Creating Closed-Loop Economies Through Reuse, Recycling and Bioproduct-Based Economic Development

Final Site Assessment Report for Hood River, Sherman and Wasco Counties, Oregon

January 1998

prepared by:

The Center for Watershed

and Community Health

P.O. Box 10933

Eugene, OR 97440

phone: (541) 744-7072

fax: (541) 744-6660

and:

Self-Reliance, Inc.

2425 18th Street, NW

Washington, DC 20009

phone: (202) 232-4108

fax: (202) 332-046

1. INTRODUCTION

The Center for Watershed and Community Health (CWCH) and Self-Reliance, Inc. (SRI) prepared a draft assessment in June, 1997, of the potential for creating new and expanded waste-based businesses in reuse, recycling and bioproducts that could promote local and regional closed-loop economic development. After a number of months of comments and feedback, this final report was prepared.

Specifically, CWCH and SRI have researched the opportunities that exist to stimulate environmentally sound closed-loop economic development within the Hood River/Columbia Gorge region based on (1) the re-use and recycling of materials in the municipal solid waste stream, (2) the re-use and recycling of materials in agricultural and forestry waste streams and (3) improvements in the local government reuse, recycling infrastructure.

The collaboration between CWCH and SRI builds on CWCH's extensive experience in watershed management and sustainable development, and SRI's extensive experience in waste-based economic development.

The principal researchers are Bob Doppelt and Robin Hawley, both of CWCH and Neil Seldman and Ann Robertson, both of SRI.

This assessment is part of a multi-year initiative to identify the policies, procedures and practices needed to stimulate closed-loop economic development through reuse, recycling, scrap-based manufacturing and bioproduct-based business enterprises throughout Oregon and the Pacific Northwest.

Our first draft report focused primarily on mid-sized business opportunities in Hood River, Wasco and Sherman Counties, Oregon. Since that time, a separate report has also been prepared identifying potential small scale business opportunities. In addition, a set of policy recommendations will be published in a final report outlining the steps required to support and foster closed-loop economic development at the state and regional levels.

The following methodology was used to prepare this report:

- preliminary waste stream data gathering;

- intensive site visits, including meetings with government, industry, agriculture, forestry, community and environment leaders to assess local waste streams and determine potential business opportunities ;

- research and analysis exploring technical and business conditions appropriate for unique needs of the three county area;

- preparation of a draft report (June,1997);

• feedback from interested parties;

• second visit, workshop and meetings to determine top priorities; and,

• technical assistance, due diligence, business site specification and financing plan leading to implementation.

• final report completion and distribution.

The Hood River, Wasco and Sherman Counties assessment has been co-sponsored by the Hood River County Chamber of Commerce and Hood River Watershed Council, both of which greatly enhanced the assessment effort. The project was also assisted by more than 40 participants from the area who shared their time, experience and expertise with the research staff. These individuals are identified in Appendix A.

NEXT STEPS:

At least one waste biomass business is already in the process of preliminary business plan development as a result of our draft report. In addition, the draft report seemed to stimulate interest by public agencies and private parties in the concepts and in specific enterprise opportunities.

Indeed, it is our hope that the release of this final report is just the first step in a long-term effort to establish closed-loop economies in the Columbia Gorge through waste-based economic development. The report is intended as the start, not the end, of the process. Our hope is that this report can serve to stimulate an on-going conversation and activity by the businesses, communities and residents of the Columbia Gorge about how to create and expand closed-loop economic development.

To continue this effort, we recommend the following:

- Economic Development agencies and governments should establish technical assistance programs to prioritize, assist and help finance waste-based businesses in reuse, recycling and bioproducts;

- Steering committees should be developed at the community, county, watershed and regional levels to help plan and implement closed-loop economic development;

- "Waste exchanges" should be developed within each community and/or the Columbia Gorge region to allow local businesses, institutions and non-profits identify and exchange waste materials;

- New policies should be developed at all levels of government to support waste-based business enterprises;

- Local news media should track and publicize not just recycling goals, but the amount of waste diverted, the quantity and cost savings of deferred use of virgin materials, increases in productivity and profitability, and the number of jobs generated through businesses in reuse, recycling and bioproducts;

- The Columbia Gorge Commission should partner with local governments, Chambers of Commerce, business associations and citizen groups to hold a conference on opportunities for environmentally sound economic development through waste-based reuse/recycling and bioproduct businesses and other closed-loop steps.

- Local entrepreneurs should investigate small scale waste-based business enterprises by identifying waste streams that can utilized by small operators and which have viable markets.

2. Background on Hood River, Wasco and Sherman Counties

A. Recycling and Closed-Loop Development Records

The three counties are doing well with regard to the state-mandated recycling goals established by the Department of Environmental Quality (DEQ). In 1991, the Oregon Legislature set a statewide 50% material recovery goal by the year 2000 and individual county recycling goals for the year 1995. Sherman County's 1995 goal was 7%; Hood River and Wasco Counties recycling goal was 25%. Hood River County officially shows a recycling rate of 16%. However, waste generated in non-county jurisdictions were mistakenly reported as waste from Hood River County. The County has notified the DEQ and expects changes to be made presently.

County	Population	Total Annual Garbage Generated (Tons)	Recycling Rate
Hood River	18,700	19,700	16%
Sherman	1,900	1,111	20%
Wasco	22,600	22,756	29%

Population, annual tons generated and recycling rates are based on 1995 data compiled by the Oregon Department of Environmental Quality and presented in the 1995 Oregon Material Recovery Survey.

In addition to this good record on recycling, there is extensive closed-loop recycling activity in the three county area. These include:

• **Hood River yard debris program and expansion plan.** The City of Hood River City Department of Public Works operates a drop-off site for yard debris. Residents deposit materials which are shredded and land-applied on public park land. Based on citizen demand the city is now requiring that the franchised hauler

provide yard debris collection services. The city will not have a drop off once the Hood River Garbage Service begins its new contract on July 1, 1997.

• **Northwest Aluminum Company dross recycling.** In addition to aluminum production from virgin materials, the company also smelts certain aluminum alloys. This leaves a residue called "dross" which the company ships out of state for processing. (Researchers have suggested siting dross recycling facilities closer to the plant and possibly siting a dross recycling plant in the region.)

• **Portland Metro/Waste Management, Inc. organics program.** Waste Management, Inc. (WMI) owns and operates a landfill complex in the City of Arlington in Gilliam County just east of the Hood River County, Wasco County and Sherman County area. Recently, Portland Metro contracted with WMI to receive 200,000 tons of vegetable wastes from supermarkets in Portland for composting. In addition, WMI has contracts to receive sewer sludge for composting. This flow of organic matter into the region provides an excellent source of top soil for application to the region's grazing lands which are suffering from soil depletion that threatens the long term agricultural capacity of the region.

• **General Climate of Opinion.** Researchers found a strong recycling and closed-loop ethic among the public, government and business sectors. A recent lead editorial in the *Hood River News* (May 7, 1997) called for additional recycling above current efforts based on a partnership between the public and the franchised hauler. The franchised haulers in both Hood River (Hood River Garbage and Recycling) and Wasco County (The Dalles Disposal) have made technical innovations (co-collection vehicles) and investments (i.e., tub grinders) to meet this citizen demand for more recycling. Interviews with business representatives demonstrated an equal zest for recycling and re-use, both among those firms that were creatively reusing their waste products (such as local breweries) and those that were actively seeking ways to recycle their waste and obtaining parts from manufacturers that used recycled content.

• **Strawboard Plant.** The Washington Wheat Growers Association is working with a private company to build a strawboard plant in Pasco, Washington. Strawboard is used in place of particleboard on construction projects. This plant would draw straw from a 50-mile radius which would reach into Oregon near Pendleton. They are planning to break ground on the plant the fall of 1997.

CWCH and SRI researchers' observation that a very palpable recycling and closed-loop ethic existed in the region was also based on the fact that government officials, environmental activists, economic development professional and business representatives attended project meetings prepared with ideas and sample projects from throughout the United States. These meetings provided excellent project ideas for the research team to consider and further analyze for site specific application.

B. Other factors that foster consideration of closed-loop economic development

The following factors are also important for stimulating closed-loop economic development through reuse, recycling, and bioproduct enterprises in the three county area:

Department of Environmental Quality. Under DEQ mandates, Oregon communities had to reach county recycling rates by the year 1995 and must recover 50% of their waste stream by the year 2000. These goals have been responsible for much of the recycling activity being carried out by local franchised haulers. As noted above, all three counties are making significant progress towards their goals.

Columbia River Gorge Commission. This commission was established in order to protect the natural resources of the region and promote environmentally sound economic growth. The Commission is now searching for ways to integrate environmentally sound economic development into their programs. The Commission has several funding programs which assist new businesses.

New Rules for Burning. Recent decisions by area governments have banned the burning of yard debris which will encourage the processing and use of this material. In addition, the use of diesel fuel for smudge pot burning is likely to be banned in the future, thus encouraging the use of alternative fuels such as those made from plant matter. Market development for yard debris and capacity building are needs.

Rising Landfill Rates. Landfill rates have been increasing in the region for the past several years, from the low $20's per ton to the mid $30's per ton. These rates are expected to increase gradually over the next few years. As disposal rates increase, the value of recycling increases as well. Landfill tip fees are a negative value that can be avoided by recycling more materials and higher volumes. These savings are added to the actual market value of a given recycled material.

Unemployment, Underemployment and Welfare Reform. The region suffers from a very high unemployment rate of 16%. There is also high underemployment, although the rate has not been documented. Recently passed welfare reform legislation may make the current employment situation more difficult, given that former recipients will now have to find employment to maintain their benefits.

Recycling and re-use enterprises are labor intensive and can make a significant contribution to expanded employment and entrepreneurial opportunities. Processing and sorting recyclables alone sustains 10 times more jobs on a per-ton basis than landfilling or incineration. Making new products from the old offers the largest economic development benefits in the recycling loop. Recycling-based

manufacturers can create more than 20 times more jobs than disposal; these jobs often represent high-paying, skilled industrial jobs. About 20% of the nation's municipal solid waste consists of reusable items. Some re-use operations create 200 jobs for every one job at a disposal facility. Thus, creating closed-loop economics through recycling and re-use based economic development can be a significant employment growth sector for the three counties.

3. Potential Business Enterprises from solid waste materials

The research team focused on categories where (1) an existing business can be expanded, (2) a new business can be attracted, and (3) infrastructure changes could reduce business or government operating costs.

We found that there were a number of potential projects in each of these three categories. Further, we discovered that projects in infrastructure change could be built into a full-blown enterprise.

We also found that the greatest potential for expanded waste-based enterprise development was not with DEQ-mandated materials, but with yard debris and wood pallets; and we found that the best option for these materials was local use, rather than increased collection of mandated materials and shipment to the Portland Metro area for marketing.

Likewise, the research team found that local uses of glass are superior to shipping to traditional markets in Portland. Traditional markets pay very little for glass and all local haulers are losing money in their mandated glass programs. The research team is currently gathering data from various jurisdictions which have used glass as a road bed material.

We also found that the local re-use of yard debris and wood pallets offers an opportunity to improve animal grazing and wheat farming areas in the region, which are threatened by severe loss of top soil and ongoing soil erosion.

A. Expand Existing Businesses

We have identified real companies in each of the fields below. However, to protect their confidentiality, the companies are listed simply by representational letters.

One local hauler has discovered a regional market for HDPE (milk and water jugs). The company assembles truckloads of this plastic and ships it to a Portland processor, which in turn ships the material to the Garten Foundation in Salem. The materials are sorted in Salem and shipped to processors and end-users in California or to the Pacific Rim.

The key to the hauler's ability to market HDPE at prices that provide a profit margin is quality control. The shipments to Portland do not have to be re-packed because of the consistently high quality and absence of contaminants. About 100 tons of material are shipped annually.

Two potential enterprises are based on this information:

(1) Franchised haulers in the Hood River, Wasco and Sherman Counties area could form a cooperative marketing arrangement to ship their HDPE materials (under the same agreement as one hauler is currently doing). Alternatively, the hauler can operate on his own, but accept high quality loads from the other franchised haulers and ship to the Portland metro area.

(2) An HDPE processing and manufacturing plant could be attracted to the region. **Company A** is one such company that has been operating at a profit from a rural location in Spickard, Missouri. The company imports baled, post-consumer HDPE bottles (milk and water jugs).

Company A uses a system that efficiently grinds the plastic into flakes, washes and dries them, and then stores the flakes for later use or for sale to other manufacturers. End-products are made using one of three technologies: (1) vacuum forming, (2) extrusion, and (3) rotational molding. These products are sheets of plastic that are used as a substitute for wood in pallets and a variety of building applications.

Company A also extrudes plastic profiles in the sizes 1" x 2" and 2" x 4," with varying lengths. It also fabricates these profiles into a variety of products, including furniture. With its rotational molding equipment, **Company A** has the capacity to produce over 30 products, including gas tanks, water reservoirs, animal feeders, dog houses, buckets, helicopter seats, pans, 18-gallon curbside containers, and 2-cubic yard dumpsters.

Company A needs between 500-1,000 tons per year of baled post-consumer HDPE to operate at a profit. The Hood River, Wasco and Sherman County area generates about 100 tons per year of this material. According to conversations with solid waste officials in Portland and with the Garten Foundation of Salem, ample materials would be available for a plant in the target region. Alternatively, a plant in another region of the state would support an expanded recovery of the material in the three county area.

Capitalization for the construction of **Company A's** plant is estimated at $750,000, not including land and building costs. About 30,000 square feet under roof and another two acres for outside operations would be needed. Company A would make its technology available and provide start-up, management and market development assistance to an

enterprise if there were a local partner to invest in this plant. Approximately 8-10 semi-skilled and skilled machine operator positions would be created.

Below is a profile of **Company A**.

Company A	
Feedstock Used	HDPE (milk and water jugs)
Amount of Feedstock Used	500-1,000 tons per year
Feedstock Cost	21-22 cents per lb.
Location of Facilities	Midwest
Sales (current year)	$2 million
Maximum Capacity (1 plant/1 shift/1 year)	750 tons
Minimum Capacity for Positive Economics	500 tons
Capital Investment (w/o lot and buildings)	$800,000
Operating Expenses	N/A
Number of Jobs per Facility	10-12
Types of Products	sheeting, molded products, vacuum formed products
Prices of Product Sold	$1-2 per lb. of recycled plastic
Expansion Plans	Interested in new rural sites

Small-Scale Paper Pulping

High- and low-grade papers are being recycled in the Hood River, Wasco and Sherman Counties area, and are routinely handled by area haulers. This material is valued from $20 to $125 per ton, minus the cost of transportation to markets. Company B of New Orleans offers a new technology that pulps 30 tons of material per day into 25 tons of market pulp. Current market prices for pulp are $525-800 per ton, providing sufficient margins to accommodate transportation costs. The unit costs $5 million outright, but can be purchased through a lease with a $1.5 million up-front investment. It requires three acres to operate. Company B, which sells the technology but does not operate plants, provides the following services for their clients:

- facility permitting assistance,
- business planning assistance, and

• market development, including trials of pulp with potential purchasers, obtaining letters of interest from cellulose insulation, molded products, fiber board prior to investment in the plant. In other words, the pulp would be pre-sold pending implementation of the plant.

The plant would create 8-10 skilled jobs. Pulp manufacturing has a very high multiplier impact of 10-15. This means that the 8-10 jobs in the plant could impact from 80-150 indirect jobs in the immediate area of the plant. In conversations with company representatives, the research team learned that the company has identified two investors who are interested in financing a plant in the three-county region.

Since the publication of our draft report in June, 1997, a local entrepreneur has pursued the development of the small scale paper pulping business. This individual was successful in obtaining a grant to complete market business feasibility studies.

Below is a profile of Company B:

Company B	
Feedstock Used	all grades of paper
Amount of Feedstock Used	30 tons per day
Feedstock Cost	$5-80 per ton
Location of Facilities	Mid West, South East
Sales (first year)	n/a
Maximum Capacity (1 plant/1 shift/1 year)	30 tons per day, can build multiple units
Minimum Capacity for Positive Economics	30 tons per day
Capital Investment (without lot and buildings)	$5 million
Operating Expenses	n/a
Number of Jobs per Facility	8 10
Types of Products	paper pulp
Prices of Product Sold	$400 - $ $750 per ton
Expansion Plans	interested in plants throughout the US

The three county area has a major disposal problem with old tires. **Company C** has obtained the U.S. rights to a tire pyrolysis process developed by a major Asian manufacturing conglomerate. The tire pyrolysis system processes the old tires, then chemically treats the feed stock to produce a variety of industrial products. The system costs under $5 million and has the capacity to handle up to one million tires annually. **Company C** is interested in selling the technology to a local business or undertaking a joint venture with local investors. Since the publication of our draft report in June, 1997, CWCH and SRI have helped link this firm with a local tire producer and discussions concerning potential partnerships have ensued.

Below is a profile of **Company C**:

Company C	
Feedstock Used	car and truck tires
Amount of Feedstock Used	5 million pounds per year
Feedstock Cost	tip fee required
Location of Facilities	Asia
Sales (first year)	$1.5 million
Maximum Capacity (1 plant/1 shift/1 year)	5 million pounds per year
Minimum Capacity for Positive Economics	3.5 million pounds per year
Initial Capital Investment (without lot and buildings)	1.5 million
Operating Expenses	$1 million
Number of Jobs per Facility	8-10
Types of Products	natural gas, industrial polymers
Prices of Product Sold	competitive with published commodity markets

	value
Expansion Plans	100 facilities within the continental U.S. over next 20 years

B. New Business Enterprises

Company D has developed alternative secondary smelting technologies for (1) aluminum cans and (2) aluminum wheels from auto and truck manufacturing.

Company D's aluminum can smelting technology, which reduces energy use and dross and salt cake generation, smelts aluminum cans into ingots for immediate use by industry. The system is small-scale and requires less than one acre for operation. It costs $1 million, not including land and building. A plant utilizing this technology would attract aluminum cans from the Washington and Oregon markets.

Company D has sold its aluminum wheel system to three industrial clients, all steel or aluminum companies in need of rapidly expanding their capacity. The aluminum wheel system uses the same smelting process as the aluminum can smelting system, with different specialty equipment to accommodate feedstock.

Below is a profile of **Company D:**

Company D	
Feedstock Used	aluminum cans, aluminum wheels
Amount of Feedstock Used	n/a
Feedstock Cost	30c-40c per lb.
Location of Facilities	West Coast
Sales (first year)	n/a
Maximum Capacity (1 plant/1 shift/1 year)	n/a
Minimum Capacity for Positive Economics	n/a

Capital Investment (without lot and buildings)	$1 million
Operating Expenses	n/a
Number of Jobs per Facility	5
Types of Products	aluminum ingots
Expansion Plans	units are available in any part of the US

Asphalt Roofing Recycling

Company E recycles asphalt roofing. This company has a facility in the Willamette Valley and has voiced interest in expanding and opening a collection and transfer station in the Columbia Gorge area. Company E collects used asphalt roofing shingles and recycles the material for use as roadbed substrate and other uses. They need a population base of roughly 50,000 to be profitable, which the Columbia Gorge area would provide. They would need 3-5 acres located near I-84 to make the site cost effective. There would be no materials processing at their site, just collection and transfer.

Company E needs a grant or low interest loan of $10,000 to $25,000 to open a collection site. These funds would be used to lease and prepare the facilities, for the purchase of a trailer and front end loader, and for market plan development. At least one full time person would be hired at approximately $12 an hour or $2,500 a month to operate and manage the site, handle accounts and collection etc.

This enterprise would benefit the community by diverting a large amount of roofing construction material from local landfills and provide at least one well paid full time job.

A number of companies can be located in the three county area that would add value to the abundant supply of wood pallets. In 1994, a nonprofit local development corporation, created **Company F**, a for-profit reclaimed wood manufacturing business. **Company F** receives discarded wood shipping containers and pallets, reclaims and remills them, and makes new solid wood products. The enterprise has three operating divisions: (1) pallet making, (2) reclaimed lumber sales and distribution, and (3) furniture, flooring, and specialty building materials manufacturing.

Company F has pioneered a unique system to produce high value-added products from wood pallets: flooring, butcherblock tables, bookshelves, and other furniture. Its flooring gives the raw material a market value equivalent to $1,200/ton; its furniture gives the raw material a market value of $6,000/ton. In contrast, a ton of wood ground into chips and used in fiberboard brings only $30/ton.

In addition to producing goods from reclaimed wood**, Company F** aims to advance the mission-driven values of its parent organization: (1) attract private capital to the community, (2) create blue-collar jobs and training opportunities, (3) help local business and government reduce disposal costs, (4) divert waste from landfills and incinerators, (5) conserve forest and timberland, and (6) protect the environment. The parent organization is working to meet these goals by operating a woodworking job training program, providing participants with basic environmental and recycling education and preparing them for entry-level jobs in the local wood products manufacturing industry. In its first year, 22 training program graduates were placed. In addition, every 100,000 ft^2 of flooring produced by Company E saves local businesses $35,000 in waste disposal costs, diverts 135 tons of waste from disposal, creates 7,300 hours of work for its employees, and, vis-a-vis the use of virgin materials, conserves one billion BTUs of energy and 22 acres of forest.

The Process

Company F receives discarded pallets from local businesses. Many of the pallets received each year are refurbished and sold back to these businesses. This part of the operation—representing closed-loop recycling—uses conventional pallet repair techniques.

Company F's distinction in the field, however, lies in its pallet remanufacturing process, which upgrades discarded pallets into high value-added products. In response to the wide range of incoming wood and the variety of finished products, the system is designed to be flexible; it is labor intensive, optimizing the quantity and quality of the reclaimed wood, and minimizing the capital equipment cost.

Using conventional equipment and techniques in a proprietary manner, the system denails, joins, planes, sorts, grades, reclaims, remills, and dries the discarded wood to make finished products from oak, maple, pine, cherry, mahogany, and other types of wood.

Other Information

Company F is soliciting expressions of interest and qualifications from companies interested in licensing its system. The license privilege includes access to **Company F's** know-how through technical assistance, feasibility analysis, business plan preparation, and a managerial training program. Prospective licensees must have business experience with at least one of the following:

(1) recycling, reprocessing,
or remanufacturing
operations

(2) sale, distribution, or manufacturing of pallets; or

(3) sale, distribution, or manufacturing of flooring, furniture, or wood products.

Below is a profile of **Company F:**

Company F	
Feedstock	Wood pallets of any size; also chokes, skids and crates
Amount of Feedstock Used	180,000 pallets/year (3,600 tons/year)
Feedstock Cost	Suppliers pay a service fee averaging $0.75/pallet. If they repurchase pallet after repair, the fee is waived.
Collection Strategy	Most pallets are delivered to sites, occasionally Company E will pick up loads
Service Area	50 mile radius for pallet repair operation, value-added products have national market
Location of Facilities	2 sites in Bronx, NY
Years in Business	Since May 1994
Sales	$1,000,000 (within three years)
Capital Investment	$1.5 million in initial capital; 30,000 ft^2 building with exterior yard space
Operating Expenses	n/a
Number of Jobs	20 (includes production and management)
Operating Schedule	1 shift/day, 52 weeks/year
Products	Rebuilt pallets, furniture, flooring and other value-added products
Price of Products	Pallets ranges in price from $2.50-6.00; Furniture ranges from small pieces, which wholesale for $75, to large pieces, which sell under contract for $2,000; Flooring sells to contractors for $1.50-1.85 per ft^2

Company G is a wood waste recycling and disposal company that started in 1984. It primarily processes wood pallets, crates, and housing debris. The majority of its wood comes from commercial facilities, such as warehouses and manufacturing operations. The company also accepts bale cardboard and bale plastic, which is then sent out for further processing and recycling. It processes 18 tons of steel per week, which is then resold.

Company G accepts 600 tons per week of waste materials. Most of the waste is picked up by truck; however, some wood waste is dropped off on-site. A tipping fee of $4.50 per cubic yard is charged for this service. **Company G** does not handle very much C&D debris because the area landfill price for this material ($25-28/ton) is not high enough to generate any incentive for companies to seek alternative disposal methods.

Company G processes all of its wood waste on-site. It converts the wood waste into rebuilt pallets, and grounds all remaining wood for sale as boiler fuel. The company does not generate any waste streams. Their facility is located on a 7-acre site.

Company G is very interested in expanding their operations. Replicating their current facility would cost approximately $1.5 million (including operating expenses). First year sales should exceed $1 million, and the plant would employ 30 people.

Below is a profile of **Company G:**

Company G	
Feedstock	Wood pallets, crates, housing debris (other materials including steel, cardboard, plastic)
Amount of Feedstock Used	600 tons/week
Cost for Feedstock	Charge a tipping fee of $4.50/yd^3
Collection Strategy	Pick up loads with truck, some materials dropped off on-site
Location of Facilities	7 acres site in West Point, VA
Products Produced	Rebuilt pallets, boiler fuel
Capital Investment	$1.5 million (included operating expenses)
Jobs Created	30
Revenues	$1 million/year (first years sales)

Re-use of commodities has a far greater beneficial impact on the waste stream than traditional recycling of glass, metal, or paper, which must be processed into new products. The reusable portion of the waste stream is bulky, and occupies an estimated 5% of landfill space. Furniture, construction materials, appliances, computers, bicycles and motors are parts of this re-use stream.

Re-used commodities are recaptured at their highest value. They may have to be repaired, but do not have to be broken down and re-manufactured. Small businesses and do-it-yourself repair projects benefit greatly from re-use enterprises as they can obtain commodities in good condition at a fraction of their original cost. Often commodities no longer available in the market place are available through the re-use enterprise.

Re-use enterprises can either be for-profit or not-for-profits. They train and employ workers and provide skills training allowing for increased wages. Research by the Self-Reliance, Inc. has identified nearly 100 re-use operations nation-wide. Most are non-profit enterprises which start-up need financing from foundations or government grants.

Company H is one of the for-profit enterprises. It is a private company based in a large metropolitan area in California, and is a pioneer in the field with 25 years of experience in the collection and marketing of used commodities.

The company has incentive packages for employees providing for (1) base wage rates, (2) bonuses based on trading, and (3) a year-end bonus based on the company's overall performance. Further, the company has developed working relationships with local governments whereby it pays no rent for the use of public land, but pays a fixed percentage of its profits to the sponsoring local jurisdiction.

Recently, **Company H** has been engaged to design a re-use system for a community of 60,000 people. This population base is similar to that of the three county area. Considering an enterprise for the Hood River, Wasco and Sherman County area, Company G directors indicated a three-site scenario for the three counties, including a central site in The Dalles, Wasco County, and two satellite sites in Hood River and Sherman Counties.

Total capitalization is estimated at under $100,000. This cost is based on arrangements for sites from the three counties in exchange for a share in future profits.

Below is a profile of **Company H**:

Company H	
Feedstock Used	used appliances, furniture, computers, building materials, tools, art, music, household and office furniture, bicycles…

Amount of Feedstock Used	5-10% of local waste stream
Feedstock Cost	$250,000 in purchasing; feedstock donated, traded and purchased
Location of Facilities	California
Sales (current year)	$1.6 million
Maximum Capacity (1 plant/1 shift/1 year)	n/a
Minimum Capacity for Positive Economics	n/a
Capital Investment (without lot and buildings)	under $100,000
Operating Expenses	up to $1.6 million
Number of Jobs per Facility	26 fte. Small, rural area facility to employ 4-5 people. Indirect effects on employment
Types of Products	Same as feedstock used above; clean and recycle broken glass, scrap and salvage to prevent landfilling of these materials add value
Prices of Product Sold	varies
Expansion Plans	Currently doing site planning for facilities to serve populations of approximately 60,000; wants to expand to many more sites.

Company I is a non-profit Community Development Corporation located in the Willamette Valley that operates very sophisticated reuse operations. They operate Thrift Stores as well as recycling and remanufacturing operations (refrigerators, washers, dryers, glass and other commodities). **Company I** has voiced interest in providing technical assistance to a local non-profit in the Columbia Gorge that wished to establish a reuse operation.

Garnetting Factor

A garnetting factory reprocesses post consumer textile waste or their by-products (discarded second hand clothing and other products that consumers no longer need and decide to discard due to wear, damage etc.) into the original product stream or into new useful end uses. Because the production of nonwoven fabrics require less fiber, labor,

equipment, time and money that the production of woven or knitted fabrics, most reclaimed fabrics are use in nonwovens rather than reconstructed into woven or knitted products. Textile companies have found nonwovens to be a profitable way of reusing used fiber.

Company J contracted for a feasibility study on the potential of establishing a garnetting factory. Their intention was to establish their own company somewhere in the Willamette Valley. The study found that the current markets for recycled fibers are just beginning to blossom and the increased public awareness of environmental issues and conservation of resources is certain to increase the interest in and value of the use of recycled materials for many products.

The **Company J** feasibility study identified five product areas that they consider suitable for application of the secondary fibers that **Company J** has access to: carpet cushions, home insulation, polyester stuffing for pet products, clean-up products and mattress pads. The study recommended that due to the characteristics of the recycled fibers and the current market, it is better to use the secondary fibers in a variety of fiber applications rather than focusing on a single product. After the materials are collected and transported to the factory, the clothing is shredded and used in any of these five products.

To operate a garnetting factory profitably, it is important to have a reliable and efficient collection and transportation system, and to operate the factory in a systematic and organized manner. Due to the nature of their business and long history of success in the collection and reprocessing/reuse/recycling of products from across the west, these are attributes that **Company J** provides extremely well.

A complete garnetting plant would cost between $2 to $3 million, depending on the type of equipment purchases etc., and create 15-20 jobs.

At this point however, **Company J** is not interested in operating this facility. They are therefore willing to partner with or sell the business proposal to the a non-profit organization or a local entrepreneur in exchange for the following:

a. **Company J** is hired to provide the consulting services needed to aid in the set up. This includes an initial feasibility study to determine the likely success of a garnetting facility in the Hood River/Columbia Gorge Area, the number of jobs it would create, a land/facilities site assessment etc. **Company J** would prepare the information for the community to review before moving forward with full blown business planning. Costs for this will be $10,000 to $12,000. These funds could be secured through a grant or others sources.

b. **Company J** would have the right of first refusal to supply the raw material for the plant.

c. **Company J** would have the right of first refusal to be able to contract for the rights to distribute the end products and to use the materials in their own stores and housing operations.

C. Infrastructure Improvements

Companies K, L and M. Some operations would improve the infrastructure of the current solid waste management system while at the same time paving the way for ongoing enterprises. One operation involves using a crusher to process mixed glass. The processed glass can be used as an aggregate for construction building materials and road beds. Also, Deschutes County, Oregon is experimenting with processing glass into a fine sand and using it in the County's water treatment system. Contacts for using crushed glass as an aggregate are: Linda Hayes-Gorman, Oregon Department of Environmental and Deschutes County, and Justin Browson, Babcock Bros. Construction Company.

Company K provides businesses, communities, and governments with the technical expertise to establish a scrap tire recycling program. The program outlines the use of whole tires or shredded tire pieces integrated with concrete to manufacture building products used in civil engineering applications, including dams, prisons, and other major facilities. The program incorporates the principles of local ownership, economic development, environmentally sound manufacturing practices and materials efficiency.

The patented recycling technology is linked to the customer by a licensing agreement. The benefits are patented building products of economic value and a comprehensive recycling program that may create jobs, job training, and may establish a community resource conservation program. The company is currently negotiating with prison construction projects in other parts of the country. Researchers have encouraged the company to contact the Hood River County Administrator in order to conduct preliminary talks with the

project designers. Below is a profile of **Company K:**

Company K	
Feedstock Used	scrap tire or tire pieces
Amount of Feedstock Used	1 ton (120 tires) for each standard block
Feedstock Cost	The company receives money to dispose of material from the state.
Location of Facilities	Facilities not necessary. Machinery is very mobile; tires baled on site of where tires are located and construction site.
Sales (first year)	approximately $6 million

Maximum Capacity (1 plant/1 shift/1 year)	n/a
Minimum Capacity for Positive Economics	n/a
Capital Investment (without lot and buildings)	approximately $100,000
Operating Expenses	
Number of Jobs per Facility	3 per shift for baler
Types of Products	concrete building material used for civil engineering applications
Prices of Product Sold	based on region and application; distance of material from project
Expansion Plans	interested in leasing its technology nation-wide

Another operation could be integrated into the prison project: vermi-composting and plastics sorting. Vermi-composting is the use of red worms to quickly digest organic waste to produce a high-quality potting soil and crops of worms. **Company L** recently won a contract from Portland Metro to receive managed amounts of vegetative waste from Portland area restaurants and supermarkets. The company is in the midst of site location and planning. The prison could offer itself as a site for this operation. Inmates would receive technical training in the management of such facilities and could earn wages from their productive work. The prison waste stream would be integrated into the system as well as materials from the Portland area.

In addition, a plastics processing operation could be located at the prison. This operation would sort mixed plastics into clean loads of HDPE, PET, PPL and others. This is a vital, quality control step for marketing plastics as noted above. This sets the stage for more cost-effective shipping of plastic to the Portland area or attracting a firm like Company A mentioned previously.

There is one other enterprise that is possible, given infrastructure developments within the three-county area. County officials anticipate a rapid increase in the amount of yard debris that will be available in the area based on demand from citizens for services and the need to divert this material from landfills as a way to achieve the 50% goal by the year 2000. **Company M** is a composting company that handles yard debris, wood pallets, vegetative wastes, and C&D wood. Located in downtown Atlanta, **Company M** began their operations two years ago, finally reaching a commercial scale in December of 1996. The company can take in approximately 100 tons/day of waste. This includes 15 tons/day of vegetative waste (mostly lettuce). The company has also just entered a joint venture

with a C&D company, and will be processing all of the waste wood obtained from that operation.

Company M charges a tipping fee of $20/ton; half the local cost of disposal in a landfill. The processing begins with the separation of the waste streams into yard, wood, and vegetative wastes. The yard waste is ground and allowed to sit for approximately 90 days. Then, various amounts of lettuce are mixed with the yard waste. Finally, the wood waste is ground and the chips are added to the mix. This is then placed in vessels (20-30 cubic yards in size) and allowed to ferment for four weeks. By containing the compost in these large vessels, no odor is produced. Odor is often a problem with composting operations, especially those located in densely populated areas.

Company M produces compost, topsoil and potting soil. Their customers include community gardens, landscaping companies, and bioremediation specialists. The cost of their products varies from $6.00-8.00/$yd^3$. The revenue generated during the first year of operation, based on 100 ton/day capacity, is over $300,000. The current operation is on a 10-acre site (located in an empowerment zone), employs three people, and requires a capital investment of $500,000 (includes operating expenses). The facility was privately funded.

Company M's operation can be replicated, and they are very interested in expanding into other regions. The company is confident that they could utilize all the wood waste in the three-county area.

The new arrangements for sewer sludge and vegetative wastes between Portland Metro and WMI, operating in Arlington, offer a huge market for wood and yard debris processed in the three-county area as composting of vegetative and sewer wastes require bulking agents. **Company M** or other waste wood and yard debris operators could negotiate with WMI for the sale of materials needed for the composting process.

Below is a profile of **Company M:**

Company M	
Feedstock Used	yard debris, wood pallets, vegetative wastes, and C&D wood
Amount of Feedstock Used	100 tons/day
Feedstock Cost	n/a
Location of Facilities	Georgia
Sales (first year)	$300,000

Maximum Capacity (1 plant/1 shift/1 year)	100 tons/day
Capital Investment (w/o lot and buildings)	$500,000 (includes operating expenses)
Number of Jobs per Facility	3
Types of Products	mulch. compost, bulking material
Prices of Product Sold	$6.00-8.00/yd^3
Expansion Plans	interested in locating plants throughout US

4. Agricultural and Forestry Waste Materials

A. Forestry Waste

Established in 1984, **Company K** produces fuel oil primarily from wood waste. The company operates three facilities, one in Manitowac, Wisconsin (Red Arrow Products, Ltd.), and two smaller plants in Ontario. The Manitowac facility uses **Company K's** patented Rapid Thermal Processing technology to process approximately 8,000 dry tons of waste wood per year (16,500 wet tons per year) into 1,200,000 gallons of Bio-Oil (comparable to fuel oils). In fact, the primary product from Red Arrow is hydroxyacetaldehyde, a food flavoring agent, and the bio-oil is used to power to the facility.

Rapid Thermal Processing (RTP) heats the dry waste wood to between 400° and 900° Celsius for about a half second at ordinary atmospheric pressure with no oxygen. The rapid heating of the biomass causes fragmentation of the chemical structure ("cracking" the chemical bonds) thus producing the liquid Bio-Oil. Rapid cooling prevents the completing of chemical reactions, therefore preserving the liquid state. There is no waste stream generated with this process. Approximately 74 percent of the resulting product is liquid Bio-Oil, 15 percent is char (which can be processed into activated carbon), and 11 percent is gas. Bio-Oil is comprised primarily of water, depolymerized lignin, carbonyls, and smaller amounts of carboxylic acid, carbohydrates, phenolics, and alcohol.

A minimum-capacity plant, producing only fuel products, would transform 36,300 dry tons of waste into 5.3 million gallons of bio-oil each year, and would cost approximately $4.5 million. Nine direct jobs would be created. A maximum-capacity plant would transform 90,940 dry tons of waste into 13.3 million gallons of bio-oil each year; data on capital investment and jobs created are not available at this time. **Company K** does not pay for any of the feedstocks, nor does it charge a tipping fee. Generally, Bio-Oil has half the heating value of light oil but is still considered to be competitive with petroleum fuels on the basis of equivalent energy. For example, a 100 ton/day plant could generate 7 to 8

megawatts of electricity in a direct-fired turbine—enough power to meet the yearly needs of 400-500 homes.

Liquid biomass fuels, such as Company K's Bio-Oil, have several logistical advantages over solid biomass fuel sources. Generally, they are easier and less costly to transport than solid fuels. Liquid heating oils are the primary source of energy for turbines and diesel generators, and therefore biologically-derived liquid fuels have a vast potential market. According to **Company K**, current fuel oil-burning generators can be easily modified to use Bio-Oil.

Company K is very interested in expanding their operations into communities with wood waste problems.

Below is a profile of **Company K:**

Company K	
Feedstocks	waste wood, sawdust, cardboard, newsprint, ag wastes, pulp sludge, other fibers
Amount of Feedstock Used	WI Plant: 8,000 dry tons/year (16,500 wet) yields 1.2 million gallons of Bio-Oil
Cost for Feedstock	$0/ton; no tipping fee
Location of Facilities	Manitowac, WI; also 2 plants in Ontario
Years in Business	Since 1984
Revenues	n/a
Minimum Capacity	36,300 dry tons/year = 5.3 mil gal Bio-Oil
Maximum Capacity	90,940 dry tons/year = 13.3 mil gal Bio-Oil
Capital Investment	Minimum capacity plant = $4.5 million
Operating Expenses	n/a
Number of Jobs	9 for a minimum capacity plant
Product	Bio-Oil, comparable in heating value to No. 2 Fuel Oil
Price of Product (based on $/BTU)*	Bio-Oil = $0.27/gal (75,000 BTU/gal) No. 2 Fuel Oil = $0.48/gal (135,000 BTU/gal)

* These figures are estimates based on the average composition of wood waste.

Company K expands to the Southeast. The Southeast Regional Biomass Energy Program (SERBEP), Environmental Resource Services (ERS) of Oklahoma City, and Company K have joined forces to build a plant in Anniston, Alabama to manufacture Bio-Fuel and other value-added products from wood wastes. Wood waste from the surrounding area, including the Anniston Army Depot and Fort McClellan will be processed and the fuel sold back to the Army and other energy consumers to replace fossil fuel. The plant is expected to process 100 tons per day of feedstock. In addition to construction jobs, the new plant will create 30-40 permanent jobs, indirectly create 65-90 additional jobs, and generate over $300,000 in tax revenues per year.

In addition to saving landfill space, this project can also solve disposal problems for area wood waste generators. The current tipping fee for private landfills in the Anniston area is $24/ton vs. $12.50/ton for wood wastes delivered to the city's wood recycling center. Another benefit is the reduction of 1,700 tons of sulfur and 689,000 tons of carbon dioxide emissions from fossil fuel combustion, expected over the lifetime of the plant. In addition, the bio-fuel manufactured in the Anniston area is expected to displace 1.4 million barrels of imported oil in 20 years of the plant's operation. Markets exist in the Anniston area for the fuel, however the presidential mandate for federal government installations (including military bases) to utilize more renewable energy is expected to increase the demand for the Bio-Fuel.

Company L uses old pallets, crates, forestry waste, and other sources of dry, relatively clean, wood to produce wallforms. Mineralized wood waste and cement are combined (a patented mix of 91% waste wood and 9% cement) to produce construction forms (8" high, 16" wide, and 8.25" deep, the same dimensions as conventional concrete blocks). These permanent forms interlock without mortar, and reinforced concrete is poured into the cores. These blocks have a four-hour fire rating and are "practically non-combustible." Because

of this, insurance premiums are low for structures using this system. The product is quite "breathable" compared to construction techniques using vapor barriers, thus improving indoor air quality. The wallforms are also a good sound barrier, and is lighter, yet sturdier, than normal concrete blocks.

R values, which measure of the insulation quality of a material, for this product range from 11 to 24, but can be increased by using a slightly thicker block (12" instead of 8.25"), and by placing insulation materials in the subsequent 3" holes in the blocks. The company currently uses extruded foam product insulation containing some post-consumer recycled material; however, because it would like to switch to "greener" products, the company is investigating the use of 92% recycled content mineral wool/fiberglass.

The unit price of the blocks is currently higher than conventional concrete blocks, but the company estimates that the life-cycle savings are 10% in overall costs and 20% in construction costs. Overall costs are determined by energy savings, insurance premium reductions, and construction cost savings. Construction costs are reduced because the

product is lighter and easier to work with than traditional poured-concrete foundations and walls, and requires no supplemental insulation material.

At this time, the company currently utilizes urban wood waste, which is relatively clean and dry (lumber mill residues can also be utilized). According to company officials, two truckloads of pallets and crates can build one modestly-sized home. Cotton residues have also been tested for use as the cellulosic component of this product, but the greatest success has been with waste wood.

Company L's Iowa facility has been operational for about 2 years, and is capable of producing 80,000 to 100,000 square feet of material per month (thickness based on 8.50" x 12" thick wall section). Current production levels are at half capacity. This plant employs approximately 17 people. The Midwest facility licenses the technology from **Company L**, and takes these stabilized fibers, combines them with concrete, and produces wall forms.

Company L owns the patent and licensing rights to a process which transforms chips into stabilized fibers, known as the K-XÔ Process. In this process, scrap wood chips are hammermilled to the pinchip size needed for a particular product (short for roof tiles, medium for wallforms, and coarse for panels). The pinchips are then processed with two mineral solutions to the point where the minerals have penetrated into the fine pores of the wood fiber. The treated pinchips are no longer susceptible to rot or decay because the elements of the wood that cause rot and decay (polysaccharides, resins, oils, and tannic acid) have been sealed within the pores or bound to the minerals. The wood fibers don't lose their positive characteristics including thermal insulating ability, light weight, and workability, but are now in a form that allows them to combine with cement to gain additional important qualities such as fire and pest resistance. The pinchips, now in this "free aggregate" form can generally be used in the same way as any gravel based aggregate (blocks, slabs, etc.), but due to its light weight, K-X aggregate can also be manufactured into many other products for which heavy aggregate mixtures are ill-suited, such as roofing tiles, sound absorption panels, and insulation panels. The minimum capital investment for this step of the process is approximately $204,000 for equipment. Approximately 20 jobs are created.

Ideally, if an existing concrete products' manufacturer was interested in expanding their product offering, an investment in the K-XÔ process and new molds could create production capacity for the wallforms. If an existing concrete products manufacturing facility could not be found, an additional $372,000 would be required for this type of processing equipment. Company officials also estimate approximately $424,000 in working capital (including inventory), license fees, PR, advertising, and consulting fees are needed. **Company L** is very interested in funding a new plant by raising equity, not loans, and relying on investors to become shareholders in the company. Currently, K-X Arkansas, Inc. is processing industrial waste wood to K-X aggregate, and is selling this to concrete block plants in the South.

Below is a profile of **Company L:**

Company L	
Feedstock Used	Pallets, crates, other wood sources
Amount of Feedstock Used	1996: 50,000 tons in 4 plants
Feedstock Cost	$30-40/ton processed K-X aggregate is $29.50/$y^3$
Location of Facilities	Ottumwa, IA; Little Rock, AR; Austin, TX
Sales (first year)	750,000 f^2 - 1,200,000 f^2 of wallforms (2 plants)
Maximum Capacity (1 plant/1 shift/1 year)	2,000,000 f^2 (2 plants)
Minimum Capacity for Positive Economics	450,000 f^2/year (per plant)
Capital Investment (without lot and buildings)	K-X plant: $300,000 wallform plant: $1,000,000
Operating Expenses	$150,000-450,000 (project dependent)
Number of Jobs per Facility	8-17 per shift (includes sales + support staff)
Types of Products	permanent concrete forms, sound absorption and insulation panels
Prices of Product Sold	1 ft^2 wallform: 8.5" = $2.20 whsl/$2.65 retail; 12" = $2.60 whsl/$2.95 retail
Expansion Plans	Company L is seeking licensees and joint venture partners for new manufacturing facilities for K-X aggregate and wallform products

Company M. An English company with a successful 40 year track record makes and markets a construction product made from wheat straw in Europe and Australia, especially in areas where timber supplies are limited. The company is also a licenser to **Company M**, which is developing U.S. manufacturing capability at this time and has aggressive expansion plans for the next five years. A facility in Rupert, Idaho will be producing product starting in fall 1997. In addition, Pierce International is currently working with communities in Utah, North Dakota, Nebraska, Washington and Virginia to site plants. The Virginia facility will come on-line in the spring of 1998.

The construction product is intended for non-structural (non-load bearing) applications. Produced in 4' x 8' x 2-1/4" panels weighing approximately 125 pounds and serves as a

substitute for interior 2" x 4" and drywall walls. The panels have a 1 hour fire rating, an R value of 9 (which is slightly higher than most interior panels/drywall), and good acoustical properties.

Currently the product is marketed as an interior wall substitution material and as a core for office partitions. An emerging market is flooring. It is currently used as flooring in Europe and is being certified for this application in the United States. Another emerging market is modular home producers. There is a modular home manufacturer who is considering locating next door to the Virginia plant to have a steady, local supply of interior wall material. Mobile home manufacturers are also very interested in using the product, especially since noise is a primary concern among owners. Also, traditional mobile homes have a total fire rating of about 15 minutes, while these panels last four times as long.

The potential for offshoot industries is also very high with these products. Most recently, the archery industry is looking into using the product as targets. Door manufacturers are also looking into the product because of the increased burn time compared to particleboard when used as the core.

A 4' x 8' panel costs $20.00 to $25.00, less than or equal to the combined price of normal drywall and 2" x 4" walls. Traditional wall systems cost approximately $11.00 for the drywall (4' x 8' of drywall at $5.50 times 2), plus $13.00 for the 2 x 4s (4 studs times $3.25

each), for a total of $24.00. This does not include labor costs, which are much higher for applying drywall than putting a 4' x 8' panel into place. One contractor that uses the product estimates a 25 to 32 percent savings over conventional construction practices. Additional savings arise because the product is more durable than the drywall or veneer paneling thereby reducing replacement costs. The product's flame retardancy can lower insurance costs for some types of homes. There is also savings potential from re-use of the product. To remodel a home you only need to strip the nails and screws from the panel and fill the holes and it can be re-used instead of landfilled.

The product is a heat compressed straw board, using no other resin or adhesive besides the natural lignin. **Company M**'s planned facilities will acquire wheat straw through straw brokers. The facility will use 15 tons of straw per shift per day, at a cost of $30 to $35 per ton delivered (potentially rising to $40 per ton). Again, note that there are custom baling operations available in your region.

A typical plant will cost $4.0 to $4.4 million, and will initially employ 35 people. Approximately $2.4 million of this total is for processing equipment. **Company M** hopes to reach production levels of five million square feet of the product per year within two years. Thus far, funders for these projects have primarily been private investors and some cooperatives, which also provide straw for production.

Company M licenses an updated technology for the production of the material. In addition, Company M and its parent company offer a complete package of support for 3 to 5 years, including equipment acquisition, training, marketing, technical support, and spare parts. They can provide your community with letters of "intent to purchase" from major construction material suppliers, as well as identifying markets within a 500 mile radius.

Below is a profile of **Company M:**

Company M	
Feedstock Used	wheat straw
Amount of Feedstock Used	15 tons of straw per shift per day
Feedstock Cost	$30 $35 ton delivered
Location of Facilities	Iowa, Idaho, and Virginia
Sales (first year)	n/a
Maximum Capacity (1 plant/1 shift/1 year)	n/a
Minimum Capacity for Positive Economics	n/a
Capital Investment (without lot and buildings)	$4 - $4.4 Million
Operating Expenses	n/a
Number of Jobs per Facility	35
Types of Products	panels for interior walls.
Prices of Product Sold	$20 - $25
Expansion Plans	Is talking to people in Utah, North Dakota, Nebraska, Washington

B. Agricultural Waste

Parallel Products. The Oregon Cherry Growers have been searching for an alternative disposal method for the brine from maraschino cherry processing. The brine is acidic and has a high BOD resulting in high disposal costs. One possible solution that they are exploring is to ferment the brine into ethanol. Research has been done which shows that the brine is fermentable. A processing facility which would meet their needs would

produce up to one million gallons per year of ethanol. This is a small operation compared to other ethanol plants, but it is not the only small plant in the country (see Appendix B for an example of ethanol-related initiatives). Other small plants include: Pabst Brewery in Olympia Washington producing 700,000 gallons per year, a Minnesota plant producing 500,000 gallons per year and a South Dakota plant producing 200,000 gallons per year.

The economic details have not been worked out at this time. The driving factor for the project is avoided disposal costs for the brine. There is a national market for ethanol and it also could be used within the state, including to meet the Portland oxygenated fuel requirement.

There is processing research left to do before building a facility. One area needing work is the removal of the sulfite from the brine. Removing the sulfite can result in a potentially useful by-product -- calcium sulfate. Calcium sulfate can be used as a liming agent on agricultural fields.

It is possible to include other waste streams as raw materials for the facility. Local breweries and vineyards produce waste that could be fermented as can the fruit waste from the packing houses and orchards. It is also possible to ferment starch from potato processing, something that happens closer to Pendleton.