Reno/Tahoe Biomass Supply and Demand Study

Addressing barriers and constraints to "utility" scale biomass power development

Prepared for the

California Department of Forestry and Fire Protection and
Western Governor's Association

January 2008

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Executive Summary

With funds made available by the Western Governors' Association, the California Department of Forestry (CDF) contracted with Sierra Economic Development Corporation (then known as the Sierra Economic Development District, SEDD) to undertake a project to "address the barriers/constraints to "utility" scale and locally owned biomass power development, and lead to increased Bioenergy awareness through outreach in a two state region." The project's objectives were addressed in two tasks, the first having five sub-tasks, as follows:

Task A Collection of Biomass Inventory and Analysis of Data

Sub-Task 1 – Inventory the supply and attributes of biomass material being made available in an eight county region surrounding the Lake Tahoe Basin

Sub-Task 2 – Forecast the demand for electrical energy by industrial sectors

Sub-Task 3 – Identify alternative woody biomass-to-energy technologies

Sub-Task 4 – Complete a cost analysis and siting requirements for conversion to appropriate technologies

Sub-Task 5 – Identify potential sites for power plants in the Tahoe Basin Project Assessment Area

Task B Outreach to utilities, investors, entrepreneurs, and land managers to identify issues and conduct a workshop to present information gathered to stimulate interest in development of biomass-to-energy plants

As coordinated with CDF, SEDCorp subcontracted with Tom Amesbury, Principal, Forester's Co-Op, for the completion of Sub-Tasks 1, 3, 4 and 5, and with Dr. Tom Harris, University of Nevada, for the completion of Sub-Task 2. SEDCorp planned, organized and hosted a regional biomass workshop on June 1, 2007 at North Lake Tahoe for completion of Task B. A detailed description of the performance of each task and sub-task follows. The key points may be summarized as follows.

<u>Sub-Task 1 – Biomass Supply</u>

Total annual woody biomass supply currently available in the Tahoe region ranges between 55,000 BDT and 129,000 BDT in a price range of between $10/BDT and $50/BDT, respectively.

There is a clear surplus of biomass material in the public and private forests of the Tahoe Basin that is estimated to be increasing at a rate of six percent per year.

Due to several cost and regulatory factors, only about two percent of the annual increase in forest biomass is being harvested. As the price of biomass increases and those cost and regulatory obstacles are overcome, the forest-derived biomass becomes an increasingly significant part of the total biomass available, especially from the public forests.

The waste stream biomass source is the largest, most consistent, least sensitive to price fluctuations, yields at least twice as much material as any of the other three primary sources examined (private timber harvests, USFS harvests, wood businesses), regardless of price, and is estimated to be increasing at a little less than one percent per year.

New technologies such as small, mobile facilities may eventually make it feasible to use more of the resources created by forest thinning operations.

Sub-Task 2 – (Biomass) Energy Demand

Though California is the lowest per-capita consumer of electricity in the country, the State is still a huge consumer of energy. Although California is the top biomass energy producing state, only about two percent of its energy is derived from biomass.

About a quarter of the biomass used in California is for home heating, nearly one half is used for electrical power generation, and the bulk of the remainder is used internally by the industrial sector. About seventy percent of the Nevada biomass consumption is for home heating, while the remainder is used for industrial purposes.

Energy supplied in Nevada from renewable sources must encompass twenty percent of total sales by 2015; California's goal is to reach the twenty percent renewable sources standard by 2010 and thirty-three percent by 2020.

Nevada has only a few biomass energy plants while California has a total of twenty-eight wood biomass plants with a capacity of 680 MW (megawatts), down from a total of seventy plants producing a total of 1600 MW in the peak year of 1985.

The Tahoe region population has expanded over the last twenty years at a rate much higher than the national average and is expected to continue to grow at nearly two percent per year. Regional employment is expected to increase at approximately the same rate as the population.

An examination of several forecasting models suggests that energy demand will keep pace with increasing Tahoe region population and employment rates, with the rate of increase being perhaps slightly higher on the Nevada side than the California side; the split between residential and non-residential use is predicted to remain relatively constant at approximately fifty-seven percent and forty-three percent, respectively.

The energy produced by the available wood fuel in the Tahoe region is predicted to produce approximately 100,000 MWH per year or two percent of the 5 million MWH per year increased demand for energy nineteen years from now.

Sub-Task 3 – Alternative Biomass-to-Energy Technologies

Three technologies – biomass-fueled microturbines, modular biomass gasifier power plants, and combination gasification and gas engine cogeneration plants - appear to be potentially feasible for continued development to serve the Tahoe Basin region.

Biomass-fueled microturbines have theoretical thermodynamic advantages over steam power systems, with indirect-fired gas turbines presenting a promising alternative to direct-fired units.

Biomass gasifier technology requires further field-testing prior to becoming a viable commercial biomass energy system.

An optimum small-scale combination gasification and gas engine cogeneration plant might yield relatively high biomass conversion efficiency although much research and development work is needed to demonstrate the economic and environmental benefits of distributed small scale biomass-fueled power plants.

Meeting allowable air emissions requirements, minimizing wastewater effluent discharge and wood ash, and transportability and minimizing operational footprint should be important considerations in future system selections.

Sub-Task 4 – Cost and Site Considerations

Biomass is a (relatively) local resource with local supply and demand determining price and availability; the diminished effect of demand from a larger geographic area can contribute to greater price stability.

Combined heat and power systems on sites that can use both are more cost-effective than electric generation-only systems.

Biomass heating systems can present viable alternatives to current fossil fuel-fired systems and make more sense when the fuel being replaced is especially expensive, an existing steam system needs replacement, or the construction of a new facility affords the opportunity to consider other alternatives in an area where an adequate supply of biomass exists or can be economically developed, especially near wood processors or waste collection facilities.

Though large plants can have greater capital and operating cost efficiencies, they also have greater supply requirements and attendant potential adverse transportation cost and environmental impacts.

Biomass plants can be developed for a cost in the range of $5,000 - $8,000 per kW for facilities in the .5-3MW range; development of mobile facilities may be cost competitive with fixed facilities on a dollar per kW basis.

Sub-Task 5 – Potential Plant Sites

The identified point and non-point sources in or closest to the Basin, to date totaling on the order of a few tens of thousands of BDT per year, roughly equal the supply needed for the three on-line or proposed facilities in the Tahoe area. This suggests the likelihood of near-term price competition and the need for development of additional sources before committing to additional major users of those sources.

Task B – Biomass Workshop

Interest in a regional biomass workshop held June 1, 2007 at the North Tahoe Convention Center was high, with more than one hundred individuals attending and one vendor display; one half of those attending provided a written workshop evaluation.

A workshop evaluation summary indicated that:
Ninety-six percent viewed the overall quality of the workshop as good or excellent;
Ninety-two percent viewed the presentations to be good or excellent;
Forty percent felt that more time was needed for interaction with the speakers;
Fifty-four percent felt that the workshop exceeded or greatly exceeded their expectations; and
Many recommended that such a conference should be an annual event.

Conclusions and Recommendations

This effort added to the general base of knowledge about biomass and, specifically, regarding the supply of biomass and the potential biomass-based energy demand in the Tahoe Basin. The workshop held at Kings Beach, North Lake Tahoe on June 1, 2007, was especially successful in stimulating continuing and expanded interest in biomass energy plants and the exploitation of biomass, in general. The success of this effort invites four specific recommendations for follow-on efforts, as follows:

1. A regional workshop capitalizing on the success of the June 1, 2007 Biomass Workshop at North Lake Tahoe should be fielded in 2008, incorporating the preferences expressed by attendees and the lessons learned from the 2007 workshop.

2. A project should be undertaken to focus on the development and fielding of small, mobile energy centers suitable for connection to the electrical power grid at any point.
3. A project should be undertaken to develop specific strategies to reduce or completely eliminate the conventional costs of transporting biomass materials.
4. A project should be undertaken to develop and document a streamlined pre-approved or over-the-counter procedure for projects that couple hazardous fuels reduction with transportation fuels production, transportation cost reduction or mobile power production.

SEDCorp will welcome the opportunity to submit full proposals for each of these recommended projects.

Reno/Tahoe Biomass Supply and Demand Study

Task A – Collection of Biomass Inventory and Analysis of Data

Sub-Task 1 – Inventory the Supply and attributes of biomass material being made available in an eight county region surrounding the Lake Tahoe Basin

The WGA Tahoe Regional Biomass Project is a Woody Biomass-focused project. The generalized term "biomass" refers to a volumetric measure of any or all organic material within the earth environs. For the purposes of this project, the abundant and underutilized biomass of interest is that which is derived from wood within the project's assessment area. The standardized definition of "woody biomass" used for this project is:

> "Woody biomass is an organic derivative from a variety of woody plant species. These derivatives can be found in many forms such as:
> 1) Forest/agricultural sourced wood, bark, and green leafy chips and shreds;
> 2) Wood manufacturing byproducts such as sawdust, planer shavings, and clean white chips; or
> 3) Waste stream derivatives such as recycled lumber, yard trimmings, and other commercial wood waste."

The standardized unit of measure for woody biomass data collected for this project is in "Bone Dry Tons" (BDT) that equates to 2,000 lbs of woody biomass material at 0% moisture content.

The WGA Tahoe Regional Biomass Supply assessment area encompasses the entire Lake Tahoe Basin including portions of eight California and Nevada Counties. This assessment area was established using knowledge of existing biomass markets and their supply chain boundaries. The "WGA Project Assessment Area Map", an 11" x 17" map on the following page, illustrates the geographical focus area for WGA project Biomass supply and availability investigations. Biomass supply information and data was assimilated using the following criteria:

1 Technical/Probable Woody Biomass Supply - All Source (Forestry, Agricultural, Wood Manufacturing, Waste Stream) Biomass Resource Totals for accumulated/grown/harvested/collected/neglected material that is potentially available within a specific geographic area and market sphere of influence.

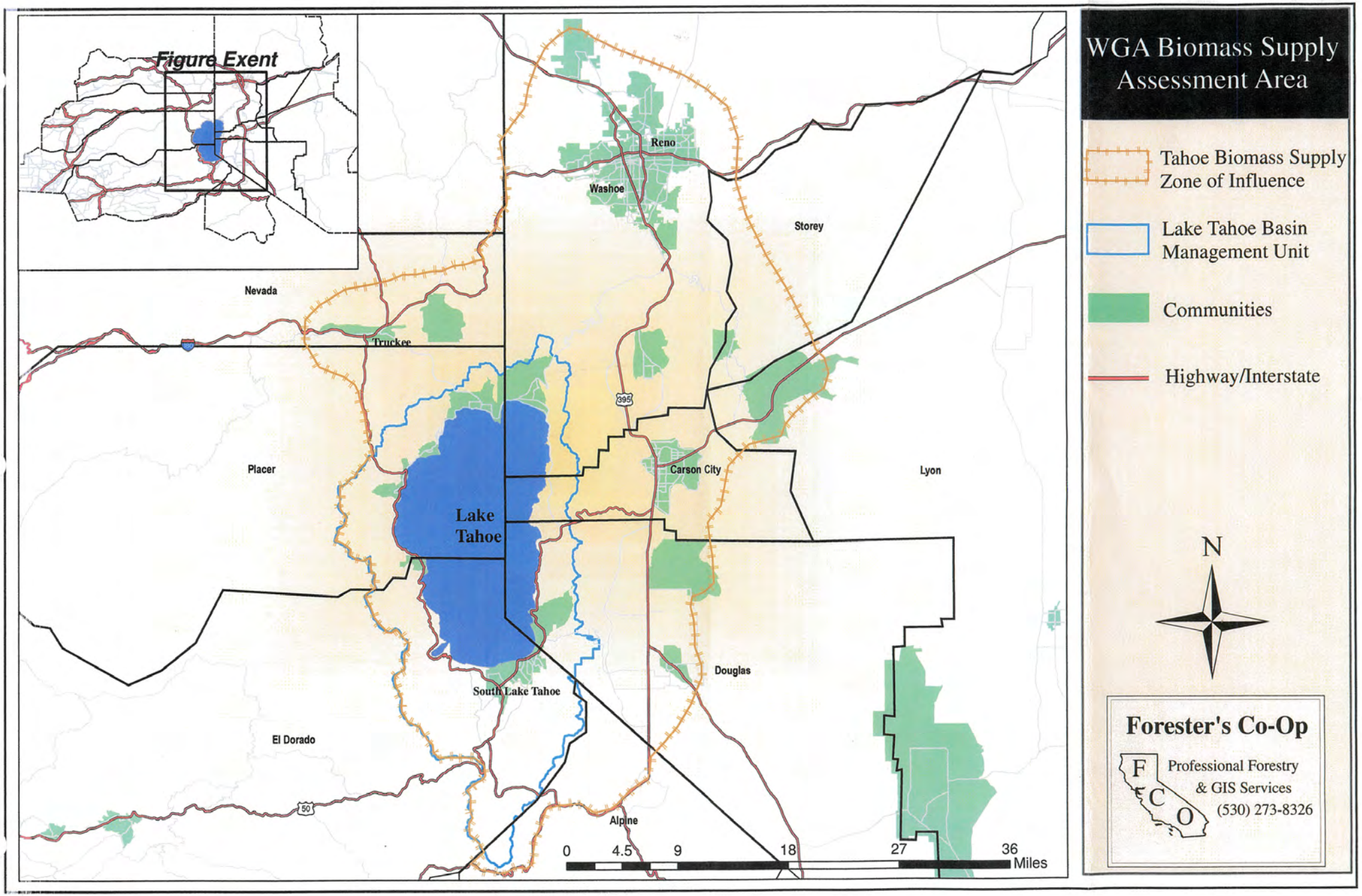
Figure Exent
Reno
Washoe
Storey
Nevada
Truckee
Placer
Lake Tahoe
Carson City
Lyon
Douglas
South Lake Tahoe
El Dorado
Alpine
0 4.5 9 18 27 36
Miles
WGA Biomass Supply Assessment Area
Tahoe Biomass Supply Zone of Influence
Lake Tahoe Basin Management Unit
Communities
Highway/Interstate
N
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2 Proven and Available Woody Biomass Supply - The portion of 1, above, that has been inventoried and has a current commercial CEQA or NEPA permit allowing for its removal and use as a biomass resource.
3 Transient and Available Woody Biomass Supply - The portion of 1, above, that transits through the region via trucks or rail that is not commercially obligated within the region.
4 Commercially Transacted Woody Biomass within the region based on interviews with supply, transport, and utilization businesses for the past two years.
5 A delivered market price range of $10/BDT to $50/BDT.

Woody biomass utilization is nothing new in the Tahoe Basin. This material has been commercially transacted throughout the region for many years. Using the above criteria, collected project data was screened and summarized to determine the actual woody biomass volumes that are readily available at a market price between $10/BDT and $50/BDT within the Tahoe region.

From our survey of urban wood suppliers and users of biomass materials, as well as a review of the most current data from the California Integrated Waste Management Board (CIWMB), California Department of Forestry and Fire Protection (CALFIRE), United States Forest Service (USFS), and the recent Mater Engineering Coordinated Resource Offering Protocol (CROP) assessment, current estimates of annual total woody biomass available within the Tahoe Region range between 129,000 BDT at $50/BDT and 55,000 BDT at $10/BDT delivered market price. Dynamic woody biomass market prices exert the greatest influence over the annual woody biomass supply availability within the region. Currently, there are three major uses of biomass within the region, including:

- Alternative daily cover (ADC) at landfills under regulations of the California Integrated Waste Management Board (CIWMB)
- Biomass power plant fuel
- Organic composting for nursery and landscape usage

ADC biomass material is used as a means to cover the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging. The CIWMB requires that ADC biomass materials be processed so that they do not allow gaps in the exposed landfill face. Power plant biomass fuel commands the highest value, while composting of green waste (grass clippings and tree/shrub trimmings) occupies the lower value spectrum for biomass in the region. Public/private timber harvest biomass and secondary wood-processing biomass offers the cleanest, most uniform source of woody biomass material that commands the highest delivered market value. Lawn/yard waste and construction woody biomass contaminated with paints and nails often have a net negative value due to disposal fees. Only ADC and composting biomass usage qualify for diversion credits to municipally-operated landfills under CIWMB regulations. CIWMB must approve waivers in order to receive diversion credits for more than ten percent of waste stream-generated biomass as fuel for electric power production. Coincidentally, it is the CIWMB that enforces stiff fines on municipalities that do not achieve the waste diversion requirements set for each landfill by the CIWMB. As for elsewhere in California, such CIWMB regulations inhibit the expanded use of waste stream-generated biomass for renewable energy production in the Tahoe Region. The balance of biomass material that is not transacted in traditional markets is burned, buried, neglected or, in some cases such as Fire Safe Council defensible space projects, it is ground or chipped on site for erosion control purposes. Figures #1 and #2 below illustrate project findings for two modeled delivered market prices for the availability of woody biomass within the Tahoe Assessment Area.

Figure #1

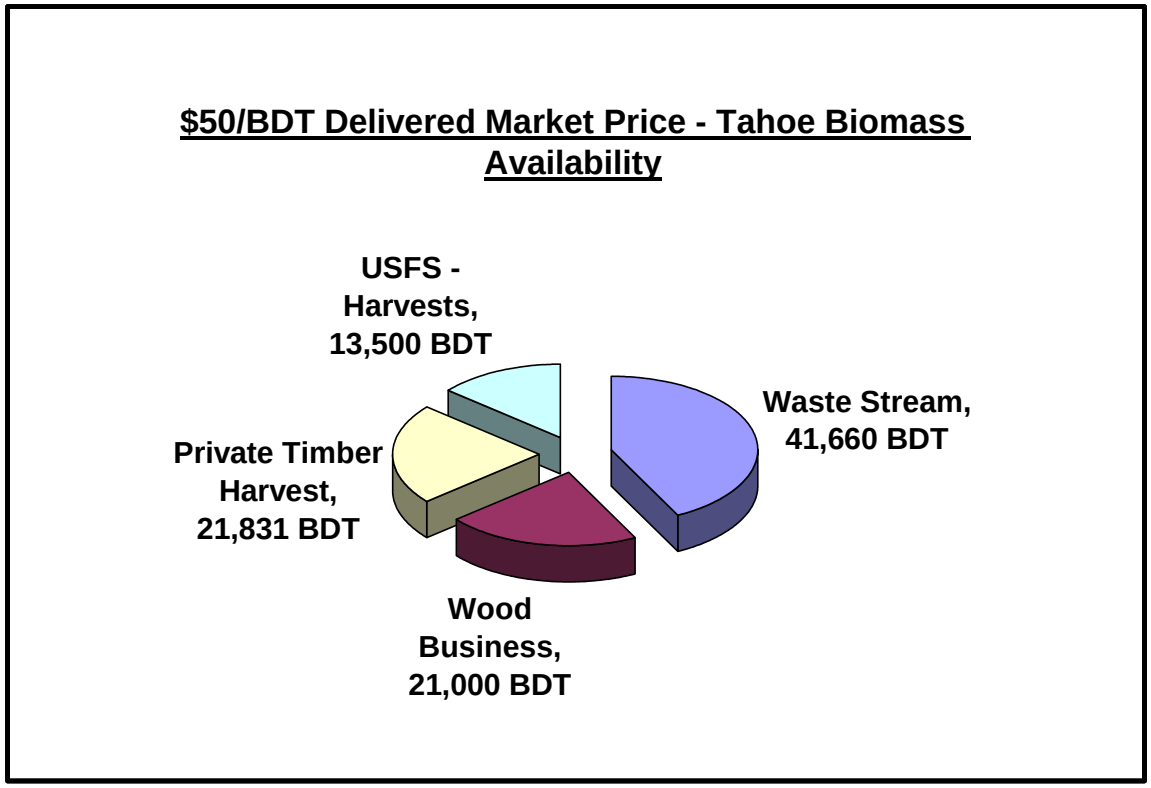
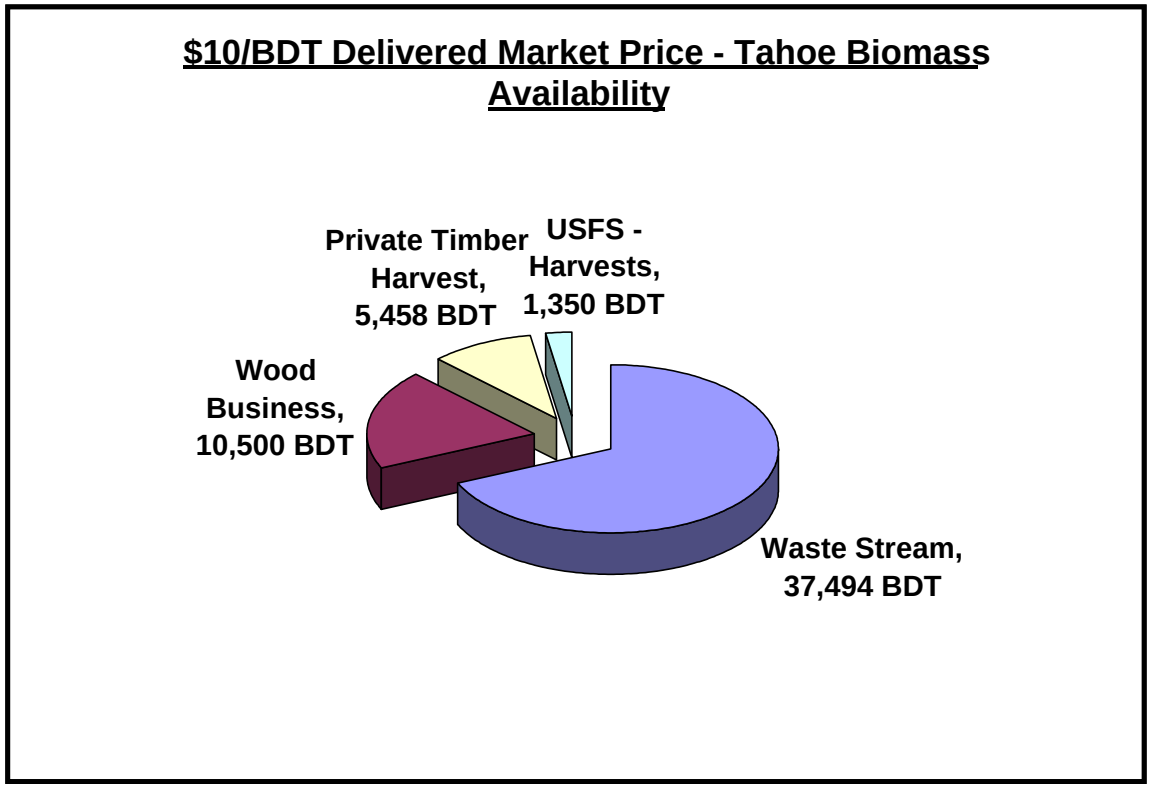
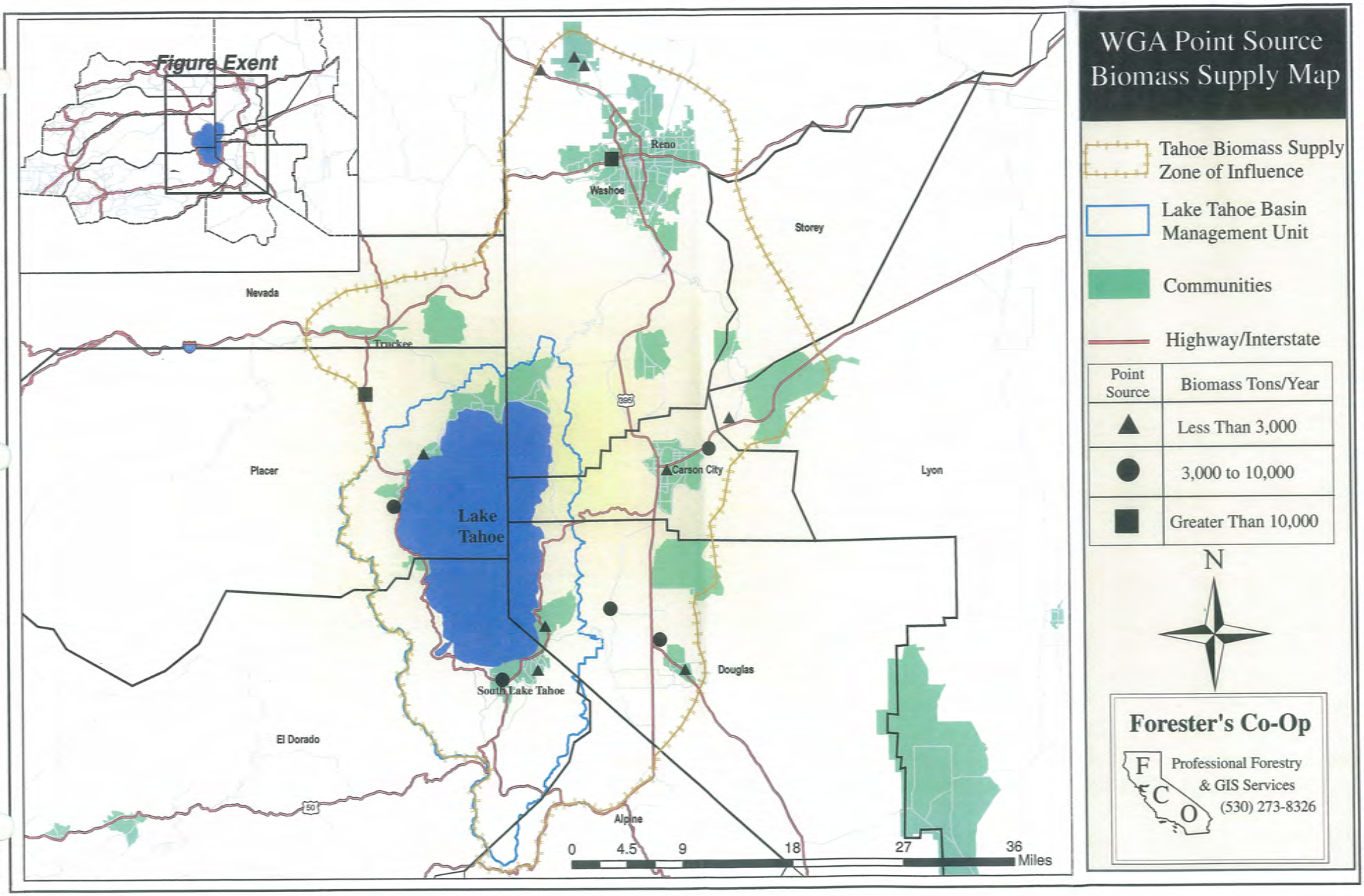


Figure #2



The two Biomass supply model maps on the following pages offer a geographic view of the regional supply picture. The "Point Source Biomass Supply Map" illustrates the important locations of wood business and waste stream biomass supply locations. The "Non-Point Source Biomass Supply Map" illustrates the important locations of permitted private timber harvest biomass supply locations. These models, used in conjunction with the USFS data, provided for planned and future biomass harvest operations in three regional national forests (Tahoe National Forest, the Lake Tahoe Basin Management Unit, and Toiyabe National Forest). USFS data for the project was obtained via material provided by the USFS to Mater Engineering for a recent CROP analysis. Regrettably, data was unavailable from the Nevada State Forestry Department for private land biomass inventories, annual harvest, or market transactions within the State of Nevada.



WGA Point Source Biomass Supply Map

Tahoe Biomass Supply Zone of Influence

Lake Tahoe Basin Management Unit

Communities

Highway/Interstate

Point Source	Biomass Tons/Year
▲	Less Than 3,000
●	3,000 to 10,000
■	Greater Than 10,000

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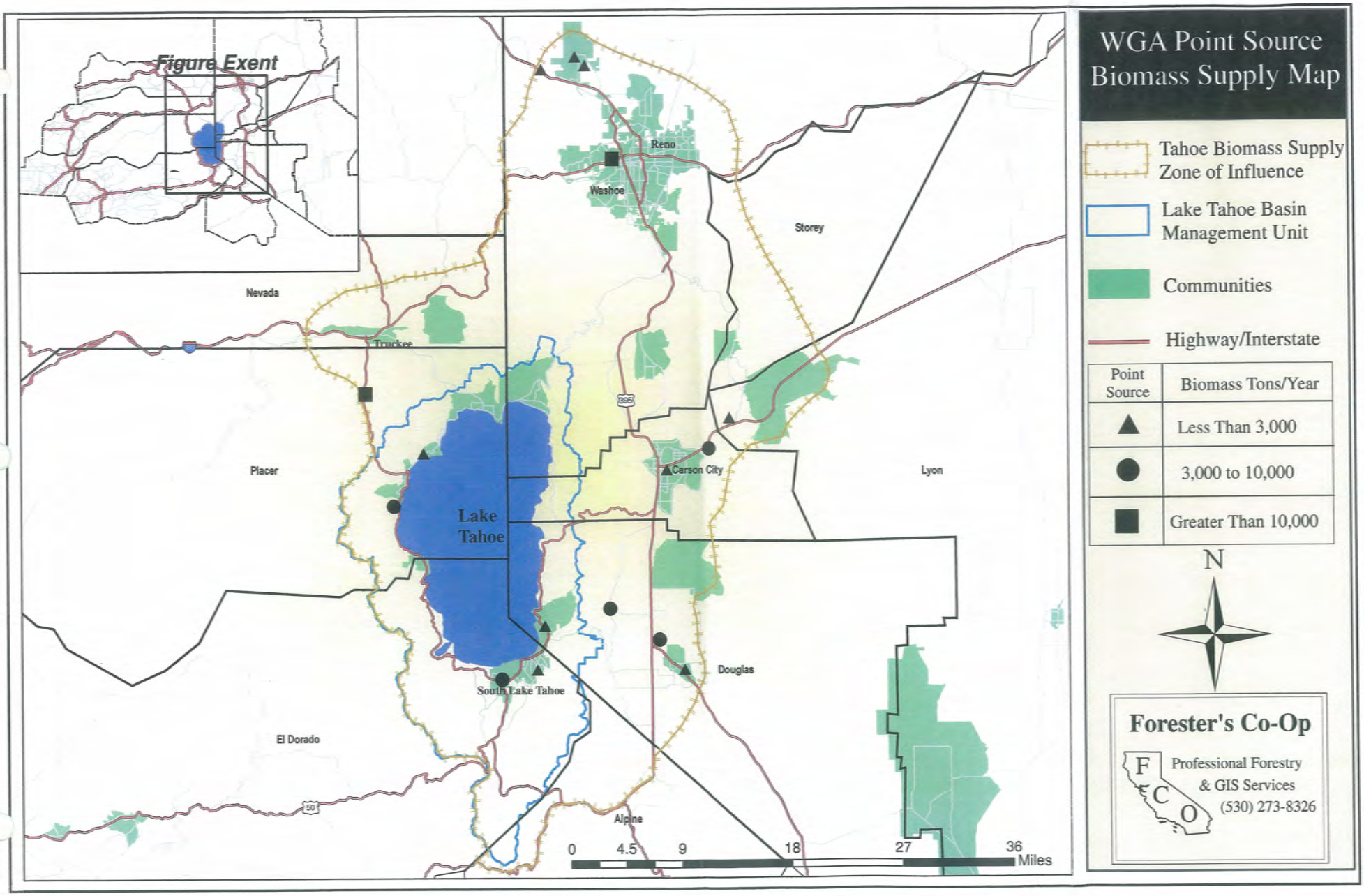

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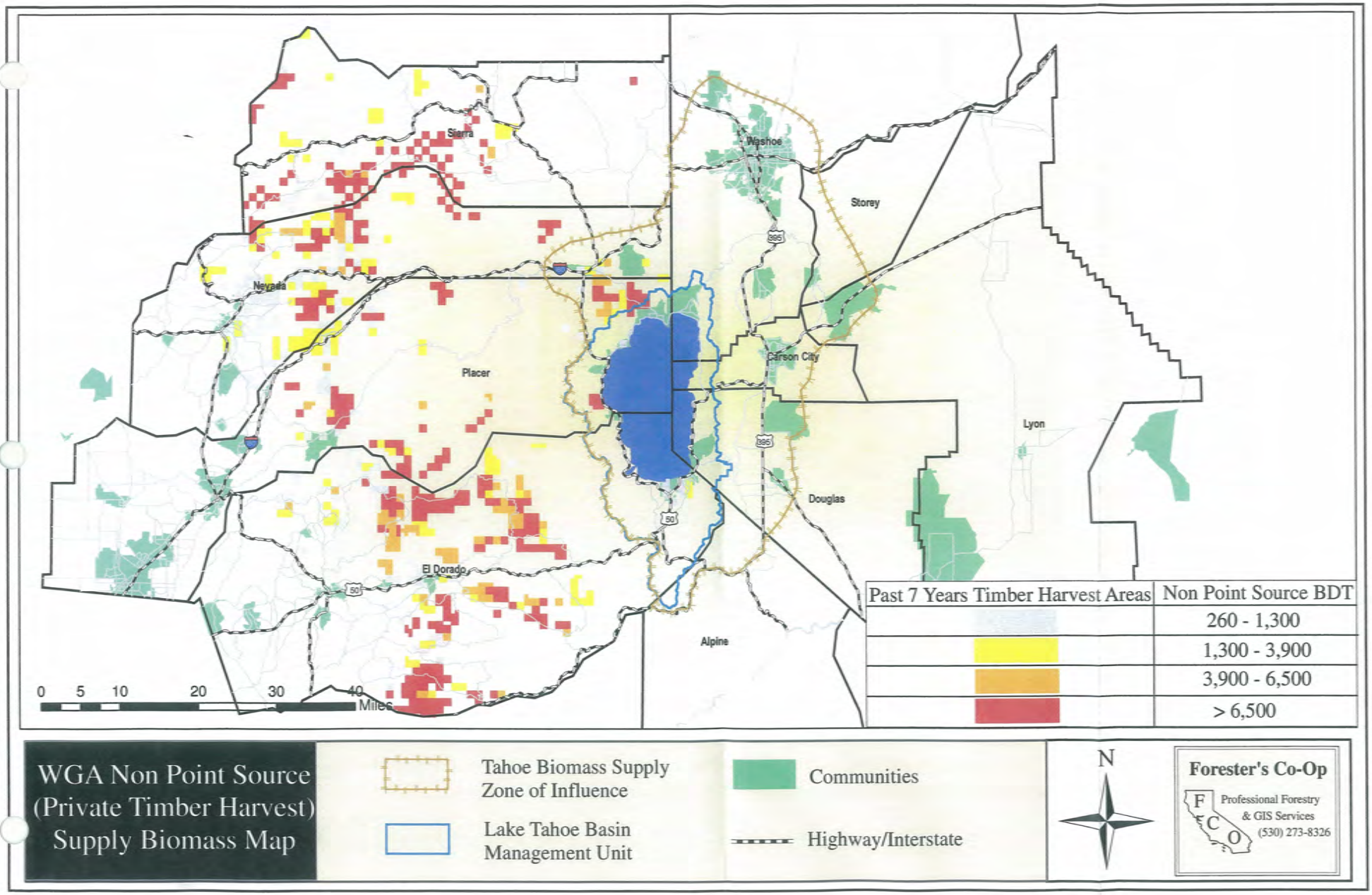
Sierra
Washoe
Storey
Nevada
Placer
Carson City
Lyon
Douglas
El Dorado
Alpine
395
50
0 5 10 20 30 40
Miles
Past 7 Years Timber Harvest Areas
Non Point Source BDT
260 - 1,300
1,300 - 3,900
3,900 - 6,500
> 6,500
WGA Non Point Source (Private Timber Harvest) Supply Biomass Map
Tahoe Biomass Supply Zone of Influence
Lake Tahoe Basin Management Unit
Communities
Highway/Interstate
N
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Analysis:

At a delivered market price of $10/BDT, our supply modeling analysis shows that USFS biomass supply is reduced by ninety percent, Private Timber Biomass Harvest is reduced by seventy-five percent, and wood business biomass supply is reduced by fifty percent from the supplies available at $50/BDT. These sources are so affected or influenced by price because of the costs to overcome one or more of the following:

1) Environmental permitting required prior to harvesting biomass on public/private timberlands;
2) Collecting or harvesting of the biomass in remote locations;
3) Processing or chipping, drying, handling and storage of biomass prior to sale to a market;
4) Seasonal operating and access restrictions;
5) Transportation of biomass to utilization market.

On the other hand, the least price sensitive biomass supply source that is consistently available is that which is derived from the waste stream. Waste stream biomass supplies are more likely to be affected by ADC demands and diversion credit limitations enforced by CIWMB than by market prices. When there is a surplus of waste stream biomass that can be exported from landfills, the material can offer an important supply for utilization businesses. Although waste stream biomass is generally of poor quality due to dirt and debris contamination, biomass businesses such as the Loyalton power plant depend on the steady flow of this material. Unlike seasonal timber harvest biomass supply sources, waste stream biomass provides a relatively steady flow of fuel even during winter months when other sources are scarce or inaccessible.

Long Term Considerations and Future Biomass Supply Trends

A frustration that arises when working with biomass supplies is that it is often clear that huge supplies of biomass lie in our forested areas and that much of that biomass seems to get "wasted" in controlled burns, as slash left on the ground, or as untreated hazardous fuels awaiting a catastrophic fire. However, making the economics work for this large supply is often very difficult. Processing, hauling and storing this biomass is expensive and,

given current technologies, it may continue to be economically infeasible to use it. In the case of hazardous fuels reduction, costs begin with initial treatment that can cost up to $2000 per acre in the Tahoe region (Bosworth 2006). Treatment produces an average of about thirteen tons of green biomass per acre in parts of the basin (McNeil Technologies Inc. 2003). Sample processing and hauling costs calculated in the McNeil study ranged from $28 to $35 per green ton in 2003. At fifty percent moisture levels, this would equate to $56 to $70 per bone dry ton. Returns from biomass energy are not likely to be able to pay the full costs in this type of scenario.

However, burning woody biomass can also produce valuable public benefit measured in other than purely economic terms. Biomass energy from forest thinning in the Tahoe Basin can be feasible when other socially desirable characteristics such as hazardous fuels reduction, forest health, cleaner energy production, lower carbon emissions and so forth are considered. Such benefits can justify government actions that lower hazardous fuel supplies, pay premiums for biomass energy or subsidize capital investments. New technologies, such as small mobile facilities, may eventually make it possible to efficiently use more of the resources created by forest thinning operations.

Forest-derived biomass, whether removed from public or private forest ownership, is not intensively managed for increased production because it is currently considered to be of marginal value. The biological forest accumulation of biomass in the region increases at a compound rate of expansion of six percent per year. The forest biomass that is annually harvested and produced in the region represents less than two percent of the annual growth rate. The biomass that is removed is as a by-product of some other objective such as forest fire hazard reduction or a green saw-log timber sale. Timberland managers have other options to treat biomass generated through forestry practices and generally chose the lowest cost option to remove or treat biomass on site. Consequently, there is no incentive for forest managers to invest in increasing the biomass production of woody biomass removed from forest lands. Future forest-derived biomass supply will tend to diminish as a part of total biomass supply in future decades unless new higher value markets are created to sustain an increase in the production of this material.

Waste stream-derived and wood business-derived biomass are heavily regulated resources from which future supply proportions can be expected to increase. Sorting and handling technologies for trash and wood by-products have been developed that increase the available biomass production from these sectors. A typical "Material Recycling Facility" (MRF) such as the one located at the Tahoe-Truckee disposal site, hand separates wood, cardboard, and paper waste from solid waste. This facility is indicative of the management intensity needed for effective recovery of biomass from this sector. Waste stream biomass production is a direct reflection of population growth and education of the public in the benefits of recycling. The population in and around the Tahoe Basin assessment area has increased beyond the national average over the last ten years; there is more wood and green waste available now than ten years ago due to that increase in population. Concurrent with the population increase has been increased promotion of materials recycling. This education aids wood and green waste recovery for alternative uses. Therefore, as population and education increase over the next twenty years, the quantity of the waste stream-derived biomass production will correspondingly increase. An estimated three percent increase in biomass supply every five years can be expected from these two sectors.

Task A – Collection of Biomass Inventory and Analysis of Data
Sub-Task 2 – Forecast the demand for electrical energy by industrial sectors.

In Task A - Sub-task 2, the Nevada, California and Tahoe Region energy supply and demand trends are compared with national trends, and the place of biomass and wood energy in these regional energy profiles is examined.

Renewable and Biomass Energy Consumption in Nevada and California

The Energy Information Administration develops state-level estimates of total energy consumption and energy consumption by source. The estimates in this section are for *all* primary energy use including transportation and production of electricity. Primary energy used in the production of electricity is counted towards consumption totals in the state where the electricity plant is located. For example, for the purposes of these estimates, a wood biomass plant in Loyalton, CA would consume energy in California only even if electricity produced at the plant was later sold to Nevada customers. Energy is generally quantified in British Thermal Units or BTUs.

As shown in Table 1**,** total energy consumed in California in 2003 was estimated to be 8,130 trillion BTU. Of this amount, about 159 trillion BTU were estimated to be from biomass sources. This was over six percent of all biomass energy consumed in the United States. Nevada was estimated to consume a total of 654 trillion BTU of which 3.3 trillion BTU was biomass energy. The proportion of total energy consumption using any type of renewable energy (including biomass, hydroelectric, solar, geothermal and wind power) was estimated to be 10.7%, 7.1% and 6.0%, respectively, for California, Nevada and the United States. Biomass energy was the source of forty-three percent of total renewable energy consumed in the United States (U.S.) as a whole, but only percent of renewable energy consumption in California and seven percent in Nevada.

Figures 3, 4 and 5 compare the share of energy consumption by source in 2003 for California, Nevada and the U.S. Biomass energy was estimated to make up 2.0%, 0.5% and 2.6% of total energy consumed in California, Nevada and the United States, respectively. In

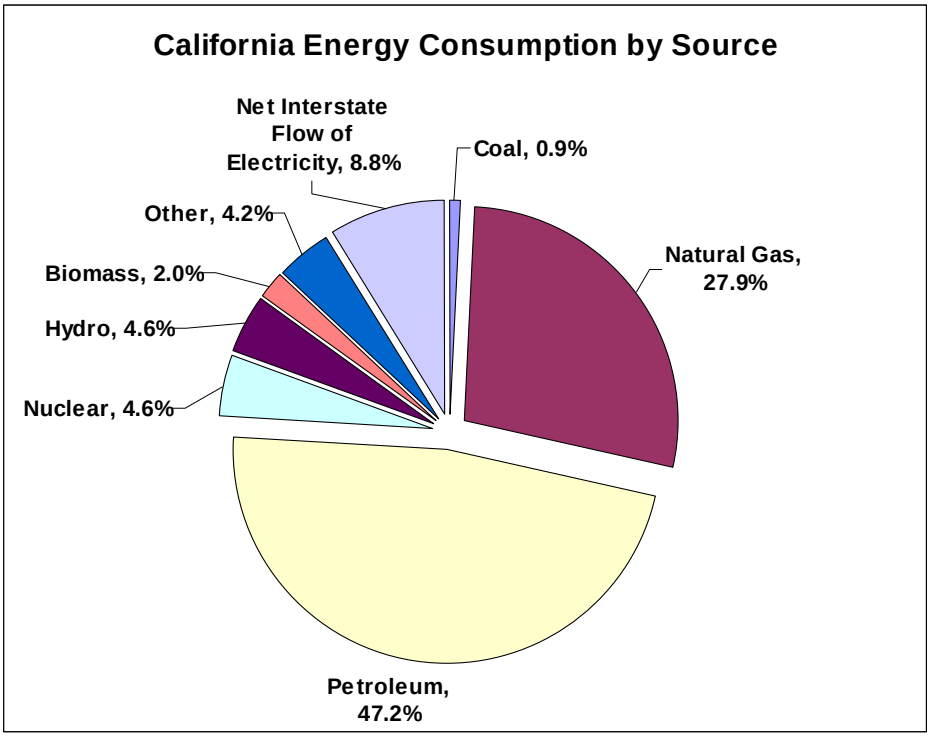
California, energy produced from biomass was a larger share of total energy use than energy produced from coal, according to Energy Information Administration estimates. The share of energy use produced from coal was very low for California at 0.9% versus 22.6% for the nation as a whole. A portion of this difference can be explained by California's net import of electric power. The share of energy use from petroleum sources was much higher in California than the nation as a whole at 47.2%, compared to 39.6% for the national average.

Table 1. Energy Consumption Estimates by Source, 2003.

State	Hydro-electric	Biomass	Other Renewable	Total Renewable	Total Energy Consumption	Renewable Share of Total Consumption	Biomass Share of Total Renewable
	Trillion BTU					%	
California	372.5	158.6	341.5	872.6	8,130.30	10.7	18.2
Nevada	18	3.3	25.2	46.5	654.2	7.1	7.1
United States	2,824.50	2,573.40	530.6	5928.5	98,605.20	6.0	43.4

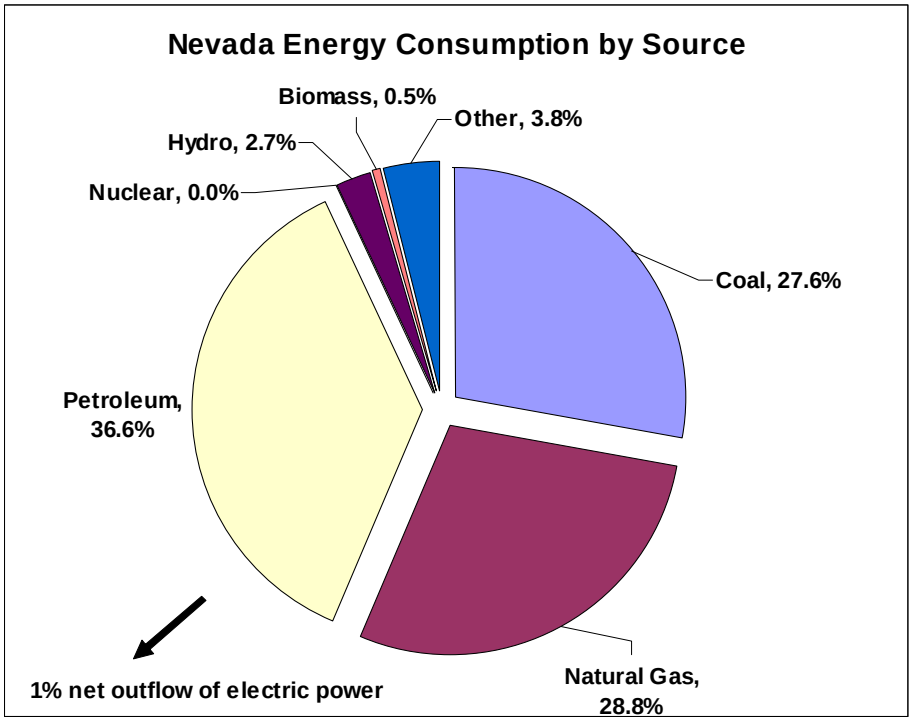
Source: "Table S3. Energy Consumption Estimates by Source, 2003", State Energy Consumption, Price and Expenditure, Energy Information Administration and UCED.

Figure 3. California Energy Consumption by Source



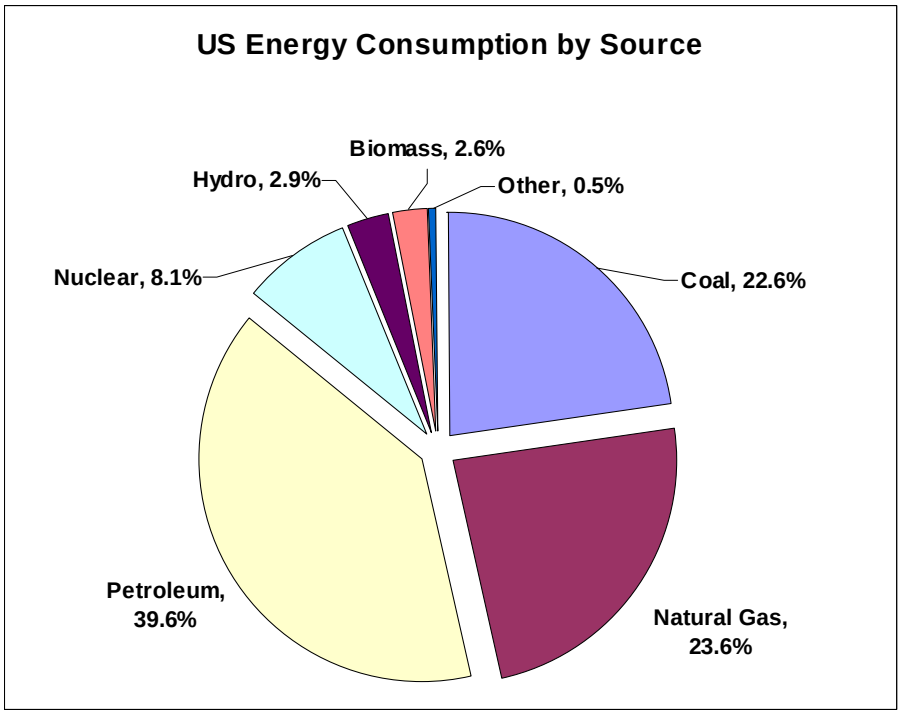
Source: "Energy Consumption Estimates by Source, 2003", State Energy Consumption, Price and Expenditure, Energy Information Administration and UCED.

Figure 4. Nevada Energy Consumption by Source



Source: "Energy Consumption Estimates by Source, 2003." State Energy Consumption, Price and Expenditure, Energy Information Administration and UCED calculations.

Figure 5. United States Energy Consumption by Source



Source: "Energy Consumption Estimates by Source, 2003." State Energy Consumption, Price and Expenditure, Energy Information Administration and UCED calculations.

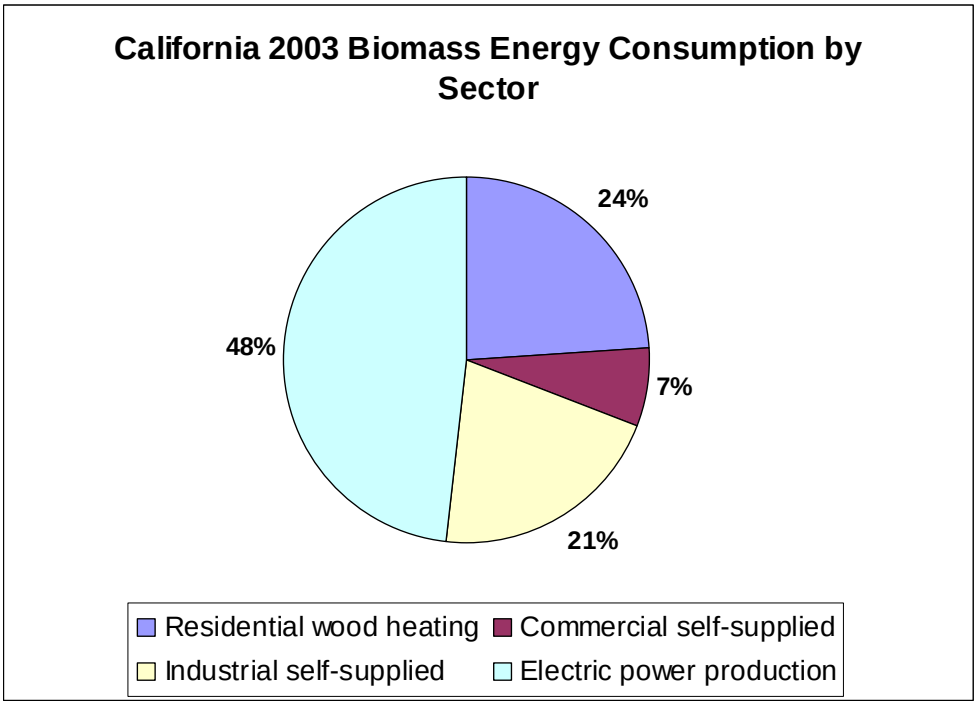
The high use of energy from petroleum sources may be because California uses the lowest amount of electrical energy per capita in the nation, partly because of climate and partly through support of energy conservation. This may increase California's share of energy used for transportation and, therefore, the share of energy use from petroleum sources. Nevada energy consumption by source is closer to the national profile except that (1) there is no nuclear component, (2) energy produced by other renewable sources is a higher share at 3.8% versus 0.5% for the United States as a whole, and (3) energy from biomass sources is lower at 0.5% versus 2.6% in the nation. Estimates in Table 2 and Figures 9, 10 and 11 do not include an estimated use of 51 trillion BTU and 3.6 trillion BTU of ethanol in California and Nevada.

Biomass Energy Trends in Nevada and California

Estimates of biomass energy consumption by major sector for California are shown in Figure 6. The estimates do not include ethanol consumption. About a quarter of biomass energy is wood used for home heating. The largest share of biomass energy consumption in California was forty-eight percent or 76.6 trillion BTU used to produce electrical energy. About thirty percent of biomass energy consumption was produced for internal use by commercial, government or industrial sectors.

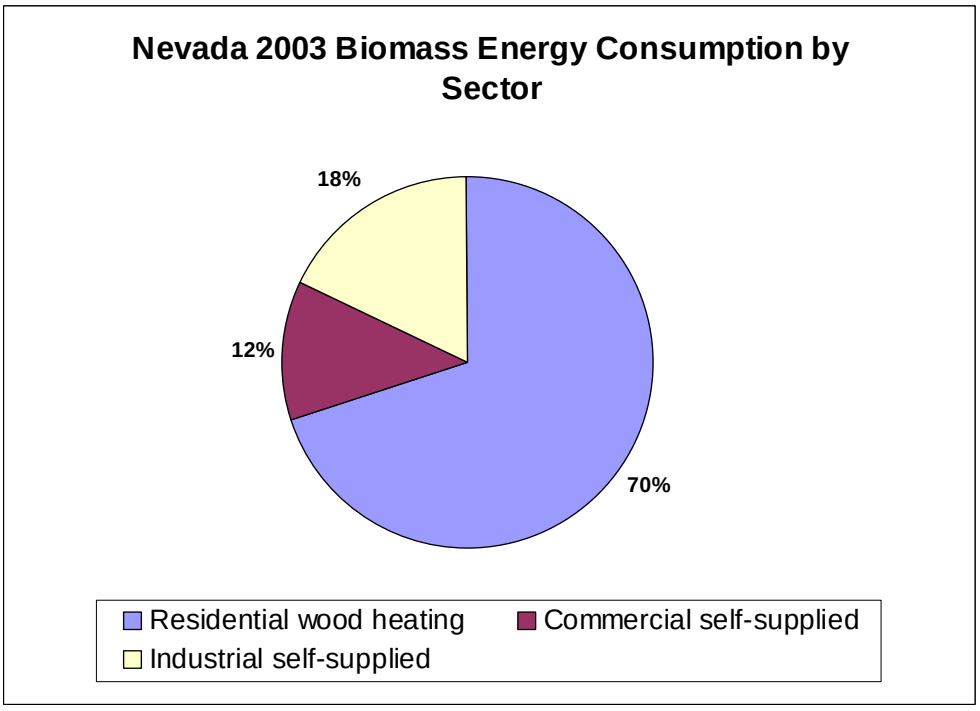
In Nevada, an estimated 2.3 trillion BTU of biomass energy, or seventy percent of the total was wood energy used to heat home residences. An additional thirty percent of the biomass energy was self-supplied electricity or heat used by commercial or industrial businesses or government entities. The consumption of 3.6 trillion BTU of ethanol is not included in the chart.

Figure 6. California Biomass Energy Consumption Estimates by End-use Sector, 2003



Source: Tables 7 to 12, State Energy Consumption, Price and Expenditure, Energy Information Administration and UCED chart.

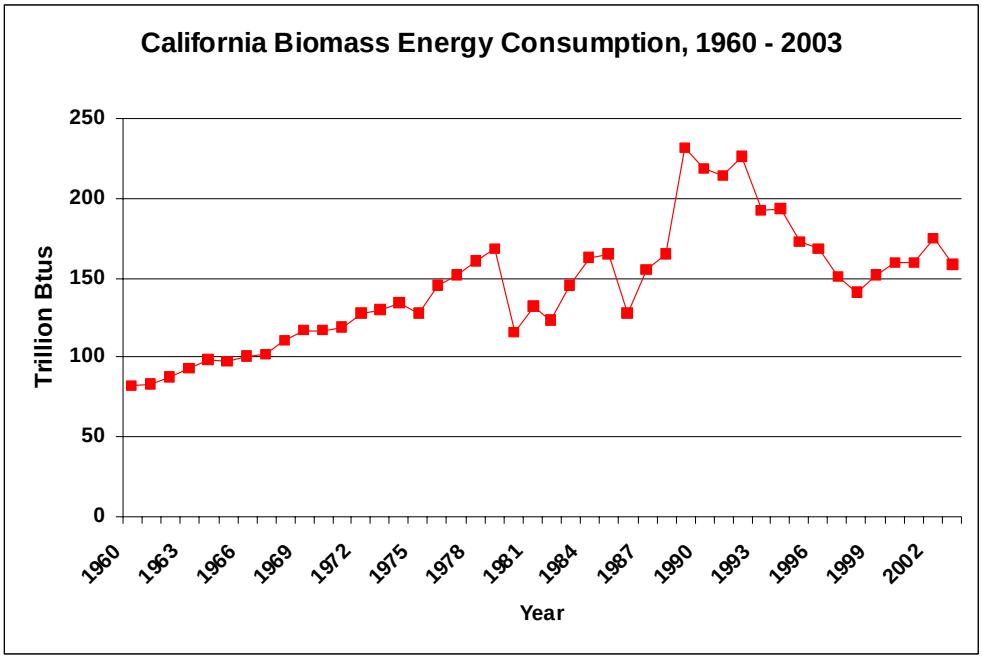
Figure 7. Nevada Biomass Energy Consumption Estimates by End-use Sector, 2003



Source: Tables 7 to 12, State Energy Consumption, Price and Expenditure, Energy Information Administration and UCED chart.

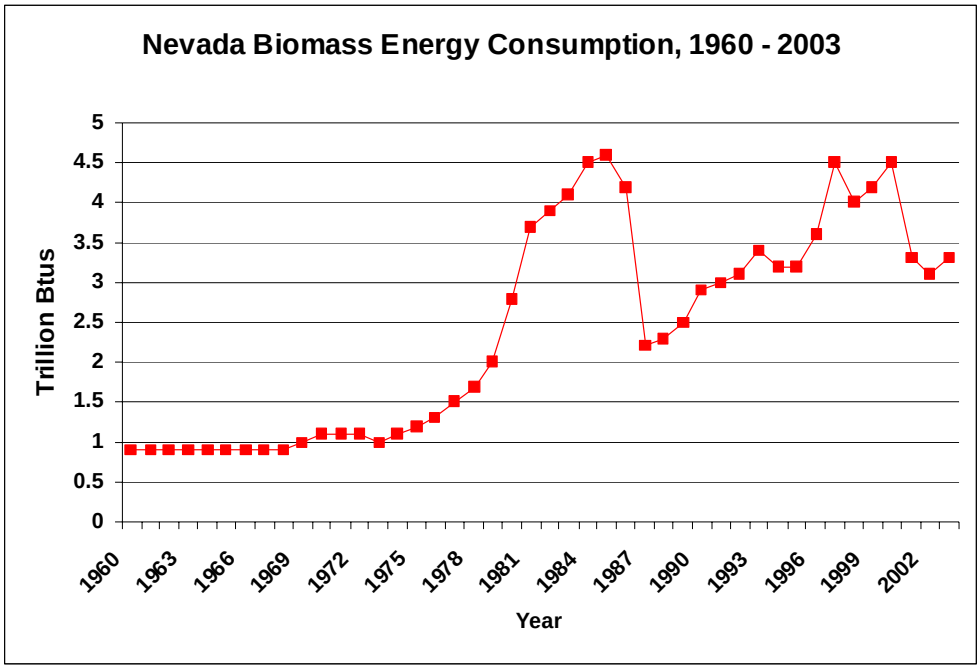
The Energy Information Administration also has constructed time series estimates of total energy consumption by source at the state level (see Figures 8 and 9). The use of biomass energy, especially wood, was at historic lows in the 1960's and 1970's. High oil and gas prices during the oil crises of 1973 and 1974 renewed interest in residential wood heating and in paper industry use of wood residuals for on-site heat and power. In 1978, the Public Utility Regulatory Policies Act was passed. This bill guaranteed that nonutilities generating power would have a market for that power, creating a better incentive structure for small biomass energy plants. California biomass took-off in the 1980s, in part in response to policies that guaranteed power purchase rates with an escalation clause. As California biomass plant capacity rose, the price for biomass feedstocks increased which, along with expiration of the favorable guaranteed rates contracts, eventually produced a crash in the California biomass industry. By 1995, half of the California biomass plants had closed (Energy Information Administration 1995).

Figure 8. California Biomass Energy Consumption Estimates, 1960 – 2003.



Source: "Energy Consumption Estimates by Source, Selected Years, 1960-2003, California.", State Energy Consumption, Price and Expenditure, Energy Information Administration and UCED chart.
Notes: In 1989, more extensive coverage of renewable energy sources creates a discontinuity in the time series between 1988 and 1989. Ethanol is not included in this series.

Figure 9. Nevada Biomass Energy Consumption Estimates, 1960 – 2003.



Source: "Energy Consumption Estimates by Source, Selected Years, 1960-2003, Nevada", State Energy Consumption, Price and Expenditure, Energy Information Administration and UCED chart.
Note: In 1989, more extensive coverage of renewable energy sources create a discontinuity in the time series between 1988 and 1989. Ethanol is not included in this series.

Renewable Electric Energy Generation in California and Nevada

In the section above, we looked at the picture for all energy uses and sources. In this section, we look at energy use and source for electrical energy only. Table 2 shows renewable electric energy generation by energy source for California, Nevada and the United States. The State of California is the top producer (by amount produced) in geothermal, solar, wind and wood/wood waste and other biomass energy production. It produces the fifth largest amount of energy from municipal solid waste and landfill gas, and it is the second highest producer of hydropower after Washington State. It is also the second highest producer of total renewable energy after Washington State, producing an estimated seventeen percent of total renewable electricity generated in the United States. Nevada is the second highest producer of geothermal energy in the nation. After the new Nevada Solar One and Solar Star projects go on-line sometime this year, Nevada will be the number one state for per capita solar energy production (Nevada Power website).

Table 3 shows estimated market shares of total electricity generation for California, Nevada and the United States in 2003. Renewable energy generation made up over thirty-one percent of capacity in California in 2003 and over eight percent in Nevada.

Table 2. Total Renewable Net Electricity Generation by Energy Source and State, 2003

State	Geothermal	Hydroelectric	MSW / Landfill Gas	Other Biomass	Solar	Wind	Wood / Wood Waste	Total
	(Thousand Kilowatt hours)							
California	12,981,763	36,370,703	1,737,793	753,785	533,606	3,895,431	3,880,037	60,153,118
Nevada	1,065,711	1,756,705						2,822,416
Total U.S.	14,424,231	275,806,329	20,179,386	3,556,287	534,001	11,187,466	37,529,099	363,216,799

Source: "Total Renewable Net Generation by Energy Source and State, 2002 and 2003.", Renewable and Alternate Fuels, Energy Information Administration.

Table 3. Renewable Market Share of Net Generation by State, 2003

State	Total State Generation	Percent Renewable	Percent NonHydro Renewable
	(Megawatts)	(%)	(%)
California	192,788,542	31.2	12.3
Nevada	33,194,888	8.5	3.2
Total U.S.	3,883,185,205	9.4	2.3

Source: "Renewable Market Share of Net Generation by State, 2002 and 2003.", Renewable and Alternate Fuels, Energy Information Administration.

Renewable Energy Portfolio Standards for California and Nevada

Renewable energy portfolio standards (RPS) have been adopted by twenty states. The standards require that electricity providers obtain a given percentage of their energy from renewable sources by a certain date. Nevada and California both have ambitious RPS (Energy Efficiency and Renewable Energy 2006).

In Nevada, the portfolio requirement requires a three percent increase every two years in percentage of electrical energy produced with renewable technologies or through energy savings from increased efficiency. By 2015, energy supplied through renewable sources or new utility subsidized energy savings must make-up twenty percent of total sales. These requirements currently apply to Nevada energy sales of Sierra Pacific Power, Nevada Power and Avista Energy. The utilities may buy portfolio energy credits or "PECs" from renewable energy producers to meet the standards. The Temporary Renewable Energy Development (TRED) Program has been formed by the Public Utilities Commission to help

establish renewable projects. The program facilitates prompt payment to renewable energy project investors to encourage project completion (North Carolina Solar Center & Interstate Renewable Energy Council 2006).

In California, legislation was passed in 2002 requiring retail sellers of electricity to increase their percentage of purchases of renewable energy by two percent per year beginning in 2003 to reach a goal of purchasing twenty percent of their electricity from renewable sources by 2017. A perception that significant progress had already been made towards this goal caused the California Energy Commission and Public Utilities Commission to increase the goal to twenty percent by 2010 and thirty-three percent by 2020. As a part of the California program, certain renewable energy producers may be eligible for supplemental energy payments (North Carolina Solar Center & Interstate Renewable Energy Council 2006).

Biomass is defined as one of the renewable energy technologies that fulfill the RPS in both Nevada and California. In California, certain restrictions apply to biomass energy production eligibility for RPS credit and for supplemental energy payments. The fuel used is restricted to agricultural wastes, solid waste materials and wood harvested as part of an approved timber harvest plan or for the purpose of forest fire fuel reduction or stand improvement. In addition, the fossil fuel use of the operation cannot exceed a maximum of five percent of all fuel used, and facility use may not exceed two percent of total energy input (California Energy Commission 2007). In Nevada, a meter approved by the Public Utilities Commission is installed, and quarterly certificates for PECs are issued to the producers of the biomass energy based both on electricity produced and any heating fuel displaced by wood heat energy in the case of cogeneration facilities. The PECs can then be sold to the highest bidder (Harris 2007).

Progress towards RPS Goals in Nevada and California

Tables 2 and 3 do not measure progress towards RPS goals. Given imports of electrical power into California and exports out of Nevada and several other factors, total generation or generation capacity does not represent where the states stand in relation to the renewable portfolio standards (RPS) each state has adopted. RPS apply to retail sales figures only, and how this relates to energy consumption at the state level is somewhat complex. Also, for

both Nevada and California, energy produced with large-scale hydroelectric plants does not count towards the RPS. Different calculations are necessary for the purposes of roughly estimating how close the states are to RPS goals. According to the California Energy Commission, about 10.2% of electricity used in the state in 2004 was produced with renewable resources meeting RPS goals, and an additional 14.9% was provided by large-scale hydroelectric power. In Nevada, an estimated 6.5% of electricity used in 2006 was produced with renewable resources that count towards RPS goals.

Wood Biomass Energy in Nevada and California

Nevada currently has one biomass energy project in a White Pine County elementary school. The project provides about two billion BTU per year in heat energy and is eligible for PEC certificates in Nevada. Another biomass energy project has just begun operations at the Northern Nevada Correctional Center in Carson City. It is a larger project that is expected to use about 16,000 tons of wood chips per year. This project is the only one within the Nevada Tahoe region. The City of Sparks has a plant that uses methane produced from the Reno-Sparks Water Reclamation Facility.

In California, a total of twenty-eight wood biomass plants with a capacity of 680 MW (megawatts) are still in operation, down from a total of seventy with 1600 MW of capacity in the peak year of 1985.

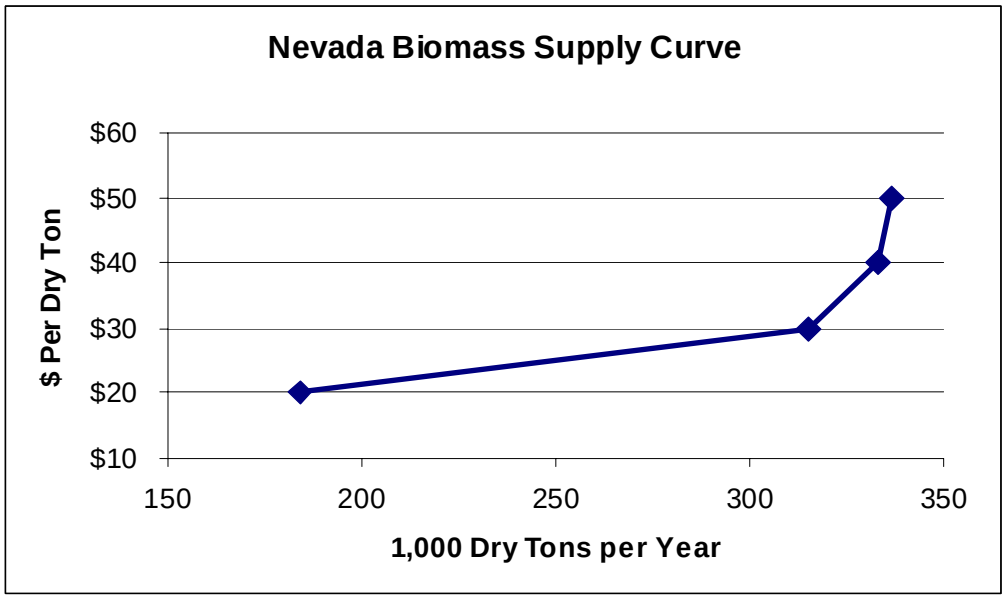
California Roadmap Goals for Biomass

California executive order S-06-06 issued by Governor Schwarzenegger in April 2006 sets out specific goals for the State's biomass production. By 2020, the State goal is to increase California biofuel production enough to meet seventy-five percent of its own demands and twenty percent of renewable electricity generation. The California Biomass Collaborative has determined that the State has the potential to triple biomass electricity generating capacity and increase biofuels production one hundred times the current levels using resources now feasibly available with some increase in the percentage of crops used for energy production. Biomass electricity capacity could expand to 2,500 megawatts (California Energy Commission 2006).

Supply Curves for Biomass

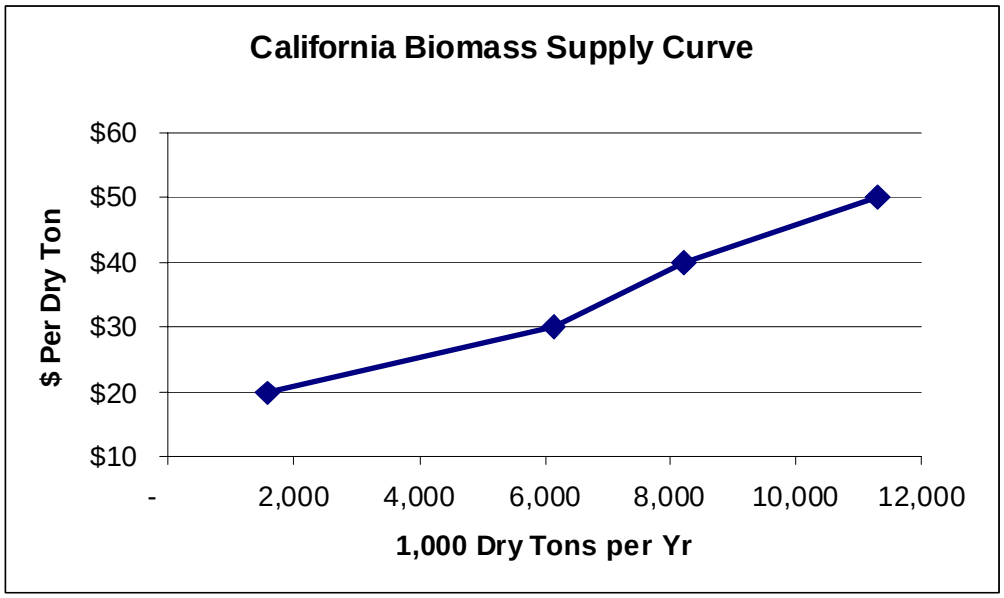
Figures 10 and 11 demonstrate how biomass supply availability changes according to the price it can command. The data in the figures is in 1999 prices and for total biomass including forest residues, urban wastes, agricultural wastes, switch-grasses and mill wastes. It suggests that, if California prices for biomass increase one hundred fifty percent from $20/delivered BDT to $50/delivered BDT, biomass feedstock availability would increase over six hundred from about 1,600,000 BDT to 11,300,000 BDT. For the same price increase in Nevada, biomass feedstock availability would increase only about eighty percent from 184,000 BDT to 337,000 BDT. Availability may not be as responsive to price in Nevada because limited water supplies constrain options for expansion of supply. All of the goods and inputs discussed in this report will be responsive to price.

Figure 10. Nevada Biomass Supply Curve



(Walsh et al. 2000), UCED Chart

Figure 11. California Biomass Supply Curve



(Walsh et al. 2000), UCED Chart

Demand and Supply of Biomass Energy: Some Basics

There are some basic principals of economics to keep in mind when considering the demand for and supply of biomass electricity. Economic theory would tell us that demand for biomass energy will depend on its price, the price of substitutes such as electricity or heat produced with coal, natural gas or fuel oil, consumer income and taste. A shift to electric vehicles would increase demand for electricity, while possibly decreasing demand for liquid fuels. Supply will depend on available technology, costs of inputs and the price for which the energy can be sold. In addition, government regulations at state, local, and federal levels regarding carbon taxes, air pollution, renewable sources, fire control and more can have a very significant effect on both demand and supply sides of biomass energy.

Tahoe Region Population and Employment Trends

In this chapter, the Tahoe region is defined as the aggregation of Sierra, Nevada, Placer, El Dorado and Alpine Counties in California and Washoe, Lyon, Storey, Carson City and Douglas Counties in Nevada. The largest population centers in the region are Reno-Sparks-Carson City on the eastern side of the Sierra Nevada Mountains in Nevada and Roseville-Rocklin-Lincoln on the western side in California. The two population centers are about one hundred fifteen miles apart on Interstate 80. Outside of these urban regions, the rest of

the area is more rural in nature, with lower population density and small population centers such as South Lake Tahoe, Tahoe City, Truckee, and Incline Village.

The Tahoe region on both the Nevada and California sides is experiencing much faster population growth than the national average. Table 5 shows historic and projected population for the region. In 1986, the ten counties had a population of about 623,000. By 2003, the population had increased to 1,078,000 or seventy-three percent. Woods and Poole project that population will increase to 1,677,000 by 2026 for a total increase of one hundred sixty-nine percent since 1986, as compared to a total projected increase of fifty-one percent over the same time period for the United States.

As seen in Figure 12, the Tahoe Region population has grown at an annual rate of 3.3% from 1986 to 2003, according to Woods and Poole estimates. The region is projected to grow more slowly over the next two decades at a rate of about 1.9% a year. In contrast, the United States as a whole grew at an annual rate of 1.1% over the period from 1986 to 2003 and is projected to grow at 1.0% a year over the next decades.

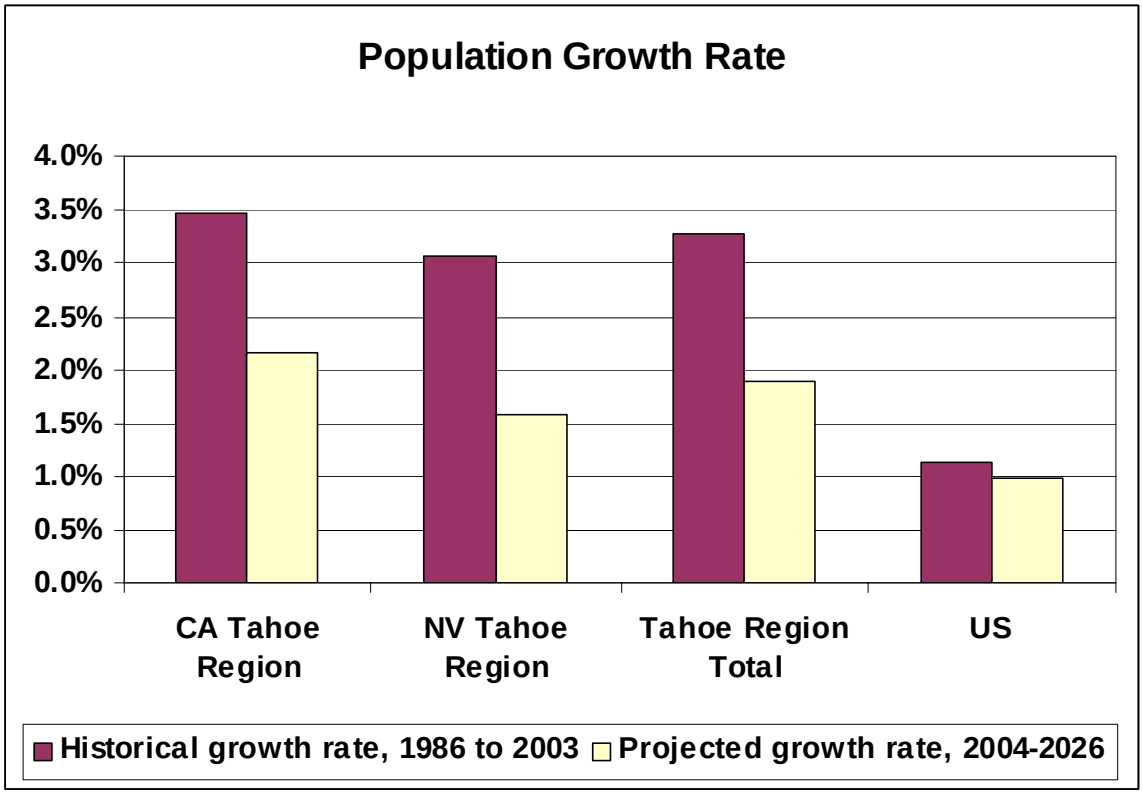
Total employment in the region has increased even faster than has population growth. Total employment increased by 3.8% annually over the period from 1986 to 2003 (see Table 7). Employment growth is projected to slow to 1.9% annual growth from 2004 to 2026, reaching over 1,000,000 in 2026 (see Table 6). Again, these were substantially higher growth rates than experienced and projected for the nation as a whole. All employment sectors in the region experienced growth over the period except for mining and the federal military. The largest numerical increase occurred in the service sector that experienced an employment increase of 105,500 from 1986 to 2003. The national service sector also expanded dramatically over this time period. The Tahoe region sectors experiencing the largest positive growth rate differential were manufacturing, wholesale trade, construction and the finance, insurance and real estate sectors. Increases in the service sector are projected to continue to be a major driver of employment, producing 152,000 jobs or forty-four percent of all new projected jobs from 2004 to 2026. The greatest differentials between regional job growth and national growth are projected to occur in manufacturing and wholesale trade sectors.

Table 5. Tahoe Region Historical and Projected Population, 1986 to 2026

	1986	1996	2003	2004*	2006*	2016*	2026*	Total growth, 1986-2026
	Thousands							%
CA Tahoe Region	316	454	564	581	614	769	930	**194%**
NV Tahoe Region	307	425	514	530	555	649	748	**143%**
Tahoe Region	623	879	1,078	1,111	1,169	1,418	1,677	**169%**
US	240,134	269,394	290,850	293,657	300,086	330,471	363,691	**51%**

Source: Woods and Poole, 2006 State Profile, State and County Projections to 2030, UCED aggregation.
*Projections

Figure 12. Comparison of Annual Population Growth Rates and Projected Growth Rates, Tahoe Region and US



Source: Woods and Poole, 2006 State Profile, State and County Projections to 2030, UCED.

Table 6. Employment by Sector, Tahoe Basin, Historical (1986, 1996) and Projected (2006, 2016, 2026)

Sector/Year	1986	1996	2006*	2016*	2026*
Total Employment	337,128	502,700	689,143	845,606	1,001,803
Farm	4,634	4,631	4,943	5,247	5,552
Agricultural Services	3,277	6,368	9,577	11,710	13,860
Mining	1,752	2,115	1,735	1,913	2,094
Construction	24,780	39,285	60,104	72,539	84,959
Manufacturing	23,983	38,559	42,683	49,651	56,523
Transport, Comm. & Util.	16,599	20,969	24,389	27,804	31,215
Wholesale Trade	10,334	20,049	24,398	31,027	37,608
Retail Trade	57,656	88,891	118,717	145,042	171,482
Finance, Ins. & Real Estate	30,082	40,462	75,805	90,661	105,482
Services	122,473	180,505	248,698	317,691	386,503
Federal Civilian Govt.	5,068	5,669	6,180	6,503	6,826
Federal Military Govt	2,180	1,992	2,075	2,010	1,942
State & Local Govt	34,310	53,205	69,839	83,808	97,757

*Projections
Data Source: Woods and Poole with UCED aggregation.

Table 7. Tahoe Region Projected and Historical Growth Rates in Workforce

Sector	Tahoe Historical 1986 to 2003	Tahoe Projected 2004-2026	U.S. Historical 1986 to 2003	U.S. Projected 2004-2026
	Compound Annual Growth Rate			
Total Employment	3.86%	1.93%	1.63%	1.37%
Farm	0.27%	0.58%	-0.55%	-0.02%
Agricultural Services	6.08%	1.91%	3.86%	1.66%
Mining	-0.26%	0.96%	-2.99%	1.06%
Construction	4.96%	1.78%	1.86%	1.38%
Manufacturing	3.14%	1.44%	-1.04%	0.35%
Transport, Comm. & Util.	2.03%	1.26%	1.63%	1.36%
Wholesale Trade	4.66%	2.25%	0.98%	1.09%
Retail Trade	3.92%	1.89%	1.70%	1.13%
Finance, Ins. & Real Estate	5.21%	1.70%	1.92%	1.18%
Services	3.72%	2.29%	3.18%	1.96%
Federal Civilian Govt.	1.08%	0.50%	-0.57%	0.28%
Federal Military Govt	-0.23%	-0.33%	-1.42%	0.06%
State & Local Govt	3.89%	1.73%	1.81%	1.36%

Data Source: Woods and Poole, UCED

Tahoe Region Electricity Consumption Trends

An estimate of 2005 electricity consumption for the ten-county Tahoe region is given in Table 8. The California Energy Commission has prepared as estimate of electricity

consumption by county for all California counties (California Energy Commission 2005). Total electricity consumption for the five California Tahoe counties was estimated at 4,634 million KWh. No county level data is available for Nevada. Nevada estimates for the Tahoe region were created by taking shares of the 2005 Public Utilities Commission of Nevada electricity consumption figures for the entire northern Nevada region (Hirsch 2007). Total electricity consumption in 2005 was estimated to be 5,227 million KWh for the Nevada side. Total electricity demand for the Tahoe region was estimated at 9,862 million KWh in 2005. Commercial and industrial use made up a larger proportion of consumption on the Nevada side at sixty-five percent of the total versus forty-eight percent of total consumption for the California side.

Table 8. Tahoe Region Electricity Consumption by County or Region in 2005

	Residential		Nonresidential		Total	
County	Number of Accounts	kWh (million)	Number of Accounts	kWh (million)	Number of Accounts	kWh (million)
ALPINE	1,077	8	171	9	1,248	17
EL DORADO	80,776	728	10,119	478	90,895	1,207
NEVADA	37,306	395	5,084	254	42,391	648
PLACER	136,296	1,258	18,003	1,480	154,299	2,737
SIERRA	1,927	15	356	10	2,283	25
Subtotal CA Tahoe Region	**257,382**	**2,404**	**33,733**	**2,231**	**291,116**	**4,634**
Nevada Tahoe Region*	**223,000**	**1,840**	****	**3,387**	****	**5,227**
TOTAL	**480,382**	**4,244**		**5,618**		**9,862**

Sources: UCED, (California Energy Commission 2005; Hirsch 2006)
*estimated using 2006 share for Washoe, Storey, Douglas, Lyon and Carson City as reported by Hirsch, personal communication. Accounts estimated using 2006 share for 2004 number of accounts.
**Currently no information on number of industrial customers

Existing Regional Electricity Demand Forecasts

Table 9 lists prominent features of some existing electricity demand forecasts for regions of California or Nevada. These forecasts are derived from structural models, general equilibrium models, or econometric models that take into account many different variables such as price forecasts, demand side management, consumer characteristics, and heating and cooling degree-days. The Energy Information Administration (EIA) Electricity Market Module (EMM) forecasts a 1.5% annual growth in demand from 2005 to 2030 for the California region. For the region containing Nevada, the EIA forecasts a somewhat higher growth rate in electricity demand of 1.8% per year. California Energy Commission 2006 to

2016 forecasts for areas near or containing the Tahoe counties ranged from 2.3% growth per year for the Sacramento area served by Sacramento Municipal Utility District (SMUD) to 1.25% for the area served by Pacific Gas and Electricity, an area that includes San Francisco. The Truckee-Donner region is included in the Other Planning Area that was forecast to increase at 1.25% a year. The most recent Public Utilities Commission of Nevada forecast for the northern Nevada region was a 2.68% annual increase in demand for the years 2005 to 2015, but the previous forecast from 2003 to 2013 had a much lower growth rate of 1.14% a year. The compound annual growth rates for all the forecasts listed in the table lie between these two estimates of 1.14% to 2.68% per year.

Table 10 gives projections of electricity demand specifically for the ten-county Tahoe region using the highest and lowest annual growth rate estimates in Table 9 and the estimates of Tahoe region electricity use for 2005 given in Table 8. Starting at 9,861 million KWh of electricity consumption per year in 2005 and carrying out the growth rates to 2026, the low estimate of demand in 2026 would be approximately 12,512 million KWh and the high would be about thirty-seven percent more at 17,184 million KWh.

Table 12 presents electricity demand projections specifically for the Tahoe region. Household demands were extrapolated by using Woods and Poole projections of number of households in the region with a per-Tahoe-household estimate of electrical consumption of 9,539 KWh per year. Commercial and industrial electricity consumption were extrapolated using per-employee electricity consumption data. According to this projection, electricity demand for the Tahoe region in 2026 would be 14,307 million KWh. The demand projection lies between the high and low estimates of 12, 512 KWh and 17,184 KWh per year in 2026 made using the existing forecasted growth rates for the overall region (see Table 8).

Electricity consumption per employee specifically for the five-county California Tahoe region for each two-digit-level NAICS sector is given in Table 11. Highest per-employee consumption of electricity was in the utility sector at 97,288 KWh per employee per year. The second highest per-employee electric use occurred in the manufacturing sector at 28,041 KWh per employee per year. The service sector tended to have relatively low electric energy

use. The lowest per-employee electricity use was for the construction sector that may primarily use different sources of energy. The prevalence of seasonal and part-time workers may also influence these per-employee estimates of energy consumption by sector.

Since estimated California Tahoe region average per-employee consumption was approximately seventy percent of the estimated average for Nevada and no information on energy use by sector was available for the Nevada Tahoe region, per-sector employee use was readjusted upward to be more representative of estimated energy use in the entire region. Further, a different aggregation was used than that presented in Table 11 so that per-employee estimates match Woods and Poole sectors. Woods and Poole projections of employment by sector were used to estimate total non-residential electricity use. By-sector projections were 3.5% lower than estimates made extrapolating per-employee average electricity use. This is because the two sectors Woods and Poole predicted to have faster than average growth, the service sector and the wholesale trade sector, both have below-average per-employee electricity consumption.

Table 9. Existing Regional Forecasts Comparison

Source	Region	Current Consumption (Year)	Historical Growth Rate (Time Period)	Projected CAGR Electric Consumption (Time Period)	Type of Model	Variables Used
California Energy Commission	Other Planning Area	4,743 GWh (2004)	2.41% (1980-2004)	1.30% (2006-2016 Base Case)	Structural model	Consumer characteristics (appliance saturations, dwelling size and age, income, demographics, utility bills), aggregated energy consumption data for nonresidential sectors by NAICS, fuel price projections, demand side management characteristics
California Energy Commission	SMUD	10,150 GWh (2004)	2.70% (1980-2004)	2.30% (2006-2016 Base Case)	Structural model	See above
California Energy Commission	PGE	101,147 GWh (2004)	1.75% (1980-2004)	1.25% (2006-2016 Base Case)	Structural model	See above
EMM from EIA	Northwest Power Pool	205.83 Billion Kilowatt Hours (2004 Total Sales)		1.8% (2005-2030)	General Equilibrium, Structural Models	Consumer characteristics and forecasts (end use services demanded, appliance saturations and turnover rates, dwelling type, size and location, income, persons per household), floor space, type of building for commercial, own-price projections, , energy use by industry, demand side management characteristics
EMM from EIA	California Region	249.96 Billion Kilowatt Hours (2004 Total Sales)		1.5% (2005-2030)	General Equilibrium, Modules	See above
Public Utilities Commission of Nevada	Northern NV	9,319.4 million KWh (2003)	3.75% (1992-2003)	1.14% (2003-2013)	Econometric model, pooled cross-section time series data, short term time-series (X11 analysis)	Population estimates and projections, own-price, annual heating plus cooling degree days, lagged customer use, commercial, government and industrial employment estimates and projections
Public Utilities Commission of Nevada	Northern NV	10,000 million KWh (2005)	3.57% (1992-2005)	2.68% (2005-2015)	See above.	See above.

(Hirsch 2004; California Energy Commission 2005; Hirsch 2006; Energy Information Administration 2007)

Table 10. Range of Regional Electricity Demand Forecasts

Year	Low projections (1.14% growth rate)	High projections (2.68% growth rate)
	Millions of kilowatt hours	
2005	9,861	9,861
2006	9,974	10,126
2007	10,087	10,397
2008	10,202	10,676
2009	10,319	10,962
2010	10,436	11,255
2011	10,555	11,557
2012	10,676	11,867
2013	10,797	12,185
2014	10,920	12,511
2015	11,045	12,847
2016	11,171	13,191
2017	11,298	13,545
2018	11,427	13,908
2019	11,557	14,280
2020	11,689	14,663
2021	11,822	15,056
2022	11,957	15,459
2023	12,093	15,874
2024	12,231	16,299
2025	12,371	16,736
2026	12,512	17,184

Table 11. Estimated Electrical Energy Consumption, Employment and Per Employee Electricity Consumption by NAICS Sector for Five California County Tahoe Region.

Sector	Average of 2003-2005 REIS Employment	Average Annual 2003-2005 Electrical Energy Consumption (KWh)	Average 2003-2005 per Employee Annual Electric Use (KWh/Emp)
Farm, forestry, fishing and related employment	4,709	8,544,770	1,815
Mining	588	8,401,696	14,289
Utilities	764	74,360,629	97,288
Construction	38,420	27,425,993	714
Manufacturing	15,096	423,302,514	28,041
Wholesale trade	6,610	26,064,689	3,943
Retail trade	40,926	382,608,334	9,349
Transportation and warehousing	5,227	107,985,586	20,658
Information	5,090	75,889,292	14,910
Finance and insurance	17,507	49,422,152	2,823
Real estate and rental and leasing	23,527	138,877,394	5,903
Professional and technical services	25,670	19,435,429	757
Management of companies and enterprises	1,742	8,540,266	4,903
Administrative and waste services	17,701	32,203,167	1,819
Educational services	4,931	82,757,891	16,785
Health care and social assistance	26,842	122,584,399	4,567
Arts, entertainment, and recreation	10,572	79,378,795	7,509
Accommodation and food services	25,926	165,218,754	6,373
Other services, except public administration	18,668	50,813,274	2,722
Government and government enterprises	33,461	347,184,976	10,376
Total employment	**323,975**	**2,231,000,000**	**6,886**

Sources: (California Energy Commission 2005; Bureau of Economic Analysis 2007), UCED

Table 12. Demand Projection Using Sectoral Electricity Consumption Data

	Electricity Demand (Millions of KWh)		
Year	Total	Non-Residential	Residential
2005	**9,862**	**5,618**	**4,244**
2006	10,093	5,737	4,356
2007	10,311	5,854	4,457
2008	10,528	5,971	4,557
2009	10,744	6,088	4,656
2010	10,960	6,205	4,755
2011	11,176	6,322	4,854
2012	11,392	6,439	4,953
2013	11,608	6,556	5,052
2014	11,821	6,673	5,148
2015	12,034	6,789	5,245
2016	12,246	6,906	5,340
2017	12,457	7,023	5,435
2018	12,667	7,139	5,527
2019	12,874	7,256	5,618
2020	13,081	7,373	5,708
2021	13,287	7,489	5,797
2022	13,492	7,606	5,887
2023	13,698	7,722	5,976
2024	13,901	7,839	6,063
2025	14,105	7,955	6,149
2026	14,307	8,072	6,235

Electricity Demand and Implications for Biomass Electricity Plants

Over the next twenty years, projections indicate that annual electricity consumption in the region will increase around forty-five percent or by about 5 million MWh. According to biomass availability estimates from Forester's Coop and using an assumption of 1 BDT per megawatt hour (MWh), the energy generated from the available wood fuel in the region would produce approximately 100,000 MWh per year or about two percent of the increased demand nineteen years from now. All of these forecasts and projections would be low if the use of electric or rechargeable hybrid cars substantially increases. If electricity prices were to rise substantially, demand for electricity would diminish.

Task A – Collection of Biomass Inventory and Analysis of Data
Sub-Task 3 – Identify alternative woody biomass to energy technologies.

Small-scale (10 to 20 million BTU or 25 – 1,000 kW/hr) cogeneration biomass systems are not commercially available for use in California. Much research and development work is needed to design, engineer, bench-test and commercially demonstrate the economic and environmental benefits of distributed small-scale biomass-fueled power plants. Three technologies have been investigated and determined to be potentially feasible for continued development in the Lake Tahoe Basin Region – biomass-fueled microturbines, modular biomass gasifiers and combination gasification and gas engine cogeneration.

Biomass Fueled MicroTurbine - Technical Relevance and Merit

Gas turbines (Brayton cycle) have theoretical thermodynamic advantages over steam power (Rankine cycle) systems because the working fluid can have far higher temperature than steam without a significant increase in pressure. Many gas turbines, for instance, operate at about 1250° C turbine inlet temperature (TIT) compared with around 500°C for steam turbines. Biomass gas turbine power generation involves combining gas turbine cycles developed for fossil fuels with biomass gasification or combustion systems. Direct-fired applications require some form of gas cleaning to reduce particulate matter and alkali vapor entering the turbine stage. Indirect-fired gas turbines are a promising alternative to direct-fired units. Indirect designs isolate the corrosive and contaminant-laden combustion gas from the turbine and offer greater flexibility in the types of fuel and combustor used. There are other advantages that make the indirect system a good choice for power generation:

1 The gas turbine operates on clean working medium, thereby minimizing wear and other potential harm to turbine blades.
2 A heat exchanger may be substituted for the complicated gas cleaning system used in direct-fired applications, offering an opportunity for simplicity with a minimum number of components for small-scale power generation.
3 Indirect designs may reduce environmental impacts and cost by eliminating water use in gas scrubbing commonly employed in direct-fired designs.

- Commercial components are available for the turbine and gasification/combustion equipment. Commercial heat exchangers are also available and, though not yet been fully proven, may be adequate for small-scale applications.

Indirect-fired gas turbines offer potentially higher overall efficiency compared with other power systems when used in cogeneration or combined-cycle mode.

Community Power Corporation(CPC) – Modular Biomass Gasifier Power Plant

CPC, developers of the BioMax® line of biopower systems in cooperation with the USDOE's National Renewable Energy Laboratory in Golden, Colorado, is focused on the commercialization of modular bioenergy conversion systems using proprietary, state-of-the-art gasification and control system technologies. CPC is known in the renewable energy industry for its pioneering work in village power in developing countries and more recently in providing BioMax® systems in the USA in cooperation with the US Forest Service, the California Energy Commission and the US Department of Defense.

Biomass gasifiers are partial-oxidation devices that convert carbon-based biomass residues to a low or medium BTU producer gas. The producer gas can be used in place of refined fossil fuels such as natural gas, propane, gasoline and diesel fuel to generate electricity, or as raw material to produce chemicals and liquid fuels.

Several demonstration CPC units have been placed for trial over the past two years. The "BioMax®" 15 kW/Hr unit placed in Truckee at the public park by the Truckee Donner Public Utility District was operated for little more than a year and was decommissioned on March 1, 2007. The project was funded by the California Energy Commission, the Truckee Donner PUD, and the Truckee Park and Recreation District and was found to be too costly and inefficient to continue operation. The Truckee system was dismantled and sold at a substantial loss to the project proponents. Other trial CPC generating systems being proposed are two 50 kW/hr units offered for trial demonstration by the USFS to be placed in Mt Shasta, Siskiyou County, and Big Bear in San Bernardino County. The National Renewable Energy Laboratory (NREL), Department of Energy (DOE), and the U.S. Department of Agriculture (USDA) continue to invest heavily in this technology that requires further field-testing prior to becoming a commercially-viable operating biomass energy system. However, at this point in time, the CPC

biomass energy equipment is not an economically viable generation system perhaps suitable as a public education tool for advocating the use of biomass as a energy fuel.

Combination Gasification and Gas Engine Cogeneration

Biomass energy conversion technologies are emerging around the world. Replicable and third party-audited commercial demonstrations are needed to validate promising technologies for application in California. With California's high retail energy prices, small biomass cogeneration technologies may be feasible to displace retail energy consumption at facilities with high 24/7 base load energy demands such as hospitals, government centers, prisons, manufacturing plants, etc. A combination gasification and gas engine cogeneration plant yields relatively high biomass conversion efficiency with about thirty percent of the wood fuel energy converted into electricity, leaving approximately fifty-five percent of the wood energy available for facility heating use. Selecting such a system such would provide an overall thermal efficiency of about eighty-five percent. An optimum small scale cogeneration biomass-fueled commercial demonstration plant for the Tahoe region would produce 600 kW of electric power, of which about ninety percent (540 kW) would displace retail energy at the local facility, and the remaining ten percent (60kW) could be sold to the local electric grid at low wholesale rates.

Additional Considerations

Due to stringent air quality regulations in the Tahoe region, future project proponents will need to partner with County air management districts for planning to meet allowable emission requirements and corresponding incorporation of emission reduction equipment. Biomass energy demonstrations will need to minimize wastewater effluent discharge and wood ash to less than one percent of throughput biomass fuel weight, important considerations in equipment manufacture/design selections. Further, cogeneration plants of this scale should be modular, transportable and have a small overall operational footprint that allows for portable demonstrations at other sites in the region.

Table #12A on the following page provides a performance ranking listing of biomass generation systems for project development consideration in the Tahoe region. Successful commercial demonstrations that thoroughly evaluate and publicly disclose all environmental and economic performance could become models for many Tahoe Basin communities that are

looking for affordable ways to produce their own energy, protect citizens from fire, restore forest health and enhance ecological systems.

Table 12A

WGA – TAHOE REGIONAL BIOMASS PROJECT – SYSTEMS AVAILABLE FOR COMMERCIAL DEMONSTRATION PERFORMANCE RANKING MATRIX Weighted Value Range: 0 to 10 10 = highest rank 0 = lowest rank								
Rank	**Biomass Combustor Vendor and Lead Contact**	**Proven Technology**	**Biomass Combustor Experience**	**Biomass Fuel Flexibility**	**Air Emissions (Projected)**	**Capital Costs**	**User Friendly Operation (Projected)**	**Total Points**
1.	**KMW Systems Inc. 3330 White Oak Road London, Ontario, Canada N6E 1L8 Richard Lepine, Project Development 519.686.1771, URL - www.kmwenergy.com**	**9**	**5**	**8**	**4**	**9**	**8**	**43**
2.	**Messersmith Manufacturing Inc. 2612 F Road Bark River, MI 49807 Gailyn Messersmith, Principal 906.466.9010, URL - www.burnchips.com**	**8**	**5**	**8**	**4**	**8**	**8**	**41**
3.	**Chiptec Wood Energy Systems 48 Helen Ave. South Burlington, VT 05403 Robert Bender, CEO 802.658.0956, URL - www.chiptec.com**	**7**	**5**	**6**	**5**	**9**	**8**	**40**
4.	**Community Power Corporation 8110 Shaffer Parkway, Suite 120 Littleton, CO 80127 Ph# (303) 933-3135 Fax# (303) 933-1497, URL - http://www.gocpc.com/**	**7**	**8**	**4**	**7**	**4**	**4**	**34**
5.	**Carbon Cycle Company 1221 Commerce Avenue Woodland, CA 95776 Kerry Sachs, CEO 530.668.0976**	**5**	**5**	**2**	**8**	**5**	**8**	**33**
6.	**Community Energy Resource Centers Charles Weiss, President 775.329.5000**	**?**	**?**	**?**	**?**	**?**	**?**	**Requested Info Never Received**

Task A – Collection of Biomass Inventory and Analysis of Data
Sub-Task 4 – Complete a cost analysis and siting requirements for conversion to appropriate technologies.

Task A – Subtask 4 will discuss some general concepts related to cost analysis and siting requirements of biomass energy projects. Some existing or planned biomass energy projects in or near the Tahoe Basin will serve for comparative cost and site implications. Table 13 lists some biomass energy uses in or near the region of Lake Tahoe. The listed power plants do not obtain all their biomass supplies from within the Tahoe Basin but may influence local market supply and demand. For the biomass users listed, a total of about 530,000 BDT of biomass are used to produce both heat and electricity; a total of 442,000 MWh of electricity are produced by the plants.

Table 13. Tahoe Region Wood Biomass Facilities and Other Users

Facility	Capacity	Fuel Consumption in BDT/year	Estimated Electricity Production (MWh)
Loyalton	10.5 MW	90,091 (2005)	81,000
Rocklin Rio Bravo	25 MW	193,000 (2005)	193,000
Lincoln	15 MW	160,000 (2005)	160,000
Northern NV Correctional Center	1 MW	16,000 (estimated future use)	8,000
Estimated firewood use		69,000 (2003 estimate)	
Total	**51.5 MW**	**528,091**	**442,000**

Source: (Amesbury 2007; Harris 2007)

General Site Requirements and Cost Analyses

One of the advantages of the biomass resource is that it is a local resource with local demand and supply determining price and quantity available. This potentially makes prices more stable because prices are not directly affected by worldwide demand, as is the case with oil, for example. Because of this local characteristic, however, biomass projects will be unique to their locality, and the economics of site location and feasibility will require separate analyses for each project. Fortunately, there are some general principals that broadly apply.

Type and Size of Project

Certain types of projects tend to be more cost effective. Given current technology, combined heat and power units on a site that can use both, such as the Northern Nevada Correctional Center, are more cost effective than electric-only plants. Biomass heating units, such as is planned at the South Lake Tahoe High School that, like the Northern Nevada Correctional Center (both are

described in more detail in Sub-task 5), takes advantage of an existing steam pipe system, are also more likely to present favorable economics. In fact, biomass energy plants make more sense when:

1 the fuel that is being replaced is especially high cost (some electricity or natural gas, for example);
2 a heating system that already uses steam is worn out and needs replacement or a system for a new facility is needed;
3 electric plants are built strategically to reduce transmission line loads; or
4 systems are built where supplies of biomass are already collected for other reasons, i.e., at or near a sawmill or a waste collection facility.

Large plants are desirable from a purely economic standpoint in that they are more efficient as capital and operational costs are spread over larger output. The major disadvantage of larger biomass plants, however, is that greater supplies are needed. This increases the risk that fuel will not be available in the required quantities and may actually increase fuel and transportation costs since supplies will necessarily come from a larger region and may be more costly as more expensive sources of wood are pursued. Smaller plants may not be as capital cost effective but are more likely to be able to secure an adequate long term supply of fuel and require a lower capital investment to start (Haase 2004; Maker 2004). The McNeil Technologies report on biomass in the Tahoe Basin suggests that, given the biomass supply available, the region should invest in small-scale biomass operations (McNeil Technologies Inc. 2003).

Sufficient long-term biomass supply, cost and quality are some of the most important factors to consider in siting and sizing a biomass energy facility. A general rule of thumb has been that biomass needs to come from within a radius of one hundred miles of the proposed facility. This rule of thumb can be affected by many factors such as highway access, railroad access, transportation fuel prices, government actions, fire, weather, competition and prices of biomass (Mason 2006). These factors suggest that the actual supply should be planned from the smallest practical area likely to reliably satisfy the needs of the facility. Close-by supplies are to be preferred and very distant supplies from further away than 100 miles are usually not economically feasible to use. Correspondingly, another field expert-suggested rule of thumb is that a plant should be sized to about one-half to one-third of estimated available supplies (Mason 2006).

Proximity to Solid Waste Supplies

As noted earlier, the diversion of biomass from the solid waste stream is the major supply source until such time as regulatory reform and other factors make the increase in supply from public and private forests more likely. Correspondingly, locating plants that will use that waste stream biomass near its source will contribute to the economic feasibility of the projects. However, the distribution of sorting facilities away from landfills will increase the possibility of shortening the haul distances and reducing the associated transportation costs for the waste stream biomass.

Relationship to Power Grid

When biomass plants are being considered primarily or substantially for electrical power generation beyond the needs of the facility itself, planning must include connection to the electrical power grid. The careful location of distributed biomass generation plants can provide important voltage support services to the grid, especially in a rural area that is likely to remain a net importer of power. Because the biomass fuel supply is widely distributed, it is unlikely that major new power transmission extensions will be needed for the grid connection (CDEAC 2005). However, even relatively short connection lines can add significant cost to the development of the plant.

Cost

Experience with the Northern Nevada Correctional Center and proposed Tahoe City co-generation projects (discussed below) and the electrical power generation-only system proposed for the Washington Ridge California Youth Authority camp in Nevada County suggest a cost in the range of $5,000 to $8,000 per kW for biomass facilities in the .5MW to 3 MW range. The estimates from the South Lake Tahoe High School project suggest that heat-only systems, especially those that can take advantage of existing capabilities such as steam pipe systems from existing or earlier heat plants, can be relatively less expensive as the cost of high-pressure turbines, electrical generators, controllers and other equipment and its installation is avoided. Improving technology suggests that small mobile plants (<100kW) can be built at costs competitive with fixed facilities on a per-kW basis.

Summary

Biomass plant siting and sizing is seen as a function of tradeoffs between maximized energy production and a maximized reliable supply area, given a number of intervening influences, over many of which the developer may have little or no control. Field experience cautions that more, smaller plants sited near sources of waste stream biomass and existing power grid connection points may be more prudent in the long run than fewer larger plants. However, additional biomass sources for those plants will need development.

Task A – Collection of Biomass Inventory and Analysis of Data

Sub-Task 5 – Identify potential sites for power plants in the Tahoe Basin

Project Assessment Area

As noted above, siting of potential power plants in the Tahoe Basin area will be at least influenced by the three nearest projects that are now operational or that will be coming on line in the relatively near future.

Northern Nevada Correctional Center

The most recent biomass energy project to go on-line in the Tahoe region is the Northern Nevada Correctional Center's Renewable Energy Center in Carson City. The correctional center had a forty-year old natural gas heating system that will stay in place as a back-up system. The distribution pipes for the old steam heating system can be used with the new biomass system. The new system costs around $8 million, part of which was covered by grants. The plant was scheduled to go into 24-hour production on September 17, 2007. The plant will provide heat, hot water and electricity to the prison and includes a 1 MW system capable of providing up to 8,000,000 KWh per year of electricity. Any excess electricity produced can be sold back to the local utility. The prison will also be issued Portfolio Credits that can be sold back to the utility for the renewable energy used on-site. The facility's round-the-clock electricity production is the most efficient method of production for biomass. The prison authority projects a savings of more than $8,000,000 over the next twenty years, as compared to installing and operating a new gas system. The facility will require from 11,000 to 16,000 tons of wood a year. The wood needs to have less than seventeen percent moisture content, be less than two inches in diameter, and have less than one percent contamination with non-wood material. The wood will be provided by a private company, Carson City Renewable Resources (CCRR). The company locates, buys, processes, stores and delivers the wood fuel. The company currently is contracted to deliver wood chips to the prison at a cost of $28.50 per ton. Currently, the wood supply comes almost entirely from urban waste wood from the Carson City region. Because using this material avoids land-fill costs, CCRR receives free deliveries of the urban wood waste. Although the wood requires heavy processing, it is currently the most cost-effective supply. Originally, it was hoped that a portion of the wood supply would come from hazardous fuel reduction operations but that has been

problematic. Costs of the wood from forest thinning have varied with the distance the material has to be transported and the amount of processing that it needs and, generally, has been too costly to be profitable. Difficulties have emerged in securing the full supply of biomass necessary to operate the biomass system at full capacity. Competition for hazardous fuels reduction biomass appears to be an issue. The combination of competition and scarce biomass resources seem to point to rising prices for the resource.

Interviewees offered several lessons learned from the Carson City Renewable Energy Center project. Installing a biomass energy facility is a major undertaking. The project requires many different types of expertise from air quality and renewable energy regulatory issues to wood fuel procurement to knowledge about the technology, operation and maintenance of the biomass energy facility. With in-house expertise on these subjects, it may be possible to steer clear of some of the pitfalls and resolve difficulties that inevitably will arise when installing a technology that is new to the region. The importance of a close examination of the local wood waste stream in advance of the project was also mentioned. The project should be designed to the amount and type of wood available. The positive environmental attributes of the project such as using a renewable resource, reduced dependence on foreign oil, low net carbon emissions, and adding life to the landfill while avoiding methane emissions were emphasized.

South Lake Tahoe High School

For the past five years, South Lake Tahoe High School has been considering a biomass heating plant to replace an old natural gas system. Steam distribution pipes are already in place from the existing system. The new system would cost about $700,000, about $500,000 more than an equivalent natural gas system. About $325,000 in grant money has been received, some of which has been used to carry out studies and application processes. A feasibility study was done by McNeil Technologies in 2003 and has been updated since that time (McNeil Technologies Inc. 2003). The most recent update of the study found that the project should save more than $3 million dollars over the thirty-year life of the system. The feasibility study assumed that wood would cost $34 per green ton or about $68 per bone dry ton and that natural gas would cost $11.07 per million BTU.

Approximately 2,500 tons of green wood would be needed annually; thirty-four percent of the fuel would be needed in December and January. Wood in this area would most likely come from U.S. Forest Service fuel reduction operations.

Air emissions permits have been a particular challenge for the proposed biomass project. Several levels of government agency regulation must be met. A Tahoe Regional Planning Agency compromise has been reached that supports biomass projects that burn materials from within the Basin that otherwise would have been fuel consumed in a controlled burn (i.e. wood from fuel reduction operations) or uncontrolled fire.

The high school biomass project is still in the early stages, but lessons learned so far suggest that it is important to try to get all the players – from system manufacturers to fuel suppliers to government agencies to environmental groups – on the same team early in the process. The high school is interested in the positive environmental aspects of the biomass project such as reduced emissions when compared to forest fires or controlled burns, lowered carbon emissions and renewable energy use. Regulatory processes that promote a standardized approach to measuring these potential benefits would help streamline the permitting process.

Tahoe City Sheriff's Substation

The proposed biomass facility at a new sheriff's substation in Tahoe City is at an earlier stage of planning than the South Lake Tahoe High School. The current proposal is for a one-to-three megawatt combined heat and power plant. The plant would cost approximately $7-to-$8 million. As currently envisioned, State funds will be provided for approximately half the project cost while the rest would be covered by a public-private partnership between Sierra Pacific Power Company and Placer County. In the long term, the County hopes to have biomass facilities in other County locations. Because the County is not within federal air quality attainment standards outside the Tahoe basin, it would be difficult to build any type of power plant outside the Tahoe Basin.

Placer County became interested in a biomass plant as a byproduct of hazardous fuels reduction programs. In addition, they are interested in the environmental benefits that attend the use of biomass such as decreasing emissions in comparison to controlled burns or fire, and lower carbon emissions.

Using rule of thumb calculations, the Tahoe City plant would require 10,000 to 30,000 BDT of wood chips annually. The County trucks two loads of green wood chips per day (or about twenty-four BDT, assuming fifty percent moisture content) to the Loyalton cogeneration plant from County facilities involved with fuels reduction programs during the summer season. If the sub-station project is realized, this wood would be used in the Tahoe City plant instead, providing a good base of biomass supply for the project. However, since the material is already being used in the region to produce biomass energy, its withdrawal for a new project will tend to tighten supplies in the region and drive costs upward. The County hopes to add to these supplies with U.S. Forest Service wood from fuels reduction programs. It is early in the process for the Tahoe City project. Air emissions permits may be a challenge, but the County is hopeful that early coalition building with government agencies, environmental groups and others will help.

Implications for Additional Biomass Plants in Tahoe Basin

Anecdotal evidence indicates that competition for biomass fuel supplies may already be developing in some Tahoe regions. Barring dramatic changes in regulations to open up and reduce the cost of the supply of biomass in the Tahoe Basin, consideration of additional sites may be pointless. The point source and non-point source supplies identified under Sub-task One, above, indicate that biomass supply sources have been located primarily in the southeastern and northwestern sectors of the Tahoe Basin. The major part of the non-point supply from timber harvest residuals has been just outside the north slope of the Basin in the area south of Truckee. Use of biomass from that source would have somewhat increased transportation costs to haul it over the crest of the Basin, even to the proposed Tahoe City facility. The identified point and non-point sources in or closest to the Basin, to date totaling on the order of a few tens of thousands of BDT per year, roughly equal the supply needed for the three facilities on-line or proposed for operation, as discussed above. This suggests the need for development of additional sources, perhaps most likely from the un-tapped forest supplies covering the Basin from the lake to the Basin rim and especially from those areas nearest residential development, before committing to additional major users of those sources. Even as available biomass supply limitations are overcome, air and water emissions permitting can be especially challenging despite the noted benefits of the controlled use of biomass. These limitations suggest the need for building public/private coalitions to underwrite research and development and undertake regulatory reform needed to bring the Tahoe region cost effective biomass energy systems. This

approach will take a considerable effort to organize and innovation in new and efficient biomass conversion technology for use in the Tahoe Region.

Task B – Outreach to Utilities, Investors, Entrepreneurs, and Land Managers to identify issues and conduct workshop to Present Information Gathered to Stimulate Interest in Development of Biomass to Energy Plants

A Biomass Workshop was held in Kings Beach, California June 1st, 2007. Planning for the workshop began in December 2006 among a core group of advisors including SEDCorp staff,

- CalFire, Doug Wickizer
- Nevada Division of Forestry, Jason Perock
- Placer County's biomass project manager, Brett Storey
- Placer County Air Pollution, Tom Christof
- Forester's Co-Op's Tom Amesbury
- University of California, Gareth Mayhead
- University of Nevada, Tom Harris
- Truckee Donner Regional Park District, Scott Terrell

The group agreed that a regional workshop inviting participation by interested parties in several western states and from the national level would be a valuable extension of the series of biomass meetings held in northern California over the last several years. It was also agreed that the workshop would address three principal points: the national and local roadmaps for furthering the biomass initiative in the western region, the current state of knowledge regarding technology, supply and energy demand, and lessons learned from recent or proposed projects regarding regulatory compliance and other obstacles to be overcome. Correspondingly, the core group identified and extended invitations to likely speakers. The final agenda for the workshop is attached and lists the speakers and their topics. Copies of most of the presentations are included on the CD accompanying this report.

One hundred two people attended the one-day workshop, including one vendor who displayed information about alternative biomass harvesting tools and equipment (attendee list attached). Attendees were asked to complete a workshop evaluation form developed by the core group of workshop advisors; fifty-one evaluations were returned, and a summary report of their results is attached. Major conclusions drawn from the attendees' feedback includes:

- Ninety-eight percent of attendees felt that the overall quality of the workshop was good or excellent
- Ninety-two percent of attendees felt that the speakers' presentations were good or excellent
- Fifty-four percent of attendees felt that the workshop exceeded or greatly exceeded their expectations
- The lessons-learned session was viewed as the most helpful
- The most common criticism was that there was too much information for the available time and too little time for interaction with the speakers

The attendees clearly supported the concept of conducting periodic (perhaps annual) follow-on workshops. Particular topics of interest included information on stewardship contracting; "green collar" labor market implications for employment, training, education and certification; hardware and technology advances; funding opportunities for biomass-related businesses; renewable energy and waste diversion credits; development of a "fast track" model for project development; portable biomass facilities; and developing markets for biomass resources other than for use in heat and power production. The respondents definitely would like to have more opportunity for networking and interaction with speakers, and there was some support for associated field trips to biomass harvesting operations and facilities using biomass.

Follow-on workshops can benefit by lessons learned from the June 1, 2007 workshop. Though the North Tahoe Conference Center was convenient, the next workshop would benefit by using a larger room shaped so as to make it easier for all participants to hear the speakers, see their presentations, and interact with both the speakers and other attendees. The catered lunch was universally deemed "excellent." An additional staff person is needed for administrative assistance. The agenda might benefit from being spread over two days rather than one, especially if one or more field trips are included. Breakout sessions might make it easier for attendees to focus on their particular interests.

Attachments

- Agenda for the June 1, 2007 Biomass Workshop held at Kings Beach, North Lake Tahoe
- June 1, 2007 Biomass Workshop attendee list
- Biomass Workshop Evaluation Summary
- Speaker presentations on enclosed CD disk.

Biomass Workshop 2007

A Consortium of California and Nevada Suppliers and Users

Sponsored By

The Western Governors' Association

North Tahoe Conference Center

8318 North Lake Tahoe Blvd., Kings Beach, CA 96143

June 1, 2007

Agenda

8:30 **Welcome: Brent Smith, Sierra Economic Development District**
Keynote Speaker: Jim Boyd, California Energy Commission

9:00 **Session 1, Moderator: Crawford Tuttle, CA Department of Forestry and Fire Protection**
Roadmap

Western Governors' Association:	Gayle Gordon
CA Biomass Roadmap:	Bryan Jenkins, UC Davis, CA Biomass Collaborative

9:30 **Session 2, Moderator: Bruce Goines, U.S. Forest Service**
Technology Advances

CHP:	Fred Tornatore, TSS Consultants
Innovation in Wood Based Products:	Gareth Mayhead, UC Berkeley
Potential Funding Sources:	Gareth Mayhead, UC Berkeley and Bruce Goines, USFS

10:30 Break

10:45 **Session 3, Moderator: Terri Marceron, Lake Tahoe Basin Management Unit**
Inventory Supply and Demand

Supply-Energy Demand Analysis:	Tom Amesbury, Foresters Co-Op and Tom Harris, UN Reno
Lake Tahoe Basin Analysis:	Steve Holl, Holl Consulting
Tahoe CROP Study:	Catherine Mater, Mater Engineering, Ltd.

12:00 **Group Luncheon**
Speaker: Ed Gee, USFS

1:00 **Session 4, Moderator: Steve Chilton, Tahoe Regional Planning Agency**
Regulation Compliance

New Source Review:	Kerry Drake, EPA
Forests, Carbon and Bioenergy:	Mark Nechodom, USFS
Air Quality Issues:	Tom Christofk, Placer County Air Pollution Control District

2:00 **Session 5, Moderator: Susan Brown, California Energy Commission**
Lessons Learned

* White Pine County School District Ely, NV:	Paul Johnson
* Northern Nevada Correctional Center	Lori Bagwell
* Truckee Biomass Demonstration Project	Scott Terrell
* SPI Loyalton Co-gen plant	Jim Turner

3:00 Break

3:15 **Session 6, Moderator: Patrick Wright, CA Tahoe Conservancy**
Project Updates

Tahoe Biomass Programs:	Brett Storey, Placer County CEO Office
Defensible Space:	John Pickett, Nevada Fire Safe Council
South Lake Tahoe High School:	Steve Morales, Lake Tahoe Unified School District
Tahoe Basin Biomass Facility, proposed demo:	Rick Robinson, California Tahoe Conservancy

4:15 **Closing remarks**
Western Governors' Association: Gayle Gordon

-- Networking --

Workshop hosted by Sierra Economic Development District and made possible by the generous support of

WGA Placer County CDF NDF USFS Foresters Co-Op UNReno UCBerkeley UCDavis Tahoe Conservancy

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Special Thanks to
the Western Governors' Association
for the funding of the Biomass Supply and Energy Demand project

BIOMASS WORKSHOP 2007
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4	Amesbury, Lisa	Forestors Co-op			
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Biomass Workshop 2007
Workshop Evaluation Form Results

Out of 75 attendees and 27 speakers, 51 evaluation forms were filled out. Below are the results.

1. General impression of the workshop

A. Overall quality of the workshop

Excellent (16) Good (31) Fair (2) Poor

B. Presentations

Excellent (18) Good (27) Fair (4) Poor

Comments: Would have liked digital versions of presentations.

C. Materials

Excellent (9) Good (19) Fair (14) Poor (4)

Comments: Some handouts would be appreciated.

D. Mix of presentation and discussion

Excellent (12) Good (14) Fair (14) Poor (6)

Comments:
1) The variety of the talks convinced me to attend.
2) Needed more time for interaction with speakers (4).

E. Registration process

Excellent (20) Good (21) Fair (6) Poor (1)

F. Facilities

Excellent (23) Good (21) Fair (4) Poor (2)
Comments: Too cold (4)

G. Meal

Excellent (28) Good (18) Fair (3) Poor

Comments: Though a veggie option would have been nice**.**

2. Comments on specific sessions of the workshop

A. Session 1 – Roadmap

Excellent (11) Good (30) Fair (5) Poor (1)

Comments:
1) A bit long – but it set the stage well.
2) I'm not focused on policy debate and concerns.
3) Reasonable overview, but didn't need so much info on speaker background and Western Governor's Association.
4) Overview helps to have policy-setter's present.
5) No room for questions.

B. Session 2 – Technology Advances

Excellent (18) Good (26) Fair (5) Poor

Comments:
1) Good info and presentations skills.
2) I wish more had been done for specifics in technology currently.
3) Time delays worked against presenters to try to make up time.
4) Not sure this audience was as interested in specific technologies. Would have appreciated more time on the funding aspect.
5) Full sense of what works.
6) Gareth was excellent (3). Great demonstration of available product opportunities.
7) Could use more discussion on this topic.
8) Not enough time for feedback.

C. Session 3 – Inventory Supply and Demand

Excellent (17) Good (24) Fair (7) Poor (1)

Comments:
1) Again, time worked against presenters, especially Catherine Mater.
2) Good info but much too detailed info in slides to be able to be absorbed.
3) Info seemed relevant and interesting. Now what to do with it.
4) Some of the graphs were very confusing and speaker (Harris) didn't explain very clearly, but good info from other speakers.
5) Catherine Mater – Best Presentation (3)
6) Mr. Holl was hard to follow and had out of date slides.
7) Tom and Steve were a little redundant; found Tom's stats, however, to be excellent. (2)
8) Problem: Lake Tahoe Region normally means only the Basin. Should not use this to refer to outside areas; it also throw off the #'s.
9) The CROP was fascinating and informative (3). Should have had the whole session.
10) Mater too detailed and overran her time.

D. Session 4 – Regulation Compliance

Excellent (18) Good (27) Fair (1) Poor (1)

Comments:
1) Nechodom had the most entertaining and the best-presented talk.
2) EPA, NFS should convey what projects will work versus trying to stop them. Only waste all the planning $ when federal gov't says no.
3) Great speaker – good humor.
4) Good and at the right level of complexity.
5) Great info, well presented.
6) More on this to bring up incentives.
7) Left local examples of progress out, e.g. TRPA 2003 Amendment to reduce pile burning.
8) Tom went too long, slides unreadable

E. Session 5 – Lessons Learned

Excellent (36) Good (11) Fair (1) Poor

Comments:
1) The most helpful of all modules (5)
2) Private sector should build projects with minimum gov't bureaucracy.
3) Lots of good examples (3).
4) Most entertaining thus far. Paul Johnson's talk also quite entertaining and insightful. So was Lori Bagwell's talk. Great session! (5)

5) This was my favorite component. It's good to hear about real-life trials.
6) True story – but could be condensed to "lessons Learned". Good stories. Checklist??
7) Paul Johnson's presentation was both entertaining and useful. Thank you. Very instructional to hear about real-life stories!
8) Good perspective. Thank you Paul for adding humor to a serious topic.
9) This whole conference was very positive, but the lessons learned proved implementing biomass, as a real energy alternative is very difficult.
10) Need to get cooperation of permitting agencies.
11) This is what I came to learn and was the best part of the day!

F. Session 6 – Projects Updates

Excellent (7)	Good (25)	Fair (4)	Poor

Comments:
1) Loved comedy hour.
2) Applied concepts and some lessons learned.
3) This is important to see what is do-able.
4) Need more in the press to continue this important current event exercise.
5) Rick Robinson's PPT too long. He did not need to explain the situation about our forests, the audience already knows this. Next time instruct presenters not to include unnecessary info.
6) Thanks to Placer County for forging a trail on regulation relief for biomass utilization.

3. How well did the workshop meet your expectations?

Greatly Exceeded (4)	Exceeded (23)	About as Expected (15)	Less than Expected (1)	Much less Than Expected

Comments:
1) A great first start.
2) The diversity of topics were greater than expected and very informative. However, presenters need to reiterate importance of broadcast burning and how using biomass alternatives accommodate needed broadcast burning.

4. Where would you like to go from here?
1) Please contact Sierra Business Council. We are preparing an on-line collaborative Biomass & Sustainable forestry tool kit so we can all work together on these issues. LORIGS@SBCOUNCIL.ORG or LGS2107@YAHOO.COM
2) Remove piles asap to prevent fires and enforce defensible space.
3) A follow-up session on labor market implications for the new green economic sector; green collar jobs; training and education requirements, etc.
4) More info on funding opportunities for independent start-ups (2).
5) How does biomass benefit jurisdictions throughout the state, meet AB 939 waste diversion?
6) For me, it's more focus and research on hardware and technology. It has been very informative regarding the challenges of permitting and regulation.
7) A field trip would have been fantastic (3).
8) Would like to see more conferences like this in the future (3).
9) Get support from On High to clear the way for projects to happen in a fast track manner.
10) Session on Calfire (CDF) permits for removal of biomass product, i.e.: forest fire prevention exemption (Lamalfa Initiative), emergency notice, and fuel hazard reduction.
11) I would like to see comparison of marketability of various by-products of biomass, electricity, heat, ethanol, synthesized gas, etc.
12) Another meeting next year! (4)
13) Definitely keep this conference as regular/annual event!

14) As a member of the Biomass Collaborative, I am disappointed that there is no room to network, ask leading questions, and share experiences. I guess Lake Tahoe has to reinvent the wheel on biomass.
15) Ensure Nevada County is plugged into way ahead.
16) Portable biomass facilities that tie into the grid.
17) How to use the biomass produced in our logging operation to help defer fuel costs?

5. Additional Comments:

1) Emission credit for fire avoidance.
2) There should have been a handout that listed all the key websites the speakers informed us where we could get copies of the presentations slides and further info. (3)
3) Please expand future workshops to include Biomass Facility Operators and Fuel Buyers (brokers).
4) Thanks for a great location, lunch and meeting.
5) Great job. I enjoyed the day greatly!
6) Length of room, screen and size of projection left those in the back of the room too far away (5). Although the speakers all had good information, for the time allocated, it appears there were too many scheduled for the time provided for the whole conference (6).
7) Nametags (3) (even self-filled out vs pre-printed) would be great for future workshops to help with networking. Lunch provider was GREAT. Might have helped to have another SEDD staffer to deal with participant questions (e.s. parking validation) – since Lisa had to run the Power Point presentations.
8) Enjoyed the session! Like the contact list as part of the packet. Looking forward to next years' session (4).
9) Get someone to present NEPA and other agencies in the approval process in a panel discussion.
10) More Q & A time.
11) Presenters need to use fewer acronyms and abbreviations. Not all the audience knows what they mean. Let's do this again!
12) Could not hear the Q&A well; room was too cold in the morning (2) even after several attendee's requests; would be nice to have more lunch options; provide attendees with PowerPoint hands before conference so we can take notes (3).
13) It would be great to have a matchmaker function which matches up people with specific needs. There is a need for breakout sessions. The gov't agencies are out of touch with the private sector and therefore out of control.
14) Too many speakers (6). Some presentations were abbreviated too much. Outstanding workshop and established a great base line for follow-up.
15) The NEPA has to be streamlined and protected from frivolous appeals and lawsuits. (4)
16) No comment on availability of presentation materials specific to CROP info.
17) Needs greater publicity for public understanding and appreciation of biomass.
18) Put biographies in written form and save time making introductions.