, engineering and design support, system integration with existing equipment, and private-sector financing through ESCO-based performance contracting.

The funding for OEMC's biomass efforts comes primarily from the Western Governors' Association (WGA). WGA is highly supportive of biomass energy development efforts through its Clean and Diversified Energy Advisory Committee. WGA recently published a task force report on the contribution that biomass energy can make towards western electricity supplies.<sup>10</sup>

**Local Agencies.** There is significant coordination that needs to take place with counties and cities, both as possible suppliers of biomass and as potential end-users through the installation of facility heating systems. Even within Jefferson County, we will need to coordinate with Parks and Open Space, Emergency Management, Facilities, School Districts and the County Jail. Boulder County recently installed a biomass heating system and they are using biomass from county-owned land as the feedstock. We should monitor this project so we do not need to recreate the wheel if Jefferson County decides to implement a heating system.

**Private Sector.** A number of private entities will be involved in this project. Their role will include provision of forest and urban biomass, transportation of feedstock, on-site and in-woods materials processing, and serving as potential end use outlets.

## **7.1 Economic Development Incentives**

Jefferson County has a long history of fostering the local economy through sound fiscal practices, quality public infrastructure and a good education system. In most instances these qualities are fundamental for allowing market forces to operate. In cooperation with the state and the Jefferson Economic Council, there exist a number of programs designed to improve the employability of workers as well as to address geographic mobility. Various business assistance

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<sup>10</sup> Available on-line at: <http://www.westgov.org/wga/initiatives/cdeac/biomass.htm>

programs cover project grants, low-interest loans, customized job-training grants, state income tax credits, personal property tax rebates, sales-and-use tax exemptions, and permit fee waivers. We are working with JEC to develop incentives for companies interested in this industry.

## 7.2 Assist with Market Development for Biomass Facility Heating Systems

A biomass processing facility requires both supply of raw material and demand for the finished products. On the demand side, Jefferson County can provide leadership and support through the installation of a biomass heating system at one or more county-owned facilities. Jefferson County can also coordinate with other potential end-users in the region, including both private and public sector entities.

**County Jail.** The county should pursue the installation of a biomass chip or pellet heating system at one or more county facilities. The jail complex located on the county campus is an ideal target for a system. In 2005, the county contracted to perform an initial feasibility study of installing a system at the jail. The economics are favorable for either chips or commercial pellets. By installing a system at the jail, the county will exhibit leadership and create an instant market outlet for several thousand tons of biomass per year. The installation would serve as a model for other facilities considering similar systems. The technology is commercial, reliable, clean-burning, cost-effective, low maintenance and efficient.

A life cycle cost analysis was performed on the jail using the Federal Energy Management Program guidelines. The results are summarized in Table 1. A wood chip heating system at the jail would require approximately 7,000 green tons/year of wood chips and would cost about \$750,000. A commercial pellet system would cost approximately \$500,000, have a smaller footprint, require less space for fuel storage, use less fuel (2,500 tons/yr), have lower O&M costs than a wood chip system and be cleaner burning. However pellet costs will be higher than chip costs, so the life-cycle costs for the pellet system are higher than for the chip system. Over a twenty-year horizon, a pellet system is more expensive to own and operate than an equivalently sized chip system but it will likely require less maintenance from facility staff and have cleaner emissions. Both systems are less expensive than natural gas on a life cycle cost basis. The operating success of either system is dependent upon well-defined fuel supply contracts as well as training and support for maintenance staff responsible for facility operation. The economic analysis is sensitive to the price of biomass fuel and natural gas prices.

**Table 1. Comparative Life Cycle Costs for Three Heating Systems at the Jefferson County Jail**

Alternative	Initial Cost	Life Cycle Cost
Natural Gas	\$ -	\$ 4,087,350
Biomass Pellets	\$ 500,000	\$ 3,847,544
Biomass Chips	\$ 765,000	\$ 2,455,844

Financing for the system could be provided by an ESCO through a performance based contract. The OEMC's *Rebuild Colorado* program is presently offering free technical and management support to public entities in Colorado that wish to pursue installation of biomass heating systems. OEMC will provide their consultant team to the county to assist with system sizing and design,



vendor selection, review of the ESCO's financing terms and conditions, integration of the biomass system with the existing heating system, project commissioning and start-up. Although the OEMC's program is focused on working with ESCOs, they will still provide assistance if the county pursues other financing options.

***Outreach to Other Potential End Users.*** The development of several additional market outlets for the biomass is an essential piece of the overall plan to develop the processing facility. Without markets for its products, the biomass processing facility will not be able to obtain and process raw material from the region's forests. With the high prices of natural gas, many facility managers are actively looking for ways to reduce energy costs. Opportunities for biomass heating systems exist in both the public and private sectors, and for both new construction and retrofits of existing systems. The role of the county would be to provide assurance to potential end-users that the feedstock supply infrastructure is in place. The county could also coordinate with OEMC and others to provide education and outreach to other potential end users. This could include organization of targeted workshops and provision of technical information to facility managers. As part of the effort, the county could coordinate a tour of Boulder County's biomass heating system. The target group would be public and private sector entities from Jefferson County.

There are several high-profile end-users that are currently exploring biomass heating. These include Xcel Energy (studying conversion of its Zuni Plant to biomass), NREL (looking at heating its campus), the Anheuser-Busch brewery near Fort Collins (evaluating meeting of process needs with biomass) and Colorado Springs Utilities (investigation mixing wood chips with coal at its power plants). A special targeted outreach effort should be made to these entities. New commercial developments such as Cabella's and the proposed hospital at the Federal Center should also be targeted for initial meetings to discuss biomass energy and the project.

### **7.3 Legislative and Policy Actions**

There are numerous policy-related actions that the county should undertake that would facilitate the development and on-going operations of the facility. Policies targeted towards county, state and federal levels would be required.

***County.*** Jefferson County could pursue several actions at the county level. One example is a waiver of property tax on biomass heating equipment. The county could also set up a revolving loan fund that would assist with financing systems for county-owned buildings or schools. The Jefferson Economic Council (JEC) is in the process of forming a renewable energy group to promote the development of renewable energy based businesses for Jefferson County. County staff should participate in the JEC group and seek to leverage economic incentives for the biomass plant. The county could show additional leadership by installing a biomass heating system at the jail, and issuing an order that facilities evaluate the economics of biomass heating and/or cooling for all future county buildings.

***State.*** At the state-level, one of the most important actions is to work with the legislature and other stakeholders to modify Amendment 37 to count the use of renewable thermal energy as an eligible resource towards meeting the A37 targets for each utility. Although biomass is an eligible resource for electricity generation under A37, in practice there is little likelihood of a biomass power plant being built in Colorado. This is because wind energy is the cheapest form

of renewable energy and it will dominate the supply from renewables for the foreseeable future. There is also a provision in A37 that requires 4 percent of the renewable electricity to come from solar energy, but there is no such provision or set-aside for biomass. Solar energy is about 3 - 4 times the cost of biomass power.

Presently, the most economic application for biomass in Colorado is to offset natural gas or propane as a fuel for providing heat. One of the goals of A37 is to displace fossil fuels with renewables through electricity generation. Biomass heating will displace fossil fuels through heat generation. Jefferson County should work to introduce a bill in the next session of the Colorado legislature that expands the definition of A37 to allow renewable-based thermal energy (e.g. biomass heat, geothermal, solar hot water) as an eligible resource for meeting targets.

It should be noted that the State of Arizona recently passed a similar provision, and we can model our efforts on their language and rules. Like Colorado, Arizona has enacted requirements that a certain portion of the state's electricity come from renewables. In early 2006, the rule was modified and thermal energy is now included as an eligible resource to meet the goals. The rules for implementing the thermal provisions are expected to be finalized in the summer of 2006. A number of groups in Colorado will support this effort including the FRFTP, Western Forestry Leadership Coalition, Colorado Timber Industry Association and the WGA.

The OEMC is in the process of creating a biomass energy users group for Colorado. This group will serve to promote the exchange of technical, economic and policy-related information relevant to the bioenergy industry. Jefferson County should be an active participant in this group.

***Federal.*** There are numerous policies at the federal level that can support the long-term success of the Jefferson County biomass facility. Actions are needed to support both the supply and demand sides of the equation. Jefferson County staff should be sure to provide regular briefings on the status of the project to Colorado's congressional delegation. Jefferson County can explore the following actions:

- Twenty dollar per ton credit. Work with Colorado's congressional staff to appropriate funding for Section 210(b) of EPACT 2005, which authorizes a credit of \$20 per green ton to facilities that utilize biomass generated from hazardous fuels reduction treatments on forested lands. If funded, Jefferson County should work to ensure that the biomass processing facility located in the county receives a share of the funds.
- Forest Treatment. Support the FRFTP's requests for additional funding to treat the Front Range's forests. One of the findings of the FRFTP Roundtable was that there is likely to be a shortfall of funding to implement all of the required treatment for the Front Range. With the USFS planning to release an RFP for a stewardship contract in late 2006, Jefferson County should work with the congressional delegation to ensure that sufficient funding is provided to the national Forests so that the maximum amount of acres can be treated per year.
- Production tax credit (PTC). Extend the PTC for biomass to be equal to what other renewables receive. Under EPACT, there is a tax credit of \$0.009/kWh (for 10 years) for the production of electricity from biomass. Wind and solar power generators receive twice this amount, or \$0.018/kWh for 10 years. There is no reason for this disparity, and Jefferson County should work with the congressional delegation to modify the PTC so

that biomass is treated equitably.

- Expand the PTC to include thermal energy from biomass. The fact that one must generate electricity to receive the PTC is likely to mean that few if any biomass plants in Colorado will receive credit. A small credit for 5-10 years, based on a value per million Btu (MMBtu) of energy produced, would help increase the market demand for biomass significantly. Eligibility for the credit could be restricted to only allow larger commercial or industrial scale plants (which will consume more biomass) to benefit from the credit.

#### **7.4 Assist Private Sector Developers**

Jefferson County has already established a leadership position in biomass by commissioning early studies and reports such as this one. The importance of a non-partisan report goes beyond informing the County employees and decision-makers. Many firms rely upon independent, publicly-funded efforts as documentation for their financing efforts. Lending institutions often utilize public documents in support of their due diligence efforts.

**Site Selection / Development Facilitation.** The issues involved with site selection and development are often daunting for small to medium-sized businesses. Jefferson County can work to facilitate the development process by providing biomass-related information on the Planning and Zoning website. The intent would be to complement the existing information with specific information regarding biomass. Important issues related to air emissions as well as disposal of wastes would be appropriate for this site. The county may also support infrastructure development activities for the facility such as grading, permitting, site work, rights of way procurement and utilities.

#### **7.5 Community Outreach, Public Meetings and Media Relations**

Community outreach is simply good public policy. It is the right of every citizen to have the opportunity to be informed and to participate in and influence public debate. Community outreach allows for consensus building that is essential to alleviating future problems. The process is important and Jefferson County has been a model for successfully encouraging broad participation.

A series of public meetings should be held to inform residents of Jefferson County of the issues and opportunities for forest management and biomass utilization. The meetings will provide a forum for involving the disparate parties and identifying important issues. The stakeholders in the area include environmental groups, public health and safety organizations, neighborhood associations in WUI areas, local energy suppliers, firms engaged in forest management and wood processing, transportation companies, as well as interested area residents. Concurrent with the meetings, it is important to prepare various documents for dissemination to the public as well as the media. Suggested venues for dissemination of information include an Internet website as well as traditional media outlets.

#### **7.6 Outreach to Stakeholders**

The project efforts to date included coordination with a great number of stakeholders, including

but not limited to the following:

- Front Range Forest Treatment Partnership Roundtable
- Potential owners of biomass facility sites (Jefferson County and Ralston Development)
- USFS Region 2 to respond to request for information regarding stewardship contracting
- Potential end users of fuel (Jefferson County, Forest Energy, Power Energy Fuels Inc. NREL, Colorado Springs Utilities, Anheuser-Busch and Xcel Energy)
- Monitoring status of NREL efforts to evaluate biomass heating
- OEMC *Rebuild Colorado* Biomass Energy Program
- Residue generators (wood recyclers, landfills and others)

We did not hold public outreach sessions because the project team believed that it was premature. The nature of the end use was in flux during the project due to the lack of a firm Stewardship Contract being issued by the USFS, and an increase in investor interest, precluding the offering of a specific development plan to present to the public.

## **8 SUMMARY**

This document provides County Commissioners and staff with a vision and action plan for the continued county-support for the creation and development of a new biomass energy industry in Jefferson County. Despite the strong interest and support for biomass of both the federal and state governments, the transportation and use of forest biomass is a local issue, requiring local leadership, partners and actions. Bioenergy development offers Jefferson County a number of public, environmental and economic development benefits, and will save the county money within its own buildings and facilities. For the next 2 years, the U.S. DOE will provide cost-shared funding support to Jefferson County to continue with project development efforts.