USDA Project RCGG-2006-CA-02
"Promoting and Sustaining California Rural Cooperative Development"

Feasibility of a California Energy Feedstock Supply Cooperative

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Executive Summary

Purpose:
This report has been developed to achieve the objectives specified in the project proposal submitted to the Rural Cooperative and Business Development Agency, U.S. Department of Agriculture (USDA) in the Spring of 2006. It is one component of the project "Promoting and Sustaining California Rural Cooperative Development" Federal ID RCGG 2006-CA-02. The purpose of this study is to determine the feasibility of developing a series of Energy Feedstock Supply Cooperatives as a means of helping California farmers convert woody biomass (orchard prunings) into a source of renewable energy and /or other products useful to home owners. The purpose of these cooperatives would be to help farmers dispose of their orchard waste using environmentally sustainable methods and actually generate income, thereby mediating costs associated with environmental air quality mandates.

Need:
There are approximately one million acres of deciduous fruit and nut trees in California producing an estimated 700,000 tons of prunings annually. In the past much of this orchard waste has been burned in the field. As of June 1, 2007 the San Joaquin Air Pollution Control District banned the burning of stumps in orchard removal in eight San Joaquin Valley counties and established a total ban on burning of all orchard waste in these counties effective June 1, 2010.This study addresses the question of what farmers options are as these regulations go into effect.

Limitations:
This study is limited by time and budget restraints to renewable energy resources from almond orchards in California. There are approximately 680,000 acres of bearing and non- bearing acres of almonds produced in 13 counties. Almond prunings and other orchard waste are estimated at a minimum of 300,000 bone dry tons annually.

Methodology:
A diverse team of almond farmers, professionals with expertise in cooperative development, management and law, renewable energy and biofuels, agricultural marketing and international trade, joined forces to explore almond farmers business options including, but not limited to the formation of agricultural cooperatives. The report discusses the financial issues involved, the diverse uses of orchard residue including their potential for conversion into energy and for foreign export. Additionally this report includes comprehensive materials needed for the organization of a Energy Feed Stock Supply Cooperative, including sample articles of incorporation, bylaws, membership application forms and a membership agreement.

Conclusions
Chapter one contains a management overview and summary of findings. It shows that at this time the highest value use for prunings is as ground material to be used as fuel for co-generators. If this woody material is valued on an energy equivalency basis with natural gas, the price per ton during the fall of 2007 should be around $50.00 per bone dry ton. This is about three times greater than prices being offered by co-generation operators. It is not likely that cooperatives will come into existence until greater opportunity for profit is shown. They may however, be formed solely as a way to dispose of residue with their cost of operation absorbed as an added expense in the overall farming operation. It does not appear that there are enough cogenerators in operation in California to absorb the amount of prunings that may become available.

Chapter 1 Management overview and summary of findings

This report addresses the issues created for the almond industry by the total ban on burning orchard prunings in eight San Joaquin Valley counties scheduled to go into effect in 2010.

Important findings from Chapter Two are:
As of the 2005-06 crop year, about 92,000 dry tons of prunings are estimated to be available from northern San Joaquin valley counties. About 105,000 dry tons of prunings will be available in the southern San Joaquin valley counties. Even larger tonnages should be available by the year 2010, if plantings and removals continue at current rates.
An estimated five different storage sites located about 100 miles apart from each other will be required to handle prunings if the prunings are not shipped directly from orchards to end users.

Important findings from Chapter Three are:
Possible uses for almond prunings fall into four generic categories: cellulosic ethanol and biodiesel production, fuel for generating electricity, landfill material, and raw material for combustion. At this time, there are no higher valued uses for prunings. The only assumption that should be made at this time is that ground material can be used as fuel for co-generators.
If woody material is valued on an energy-equivalency basis with natural gas, the price per ton during Fall 2007 should be around $50 per dry ton. This is at least three times greater than prices being offered currently by co-generator operators.

Important findings from Chapter Four are:
Four alternative processes for handling brush will be available to growers in the San Joaquin Valley beginning in 2010. The processes are: 1) in-row shredding; 2) in-row chipping; 3) in-row chipping and removal of material from the orchard; and, 4) pushing brush to roadside grinding operations. The first two options are not viable since they make other farm operations such as mowing and harvesting impractical. The costs of brush removal are $41 to $42/wet ton depending on the type of grinding.
Pushing brush to grind at roadside will require temporary storage space and enough area to park and operate a large grinder. This aspect is not “costed” in this analysis, but this lack of adequate space at roadside will be a major concern to most orchard operators and could, in fact, result in productive trees being removed so that these operations can occur.

Important findings from Chapter Five are:
If higher valued end uses for resized prunings can be found, co-operative costs of operation and some grower costs could be offset as volume increases. With higher values, a surplus is expected in the second year, increasing to $7.2/acre in 2012.

If lower valued end uses for “orchard run” ground material can be found, co-operative costs of operation are projected to be funded by grower contributions for the duration of the planning horizon. In this scenario, producers would need to cover the losses starting at $8.2/acre and decreasing every year until a surplus is reached in 2012.

Important findings from Chapter Six are:
Organizational documents for a service organization (co-operative) are very straightforward and should be easy to use when establishing a business entity.

Chapter 2 Development of estimates of amounts of material available

Almond Production

There are in excess of 680,000 bearing and non-bearing acres of almonds in California. Principal growing areas are the Sacramento and San Joaquin valleys. Most fruit and nut crop acreages are reasonably stable over the years because of the length of time trees will bear. However, almond bearing acreage has increased about 40-percent over the last decade. And plantings continue to exceed removals by a large amount.

Table 2.1 summarizes almond production data for California by valley and county for the 2003-04 through 2005-06 crop years. About 16-percent of California's almonds are produced in the north (Sacramento valley) counties. The balance of the crop comes from the south (San Joaquin valley) counties – where Kern, Fresno, and Stanislaus counties together produce over 60-percent of the area's total production each year.

Table 2.1 Almond production by county and year, 2003-2006(1)

	03-'04	04-'05	05-'06
		(meat tons)	
Sacramento Valley Counties			
Colusa	27,500	19,000	20,150
Butte	25,000	22,500	25,200
Glenn	21,300	18,600	21,150
Tehama	4,200	3,450	4,000
Yolo	2,800	2,350	3,300
Sutter	2,850	2,300	2,300
Others			
Subtotals	83,650	68,200	76,100
Northern San Joaquin Valley Counties			
San Joaquin	27,650	25,500	20,900
Stanislaus	84,650	81,950	66,100
Merced	64,650	63,800	51,050
Subtotals	176,950	171,250	138,050
Central and Southern San Joaquin Valley Counties			
Madera	47,250	46,700	41,200
Fresno	88,450	86,750	80,050
Tulare	9,250	10,200	7,950
Kings	6,150	6,500	6,000
Kern	102,950	107,900	105,050
Subtotals	254,050	258,050	240,250
Totals	514,650	497,500	454,400

(1) Source: Almond Almanac 2006, p. 32.

Amount of Almond Prunings

The availability of prunings is a function of bearing acreage. Table 2.2 reports the number of bearing acres of almonds and the estimated amount of prunings by valley and county for the three most recently reported crop years. Counties in the San Joaquin valley account for about 80-percent of California's bearing acreage. There are about 100,000 bearing acres in the north valley with Butte and Glenn counties accounting for about 60-percent of this acreage. San Joaquin valley bearing acreage has probably reached 425,000 by this time.

Table 2.2 Almond Acreage and Estimated Prunings by county and year, 2003-2006

	Estimated Bearing Acreage			Almond Prunings - dry tons		
	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
North Valley Counties						
Tehama	6,717	6,215	6,490	3,174	2,937	3,067
Butte	34,455	33,636	33,255	16,280	15,893	15,713
Glenn	26,906	27,939	27,119	12,713	13,201	12,814
Colusa	20,667	21,734	22,650	9,765	10,269	10,702
Yolo	5,173	5,213	5,678	2,444	2,463	2,683
Sutter	3,912	3,936	3,887	1,848	1,860	1,837
Subtotals	97,830	98,673	99,079	46,225	46,623	46,815
Northern San Joaquin Valley Counties						
San Joaquin	31,173	31,376	31,346	14,729	14,825	14,811
Stanislaus	77,604	77,657	78,569	36,668	36,693	37,124
Merced	82,202	83,449	84,308	38,840	39,430	39,836
Subtotals	190,979	192,482	194,223	90,238	90,948	91,770
Central and Southern San Joaquin Valley Counties						
Madera	48,050	47,106	47,590	22,704	22,258	22,486
Fresno	60,688	65,096	67,763	28,675	30,758	32,018
Kings	2,896	3,562	3,754	1,368	1,683	1,774
Tulare	11,333	11,041	11,686	5,355	5,217	5,522
Kern	87,700	90,469	91,749	41,438	42,747	43,351
Subtotals	210,667	217,274	222,542	99,540	102,662	105,151
State Totals	499,476	508,429	515,844	236,002	240,233	243,736

(1) Source: Almond Board of California

(2) Source: Holtz, et.al. Almond Board of California, 34th Almond Industry Conference Proceedings, pages 254-261. The average annual amount of green (wet) tonnage per bearing acre used in this analysis is .75. Holtz has estimated that the dry weight of almond prunings is about 63% of the wet weight.

Table 2.2 also shows an estimated dry tonnage of prunings available, by county, for the three most recently reported crop years. These estimates are based upon an average of 1,500 pounds of wet (green) material per acre. Reducing the wet tonnage to dry tonnage is done by multiplying the wet tonnage by a factor of 63 percent. There are an estimated 46,000 tons of almond prunings available annually in the North Valley counties, with the majority coming from Butte and Glenn counties. Significantly greater tonnages of prunings are estimated to be available annually from the San Joaquin valley counties. Kern County tonnage alone accounts for approximately the same tonnage as do all the North Valley counties together. Other counties in the San Joaquin valley with significant estimated tonnages available are Merced, Stanislaus, and Fresno.

Possible Processing Locations

One of the objectives of this report was to identify the number of local sites that could be used to store and reprocess almond prunings. Table 2.3 provides this information. According to owner-operators of large trucks, if one-way transportation distances can be kept to less than about 50 miles, trucking costs will remain in the $7/ ton range. Greater distances make the cost/ton rise.

In order to select possible storage sites, circles with 100-mile diameters were placed edge to edge on a map of California. A town was selected from the approximate center of each circle. These towns are shown on the left-hand side of Table 2.3.

On the right-hand side of Table 2.3 are estimates of the dry tonnage of prunings that are theoretically available to each possible storage site. For example, only one processing and storage site (Williams or Live Oak) would be needed for the six north valley counties. Five processing and storage sites appear to be necessary to handle the prunings from the South valley area. From north to south in the San Joaquin valley, these towns and tonnages are: 1) Manteca at 52,000 tons; 2) Merced at 40,000 tons; 3) Madera at 32,000 tons; Tulare at 30,000 tons; and, 5) McFarland at 43,000 tons.

Table 2.3 Possible Regional Locations of Centralized Processing Facilities

Possible Processing Locations (1)	Counties	Bearing acres (2) '03-'04 - '05-'06 average acres	Prunings Available (3) dry-tons per year
	North Valley		
Williams or Live Oak	subtotal	98,527	46,554
	Tehama	6,474	3,059
	Butte	33,782	15,962
	Glenn	27,321	12,909
	Colusa	21,684	10,246
	Yolo	5,355	2,530
	Sutter	3,912	1,848
	Northern San Joaquin Valley		
Manteca or Escalon	subtotal	109,242	51,617
	San Joaquin	31,298	14,788
	Stanislaus	77,943	36,828
Merced or Tuttle	Merced	83,320	39,369
	Southern Joaquin Valley		
Madera	subtotal	67,582	31,932
	Madera	47,582	22,482
	Fresno (4)	20,000	9,450
Tulare	subtotal	59,273	28,006
	Fresno (4)	44,516	21,034
	Kings	3,404	1,608
	Tulare	11,353	5,364
McFarland or Famoso	Kern	89,973	42,512

Note (1) Determined by estimates of acreage within 50 miles radius
Note (2) Almond Board of California. Three season averages calculated from Table 2.2
Note (3) Assumes the average amount of green (wet) prunings per bearing acre is 1500 pounds. Converted to dry -ton basis using Holtz estimate of 63%.
Note (4) Fresno County acreage allocated 20, 000 to "Madera" area, and remainder to "Tulare"

Chapter 3 Possible commercial uses for almond prunings

This chapter is focused on operations that occur away from the orchards.

Generally, possible uses for almond prunings fall into four generic categories: 1) conversion to ethanol and biodiesel; 2) use as landfill material; 3) use as fuel for electrical generation facilities (conventional or gasification); and 4) use as raw material for other combustible products.

Cellulosic ethanol and biodiesel

Lately a great deal has been written about the potential of using wood biomass for ethanol for fuel and biodiesel. To the authors' knowledge, however, cost-effective processes have yet to be developed in California on a scale large enough to be an outlet for almond prunings or other woody biomass from agricultural sources.

Pyrolys is a well established waste management process. Three products result from pyrolysis: 1) a combustible gas that is used to generate the heat required for pyrolysis; 2) a liquid bio-oil similar to diesel that can be combusted directly to produce electricity or converted to a syngas from which clean fuels can be synthesized, and 3) a solid char that can be used as fuel or as a soil amendment. Substantial additional research is needed in order to more accurately assess the potential of pyrolysis in converting almond prunings to bio-oil or syngas. Without the additional research, it is probably safest to suggest that almond prunings would have no greater value in a pyrolysis system than they have as fuel in a co-generation facility.

Appendix C discusses pyrolysis in more detail. The contents of this were provided by Robert McChesney of Carbon Sequestration LLC.

Landfill material

If no immediate commercial use can be found, it is reasonable to assume that the material will have to be transported to a nearby landfill-type site. Based upon conversations with operators of county landfill operations in Northern California, it is not practical to plan on using these sites for two reasons: 1) the daily tonnages of refuse which the facilities are currently receiving are now about at the design maximums; and 2) land fill operators are charging tipping fees (costs to unload) in excess of $20 per ton for green biomass.

A possible alternative to municipal or county-operated landfill sites is remote private property where the chipped or ground material could be stored until it could be used commercially. There would certainly be costs associated with this approach (e.g., land costs, establishment costs, permitting costs, materials handling equipment costs, etc.). Given that both municipal landfills and private storage sites are not really viable destinations for this material in the near future, these alternatives are omitted from further consideration in this report.

Electricity generation fuel

Chipped or ground prunings have been transported directly from the orchards to electrical generation facilities. Just as directly, it could be trucked to a more centralized, though local, storage and re-processing facility. If prunings are destined for use as electricity generator fuel, it makes economic sense to ship directly. In this way, a second round of handling, storage and transportation costs will not be incurred by the farmers.

Table 3.1 shows a list of operating biomass power plants in Northern California. Those facilities located in San Joaquin valley counties should be the ones in the best position to accept woody material from almond operations facing the 2010 prohibition of burning agricultural biomass. The M/W size of these power plants is shown, as are the amounts of wood used as fuel.

Apparently, the economics of running a biomass power plant connected to the grid are not favorable enough to allow operators to pay a great deal for wood fuel. And, in some cases, the power plant operators are paid to take woody material. They receive tipping fees from demolition and construction material that is flowing north out of the LA basin when landfills there will not accept it. Recently reported prices offered by power plant operators for shredded almond prunings in the San Joaquin valley range from about $11/ dry ton to about $25/ dry ton. $11/ dry ton is equivalent to the cost of transporting the material to the power plant from nearby farms. Even though recently reported prices from this market do not cover much, if any, of growers' costs of handling prunings, this outlet must be retained in a marketing plan because it is a proven outlet.

Table 3.1 Operating California Electricity Generating Plants, Located in Northern Areas, Using Wood for Fuel, 2007

Utility Name	Plant Name	Plant County	Nameplate rating MW	Total NG	Total PC	Total WDS	Total AB
Fairhaven Power Co	Fairhaven Power	Humboldt	19			261.7	
Sierra Pacific Industries Inc	Sierra Pacific Lincoln Facility	Placer	14			122	
Centric Operating Services Company	Burney Forest Products	Shasta	31	159,764		206	
Collins Pine Co	Collins Pine Project	Plumas	12			76.9	
Rio Bravo Fresno	Rio Bravo Fresno	Fresno	28	51,377		193.7	
Rio Bravo Rocklin	Rio Bravo Rocklin	Placer	28	35,604		175	
CMS Generation Co	HL Power	Lassen	28			139.8	
Woodland Biomass Power Ltd	Woodland Biomass Power Ltd	Yolo	28	53,873		185.8	
AES Mendota LP	AES Mendota	Fresno	28			166.9	
AES Delano Energy Corporation Inc	Delano Energy	Kern	57			371.8	
Pacific Lumber Co	Pacific Lumber	Humboldt	17			613	
Sierra Pacific Industries Inc	Sierra Pacific Burney Facility	Humboldt	34			146	
Sierra Pacific Industries Inc	Sierra Pacific Loyalton Facility	Shasta	20			97	
Sierra Pacific Industries Inc	Sierra Pacific Quincy Facility	Sierra	20			225	
Wadham Energy Ltd Partners	Wadham Energy LP	Colusa	15	12,687			132
Pacific Ultrapower Chinese	Pacific-Ultrapower Chinese Station	Mariposa	29			160	
Burney Mountain Power	Burney Mountain Power	Shasta	35			90.4	
Mt Lassen Power	Mt Lassen Power	Shasta	11			84.9	
Pacific Oroville Power Co	Pacific Oroville Power Inc	Butte	11			157.2	
	Total WDS for Sacramento Valley County plants					343	
	Total WDS for San Joaquin Valley County plants					732.4	

**Fuel codes and units:
NG - Natural gas, thousand cu.ft.
PC - Petroleum coke, thousand tons
WDS - Woods, thousand tons
AB - Agricultural biomass, thousand tons

Source: http://biomass.ucdavis.edu, with updates

It is interesting to look at the value of wood as fuel when the wood is priced on an energy-equivalency basis with natural gas, even though this approach will probably never be made operational in the California market. The following two tables pertain to this approach. Table 3.2 shows energy equivalence between wood and natural gas. Table 3.3 shows how the value of wood as fuel changes with moisture content and the value of natural gas. Based upon Table 3.3, and allowing for a 40-percent reduction in value (due to system and combustion losses), the value of wood with a 15-percent moisture content should be around $50/ ton when the price of natural gas is about $5.50/Mcf.

Table 3.2 Energy Equivalency of Almond Prunings and Natural Gas

Prunings with moisture content of	Approximate Btu/lb (1)	Natural gas cubic feet equivalent (2)	Approximate Btu/ton (3)	Natural gas cubic feet equivalent (1)(2)
45%	5,000	5	10,000,000	10,000
30%	6,500	6.5	13,000,000	13,000
15%	8,000	8	16,000,000	16,000

(1) heat values do not include combustion losses
(2) 1,000 Btu/cubic foot used in this analysis. Actual value is 1,029 Btu/cubic foot.
(3) (2,000 lbs/ton)(5,000 Btu/lb)
(4) Col. 3 divided by 1,000.

Table 3.3 Price Equivalency of Almond Prunings and Natural Gas

Prunings with moisture content of	If gas price is $3.0/Mcf then the value of prunings:: $/lb	$/ton	If gas price is $4.5/Mcf then the value of prunings:: $/lb	$/ton
45%	0.0150	30.0	0.02250	45.0
30%	0.0195	39.0	0.02925	58.5
15%	0.0240	48.0	0.03600	72.0

Prunings with moisture content of	If gas price is $5.0/Mcf then the value of prunings:: $/lb	$/ton	If gas price is $5.5/Mcf then the value of prunings:: $/lb	$/ton
45%	0.0250	50.0	0.02750	55.0
30%	0.0325	65.0	0.03575	71.5
15%	0.0400	80.0	0.04400	88.0

Prunings with moisture content of	If gas price is $6.0/Mcf then the value of prunings:: $/lb	$/ton	If gas price is $7.5/Mcf then the value of prunings:: $/lb	$/ton
45%	0.0300	60.0	0.03750	75.0
30%	0.0390	78.0	0.04875	97.5
15%	0.0480	96.0	0.06000	120.0

Mcf: thousand cubic feet

Natural gas spot market contract prices in California, during late August 2007 ranged from $5.15 to $5.50 per thousand cubic feet as reported by the. Natural Gas Weekly Update (eia.doe.gov).

Raw material for combustible products

A local material handling location would be necessary if the almond prunings were destined for additional processing. Enough area would be needed so that drying could occur prior to processing. This would have to be a fairly large space, since thousands of tons of material would be on hand drying during some parts of the year. After some drying occurs, there are four options available:

Direct shipment of dried material to local buyer
Operation of a pellet mill to manufacture fuel for stoves and fireplaces
Operation of a large baler and bale press
Resizing (regrinding) almond prunings into sawdust-like product

1. Direct shipment to a local buyer from a handling location offers the advantages of not having to do much more than reload the material into trucks so that it may be delivered to the end-user. At this time, it seems clear that there is not enough potential volume in this market to account for all of the material. But it is something that could be done in addition to other activities. Also, the value of raw material to potential buyers is not known. It would be fortunate if the value would be large enough to at least cover re-loading the ground material into trucks and the costs of trucking.

2. ***Operation of a pellet mill*** using almond by-products to produce wood pellets for stoves, bar-b-q sized pellets for cooking, and fireplace logs has been attempted by various firms over the past 25 years. The most recently operating firm ceased operations about 10 years ago. Attempts to manufacture wood heating products from almond wood proved expensive … and, when attempted, were met with strong competitive pressures from manufacturers of similar products who were well established in the market**.**

A rather large capital investment is required to enter this business. Needed equipment includes: materials handling equipment; a dryer, a large hammer mill, a pellet mill, a firelog forming machine, wax storage tanks, a source of heat for the dryer, and packaging equipment. Also, when almond prunings (or other fruit woods) are made into pellets for pellet stoves, the almond material must be blended (in a 1/1 ratio) with forest-sourced soft wood. The cost of this material must be added to the process.

Since there is not a viable market for this type of product at this time, or businesses willing to invest in a processing facility, these types of operations are omitted from further consideration in this report.

3. Operation of a large baler and bale press was investigated at a conceptual level. The idea of preparing ground almond prunings for export by compressing them was considered. Thoughts revolved around using a large commercial baler/compactor of some kind (e.g., a cotton module builder) to compress ground almond prunings at a local site. Initially, it was thought that the compressed material could, in some way, be baled, re-compacted, pushed into sea-going containers, and then trucked to nearby port facilities. It was thought that, if the material was made available, buyers in world markets might be found.

Upon further investigation it was learned that forest-sourced wood chips were no longer being exported from California. However, forest-sourced wood chips are being prepared into a form of slurry (for later manufacture into paper) and are being exported in this form. Unfortunately, fruit woods are not useful for making paper. It was also learned that the only wood-based materials in compressed form now being exported from California are used paper and used cardboard.

Necessarily, this type of operation is omitted from further consideration in this report.

4. Resizing (regrinding) prunings into a sawdust-like product would involve the use of a larger hammer mill at a local site. This material could either be used locally in a pyrolysis operation or shipped overseas.

Following regrinding, the material could be directly loaded into ocean-going containers. Loading could be done using either a conveyor belt or a blower. Added costs will be incurred because of the reprocessing and moving the containers to the nearest port. The bulk density of sawdust material should make shipping in standard-sized containers (holding about 15 tons of resized almond wood product) economically feasible. Other advantages include: 1) being able to transport the material using existing technologies and capital; 2) resizing the material in rural locations prior to any shipment; and 3) being able to stockpile material until enough material has been accumulated for ocean transport.

There is precedence for this approach. According to press releases and web sites (e.g., www.greenenergyresources.com), green bio-energy supply companies have begun to ship sawdust products internationally from the U.S. Sawdust from the U.S. has been used in overseas locations to reduce coal-polluting emissions in co-firing.

Utilities in Europe have been successful with this approach. China is seen by many as a country that could make excellent use of this technology as they continue to expand their coal-fired electricity generating capacity while attempting to reduce emissions from these facilities. Recent information, however, suggests that China is not currently able to use sawdust material for the following reasons: 1) sawdust handling facilities are not in place at ports; 2) infrastructure may not exist to enable easy transport from ports to coal-fired electricity generators; and, 3) there may already be adequate supplies of woody biomass in China should the Chinese opt to move toward co-firing. However, in the longer run, it is possible that overseas markets for sawdust from west coast operations could become viable as world-wide pressure mounts to curb emissions from coal fired electricity generation facilities.

In summary, the markets that do exist for almond prunings are as fuel for electricity generating plants and as feedstock for firelog manufacturing. Markets which may exist in the future are exporting sawdust for use in co-firing at coal burning electricity generating plants and as feedstock for pyrolysis-based bio-oil manufacturing operations.

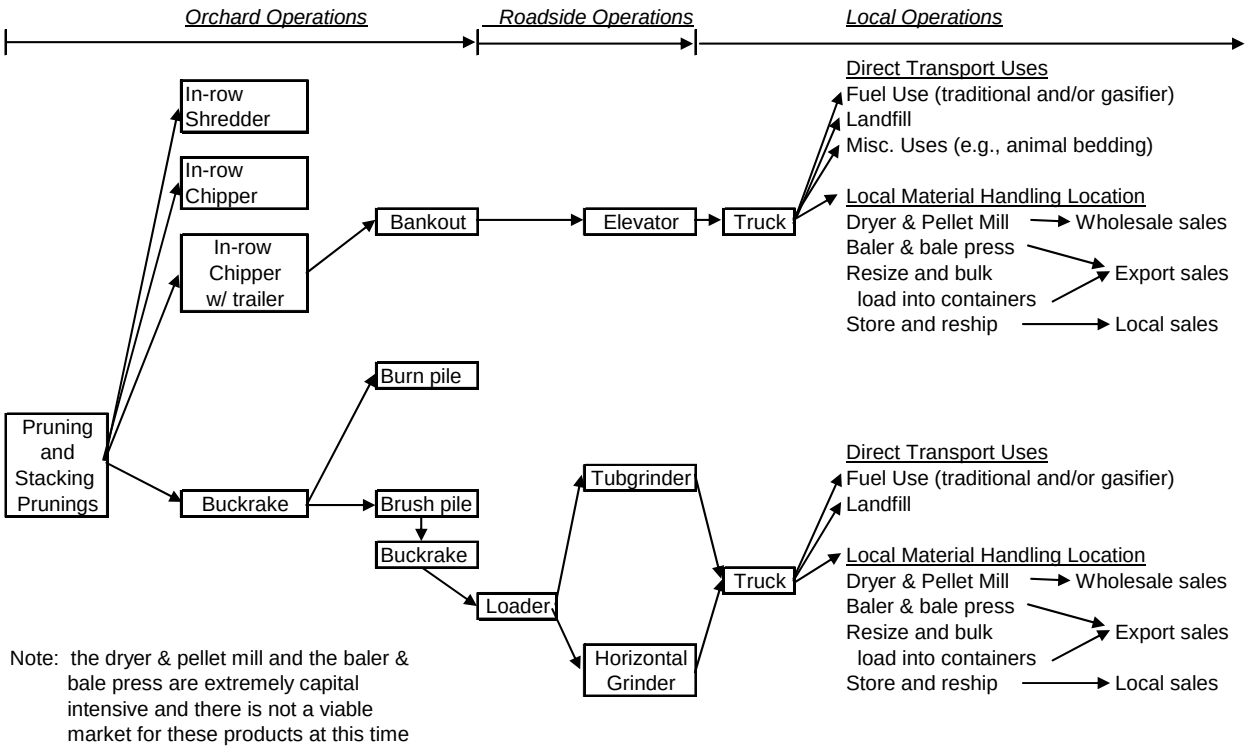
Any values that could be derived from carbon markets (carbon credits) are not factored into this report. However, Appendix B provides background data and estimates that pertain to possible carbon sequestration and carbon dioxide “uptake” at the orchard level. These estimates may be of use to those who seek to explore this market in the future.

Chapter 4 Product flows, operational systems, and costs

Product Flow

Figure 4.1 is a product flow diagram for almond prunings. Operations conducted in the orchard are shown on the left hand side. Operations which can occur at a roadside location (out of an orchard per se) are shown in the center. Operations that can occur away from the orchard, as well as possible commercial uses, are shown on the right hand side.

Figure 4.1 Almond Prunings Product Flow Diagram



Operational Systems

This section is devoted to operations in the orchard and at roadside. Chapter Three of this report concentrated on operations that occur away from the orchard.

Operations conducted within the orchard start with pruning the trees. This is done in the late fall and early winter and should certainly be completed by early January. As the pruning crew moves through an orchard, a second crew will follow to pick up the prunings from beneath the trees and stack them. Stacking will be done in the open spaces between tree rows. In most cases, the prunings will be stacked in every other open space so that other winter-time operations can be conducted.

If the brush is to be shredded and left in the orchard, or picked up using a buckrake, it must be stacked at 90-degrees to the tree rows. The only time the brush will be piled in a row that parallels the tree rows is when an in-row chipper is going to be used. Therefore, growers must be able to anticipate the type of equipment that will be used to remove brush and properly instruct the crew stacking the brush.

Shredders will, and in-row chippers may, discharge their products directly onto the orchard floor. If an in-row chipper is used to remove material from the orchard, a trailer pulled by the chipper will be needed to store the material until a bankout machine can shuttle the chips to truck trailers parked at roadside.

If buckrakes are used to move prunings from an orchard, two options currently exist. The first is burning as the material is being removed. The burn piles will be located within and/or at the edges of an orchard. The buckrake operator feeds the fires slowly all day long, keeping the size of the fires relatively small. A major benefit to grower of this option is that the almond prunings do not pile up and become a storage problem. This option is scheduled to not be available in the San Joaquin Valley air basin for almonds after 2010. The second option is to pile the brush for later handling using a grinder. Ground material will be discharged onto a conveyor belt and loaded directly into a truck trailer. If the ground material is piled on site, it would have to be reloaded at a later time.

If a grinder is used at roadside, a significant amount of open space will be needed to temporarily store the almond prunings. This will be in addition to the space needed to safely operate the machine. Many orchards will not be able to make space available without removing producing trees. While this factor may be the most significant of all when grinding prunings at roadside, it is impossible to meaningfully “cost” it in this analysis.

Table 4.1 is an operational considerations matrix listing the advantages and disadvantages of each system. Heavier soils (that retain water) in the northern areas of California are much more subject to compaction by heavy machines than are the lighter, sandier soils of the southern San Joaquin Valley.

Table 4.1 Operational Considerations Matrix

System	*Advantages*	*Disadvantages*
In-row Shredder	Possible improvement of air quality at orchard (1) Single equipment pass Does not require co-ordinated operations	Possible soil compaction & rutting Pruned material remains on orchard floor Shorter operational season
In-row Chipper w/ shuttle (bankout)	Possible improvement of air quality at orchard (2) Single equipment pass Prunings removed Sizes of processed material can be varied	Possible soil compaction & rutting Shorter operational season Requires co-ordinated operations
Tub Grinder	Possible improvement of air quality at orchard (3) Minimal soil compaction Prunings removed Extended operating season Sizes of processed material can be varied	Orchard-side storage area needed Buckrake needed for 2nd handling Requires co-ordinated operations May require local air quality permit Additional loader required
Horizontal Grinder	Possible improvement of air quality at orchard (4) Minimal soil compaction Prunings removed Extended operating season Greater thru-put rate Sizes of processed material can be varied	Orchard-side storage area needed Buckrake needed for 2nd handling Requires co-ordinated operations May require local air quality permit Additional loader required
On-site Burning	Prunings removed Minimal soil compaction Does not require co-ordinated operations	Possible loss of air quality at orchard (5)

(1) No burn is offset by diesel fuel emissions of shredder
(2) No burn is offset by diesel fuel emissions of chipper, bankout, trucks, and possible re-processing away from orchard
(3) No burn is offset by diesel fuel emissions of buckrake, tub grinder, 2nd buckrake, loader, trucks, and possible re-processing away from orchard
(4) No burn is offset by diesel fuel emissions of buckrake, horizontal grinder, 2nd buckrake, loader, trucks, and possible re-processing away from orchard
(5) Emissions from burning prunings and diesel fuel emissions of buckrake

Equipment Costs

Estimates of equipment costs for chipping and grinding are provided by Table 4.2. Costs per ton in Table 4..2 are shown on a wet ton basis.

Table 4.2 Equipment costs

	Horizontal Grinder		Horizontal Grinder		Tubgrinder		In-row Chipper w/ collection equip.	
		$/PMH		$/PMH		$/PMH		$/PMH
Horsepower	580		325		275		225	
Acquisition Cost	365,000		312,000		250,000		280,000	
Years of depreciation	5		5		5		5	
Productive machine hours (PMH)/yr)(1)	1,200		1,200		1,200		400	
Lifetime PMH	6,000		6,000		6,000		2,000	
Lease pmt or hourly depreciation		49		42		33		112
Salvage value (20%)	73,000		62,400		50,000		56,000	
Interest on avg. investment (8%)		15		12		10		34
Insurance per year (3% ac. cost)	10,950	9	9,360	8	7,500	6	8,400	21
Fixed Cost/Hour		72		62		50		167
Fuel cost/gallon	3		3		3		3	
Fuel consump./hour (.04 gal/hp/hr)	23	60	13	34	11	29	9	23
Engine Maint. (.30/gal)		7		4		3		3
Misc. rebuild (.15/gal)		3		2		2		1
Oil, filters, etc. (.09/gal)		2		1		1		1
Bits, grates, etc.		8		8		7		3
Hammers, rotors, etc.		3		3		3		-
Belts, etc.		2		2		2		-
Infeed chain, etc.		1		1		-		-
Service Labor ($32/hour @ .15 hours/hr)		5		5		5		5
Operator labor, incl. bene. ($25/hour)		25		25		25		25
Move & set-up costs ($300/20 hrs operation)		15		15		15		15
Variable Cost/Hour		131		99		90		76
Fixed and Variable Costs/hour		204		161		140		242
	Prod'n. (t/hr)	Cost/ton	Prod'n. (t/hr)	Cost/ton	Prod'n. (t/hr)	Cost/ton	Prod'n. (t/hr)	Cost/ton
	12	17	12	13	12	12	6	40
	15	14	15	11	15	9	8	30
	18	11	18	9	18	8	10	24
	21	10	21	8	21	7		
	24	8	24	7	24	6		

Note (1) for grinders: 1200 hours/yr w/ 800 hrs/yr in almonds
for in-row chipper:: 400 hours/yr w/ 400 hrs/yr in almonds

Costs for Alternative Methods of Handling Prunings

The in-row shredder and in-row chipper methods result in pruned material remaining on the orchard floor. Burning does remove the material. In these three cases material is not recovered for possible sale at a later time. The in-row chipper (with trailer), tub grinder and horizontal grinder processes do remove material from the orchard for possible later use.

Table 4.3 Costs of Prunings Handling Alternatives

	In-row Shredder ($/wet ton)	In-row Chipper ($/wet ton)	In-row Chipper w/ trailer ($/wet ton)	Tub Grinder ($/wet ton)	Horiz. Grinder ($/wet ton)	Burn ($/wet ton)
Brush remains in orchard						
Handling brush (1)	40	37				
Brush removed using in-row chipper						
Handling brush (1)			25			
Bank out for in-row chipper			3			
Elevator for chips			1			
Brush removed using buckrakes and burned or processed at roadside						
Buckrake from orchard (2)				20	20	34
Move from pile to loader (3)				2	2	
Load grinder (4)				2	2	
Grind (5)				9	10	
Truck from orchard to end user or central storage location			8	8	8	
Costs Incurred by Growers and Co-op thru Transport to Local Site						
Costs ($/ wet ton)	40	37	37	41	42	34
Costs ($/ dry ton) (6) (7)	64	59	59	66	67	54

(1) Shredder: $28-$32/acre for 1500 lbs. prunings
In-row chipper: $25-$30/hour for 1500 lbs. prunings
(2) Buckrake to burn: $200/day for 6 tons
Buckrake to pile: $200/day for 10 tons
(3) Buckrake: $25/hr for 18 tons/hr
(4) Loader: $35/hour for 18 tons/hr
(5) Source: Table 4.3
(6) Factor of 1.6 used to increase cost of wet ton to equivalent cost per dry ton.
(7) Costs of loading grinder, grinding and transport. In-row chipper costs may or may not have been met by grower.

Grower costs

Estimates of costs ($/ton) are shown for each step required by each different process. Costs incurred through transportation to a local site are shown in both dollars per wet ton and dollars per dry ton. On a wet ton basis, cost estimates per acre range from $34/ wet ton for burning to $42/ wet ton for a horizontal grinder. Significantly higher costs per dry ton are shown for each of the processes. It is critical to note that these cost estimates DO NOT include any costs of management and operation of a cooperative that would be needed to coordinate the entire set of operations

Table 4.4 Summary Cost Comparison

Prunings Handling Systems cost components	*Shred in Place*	*Rake & Burn*	*Chip & Remove*	*Remove & Grind*
			dollars per wet ton	
Shred in Place				
shredder	40			
Rake & Burn				
buck-rake to roadside		34		
Chip & Remove				
chipper			25	
bankout and load			4	
transport to central			8	
Remove & Grind				
buck-rake to roadside pile				20
pile to grinder				4
tub grinder				9
transport to central				8
Sum of prunings handling costs	40	34	37	41
dollars per acre @1,500 lbs per acre	30	26	28	31

Chapter 5 Business plan and *pro forma* financial information

Business Potential

This chapter is focused on the operation and costs of a cooperative (or LLC) formed and operated to assist grower-members, sell the almond prunings and coordinate overall operations. Chapter Four identified four alternate methods for growers to dispose of almond prunings. Two of those, "Chip & Remove" and "Remove and Grind" generate wood product that may be sold. Costs of operations at the farm level, including grinding operations at roadside and transportation to either a buyer of the ground material (e.g. co-gen) or to a central location for short-term storage and possible re-sizing were developed.

The central focus of this chapter is on the feasibility of operating a business which can handle the post-farm marketing and return surpluses to growers to at least partially offset costs of handling the pruning. This will depend upon both the costs of handling and further processing as needed, and the market returns available.

Market for Prunings

There are two forms for possible sales. The first is a "low value" alternative where the material ground at roadside is suitable for direct use by co-generation facilities. The second form is "higher value" where material is resized (made into sawdust) to a form suitable for pyrolysis or export. Estimates of potential revenues from local sales of ground material are $15/ dry ton. The resized material may generate revenues of $35 per dry ton.

Business Plan

This chapter investigates the potential for a business set up to handle the prunings from approximately 25,000 to 60, 000 acres, or a volume of 19,000 to 45,000 wet tons of prunings annually. The firm would have the following key operating policies:

- Growers would pay costs of moving the material out of the orchards.
- Growers would invest a fixed amount per acre (e.g. $10) as permanent equity,
- Growers would agree to an annual fee per acre, and a per ton charge.
- The business would contract for equipment services and lease office space and land for storage and facilities.
- The business would be responsible for grinding at roadside, and additional processing as needed, sales, and arranging delivery to end users
- Sales proceeds would be used to offset operating costs, with any surplus amounts available to be returned to growers at the end of the operational year.

The remainder of this chapter presents results from a model of the business with projections for five years under two scenarios. In both scenarios, the business overhead would be the same. Table 5.1 breaks down estimates of expenses a cooperative would incur for Administration & Overhead (A&O). Monthly costs are shown for each of the five years of operation. Monthly totals ($30,610) when multiplied by 12 result in annual A&O costs of about $370,000.

Table 5.1 Overhead Assumptions

Overhead Assumptions

Fiscal year beginning October 1, ---	2008	2009	2010	2011	2012
			monthy rates		
Staff Wages					
Manager	5,000	5,000	5,000	5,000	5,000
Office Manager	3,000	3,000	3,000	3,000	3,000
Field Representative	3,000	3,000	3,000	3,000	3,000
Maintenance Supervisor	4,000	4,000	4,000	4,000	4,000
Health Insurance contribution /month	600	600	600	600	600
payroll load, taxes % of payroll	13%	13%	13%	13%	13%
Payroll accounting services					
% of payroll + payroll taxes	3%	3%	3%	3%	3%
Office space rental	1,000	1,000	1,000	1,000	1,000
Plant Site rental	1,000	1,000	1,000	1,000	1,000
Utilities	500	500	500	500	500
Office Supplies	100	100	100	100	100
Phones, Internet	1,500	1,500	1,500	1,500	1,500
Office equipment	300	300	300	300	300
Travel	500	500	500	500	500
Auto expense	2,400	2,400	2,400	2,400	2,400
Business Insurance	1,500	1,500	1,500	1,500	1,500
Licenses, assn fees	250	250	250	250	250
	0	0	0	0	0
Consulting					
Accounting	1,000	1,000	1,000	1,000	1,000
Legal	500	500	500	500	500
Info Systems	200	200	200	200	200
Interest Expense	0	0	0	0	0
Provision for Income Taxes	0	0	0	0	0

Scenario Number One – Sales of Resized Material for a Relatively High Value

Table 5.2 gives the parameter values for the first model projection.

Table 5.2 Scenario One Assumptions

Fiscal year beginning October 1, ---	2008	2009	2010	2011	2012
Acres Committed	25,000				
Change acres		5,000	5,000	10,000	15,000
Material per acre wet lbs	1,500	1,500	1,500	1,500	1,500
Tub Grinding Operations per wet ton	19.00	19.00	19.00	19.00	19.00
Percent material direct to co-gen					
Resizing Operations wet ton	3.50	3.50	3.50	3.50	3.50
Sawdust Revenue per dry ton	35.00	35.00	35.00	35.00	35.00
Field run material Revenue per dry ton	15.00	15.00	15.00	15.00	15.00
Initial Equity Capital	10.00	10.00	10.00	10.00	10.00
Operating per acre Charge	10.00	10.00	10.00	10.00	10.00
Operating per wet ton Charges	5.00	5.00	5.00	5.00	5.00

As shown, the model assumes 25,000 acres during the first year of operations. The plan then suggests that an additional 5,000 acres in each of the second and third years would be added. In year four, 10,000 acres are added. In the fifth year an additional 15,000 acres would be added.

The average quantity of wet prunings per acre is assumed to be 1,500 pounds, giving and equivalent dry weight of about 1,000 pounds per acre. Consequently, wet tonnage of prunings to be handled by the cooperative increases from an initial 18,750 tons to 45,000 tons five years later. The first three rows of Table 5.2 summarize these assumptions.

Also shown in the assumptions table are the amounts of the grower assessments and charges that will provide permanent equity and working capital sources of funds expected to be available to initially capitalize, and then operate annually, the service cooperative. For the purposes of this analysis, growers' initial equity investment is suggested to be $10 per acre for those acres supplying prunings. The annual operational funding requirement from growers is suggested to be $10 per acre and $5 per wet ton of prunings handled by the cooperative. Note that the sum of these two costs, when added to the costs incurred by a grower for orchard operations, sums to about $35 per wet ton (cost now being incurred for burning prunings).

Table 5.3 contains the key parameters required to represent the product flow relationships. These are assumed hold over the five year horizon. An operational year is from October through the following September. The initial number of acres (25,000) and wet tonnage to be received are shown in the first two rows. The assumed proportion of the annual total tonnage to be handled monthly is shown in the "roadside factors" row of the table. For example, 20-percent of the annual tonnage is expected to be generated in December, 30-percent in January, etc. In order to allow some drying time, resizing operations at a central location are suggested to begin in March and conclude the following July, with 20-percent of the material handled and sold each month. The bottom rows of Table 5.2 show the quantity of material expected to be stockpiled on a monthly basis. For the second through fifth years of operation the percentages are the same and the seasonal patterns are similar.

Table 5.3 Scenario One Product Flow Parameters

Material timing	***Year One***	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
							fiscal year totals						
membership acreage		25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
prunings rec'd, wet tons		18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750
							percentage of fiscal year total handled in given month						
roadside factors				20%	30%	30%	20%						
local sales factors													
resizing factors							20%	20%	20%	20%	20%		
							wet tons						
Local sales		-	-	-	-	-	-	-	-	-	-	-	-
Stockpile @ Site, beginning					3,750	9,375	15,000	15,000	11,250	7,500	3,750		
new from road side				3,750	5,625	5,625	3,750						
resized utilization							(3,750)	(3,750)	(3,750)	(3,750)	(3,750)		
Stockpile @ Site, ending				3,750	9,375	15,000	15,000	11,250	7,500	3,750			

Table 5.4 is a cash flow model for the first year of operation. The basic assumptions underlying the model are that all product is resized and sold for a relatively high value ($35 per dry ton). Entries are shown on a monthly basis according to assumptions made in Table 5.3. Cash inflows from growers and revenues from sales of product are shown in the top portion of the table. Expected expenditures (grinding operations at roadside and transportation, resizing operations, and Administration and Overhead (A&O)) are shown in the middle of the table, and the net cash flows are shown at the bottom. Cumulative cash flows shown on a monthly basis illustrate that positive values early in the year turn negative after a few months and the first year concludes with a deficit of $35,000. Deficit cash flows will be covered using the equity invested in the cooperative. For the second through fifth years of operation the percentages are the same and the seasonal patterns are similar.

Table 5.4 Scenario One Cashflow Model Year One

Cashflow Summary ***Year One***	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
Cash Inflows	monthly dollars											
Growers' charge @ 10.0 /acre	250,000											
Growers' charge @ 5.0 /wet ton			18,750	28,125	28,125	18,750						
Sales resized @ 35.0 / dry ton						82,031	82,031	82,031	82,031	82,031		
Sales field run @ 15.0 / dry ton												
Total Cash Inflows	250,000		18,750	28,125	28,125	100,781	82,031	82,031	82,031	82,031		
Cash Outflows												
Tub-Grinding ops @ 19.0 / wet ton			(71,250)	(106,875)	(106,875)	(71,250)						
Resizing ops @ 3.5 / wet ton						(13,125)	(13,125)	(13,125)	(13,125)	(13,125)		
A & O Cash Outlays	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)
Total Cash Outlays	(30,610)	(30,610)	(101,860)	(137,485)	(137,485)	(114,985)	(43,735)	(43,735)	(43,735)	(43,735)	(30,610)	(30,610)
Net cash flow from ops	219,390	(30,610)	(83,110)	(109,360)	(109,360)	(14,204)	38,296	38,296	38,296	38,296	(30,610)	(30,610)
Cumlative Cash Flow	219,390	188,780	105,670	(3,690)	(113,050)	(127,254)	(88,958)	(50,661)	(12,365)	25,931	(4,679)	(35,289)
Pool Surplus Closed												(35,289)
	fiscal year totals											
membership acreage	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
prunings rec'd, wet tons	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750

Table 5.5 summarizes annual cash flow projections over a five-year horizon. Cash inflows are shown at the top, cash outflows in the middle, and cumulative cash flows in the bottom rows of the table. The final set of values shown in the table is the amounts of funds, on an annual basis, that may be returned to growers to offset costs of operation at the orchard level.

Table 5.5 Scenario One Five Year Projections

Cashflow Summary Five Year Projection	2008	2009	2010	2011	2012
Cash Inflows					
Growers' charge @ 10.0 /acre	250,000	300,000	350,000	450,000	600,000
Growers' charge @ 5.0 /wet ton	93,750	112,500	131,250	168,750	225,000
Sales resized @ 35.0 / dry ton	410,156	492,188	574,219	738,281	984,375
Sales resized @ 15.0 / dry ton					
Total Cash Inflows	753,906	904,688	1,055,469	1,357,031	1,809,375
Cash Outflows					
Tub-Grinding ops @ 19.0 / wet ton	(356,250)	(427,500)	(498,750)	(641,250)	(855,000)
Resizing ops @ 3.5 / wet ton	(65,625)	(78,750)	(91,875)	(118,125)	(157,500)
A & O Cash Outlays	(367,320)	(367,320)	(367,320)	(367,320)	(367,320)
Total Cash Outlays	(789,195)	(873,570)	(957,945)	(1,126,695)	(1,379,820)
Surplus	(35,289)	31,118	97,524	230,336	429,555
Surplus per wet ton	(1.88)	1.38	3.72	6.82	9.55
Average Surplus per acre	(1.41)	1.04	2.79	5.12	7.16
membership acreage	25,000	30,000	35,000	45,000	60,000
prunings rec'd, wet tons	18,750	22,500	26,250	33,750	45,000

Scenario Number Two – Sales of Ground Material for a Relatively Low Value

The following sets of tables (Table 5.6 through 5.9) consider an alternative sales scenario wherein ground almond prunings are moved directly from roadside grinding operations to an end use paying a relatively low value (e.g., fuel for co-generation unit). A sales value of $15 per dry ton ($10 per wet ton) is used in this analysis, even though this probably exceeds prices offered by co-generator operators in late 2007.

Table 5.6 gives necessary assumptions for this scenario. The key parameter to focus on low value sales is the percentage of total prunings sold directly to local co-gen operators. Note in Table 5.6 model this value is set at 100%.

Table 5.6 Scenario Two Assumptions

Fiscal year beginning October 1, ---	2008	2009	2010	2011	2012
Acres Committed	25,000				
Change acres		5,000	5,000	10,000	15,000
Material per acre wet lbs	1,500	1,500	1,500	1,500	1,500
Tub Grinding Operations per wet ton	19.00	19.00	19.00	19.00	19.00
Percent material direct to co-gen	**100%**	**100%**	**100%**	**100%**	**100%**
Resizing Operations wet ton	3.50	3.50	3.50	3.50	3.50
Sawdust Revenue per dry ton	35.00	35.00	35.00	35.00	35.00
Field run material Revenue per dry ton	15.00	15.00	15.00	15.00	15.00
Initial Equity Capital	10.00	10.00	10.00	10.00	10.00
Operating per acre Charge	10.00	10.00	10.00	10.00	10.00
Operating per wet ton Charges	5.00	5.00	5.00	5.00	5.00

The other assumptions In Table 5.6 are the same at Table 5.2 for Scenario One. In particular the acreage, volume of prunings, and grower assessments and charges are the same.

Table 5.7 shows, for the first year of operations, local sales factors and the months sales are expected to occur. Resizing and stockpiling do not occur and related costs are not incurred. A & O costs are shown, since an organization is needed to coordinate overall operations. For the second through fifth years of operation the percentages are the same and the seasonal patterns are similar.

Table 5.7 Scenario Two Product Flow Parameters

Material timing	***Year One***	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
		fiscal year totals											
membership acreage		25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
prunings rec'd, wet tons		18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750
		percentage of fiscal year total handled in given month											
roadside factors				20%	30%	30%	20%						
local sales factors				100%	100%	100%	100%						
resizing factors							20%	20%	20%	20%	20%		
		wet tons											
Local sales		-	-	3,750	5,625	5,625	3,750	-	-	-	-	-	-
Stockpile @ Site, beginning													
new from road side													
resized utilization													
Stockpile @ Site, ending													

Table 5.8 shows the cash flows for the first year of operation. Net cash flows clearly illustrate that costs of operation greatly exceed the amounts of money contributed by growers. For the second through fifth years of operation the percentages are the same and the seasonal patterns are similar.

Table 5.8 Scenario Two Cashflow model Year One

Cashflow Summary ***Year One***	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
Cash Inflows	monthly dollars											
Growers' charge @ 10.0 /acre	250,000											
Growers' charge @ 5.0 /wet ton			18,750	28,125	28,125	18,750						
Sales resized @ 35.0 / dry ton												
Sales field run @ 15.0 / dry ton			35,156	52,734	52,734	35,156						
Total Cash Inflows	250,000		53,906	80,859	80,859	53,906						
Cash Outflows												
Tub-Grinding ops @ 19.0 / wet ton			(71,250)	(106,875)	(106,875)	(71,250)						
Resizing ops @ 3.5 / wet ton												
A & O Cash Outlays	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)
Total Cash Outlays	(30,610)	(30,610)	(101,860)	(137,485)	(137,485)	(101,860)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)
Net cash flow from ops	219,390	(30,610)	(47,954)	(56,626)	(56,626)	(47,954)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)	(30,610)
Cumlative Cash Flow	219,390	188,780	140,826	84,201	27,575	(20,379)	(50,989)	(81,599)	(112,209)	(142,819)	(173,429)	(204,039)
Pool Surplus Closed												(204,039)
	fiscal year totals											
membership acreage	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
prunings rec'd, wet tons	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750

Table 5.9 shows annual cash flow summaries for the five year operational horizon for Scenario Number Two.

Table 5.9 Scenario Two Five year Projections

	Cashflow Summary Five Year Projection				
	2008	2009	2010	2011	2012
Cash Inflows					
Growers' charge @ 10.0 /acre	250,000	300,000	350,000	450,000	600,000
Growers' charge @ 5.0 /wet ton	93,750	112,500	131,250	168,750	225,000
Sales resized @ 35.0 / dry ton					
Sales resized @ 15.0 / dry ton	175,781	210,938	246,094	316,406	421,875
Total Cash Inflows	519,531	623,438	727,344	935,156	1,246,875
Cash Outflows					
Tub-Grinding ops @ 19.0 / wet ton	(356,250)	(427,500)	(498,750)	(641,250)	(855,000)
Resizing ops @ 3.5 / wet ton					
A & O Cash Outlays	(367,320)	(367,320)	(367,320)	(367,320)	(367,320)
Total Cash Outlays	(723,570)	(794,820)	(866,070)	(1,008,570)	(1,222,320)
Surplus	(204,039)	(171,383)	(138,726)	(73,414)	24,555
Surplus per wet ton	(10.88)	(7.62)	(5.28)	(2.18)	0.55
Average Surplus per acre	(8.16)	(5.71)	(3.96)	(1.63)	0.41
membership acreage	25,000	30,000	35,000	45,000	60,000
prunings rec'd, wet tons	18,750	22,500	26,250	33,750	45,000

Conclusions

Table 5.10 compares the summary outcomes from the five year model projections for the scenarios.

Table 5.10 Comparisons of Projections

Year		*2008*	*2009*	*2010*	*2011*	*2012*
Senario One	***All sales resized and sold at $35 per dry ton***					
Surplus		(35,289)	31,118	97,524	230,336	429,555
Surplus per wet ton		(1.9)	1.4	3.7	6.8	9.5
Average Surplus per acre		(1.4)	1.0	2.8	5.1	7.2
Scenario Two	***All sales from field and sold locally (e.g. co-gen) at $15 per wet ton***					
Surplus		(204,039)	(171,383)	(138,726)	(73,414)	24,555
Surplus per wet ton		(10.9)	(7.6)	(5.3)	(2.2)	0.5
Average Surplus per acre		(8.2)	(5.7)	(4.0)	(1.6)	0.4
Base information: both scenarios						
membership acreage		25,000	30,000	35,000	45,000	60,000
prunings rec'd, wet tons		18,750	22,500	26,250	33,750	45,000
member equity contribution	$/ acre	10	10	10	10	10
member annual charge	$/ acre	10	10	10	10	10
cooperative handling charge	$ / wet ton	5	5	5	5	5

Scenario One demonstrates the potential for a business to generate surpluses to offset growers costs of handling almond pruning without burning. The potential depends upon realizing high returns for value added activities.

In contrast, Scenario Two demonstrates the likely outcomes if high value sales are not realized. The results emphasize how crucially important the level of sales returns will be to success, and the problems that will arise if the company establishes an overhead base sufficient to handle additional processing and high value sales, but in fact is only able to sell in low value markets.

By the end of the first year under the Scenario Two assumptions, the shortfall is estimated to be about $ 200,000. Presumably this could be met by drawing down permanent capital, or by imposing higher per acre annual and per ton charges. The problem dramatizes the importance of working capital financing and beginning with an adequate level of permanent capital.

Cumulative cash flows over this period illustrate the additional monies that would have to be contributed annually by growers in order for the cooperative to continue to operate. These dollar amounts range from $8 per acre in year one to about $2 per acre in year four. By year five, the total acreage and volume is large enough to offset the overhead base, and provide a small surplus.

Chapter 7 Sample legal documents for local agricultural co-op

The sample legal documents shown in Appendix A have been prepared for general information purposes only. They are intended as a starting point for those interested in forming an agricultural cooperative. Since it is impossible to cover all legal contingencies and provisions for every situation, the reader is advised to consult with a legal professional to ensure the documents conform to Federal, State and local law. Most of the language shown is suitable for a service and/or a marketing association. Counsel can help make the modifications necessary to cover the type of cooperative desired.

The following are key components of the legal documents:

Agreement to Participate in Organizing- spells out the objectives of the organization, the patronage requirements and the financial commitment necessary. It also shows what findings are necessary before a decision will be made to proceed with the formation of the organization.

Articles of Incorporation- establish the core characteristics of the cooperative corporation. It includes a statement of purpose, whether it is a stock or non-stock corporation, who qualifies as members, voting rights, powers, and who the organizers are.

Bylaws- provide a detailed description of the structure and method of operation of the organization.

Membership Application- certifies that the applicant is a producer of an agricultural product as defined by law and is qualified to be considered for membership.

Membership Agreement and Contract- serves as the official notice an applicant has been accepted into membership status and the terms and conditions of membership.

Acknowledgements

We acknowledge the assistance of the Technical Advisory Committee. These industry leaders contributed time and expertise both at the initial planning stages and during the accomplishment of this study.

Gene Beach, President, California Almond Hullers & Processors Association

Thor Bailey, President, Ag Biomass Council Inc.

Bob DuBose, Principal, Tink Inc-Farm Machinery Manufacturing

Lee Brown, Principal, San Joaquin Biomass

Bob Kahler, Manager, Nichols Ranch

Steve Taylor, Manager Stratford Growers Association

Steve Easter, Retired, Blue Diamond Growers

* Chairman Advisory Committee

Appendix A Sample Legal Documents

Agreement to Participate
In Organizing
The XXXX Energy Feedstock Supply Cooperative

Section 1. Purpose

The undersigned is a producer of agricultural products, hereinafter referred to as "Producer", together with other producers who have signed agreements similar hereto, promises to participate in organizing a cooperative association, hereinafter referred to as "Association", in accordance with Chapter 1, Division 20 of the California Food and Agriculture Code for the purpose of engaging in activities involving woody agricultural biomass from the pruning of orchards owned or leased by its members in any one or more of the following ways: Aggregating , processing, manufacturing, marketing, selling or transporting.

Section 2. Organization Development Task Force

It is understood by the Producer that the Association shall be organized with and governed by articles of incorporation and bylaws created and determined by an Organization Development Task Force consisting of the following persons:

Name	Address
---	---
---	---
---	---
---	-- ---

It is understood by the Producer that each and every person of the abovementioned Organization Development Task Force has executed an "Agreement to Participate In Organizing The XXXX Energy Feedstock Supply Cooperative". It is likewise understood by the Producer that the abovementioned Organization Development Task Force, in reliance on their abovementioned collective unilateral promises and the promises by the Producer contained in this document, will act with due diligence to accomplish the tasks and satisfy the conditions set forth in Section 5 of this document, and take the necessary subsequent actions to complete the organization and formation of the "XXXX Energy Feedstock Supply Cooperative.

Section 3. Patronage Commitment

Producer promises to sign a Membership Agreement to commit all woody biomass from the pruning of orchards on _____ acres of land, owned or leased by the Producer to the Association for any or all of the purposes stated in Section 1 of this document.

Section 4. Financial Commitment

The Producer agrees to commit to a Organization Development Fee of $____ for each acre committed in Section 3 of this document, the sum of which is to be deposited in an Organization Development Fund account maintained by an appropriate responsible institution or entity, and used by Organization Development Task Force for the initial expenses of organizing the Association. It is the Producer's understanding that provision may be made in the bylaws of the Association to reimburse Producer, from Association funds, any or all of the amount of the Organization Development Fee contributed by the Producer pursuant to the promises made within this document.

Section 5. Contingencies and Vote to Proceed

Producer understands that proceeding with the formation and operation of the Association is contingent upon the occurrence of all of the following conditions:

1. On or before _____, the Organization Development Task Force is able to demonstrate that a sufficient number of eligible producers of agricultural woody biomass from the pruning of orchards have agreed to execute marketing agreements covering _____ acres and providing equity to the association of at least $_____ .

2. On or before the date of _____, the Organization Development Task Force has set a date, time and place for a meeting of those producers who have signed an "Agreement to Participate in Organizing the XXXX Energy Feedstock Supply Cooperative", wherein at such meeting said producers, by majority vote, must favor proceeding with the formation and operation of the Association.

Section 6. Accounting and Disbursements

The Producer understands that the Organization Development Task Force will keep detailed and accurate accounts of all receipts and of all expenditures and shall, after appropriate Association formation and elections have occurred, render a written report and accounting to the board of directors of the Association and deliver to the officers of the Association any net balances or unexpended monies from any and all funds and fees received. Said net balances or unexpended monies may, at the discretion of the board of directors of the Association, subsequently be remitted from Association funds to those Producers that contributed to the initial Organization Development Fund on a pro rata contribution basis. If for whatever reason the Association is not formed or organized, any unexpended net balances or monies shall be distributed to those who contributed to the Organization Development Fund on a pro rata contribution basis.

The undersigned, referred to as "Producer" throughout this document, has read, understands and agrees to the promises and provisions contained within this document.

Date_____, 20___

_____
Producer's Name (Typed or Printed)

_____
Producer's Address (Typed or Printed)

Signed:_____
Producer's Signature

Articles of Incorporation

Articles of Incorporation Of XXXXX Energy Feedstock Supply Cooperative

Preamble

We the undersigned, a majority of whom are residents of the State of California, and each of whom is engaged in the production of an agricultural product as defined in Section 54004 of the Food and Agriculture Code of the State of California, have associated ourselves together and propose to incorporate a nonprofit cooperative association pursuant to the provisions of Chapter 1 of Division 20 of the Food and Agricultural Code of the State of California.

I. Name

The name of this Association shall be XXXX Energy Feedstock Supply Cooperative.

II. Purposes

The Association is formed for the purposes of engaging in any activity connected with any one or more of the following activities:

(1) The production, marketing or selling of the products as defined in Section 54004 of the Food and Agricultural Code of its members.
(2) The aggregation, processing, transportation, and/or marketing of any woody biomass products produced by its members.
(3) The manufacturing and marketing of member produced woody biomass byproducts.
(4) The financing of any of the above activities.

III. Principal Office

The county where the principal office for the transaction of business of the Association is to be located is_____ County, California.

IV. Initial Agent for Service of Process

The name of the Corporation's initial agent for service of process is _____. The agent's complete address is _____.

V. Membership

The cooperative shall admit applicants to membership in the cooperative upon such uniform conditions as may be prescribed in the Bylaws.

VI. Directors

The Association shall have not less than five or more than nine Directors. The exact number of Directors shall be fixed by approval of the board listed as first directors of the association. The directors shall be known collectively as the Board of Directors.

The name and addresses of the persons who are to serve as the first directors of the Association are:

Names	Addresses
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

VII. Voting Rights

The Association is a membership association organized without shares of stock.

The voting rights of each member of the association shall be unequal and shall be determined and fixed in accordance with the general rule applicable to all members of this association: Each member shall have one vote as a member plus an additional vote for each acre under contract. In no case however, shall any individual member be entitled to exercise over twenty-five percent of the total votes collectively allotted to members.

VIII. Revolving Funds

To provide funds for effecting corporate purposes, the Association may collect or retain from members for its own use sums to be determined from time to time by the Board of Directors of the association, in accordance with any applicable provisions contained in the bylaws. Pursuant to those provision, retained funds shall be placed in one or more Association funds called" Revolving Funds" to the credit of the respective members from whom collected or retained, and each member shall be entitled to a credit, called "Revolving Fund Credit" for the amount collected or retained from that member. Revolving Fund Credits shall be repayable out of moneys in any Revolving Fund not required for the use of the Association at that time, with the priorities and on the conditions provided in the bylaws of the Association.

Revolving Fund Credits may also be set up on the books of the Association and admitted by the Association in payment for property purchased by the Association or as consideration for moneys loaned or advanced to the Association, the principal of which shall be payable solely and exclusively out of the moneys in the Revolving fund to which credited in the same manner as Revolving Fund Credits for retained funds.
The matter of payment of interest (which in no event may exceed eight (8) percent per annum) on the Revolving Fund Credits shall be appropriately provided for in the bylaws.

IX. Property Rights

The property rights and interests of each member of the Association shall be unequal and shall be determined and fixed by the following general rule applicable to all members of the Association:

Each member's property rights and interests in the Association shall be measured by the unrefunded contribution of that member in money or property to Association's Revolving Fund or Funds and shall be in the same proportion that the member's unrefunded contribution to that Revolving Fund bears to all unrefunded contributions made to the Revolving Fund by all members of the association.

X. Powers

In order to carry out the purposes for which it was formed, the Association shall have and exercise each and every power, privilege, right, and immunity now or hereafter authorized for a corporation organized and existing pursuant to Chapter1 of Division 20 of the Food and Agriculture Code.

XI. Period of Duration

The cooperative shall have perpetual existence.

Signatures
We the undersigned hereby declare that we are the persons who executed the foregoing Articles of Incorporation, and that the execution is our act and deed.

Dated_____, 20__

_____ _____
typed name signature

_____ _____
typed name signature

_____ _____
typed name signature

Bylaws

BYLAWS

The XXXX Energy Feedstock Supply Cooperative

ARTICLE I. GENERALLY

Purposes

Section 1.01. The purpose of the Association is to render, within the limitations of the Cooperative Marketing Law of California, service to its members at cost in connection with the aggregation, processing, transportation or marketing of any woody biomass products produced by its members.

Principal Office

Section 1.02. The principal office of the Association is in the County of _____, California, at a place to be determined from time to time by the Board of Directors.

Definitions

Section 1.03. As used in these Bylaws:

The term "Association" means the XXXX Energy Feedstock Supply Cooperative.

The term "Board" means the Board of Directors of that Association.

The term "Cooperative Marketing Law" means the provisions of Chapter 1 of Division 20 of the Food and Agricultural Code of the State of California.

The term "Articles of Incorporation" includes amendments and means the Articles of Incorporation of the Association as last amended.

The term "Products" means agricultural woody biomass produced by members.

ARTICLE II. MEMBERS

Admission to Membership

Section 2.01. Any person desiring membership in the Association shall submit a membership application on a form prescribed by the Board of Directors. The application shall contain an agreement to abide by the Bylaws, rules, and regulations of the Association. The Board shall admit or deny membership in its discretion. Acceptance of the application shall make the agreement immediately effective and binding on the member. The word person as used in this article includes individuals, firms, partnerships, corporations, associations, lessees and tenants of lands used for or in the production of products, and any lessor or landlord who receives as rent all or part of the products raised on leased premises. If the member is not a natural person, then that member may be represented by any individual, associate, officer, or manager or member of it who is duly authorized in writing to represent it.

Membership Certificate

Section 2.03. Each member of the Association is entitled to a membership certificate, signed by the President and Secretary of the Association.

Joint Owners

Section 2.04. When the right to dispose of any product is owned by more than one person, whether as cotenants, joint tenants, partners, an unincorporated association, or otherwise, all owners may be collectively admitted to membership as a single member entitled to one membership certificate. The membership certificate may be issued in the names of all owners or in any name that they have chosen as their collective name. All of them collectively shall be deemed a single member of the Association and will possess the rights of one member. The right to vote and assent shall be held by those persons as authorized in a written document filed with the Association. In the absence of an authorization, the right to vote and assent may be exercised by any one of those persons.

Transfer of Membership

Section 2.05. No transfer or assignment of membership certificates may occur without the written consent, approval and authorization of the Board of Directors of this Association. The transfer of membership certificates to any person who does not fall within one of the following categories is prohibited:

(a) Any person who is engaged in the production of any product that is handled by or through the Association.

(b) Any person who uses or employs any service or facility offered by the Association on, or in connection with, land which is used for the production of any product, including any person who is a lessor or landlord who receives as rent all or part of the crop which is raised on the leased premises.

The foregoing transfer restriction shall be printed on every membership certificate issued by the Association.

Termination of Membership

Section 2.06. A membership and all membership rights shall automatically terminate upon any of the following events:

(a) The loss of qualifications necessary for admission to membership.

(b) The withdrawal of a member from membership upon compliance with such uniform terms and conditions as the Board may prescribe.

(c) The death of a member or the dissolution of a corporate member.

(d) The expulsion of a member pursuant to Section 2.07 of these Bylaws.

Expulsion

Section 2.07. A member who fails to comply with the Bylaws, rules or regulations of the Association shall be expelled from membership in the Association only after reasonable notice and an opportunity to be heard is given pursuant to this section. The Association must provide written notice of the expulsion and the reasons for expulsion at least 15 days prior to the effective date of the expulsion. The notice must be given personally or sent by first-class or registered mail to the last address of the member shown on the Association's records. The provided opportunity for a hearing shall be one week before the effective expulsion date and shall be held before a committee appointed by the Board.

Effect of Termination

Section 2.08. All rights as a member of the Association shall cease upon termination of membership. Termination shall not relieve that member from any obligations to the Association. A terminated member shall not be entitled to payment on account of any property interest in the Association except as follows:

(a) The terminated member shall be entitled to receive payment on account of any moneys received by the Association from the sale of Products produced by that person, and on account of any funds credited to that person in the Revolving Fund after termination.

(b) In the case of any member terminated other than by expulsion, the member shall be entitled to receive payment on account of any interest in the unallocated property and assets of the Association upon dissolution.

(c) In the case of an expelled member, the Board of Directors shall equitably and conclusively appraise that member's property interest in the Association and fix the amount in money. The fixed amount shall be paid to the expelled member within one year of expulsion.

ARTICLE III. VOTING AND PROPERTY RIGHTS

Voting Rights

Section 3.01. The voting rights of each member of the Association shall be unequal and shall be determined and fixed in accordance with the general rule applicable to all members of the Association. Each member shall have one vote as a member plus an additional vote for each acre under contract. In no case however, shall any individual member be entitled to exercise over twenty-five percent of the total vote allotted to members.

Voting by Proxy

Section 3.03. Voting by proxy for any purpose shall not be permitted.

Property Rights

Section 3.04. The property rights and interests of each member shall be unequal and shall be determined and fixed by the following general rule applicable to all members of the Association:
Each member's property rights and interests in the Association shall be measured by the unrefunded contribution of that member in money or property to the Association's Revolving Fund and shall be in the same proportion that the member's unrefunded contribution bears to all unrefunded contributions made to the Revolving Fund by all the members of the Association.

Property Rights upon Dissolution

Section 3.05. Upon dissolution of the Association, all of the money, property, and assets shall be applied and distributed as follows:

(a) First, in payment of all debts, liabilities, and obligations of the Association other than those represented by Revolving Fund Credits or other credits issued to members or patrons.

(b) Second, in payment of all Revolving Fund Credits and other credits issued to members and patrons.

(c) Third, any residue remaining after payment in full of all indebtedness, including that evidenced by Revolving Fund Credits and other credits issued to members and patrons, shall be distributed to those members in good standing who held Revolving Fund Credits at the time of commencement of proceedings for liquidation or dissolution, in the proportion that the amount of Revolving Fund Credits held by each of them at that time bears to the total amount of credits outstanding at that time.

ARTICLE IV. MEETINGS OF MEMBERS

Annual Meeting

Section 4.01. The annual meeting of members shall be held in _____ each year at such time and location within the area of membership as the board from time to time determines.

Special Meetings

Section 4.02. Special meetings of the members of the Association shall be called by the Secretary of the Association on request of the President of the Association, the Board of Directors, or members holding not less than twenty percent (20%) of the voting power of the Association. The requests shall be in writing, shall be filed with the Secretary of the Association, and shall state the time, place, and the general nature of the business to be transacted.

Notice of Meetings

Section 4.03. Written notice of each meeting of members, whether annual or special, shall be given by the Secretary of the Association to each member entitled to notice, not less than fifteen (15) days nor more than sixty (60) days before the meeting, either by personal delivery or by first class mail, postage prepaid, to the address of each member as listed in the books of the Association. One method of service may be used as to some members and the other method as to other members.

Contents of Notice

Section 4.04. Notice of any membership meeting shall specify the place, day, and hour of the meeting. In the case of special meetings, the general nature of the business to be transacted at the meeting shall be stated in the notice. In the case of the annual meeting, the nature of the business to be transacted at the meeting need not be stated. However, when a proposal to amend the Articles of Incorporation or these Bylaws is to be voted on at any meeting notice of that fact shall be given.

Members Entitled to Notice

Section 4.05. Notices of meetings shall be mailed on the same day and at the same time to each member who, on the record date for notice of the meeting, is entitled to vote. The record date for determination of members entitled to notice is 5:00 p.m. local time at the office of the Secretary of the Association on the day immediately preceding the day of mailing.

Quorum

Section 4.06.Members present in person at any membership meeting representing a majority of those present shall constitute a quorum for the transaction of all business that may legally come before that meeting

Business to Be Transacted

Section 4.07. At the annual meeting of members, any business may be transacted with respect to which the members are permitted to act, including, subject to the provisions for notice, the amendment, repeal, and adoption of bylaws and the approval and ratification of amendments to the articles of incorporation. At a special meeting of members, only the business specified in the notice of meeting, may be transacted.

Manner of Voting

Section 4.08. At meetings of members all questions, except as otherwise expressly provided by statute or by these Bylaws, shall be determined by a majority of the votes represented at the meeting. All voting shall be by voice vote, unless a majority of the members represented at the meeting demand a vote by written ballot.

ARTICLE V. DIRECTORS

Number

Section 4.09. The Association shall have not less than five (5) or more than nine (9) Directors. The exact number of Directors shall be fixed, within the specified limits, by approval of the board listed as the first directors of the Association .The Directors shall be known collectively as the Board of Directors.

Term

Section 4.10. The Directors shall be elected at each annual meeting and shall hold office until their successors have been elected and qualified for office.

Qualifications

Section 4.11. Each Director shall be a duly qualified member of the Association.

Vacancies

Section 4.12. Vacancies on the Board of Directors arising other than by expiration of the term of office of a Director shall be filled by the majority vote of the remaining Directors then in office. The newly appointed Director shall hold office for the unexpired portion of the term of office of the Director he or she is appointed to replace, and until the election and qualification of a successor.

Removal of Director

Section 4.13. Whenever any director fails to meet the qualifications as described in Section 2.01, it shall be the duty of the board to remove the director and to fill the vacancy in accordance with Section 4.12 of this Article. Members through petition noting the charges and signed by at least fifty-one percent (51%) may request the removal of any director. That director shall notified in writing of the charges and given the opportunity to be heard at a membership meeting of the cooperative. In this instance a quorum shall constitute fifty-one percent (51%) of the membership in attendance and the majority must vote for removal of the director. Any vacancy resulting from such action shall be filled by nomination and vote of members at the meeting.

Organizational Meeting

Section 4.14. A meeting of the Board of Directors, to be known as the "organizational meeting," shall be held immediately following adjournment of the annual meeting of members for the purpose of organizing, electing, and appointing officers of this Association. Any other business may also be transacted at the meeting. No notice of an organizational meeting need be given. If not held at the time appointed, or if the organizing, electing, and appointment of officers of this Association is not effected or completed at the meeting, the business or organizing, electing, and appointing officers of this Association shall be transacted or completed at the next regular or special meeting of the Board of Directors.

Regular Meetings

Section 4.15. Regular meetings of the Board of Directors shall be held at least quarterly, at such time and place as the board may determine

Special Meetings

Section 4.16. A special meeting shall be held whenever called by the President or by any five directors or by action of the board at a previously called meeting. Each call for a special Meeting shall be in writing, signed by the person or persons making the call and addressed and delivered to the Secretary, and shall state the time, place and purpose of the meeting.

Notice of Special Meetings

Section 4.17. Written notice of a special meeting of the Board of Directors, specifying the time and place of the meeting, shall be given by the Secretary of the Association to each Director at least not less three days prior to the meeting

Waiver of Notice

Section 4.18. Unless otherwise prohibited by law, a Director may waive notice of a special meeting of the Board of Directors. Attendance at and participation in the proceedings of any special meeting shall be deemed such a waiver. The waiver of any Director not present or participating in any special meeting shall-be in writing, signed by the Director, either before or after the holding of the meeting, and filed with the Secretary of the Association.

Quorum

Section 4.19. A majority of the authorized number of Directors shall be necessary to constitute a quorum for the transaction of business. Unless otherwise required by law or these bylaws, every act or decision done or made by a majority of the Directors present at a meeting duly held at which a quorum is present shall be regarded as the act of the Board of Directors.

Adjournment

Section 4.20. If a quorum is not present at the time set for holding any meeting of the Board of Directors, the Directors present shall have the power to adjourn the meeting, without notice other than oral announcement at the meeting, until a quorum shall be present. Any business that might have been transacted at the meeting as originally noticed may be transacted at an adjourned meeting.

Business to Be Transacted

Section 4.21. Any and all business presented may be transacted at any regular meeting of the Board of Directors or at any adjournment thereof, or at any meeting held by written consent or for which a waiver of notice has been obtained.

Compensation of Directors

Section 4.23. The Directors of the Association shall receive no compensation for their services as Directors but shall be entitled to reimbursement for all traveling and other actual expenses reasonably incurred by them in connection with attendance at any meetings of the Board of Directors, or any committee on presentation to the Treasurer of vouchers on a form prescribed by the Board of Directors.

Powers and Duties of Directors

Section 4.25. The Directors shall have the power and duty to manage the business and affairs of the corporation and to exercise all corporate powers, including the duty to:

(a) Prescribe the qualifications and requirements for membership.

(b) Accept or deny membership applications.

(c) Issue membership certificates.

(d) Make and enter into agreements with producers, processors, distributors, and others for the aggregation, processing, sale, marketing, and consignment of the products produced by members.

(e) Carry out the membership and marketing agreements of the Association to the members' benefit.

(f) Install an auditing system to keep a complete record of the property rights and interests of the members.

(g) Determine and fix any amounts to be charged and retained for services rendered to members.

(h) Establish grades, standards, and classification of products when necessary and to determine and fix the prices for those products.

(i) Determine, from time to time, which members are in good standing, and to terminate the membership of those members not in good standing.

(j) Send to each member, no later than 120 days after the close of the fiscal year, an annual report of the Association's operations, including a balance sheet, approved by a certified public accountant pursuant to Food and Agricultural Code Section 54204.

Executive Committee

Section 4.26. The Board shall have the power to establish an Executive Committee consisting of the chairman and other such members as the board selects from members of the board. The Executive Committee shall have such duties and powers as may be prescribed by the board and, except as otherwise provided by law, their duties and powers may be all the duties and powers of the board.

ARTICLE VI. OFFICERS

Election and Term of Officers

Section 4.27. The elected officers of the Association shall be a Chairman of the Board, one or more Vice Chairmen, a Secretary, and a Treasurer. All officers shall be members of the Board of Directors. Any two or more offices, except those of chairman and secretary, may be held by the same person. The Board of Directors shall elect officers annually.

Appointive Officers

Section 4.28. The Board of Directors may appoint Assistant Secretaries, Assistant Treasurers, and any other officers it deems necessary serve at the pleasure of the Board of Directors and who shall perform the duties prescribed by the Board of Directors.

Compensation of Officers

Section 4.29. The Officers of the Association shall receive no compensation for their services as Officers, but shall be entitled to reimbursement for all traveling and other actual expenses reasonably incurred by them in connection with Association business upon presentation to the. Treasurer of vouchers on a form prescribed by the Board of
Directors.

Duties of Officers

Section 4.30 Chairman of the Board
The Chairman of the Board shall have responsibility for general supervision direction and control of the business and affairs of the association. He/she shall preside over meetings of the association and board of directors, call special meetings of the board appoint committees as the board may deem advisable for the proper conduct of the cooperative, and perform all acts and duties usually performed by a presiding officer.

Section 4.31 Vice-Chairman
In the absence of the Chairman, the Vice-Chairman shall perform all the duties of the Chairman and in so acting have all the powers of the Chairman.

Section 4.32 Secretary
The Secretary shall keep a complete record of all meetings of the Association and of the Board, and shall have general charge and supervision of the books and records of the association. He/ she shall make service of such notices to Directors and notice to members as may be necessary or proper and make a full report of all matters and business pertaining to the office of Secretary to the members at the Annual Meeting.

Section 4.33 Treasurer
The Treasurer, who also shall be the Chief Financial Officer, shall be responsible for the keeping and disbursing of all monies of the association, and shall keep accurate books of accounts and transactions of the association. The treasurer shall perform such other duties with respect to finances of the association as may be prescribed by the board. At the expiration of his/her term of office, the Treasurer, shall promptly turn over to the successor all monies, property, books, records and documents pertaining to his office or belonging to the association.

Section 4.34 Chief Executive Officer
The Chief Executive officer hired by the Board may at the discretion of the Board be given the title of President. He /she shall manage the affairs of the association as directed by the Board and shall perform all acts and duties usually performed by an executive officer.

Section 4.35 Other Officers
The board may appoint Assistant Secretaries, Assistant Treasurers and such other officers as the Board may see fit in its discretion to designate.

ARTICLE VII. REVOLVING FUND

Retains

Section 4.36. Subject to the provisions of its membership or marketing agreements, to provide capital for its corporate purposes, the Association shall temporarily retain from the net returns of the sale of Products of its patrons, as set forth in Section 3.04, any amounts, called "retains," that may be determined by the Board of Directors. The aggregate of the amounts retained that have not subsequently been paid to members shall be known as the "Revolving Fund" of the Association. The patrons of the Association shall be credited on the books of the Association with the amounts retained from each of them respectively. These credits shall be known as "Revolving Fund Credits."

Amount of Retains

Section 4.37. The amount of the retains for any fiscal year or season shall be fixed by the Board of Directors during or at the end of the fiscal year and in no case later than thirty (30) days after close of such fiscal year.

Credits Represent Association Indebtedness

Section 4.38. Revolving Fund Credits shall be deemed to evidence an indebtedness of the Association to the respective person to whom credited, payable solely and exclusively on the conditions and at the time or times herein provided. No interest shall be payable on or in respect to said Revolving Fund Credits unless otherwise provided by the Board of Directors, and in no case shall interest be payable on any such Revolving Fund Credits at a rate exceeding eight (8) percent per annum].

Revolving Fund Statements

Section 4.39. As soon after the end of each fiscal year as practicable, and in no event later than the fifteenth day of the ninth month following the close of the year, there shall be mailed or delivered to each patron a statement showing the amount retained or collected from and credited to that patron as a Revolving Fund Credit during that year. The statement shall be in the form and contain any other information as the Board of Directors prescribes.

Payment of Revolving Fund Credits

Section 4.40 From time to time the Board of Directors shall, by resolution, determine the amount of moneys not then needed and that will not be needed for the use of the Association and that is available for payment of Revolving Fund Credits. From the amount determined to be available, the oldest unpaid Revolving Fund Credits shall, as soon as practicable after that determination, be paid. In determining the oldest credits, all credits for the same fiscal year shall have the same priority. If there are not sufficient moneys available for the payment of all Revolving Fund Credits of a particular year, the same proportionate part of each credit for that year shall be paid.

Assignment of Revolving Fund Credits

Section 4.41. No assignment or transfer of any Revolving Fund Credit, whether voluntary or involuntary, shall be of any effect as against the Association or entitle the assignee or transferee to receive any moneys from the Association until evidence satisfactory to the Association of assignment or transfer is submitted.

No Assignment While Indebted to Association

Section 4.41. No assignment or transfer of any Revolving Fund Credit, whether voluntary or involuntary, by act of law or otherwise, can be made or be of any effect against the Association, as long as the party whose interest is to be assigned or transferred is indebted to the Association in any manner, whether that indebtedness is liquidated or unliquidated, due or not due. The Association may withhold consent to and refuse to recognize or be bound by any assignment or transfer, as long as any indebtedness or liability exists. The Association shall have and is hereby given a prior lien on and against the Revolving Fund Credits of any person to secure any indebtedness or liability owed to the Association by that person. The Association may, at any time, set off against any of the Revolving Fund Credits of any person an amount equal to any indebtedness of that person to the Association for which indebtedness the Association is given a lien. In such a case, indebtedness on both sides in the same amount shall be deemed canceled and satisfied.

Association Relies on Own Records

Section 4.42. In making payments of the indebtedness represented by any Revolving Fund Credits, the Association may rely absolutely on its own records, and shall not be liable to any person other than the person appearing by its records to be the owner or entitled to payment thereof.

Payment of Revolving Fund Credits on Dissolution

Section 4.43. In event of the dissolution or winding up of the affairs of the Association, all indebtedness represented by Revolving Fund Credits shall be deemed due, but shall not be paid in any part until all other indebtedness of the Association has been paid or its payment secured. Thereafter, the Revolving Fund Credits shall be paid from the remaining funds and assets of the Association without regard to the time or year in which they were incurred or to the priorities applicable in the case of revolution of the fund.

No Segregation of Funds Required

Section 4.44. The moneys retained for the Revolving Fund may be commingled with other moneys belonging or coming to the Association and may be used for any and all corporate purposes. Nothing contained in these Bylaws shall be deemed to require that any specific moneys or funds be physically segregated or designated, or marked or set apart or held for the Revolving Fund, nor shall the Revolving Fund be deemed a trust fund held for the owners of the Revolving Fund Credits. The liability represented by Revolving Fund Credits shall be junior and subordinate to all other obligations and indebtedness of the Association.

Revolving Fund Credits for Other Indebtedness

Section 4.45. Whenever the Association shall incur indebtedness in the purchase or acquisition of any property or for moneys borrowed or moneys advanced as capital contribution, the Board of Directors may provide for payment of that indebtedness out of the Revolving Fund. For such purpose, the creditor shall have Revolving Fund Credits in the amount and with the priority designated by the Board of Directors. In that event, the credits will have the same rights as though they had originally arisen on account of retains for the Revolving Fund made in the fiscal year designated by the Board of Directors.

Income Other Than From Retains

Section 4.46. In the event the Association should receive or realize income other than from retains as herein defined, whether or not that income is derived from patronage, the Board of Directors of the Association shall, in its discretion and subject to limitations of the laws of the State of California and the United States, employ those funds for expenses of the Association, for capital expenditures, and for the establishment of reasonable reserves for whatever purposes the Board of Directors deems to be in the best interests of the Association. Those amounts shall be credited to members on the basis of each member's pro rata share of the volume of products handled by the Association, and shall be retained in the Association's Revolving Fund together with the proceeds from patrons' products.

Compromising and Discounting Revolving Fund Credit

Section 4.47. Notwithstanding any other provision of these Bylaws, the Board of Directors of the Association shall have power to pay off or obtain a release or satisfaction of any one or more Revolving Fund Credits for either of the following purposes:

(a) To compromise or settle a dispute in respect to the credit or a dispute with the holder thereof.

(b) To obtain for the Association a discount for advance payment that the Board of Directors, in its absolute discretion, deems substantial.

ARTICLE VIII. AGREGATING, PROCESSING AND MARKETING

Membership Agreement and Contract Required

Section 4.47. The Board of Directors shall require all member patrons of this Association to enter into a “Membership Agreement and Contract” with the Association as a condition to membership in this Association, or as a condition to the handling, aggregating, processing or marketing by this Association of the Products produced by that member or patron.

Form and Contents of Membership Agreement and Contract

Section 4.48. Any “Membership Agreement and Contract”, executed by this Association with any member or patron shall be in the form prescribed by the Board of Directors and may contain any of the following provisions:

(a) Provisions concerning the procedure for aggregation, processing, or marketing of member products.

(b) Provisions for manufacturing and marketing of member produced woody biomass. products.

(c) Provisions for the Association to pay to the patron or member any net returns as defined in Section 4.50.

(d) Provisions for liquidated damages on breach of the agreement by the member or patron.

(e) Any other provisions that may be prescribed by the Board of Directors.

Nonprofit Operation of Association

Section 4.49. In rendering service to members, such as processing, marketing, selling, otherwise handling products, or otherwise making facilities or services available to patrons within the limitations of the Cooperative Marketing Law, the Association shall at all times be operated on a nonprofit cooperative basis for the benefit of its patrons as producers of Products. The Association is obligated to account for "net returns" as defined in Section 4.50, on a patronage basis to all of its patrons, members and nonmembers alike, for all amounts received on account of the sale of products.

Determination of Net Returns

Section 4.50.
The producer will pay an annual service assessment fee on a per acre basis established by the Board of Directors to fund the estimated operating costs of the Association for the annual period of operation.

Any unexpended assessments, fees or net proceeds, if any, will be returned to members at the end of the operational year as a patronage dividend. The dividend will be pro rated in accordance with the tonnage actually marketed, processed or handled on the member's behalf.

Losses

Section 4.52. The Board of Directors may charge losses as current operating expenses or carry those losses forward to be charged against future proceeds, or it may charge the losses ratably against any reserves or funds of the Association as it may deem appropriate.

Income Tax Consent

Section 4.53. Each person who hereafter applies for and is accepted into membership in this Association, and each member of the Association on the effective date of these Bylaws who continues as a member of the Association after that date, consents, by that act alone, that he or she shall take the following into account at the stated dollar amounts in the manner provided in Section 1385(a) of the Internal Revenue Code in the taxable year in which received:

(a) The amount of any distribution of patronage dividends as defined in Section 1388(a) of the Internal Revenue Code, when made in written notices of allocation as defined in Section 1388(6) of the Internal Revenue Code and received by that member from the Association.

(b) The amount of any distributions, referred to in Section 1382(c)(2)(A) of the Internal Revenue Code, of income derived by the Association from business done with the United States, its agencies, or from sources other than patronage, when made in written notices of allocation as defined in Section 1388(b) of the Internal Revenue Code and received by that member from the Association.

(c) The amount of any per-unit retain allocations, as defined in Section 1388(f) of the Internal Revenue Code, when made in per-unit retain certificates as defined in Section 1388(g) of the Internal Revenue Code and received by such member from the Association.

ARTICLE IX. MISCELLANEOUS

Notices

Section 4.55. Unless otherwise expressly provided in these Bylaws, any notices, statements, or other instruments required to be served on, given to, delivered to, or mailed to any patron, member, or director of the Association shall be deemed duly served, given, delivered, or mailed when deposited in the United States mail, postage prepaid, addressed to the patron, member, or director at the address appearing for that person on the books of the Association, or if no address appears on the books of the Association for that person, then addressed to him or her in care of General Delivery at _____, California, the city where principal office of the Association is located.

Unclaimed Payments

Section 4.56. Whenever a member or patron is entitled to receive any payment or allocation from the Association, and the Association, after making reasonable efforts to do so, is unable to locate that person or a duly authorized representative of that person, the Association may, after the expiration of the applicable statute of limitations, discharge that liability on its books, whereupon the claim of that person to those moneys shall be extinguished, and the Association shall treat the amount of money so charged off as incidental income to the Association in the current tax year.

Association Member of Other Cooperative

Section 4.57. This Association shall be eligible to become a member of any other cooperative association organized under the provisions of the Cooperative Marketing Law of California, or under a similar law of any other state, and this Association is hereby authorized to invest in the capital fund of another cooperative any amounts as may be provided for in any contract between this Association and the other cooperative.

Amendment of Bylaws

Section 4.58. These Bylaws may be amended, repealed, and new Bylaws adopted by the vote or written assent of members holding a majority of the voting power of the Association, or by the Board of Directors of the Association when authorized to so do by the vote or written assent of members holding a majority of the voting power of the Association.

Fiscal Year

Section 4.59. The fiscal year of the Association shall begin on the _____day of _____and end on the _____ day of _____ of each year.

CERTIFICATE OF THE SECRETARY

OF THE

XXXX ENERGY FEEDSTOCK SUPPLY COOPERATIVE

I hereby certify that I am the duly elected and acting Secretary of this corporation and that the foregoing Bylaws constitute the Bylaws of this corporation, as duly adopted by the Board of Directors on _____, 20_____.

Dated: _____, 20____.

Signed:_____ , Secretary

Typed or printed name of Secretary:_____

Membership Application

XXXX Energy Feedstock Supply Cooperative

The undersigned hereby applies for membership in the XXX Energy Feedstock Supply Cooperative, a non-profit cooperative association organized pursuant to the provisions of Chapter 1, Division 20, of the California Food and Agriculture Code.

The undersigned agrees to abide by the articles of incorporation and bylaws of the association, now or hereafter in effect, copies of which have been presented to the undersigned for inspection.

The undersigned certifies that he or she meets the qualifications for membership, is a producer of woody biomass from the pruning of orchards on acreage that the undersigned owns or leases, and promises to complete and sign a Membership Agreement and Contract as a condition of membership.

Date_____

Applicant's printed or typed name_____

Applicant's Address_____

Telephone_____ Fax _____, Email_____

Applicant's Signature_____

Acceptance of Membership.

This certifies that _____, is accepted as a member of the XXXX Energy Feedstock Supply Cooperative and is entitled to all rights and privileges of membership in the association.

Date_____, 20___

President_____

Secretary_____

Membership Agreement and Contract

XXXX Energy Feedstock Supply Cooperative

This Agreement is made between XXXX Energy Feedstock Supply Cooperative, herein after referred to as “Association”, and the undersigned qualified producer as a member of the XXXX Energy Feedstock Supply Cooperative.

As a member I understand and certify that:

· This agreement is in effect upon my signature and that it shall continue for five years from the date of execution unless terminated by my giving 30 days written notice to the Association prior to September 1 of a crop year within that five year period.

· I agree to be bound by the Association’s articles of incorporation, bylaws, rules and regulations.

· I will pay an initial membership fee of $_____ per acre and will pay a pro rata share of the annual operating costs of the Association to the extent such operating costs are not covered by the service charge per acre paid to the Association.

· I will commit all woody biomass from the pruning of orchards (herein after referred to as “products”) on _____acres of land, owned or leased by me to the Association for aggregation, processing, marketing or for any use that the Association determines appropriate.

· If the Association engages in marketing of my products, I hereby appoint the Association as my agent to sell all products contracted for under this agreement and empower the association to take possession of such products when the products are ready for marketing. I understand that the Association may market the products on any terms and in any form that the Association may determine.

· I understand that the Association will pay to me the net proceeds of any sale as provided in this Agreement and in the bylaws of the Association.

· I understand that the number of votes and my voting rights as a member will be based as follows: One vote based on the holding a membership, plus a additional vote for each acre under contract. However, notwithstanding the above, I understand that no individual member shall be entitled to exercise over twenty-five (25) percent of the total votes collectively allotted to all members.

· The Articles of Incorporation and Bylaws of the Association are incorporated by reference and shall be considered as a part of this contract, and any amendment to the articles, or to the bylaws made in a manner provided by law, shall automatically modify this contract.

· I acknowledge and understand that the Association’s bylaws includes language that provides that, by becoming a member of the Association, I agree that I shall take into account, at their stated dollar amounts, in the manner provided in Section1385 (a) of the Internal Revenue Code, all patronage dividends, or distributions made pursuant to Section 1382 (c)(2)(A) of the Internal Revenue Code, when made in written notices of allocation, and the amount of any per-unit retain allocations when made in per-unit retain certificates.

· This agreement shall not be assigned or transferred to any person without the prior expressed written consent of the Association’s board of directors.

· I acknowledge that this agreement is binding to my heirs, administrators, successors and assignees.

· I understand that a violation of this Agreement in any material respect shall be grounds for the board of directors to terminate my membership in the Association.

· The following is a description of the land producing the products forming the subject of the agreement:

Orchard Number.	Acres	Tree Crop
_____	_____	_____
_____	_____	_____
_____	_____	_____

· The parties below agree that this Agreement constitutes the entire contractual understanding of the parties with respect to the subject matter thereof and no statements, representations or understandings whether oral or written shall be of force or effect unless set forth herein.

IN WITNESS WHEREOF, the parties executed this Agreement and Contract this _____day of_____, 20____.

Member Signature:_____
Typed or Printed Name of Member:_____

XXXX Energy Feedstock Supply Cooperative
By (signature): _____
Typed Name and Title of Person Signing on Behalf of
Association._____

Appendix B Carbon Dioxide Sequestration

The purpose of this appendix is to provide background data and estimates that pertain to carbon, carbon sequestration, and carbon dioxide "consumption" by almond trees during the almond growing season. Carbon dioxide is one of the "greenhouse gases" that have become of great interest to large numbers of people, agencies, and political leaders. Other greenhouse gases include methane and water vapor.

This interest has resulted in a number of different programs to buy and sell carbon credits, to calculate carbon "footprints," and to suggest carbon sequestration verification systems. The two major systems to limit carbon dioxide emissions which are being discussed at this time are: 1) some kinds of "cap-and-trade;" and 2) various forms of "taxation." A recent article in the *Wall Street Journal* ("Carbon's New Battleground" by Deborah Solomon, dated September 2, 2007) discusses the possible ramifications of both kinds of systems, the additional costs of various consumer products resulting from these efforts, and mentions some of the more well-known political supporters of each system.

The almond sub-sector may be in a position to "take credit where credit is due" as the overall efforts to curb greenhouse gas emissions begin to evolve. It should be noted that providing estimates of carbon dioxide emissions from the transportation, processing, and marketing of almonds is beyond the scope of this . Once these estimates are made, however, the carbon dioxide emitted because of processing and transportation and use of almond products can be balanced against the carbon sequestration occurring in the orchards in order to determine the "net" effect of the entire almond sub-sector on overall carbon dioxide in the atmosphere.

At the end of this appendix, a series of tables are presented which document how estimates are developed of the amounts of carbon sequestered and the amounts of carbon dioxide that are removed from the atmosphere on an annual basis by the almond orchards in California.

A. Sequestered Carbon

Tables B.1 through B.5 five develop estimates of the amount of carbon sequestered by the almond orchards. Table B.6 summarizes the first five tables.

Table B.1 shows almond production in meat tons, and bearing acreages by county and year. In the 2005-06 year, California's total almond meat production was just over 454,000 tons. Shell production is estimated at another 454,000 tons and almond hull production is estimated at 909,000 tons. As is shown in Table B.1 production varies by year. This volume should be trending upward in the coming years as recently planted acreage comes into production.

Table B.2 gives estimates of in-shell production and almond hull production. These are inferred from the meat – kernel production figures given in Table B.1, and conversations with managers of huller/shellers. Their experience has been that the weight of the shells is approximately equal to the weight of the kernels. The weight of the hulls averages about two times the weight of the kernels.

Table B.3 develops county-by-county estimates of the carbon content of almond prunings over a three-year period. Counties in the North Valley accounted for about 24,000 tons of carbon being sequestered annually. South Valley counties accounted for about four times this amount over the same 3-year period. The estimated state-wide total amount of carbon being sequestered annually ranged from about 120,000 tons during the 2003-04 crop year to about 124,000 tons during the 2005-06 crop year.

Table B.4 shows estimates of the carbon content of in-shell almond production on a county-by-county basis. North Valley county carbon sequestration varied from a high in 2003 of about 87,000 tons to a low of about 71,000 tons. Over the same three-year period, South Valley counties varied from about 448,000 tons of carbon in 2003 to a somewhat lower value of 393,000 tons in 2005.

Table B.5 illustrates the estimated carbon content of almond hulls on a county-by-county basis for the three crop years. Total values for the North Valley counties ranged from a high of 75,000 tons during the 2003 crop year to a low of about 61,000 tons the following year. South Valley counties exhibited a slightly different pattern. The largest tonnage of sequestered carbon occurred in 2003 and the lowest value was in the 2005 crop year.

Table B.6 summarizes the carbon content of the entire almond crop. Slightly more than one billion tons of carbon was sequestered annually on a state-wide basis. About 84-percent of the sequestered carbon was in the eight South Valley counties. Acreage is much greater in the South Valley than in the North Valley and per-acre yields are usually significantly larger there, as well.

B. Carbon Dioxide Consumption/Uptake

The purpose of Tables B.7-B.9 is to convert the estimated amounts of sequestered carbon to the amounts of carbon dioxide consumed (uptaken) annually by almond trees. Table B.10 presents the calculation of carbon dioxide amounts that are net of diesel fuel consumption during the crop year and shows a further reduction due to the possible burning of prunings.

Table B.7 shows the estimated amount of carbon dioxide uptaken annually by almond trees on a county-by-county basis. The estimates are based on the process of photosynthesis. The process of photosynthesis notes that if one pound of carbon is sequestered in a plant, then 3.67 pounds of carbon dioxide will have been drawn from the atmosphere. Together, North Valley Counties accounted for an average of 628,000 tons of carbon dioxide per year during the 2003 through the 2005 crop years. Over this same period, all counties in the South Valley accounted for an average annual amount of about 3.3 billion tons. The average state-wide total was 3.9 billion tons.

Table B.8 develops county-by-county estimates of the amount of carbon dioxide uptaken annually per acre. Calculated values range from 9,000 pounds of carbon dioxide per acre to well in excess of 20,000 pounds per acre. Table B.9 shows the estimated three-year average amounts of carbon dioxide uptaken by almond trees on a county-by-county basis.

Table B.10 shows the net amount of carbon dioxide uptaken, after allowing for diesel fuel consumption during the growing season. A further calculation permits the reader to estimate a truer net amount of carbon dioxide uptaken after allowing for the burning of prunings. Per acre average values for each county are shown. The estimates after burning prunings range from 7,400 pounds per acre in Yolo County to about 2,600 pounds per acre in Kings County.

Table B.1 Almond production and bearing acreage, by county and season

	Almond Production by County and Year (1) (meat tons)			Estimated Bearing Acreage by County and Year (1)		
North Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Colusa	27,500	19,000	20,150	20,667	21,734	22,650
Butte	25,000	22,500	25,200	34,455	33,636	33,255
Glenn	21,300	18,600	21,150	26,906	27,939	27,119
Tehama	4,200	3,450	4,000	6,717	6,215	6,490
Yolo	2,800	2,350	3,300	5,173	5,213	5,678
Sutter	2,850	2,300	2,300	3,912	3,936	3,887
Others	2,050	1,450	1,350			
Subtotals	85,700	69,650	77,450	97,830	98,673	99,079
South Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Kern	102,950	107,900	105,050	87,700	90,469	91,749
Fresno	88,450	86,750	80,050	60,688	65,096	67,763
Stanislaus	84,650	81,950	66,100	77,604	77,657	78,569
Merced	64,650	63,800	51,050	82,202	83,449	84,308
Madera	47,250	46,700	41,200	48,050	47,106	47,590
San Joaquin	27,650	25,500	20,900	31,173	31,376	31,346
Tulare	9,250	10,200	7,950	11,333	11,041	11,686
Kings	6,150	6,500	6,000	2,896	3,562	3,754
Subtotals	431,000	429,300	378,300	401,646	409,756	416,765
California Totals	516,700	498,950	455,750	499,476	508,429	515,844

(1) Source: Almond Almanac 2006, p. 32.
(2) Source: Almond Board of California

Table B.2 Almond shells and hulls, production by county and season

	Estimated Shell Production by County and Year (2) (tons)			Estimated Almond Hull Production by County and Year (3) (tons)		
North Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Colusa	27,500	19,000	20,150	55,000	38,000	40,300
Butte	25,000	22,500	25,200	50,000	45,000	50,400
Glenn	21,300	18,600	21,150	42,600	37,200	42,300
Tehama	4,200	3,450	4,000	8,400	6,900	8,000
Yolo	2,800	2,350	3,300	5,600	4,700	6,600
Sutter	2,850	2,300	2,300	5,700	4,600	4,600
Others	2,050	1,450	1,350	4,100	2,900	2,700
Subtotals	85,700	69,650	77,450	171,400	139,300	154,900
South Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Kern	102,950	107,900	105,050	205,900	215,800	210,100
Fresno	88,450	86,750	80,050	176,900	173,500	160,100
Stanislaus	84,650	81,950	66,100	169,300	163,900	132,200
Merced	64,650	63,800	51,050	129,300	127,600	102,100
Madera	47,250	46,700	41,200	94,500	93,400	82,400
San Joaquin	27,650	25,500	20,900	55,300	51,000	41,800
Tulare	9,250	10,200	7,950	18,500	20,400	15,900
Kings	6,150	6,500	6,000	12,300	13,000	12,000
Subtotals	431,000	429,300	378,300	862,000	858,600	756,600
California Totals	516,700	498,950	455,750	1,033,400	997,900	911,500

Source: Almond meat production and acreage from Appendix Table D1

(2) Source: conversations with huller/sheller managers. Value is about equal to kernel weight.

(3) Source: conversations with huller/sheller managers. Equals about two times kernel weight.

Table B.3 Almond prunings available, estimated carbon content, by county and season

	Estimated Dry Tons of Almond Prunings Available (2) (tons)			Estimated Carbon Content of Almond Prunings (3) (tons)		
North Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Colusa	9,765	10,269	10,702	4,980	5,237	5,458
Butte	16,280	15,893	15,713	8,303	8,105	8,014
Glenn	12,713	13,201	12,814	6,484	6,733	6,535
Tehama	3,174	2,937	3,067	1,619	1,498	1,564
Yolo	2,444	2,463	2,683	1,247	1,256	1,368
Sutter	1,848	1,860	1,837	943	948	937
Others						
Subtotals	46,225	46,623	46,815	23,575	23,778	23,876
South Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Kern	41,438	42,747	43,351	21,134	21,801	22,109
Fresno	28,675	30,758	32,018	14,624	15,687	16,329
Stanislaus	36,668	36,693	37,124	18,701	18,713	18,933
Merced	38,840	39,430	39,836	19,809	20,109	20,316
Madera	22,704	22,258	22,486	11,579	11,351	11,468
San Joaquin	14,729	14,825	14,811	7,512	7,561	7,554
Tulare	5,355	5,217	5,522	2,731	2,661	2,816
Kings	1,368	1,683	1,774	698	858	905
Subtotals	189,778	193,610	196,921	96,787	98,741	100,430
California Totals	236,002	240,233	243,736	120,361	122,519	124,306

(1) Source: Almond Board of California

(2) Source: Holtz, et.al. Almond Board of California, 34th Almond Industry Conference Proceedings, pages 254-261. The average annual amount of green tonnage per bearing acre used in this analysis is .75. Holtz has estimated that dry weight of almond prunings is about 63% of the wet weight.

(3) Source: www.woodgas.com/proximat.htm. The percent of C in dry almond prunings is shown as 51.3 percent. An estimate of 51% is used in this analysis.

Table B.4 Almond production, meats and shells, and estimated carbon content, by county and season

	Estimated In-shell Production by County and Year (1) (tons)			Estimated Carbon Content of Inshell Production (2) (tons)		
North Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Colusa	55,000	38,000	40,300	28,600	19,760	20,956
Butte	50,000	45,000	50,400	26,000	23,400	26,208
Glenn	42,600	37,200	42,300	22,152	19,344	21,996
Tehama	8,400	6,900	8,000	4,368	3,588	4,160
Yolo	5,600	4,700	6,600	2,912	2,444	3,432
Sutter	5,700	4,600	4,600	2,964	2,392	2,392
Others						
Subtotals	167,300	136,400	152,200	86,996	70,928	79,144
South Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Kern	205,900	215,800	210,100	107,068	112,216	109,252
Fresno	176,900	173,500	160,100	91,988	90,220	83,252
Stanislaus	169,300	163,900	132,200	88,036	85,228	68,744
Merced	129,300	127,600	102,100	67,236	66,352	53,092
Madera	94,500	93,400	82,400	49,140	48,568	42,848
San Joaquin	55,300	51,000	41,800	28,756	26,520	21,736
Tulare	18,500	20,400	15,900	9,620	10,608	8,268
Kings	12,300	13,000	12,000	6,396	6,760	6,240
Subtotals	862,000	858,600	756,600	448,240	446,472	393,432
California Totals	1,029,300	995,000	908,800	535,236	517,400	472,576

(1) Source: Table __.1. Almond meat production plus shell production.
(2) Source: www.woodgas.com/proximat.htm. The percent of C in peach pits is shown as 53 percent and the percentage of carbon in almond prunings is shown as 51.3 percent. Since no value was shown for inshell almonds, a value of 52 percent is used in this analysis.

Table B.5 Almond hulls produced and estimated carbon content, by county and season

	Estimated Almond Hull Production by County and Year (1) (tons)			Estimated Carbon Content of Almond Hulls (2) (tons)		
North Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Colusa	55,000	38,000	40,300	24,750	17,100	18,135
Butte	50,000	45,000	50,400	22,500	20,250	22,680
Glenn	42,600	37,200	42,300	19,170	16,740	19,035
Tehama	8,400	6,900	8,000	3,780	3,105	3,600
Yolo	5,600	4,700	6,600	2,520	2,115	2,970
Sutter	5,700	4,600	4,600	2,565	2,070	2,070
Others						
Subtotals	167,300	136,400	152,200	75,285	61,380	68,490
South Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Kern	205,900	215,800	210,100	92,655	97,110	94,545
Fresno	176,900	173,500	160,100	79,605	78,075	72,045
Stanislaus	169,300	163,900	132,200	76,185	73,755	59,490
Merced	129,300	127,600	102,100	58,185	57,420	45,945
Madera	94,500	93,400	82,400	42,525	42,030	37,080
San Joaquin	55,300	51,000	41,800	24,885	22,950	18,810
Tulare	18,500	20,400	15,900	8,325	9,180	7,155
Kings	12,300	13,000	12,000	5,535	5,850	5,400
Subtotals	862,000	858,600	756,600	387,900	386,370	340,470
California Totals	1,029,300	995,000	908,800	463,185	447,750	408,960

(1) Source: Table __.1

(2) Source: www.woodgas.com/proximat.htm. The percent of C in dry almond prunings is shown as 51.3 percent. The percent of C in corncobs is 46.6%. The percent of C in cotton stalks is 43.6 %. This analysis uses 45% C for almond hulls.

Table B.6 Carbon content estimates from almond production, by county and season

	Estimated Carbon Content of Almond Production (1) (tons)		
North Valley Counties	03-'04	04-'05	05-'06
Colusa	49,750	34,373	36,453
Butte	45,227	40,704	45,589
Glenn	38,533	33,649	38,262
Tehama	7,598	6,241	7,236
Yolo	5,065	4,251	5,970
Sutter	5,156	4,161	4,161
Others			
Subtotals	151,330	123,379	137,671
South Valley Counties	03-'04	04-'05	05-'06
Kern	186,245	195,200	190,044
Fresno	160,013	156,938	144,817
Stanislaus	153,139	148,254	119,580
Merced	116,957	115,419	92,354
Madera	85,479	84,484	74,534
San Joaquin	50,021	46,132	37,810
Tulare	16,734	18,453	14,382
Kings	11,126	11,759	10,854
Subtotals	779,713	776,638	684,375
California Totals	931,043	900,017	822,046

(1) Calculated sum from
Table D3 Prunings
Table D4 In-Shell (meats + shell)
Table D5 Almond hulls

Table B.7 Carbon content and consumption from almond production, by county and season

	Estimated Total Carbon Content of Almond Crop(1) (tons)			Estimated Carbon Dioxide Consumed by almond production (2) (tons)		
North Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Colusa	58,330	42,097	44,549	214,071	154,496	163,495
Butte	56,803	51,755	56,902	208,467	189,941	208,830
Glenn	47,806	42,817	47,566	175,448	157,138	174,567
Tehama	9,767	8,191	9,324	35,845	30,061	34,219
Yolo	6,679	5,815	7,770	24,512	21,341	28,516
Sutter	6,472	5,410	5,399	23,752	19,855	19,814
Others						
Subtotals	185,857	156,085	171,510	682,095	572,832	629,442
South Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Kern	220,857	231,127	225,906	810,545	848,236	829,075
Fresno	186,217	183,982	171,626	683,416	675,214	629,867
Stanislaus	182,922	177,696	147,167	671,324	652,144	540,103
Merced	145,230	143,881	119,353	532,994	528,043	438,026
Madera	103,244	101,949	91,396	378,905	374,153	335,423
San Joaquin	61,153	57,031	48,100	224,432	209,304	176,527
Tulare	20,676	22,449	18,239	75,881	82,388	66,937
Kings	12,629	13,468	12,545	46,348	49,428	46,040
Subtotals	932,928	931,583	834,332	3,423,846	3,418,910	3,061,998
California Totals	1,118,785	1,087,668	1,005,842	4,105,941	3,991,742	3,691,440

(1) Source: App. Table 5
(2) The process of photosynthesis suggests that one pound of carbon "stored" in a plant requires 3.67 pounds of CO_2 to be drawn from the atmosphere.

Table B.8 Carbon consumption from almond production, by county and season

	Carbon Dioxide Consumed Annually by Almond Trees (tons)			Carbon Dioxide Consumed Annually by Almond Trees (pounds per bearing acre)		
North Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Colusa	214,071	154,496	163,495	20,716	14,217	14,437
Butte	208,467	189,941	208,830	12,101	11,294	12,559
Glenn	175,448	157,138	174,567	13,042	11,249	12,874
Tehama	35,845	30,061	34,219	10,673	9,674	10,545
Yolo	24,512	21,341	28,516	9,477	8,188	10,044
Sutter	23,752	19,855	19,814	12,143	10,089	10,195
Others						
Subtotals	682,095	572,832	629,441	78,152	64,710	70,655
South Valley Counties	03-'04	04-'05	05-'06	03-'04	04-'05	05-'06
Kern	810,545	848,236	829,075	18,484	18,752	18,073
Fresno	683,416	675,214	629,867	22,522	20,745	18,590
Stanislaus	671,324	652,144	540,103	17,301	16,795	13,749
Merced	632,994	528,043	438,026	15,401	12,655	10,391
Madera	378,905	374,153	335,423	15,771	15,886	14,096
San Joaquin	224,432	209,304	176,527	14,399	13,342	11,263
Tulare	75,881	82,388	66,937	13,391	14,924	11,456
Kings	46,348	49,428	46,040	32,008	27,753	24,529
Subtotals	3,523,845	3,418,910	3,061,998	149,279	140,852	122,146
California Totals	4,205,940	3,991,742	3,691,439	227,430	205,562	192,801

(1) Source: App. Table 6
(2) Source: App. Table 2

Table B.9 Carbon consumption from almond production, per bearing acre, by county,

	Estimated Three-Year Average Carbon Dioxide Consumed	Average Bearing Acres	Estimated Three-Year Average Carbon Dioxide Consumed
	tons	acres	pounds per bearing acre
North Valley Counties			
Colusa	177,354	21,684	16,358
Butte	202,413	33,782	11,983
Glenn	169,051	27,321	12,375
Tehama	33,375	6,474	10,310
Yolo	24,790	5,355	9,259
Sutter	21,140	3,912	10,808
Others			
Subtotals	628,123	98,528	71,094
South Valley Counties			
Kern	829,285	89,973	18,434
Fresno	662,832	64,516	20,548
Stanislaus	621,190	77,943	15,940
Merced	533,021	83,320	12,795
Madera	362,827	47,582	15,251
San Joaquin	203,421	31,298	12,999
Tulare	75,069	11,353	13,225
Kings	47,272	3,404	27,774
Subtotals	3,334,917	409,389	136,965
California Totals	3,963,040	507,917	208,058

(1) Source: App. Table 7
(2) Source: App. Table 2
(3) Source: for each row: (column 1)(2000 lbs/ton)/column 2.

Table B.10 Carbon consumed, released and net consumed, per acre of almonds, by county

	Estimated Three-Year Average Carbon Dioxide Consumed lbs / acre/ year	Estimated Three-Year Average Carbon Dioxide Released (2) from Cultural and Harvest Practices lbs / acre/ year	Estimated Net Carbon Dioxide Consumed lbs / acre/ year
North Valley Counties			
Colusa	16,358	622	15,736
Butte	11,983	622	11,361
Glenn	12,375	622	11,753
Tehama	10,310	622	9,688
Yolo	9,259	622	8,637
Sutter	10,808	622	10,186
Others			
Subtotals	71,093	3,732	67,361
South Valley Counties			
Kern	18,434	622	17,812
Fresno	20,548	622	19,926
Stanislaus	15,940	622	15,318
Merced	12,795	622	12,173
Madera	15,251	622	14,629
San Joaquin	12,999	622	12,377
Tulare	13,225	622	12,603
Kings	27,774	622	27,152
Subtotals	136,966	4,976	131,990
California Totals	208,059	8,708	199,351

(1) Source: App. Table 9

(2) Source: Grower data suggests that about 8 gals of diesel fuel per acre per year are use for all cultural practices and about 13 gals of diesel fuel per acre per year are used to irrigate using a diesel engine powered well pump. Custom harvest operator suggests of diesel fuel per acre per year are used to irrigate using a diesel engine powered well pump. Custom harvest operator suggests that the entire harvest operation uses about 7 gals of diesel per acre. (28 gals/acre)(22.2 lbs CO2/gal) = 622 lbs. CO2

(3) This column does not reflect the carbon dioxide emissions associated with processing, marketing, etc.

(4) These values should be reduced by approximately 1200 pounds if prunings are burned on-site.
Calculation: 1500 lbs green prunings at 63% dry matter, half of which is carbon.
An estimated 70% of the carbon is returned to the atmosphere as CO2 using a factor of 3.67 pounds.
thus, (1500 lbs prunings)(.32)(.70)(3.67) = 1233 lbs of CO2

Appendix C Pyrolysis of Almond Prunings

Notes on Commercial Pyrolysis of Agricultural Residues

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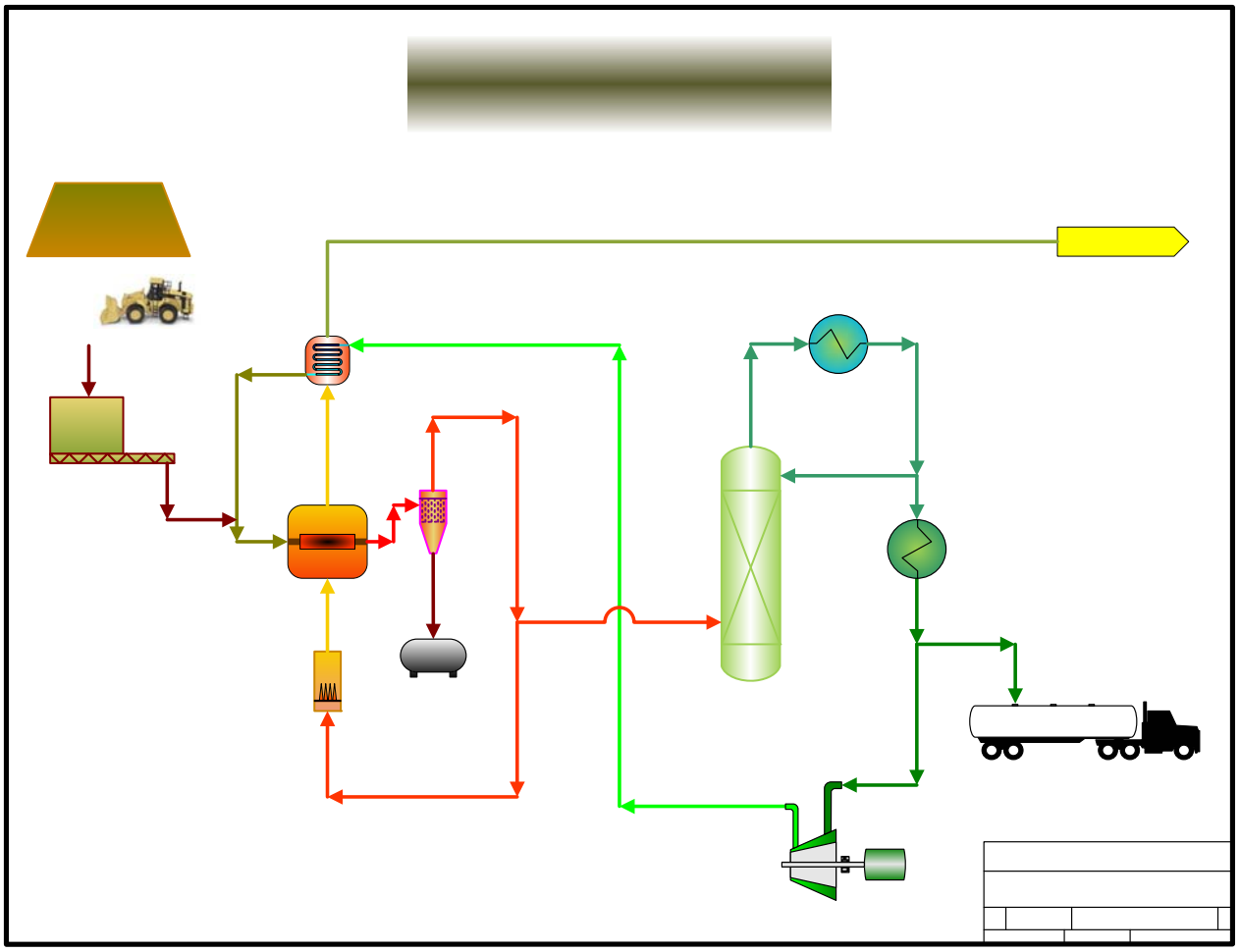
Recycling Process

Recovering energy from agricultural residue will require collaboration between; growers, shredding, conversion services, and energy consumers. Operationally, each grower collects and stockpiles his/her almond prunings in a location where it can be conveniently processed by the grinding/shredding service. The service periodically shreds each grower's residue and stockpiles it in a local conversion facility yard. The conversion service converts the shredded residue to bio-oil and ships it to the industrial, commercial and institutional energy consumers.

Technology

Bio-oil can be produced from shredded agricultural residues by pyrolyzing the residues at about 900 °F to maximize liquids production. In addition to the operating temperature, it is important to minimize the time taken to heat the wood and the oil. By doing so, the quality and yield of liquid bio-oil is sustained. Typical residence time is one second or less. To heat particles in the time frame of one second entails small particle sizes, typically 1/16 inch or less. Additionally the particles must also be dry – less than 10% moisture.

The rapid ablative pyrolysis process being considered has produced bio-oil from various forms of biomass including wood wastes, sewage sludge, tires and municipal refuse. A simplified version of the process arrangement for producing bio-oil is illustrated in the flow diagram shown below.



Dried, pulverized residue is fed through a pressurized feeder and pneumatically conveyed into the pyrolyzer by hot recirculated bio-gas. The feed particles are indirectly heated to vaporization. The products leaving the pyrolyzer are a mixture of hot gas, vaporized liquid and char. The char is separated in a hot gas filter and can be sold to produce activated carbon, briquettes or soil amendment.

Some of the cleaned gas is compressed and used to pneumatically transport fuel solids into and through the converter. The remaining clean gas and vapor are piped to a direct contact condensing column to maximize gas/liquid contact and minimize the formation of fine mist. The cooled liquid is pumped into tanks for storage until it can be shipped to the energy consumer.

The system consists of prefabricated modules that can be readily shipped and installed.

Surge Bin

Bio-Oil Product

Property	BioOil	Heating oil #2	Heavy fuel oil
Higher Heating Value (Btu/lb)	7,600	19,700	18,400
Higher Heating Value (Btu/gal)	75,000	141,000	150,000
Flash Point (°F)	118-131	100	140
Pour Point (°F)	12	21	-
Specific Gravity @ 60 °F	1.2	0.865	0.986
Acidity (pH)	2 - 3	-	-
Solids (wt%)	0.01-0.2	-	-
Moisture (wt%)	20-25	-	< 0.5
Ash (wt%)	<0.02	Trace	0.08
Kinematic Viscosity (cSt)	-	-	-
20°C	70	3 - 6	2000-9000
40°C	19	1.8-3.5	500-1000
60°C	8	1.4-2.5	100-200
80°C	4	1.1-1.8	40-70
Ultimate Analysis (wt%)			
Carbon	42 - 47	86.4	85.7
Hydrogen	6 - 8	12.7	10.5
Oxygen	46 - 51	0.04	0.38
Nitrogen	<0.1	0.006	0.18
Sulfur	<0.02	0.2 - 0.7	<2.8
Ash	<1	<0.01	0.0. - 0.08

The bio-oil so produced is quite different from conventional hydrocarbon oils in a variety of ways. As can be seen from the following table, the bio-oil is denser, has a lower pH and a lower heating value than conventional oil. It will also increase in viscosity under long term storage.
Because of these differences, conventional combustion systems must be modified to handle bio-oil. The oil has been burned commercially in conventional boilers with some minor modifications so there is no reason to suppose that existing boilers cannot be retrofitted for use with bio-oil.

While extensive testing has been carried out with gas turbines and commercial applications are under construction, additional development is necessary for its use in reciprocating engines.

The bio-oil also has potential as a source of chemicals some of which are high value. The one most commonly extracted is liquid smoke, which is used as a BBQ flavoring substance and a browning agent for hot dogs etc. Adhesives have also been produced from bio-oil.

Market

Most large industrial, commercial and institutional natural gas consumers can benefit by adapting their existing boilers to use bio-oil in place of natural gas. Bio-oil can also be used to produce less costly, on site or distributed, electrical power.

Benefits of Using Bio-Oil

- Eliminate open burning pollution

- Eliminate time and labor involved in burning
- Create shredding and conversion service businesses
- Stabilize costs for industrial, commercial and institutional energy consumers
- Reduce consumer’s fossil fuel dependency and pollution

Appendix D: Government Sources of Financial Assistance

Several government programs exist that are well suited to fund the planning, capitalization, and operating costs associated with the establishment of an energy feedstock cooperative. The following is an overview of the federal grant programs that we have identified as high probability for funding the cooperative.

USDA Cooperative Development Grants are administered through USDA Rural Development State Offices. These grants are used to facilitate the creation or retention of jobs in rural areas through the development of new rural cooperatives, value added processing and other rural businesses. The ceiling on awards is around $200,000. Applicants must commit to providing more than 25 per cent matching contributions with private funds and in-kind contributions.

USDA Value Added Producer Grants can be used for planning activities and working capital for marketing farm-based renewable energy. The maximum amount that can be awarded is $500,000 and all VAPG funds must be matched by an equal amount of funds from the applicant or a third party.

USDA Business and Industry (B&I) Guaranteed Loan Program guarantees up to 80% of a loan made by a commercial bank. Loan proceeds may be used for working capital, machinery, buildings and certain types of debt refinancing. The primary purpose is to create employment and improve the economic climate in rural communities.

USA Renewable Energy System and Energy Efficiency Improvements Program may provide up to 25% of eligible project costs. Applicants must be agricultural producers or rural small businesses that have demonstrated financial need.

Export-Import Bank (Ex-Im) of the United States Working Capital Guarantee Program is an asset-based lending program for U.S. exporters that guarantees working capital loans based on inventory and accounts receivable related to exports. Ex-Im Bank guarantees 90 percent of the working capital loan, including principal and interest. The guarantee can cover either a single loan or a revolving line of credit that can support several export transactions.

Small Business Adminstration includes working capital to meet cash flow needs, real estate and fixed assets such as machinery. Through an extensive network of field offices SBA offers services throughout the U.S. It has a SBA (7a) Guaranteed Business Loan Program which will provide 50-90% of each loan with a maximum of $1million.

Department of Energy- Renewable Energy Biomass Program run by the Office of Energy Efficiency and Renewable Energy includes major programs including grants for developing and improving technology for biomass power and for making biofuels.

California Energy Commission Energy Innovations Small Grant Program award a maximum of $95,000 for hardware projects and up to $50,000 for modeling projects for small businesses, non profits and individuals, and academic institutions to conduct research that establishes the feasibility of new innovative energy concepts. Projects must target one of six PIER program areas, address a California energy problem and provide a potential benefit to California electric and natural gas ratepayers.