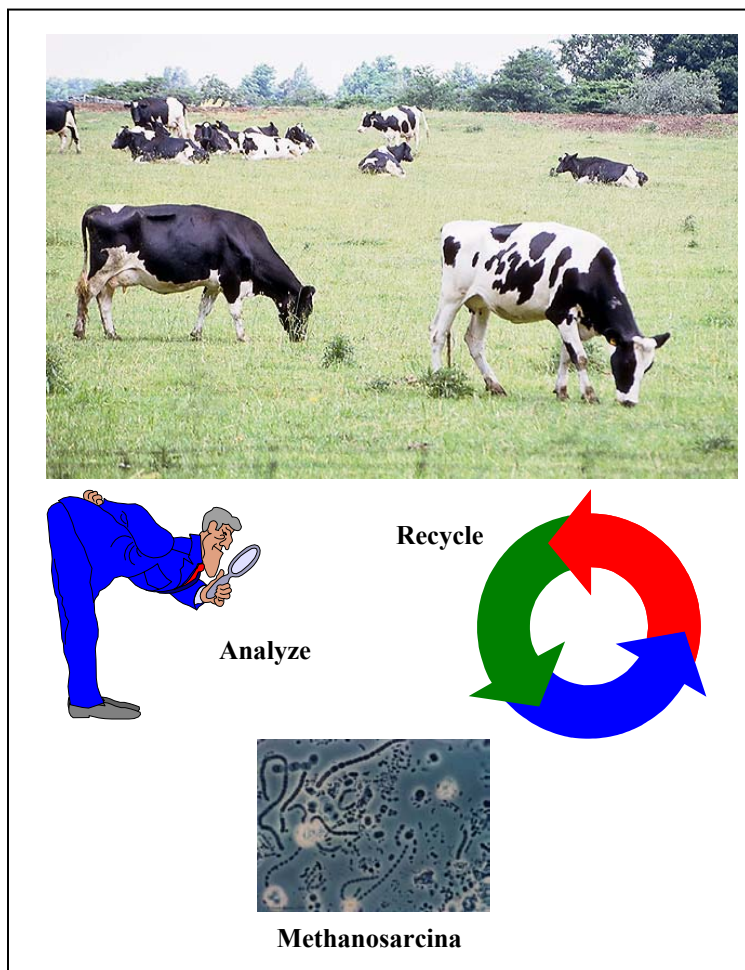


PROPRIETARY AND CONFIDENTIAL

FEASIBILITY STUDY

Dairy Waste Anaerobic Treatment & 1.5 MW Power Plant



Exel's Holsteins

2002 N. Thornton Road, Lodi, CA 95242

BioWasteEnergy

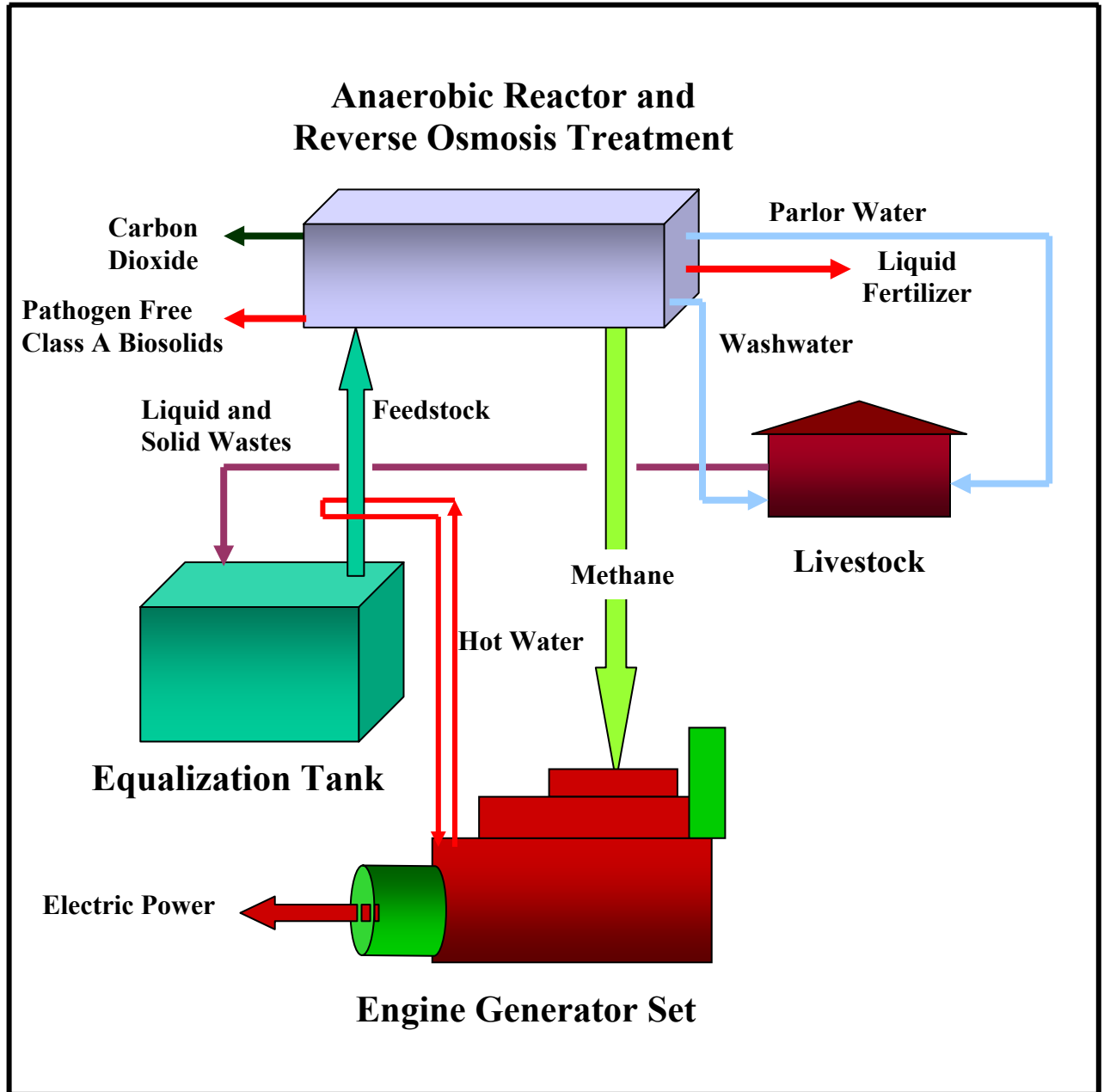
A Division of WaterSmart Environmental, Inc.

www.biowastenergy.com

March 8, 2001

PROPRIETARY AND CONFIDENTIAL

Anaerobic Reactor Process Flow Diagram



California

PROPRIETARY AND CONFIDENTIAL

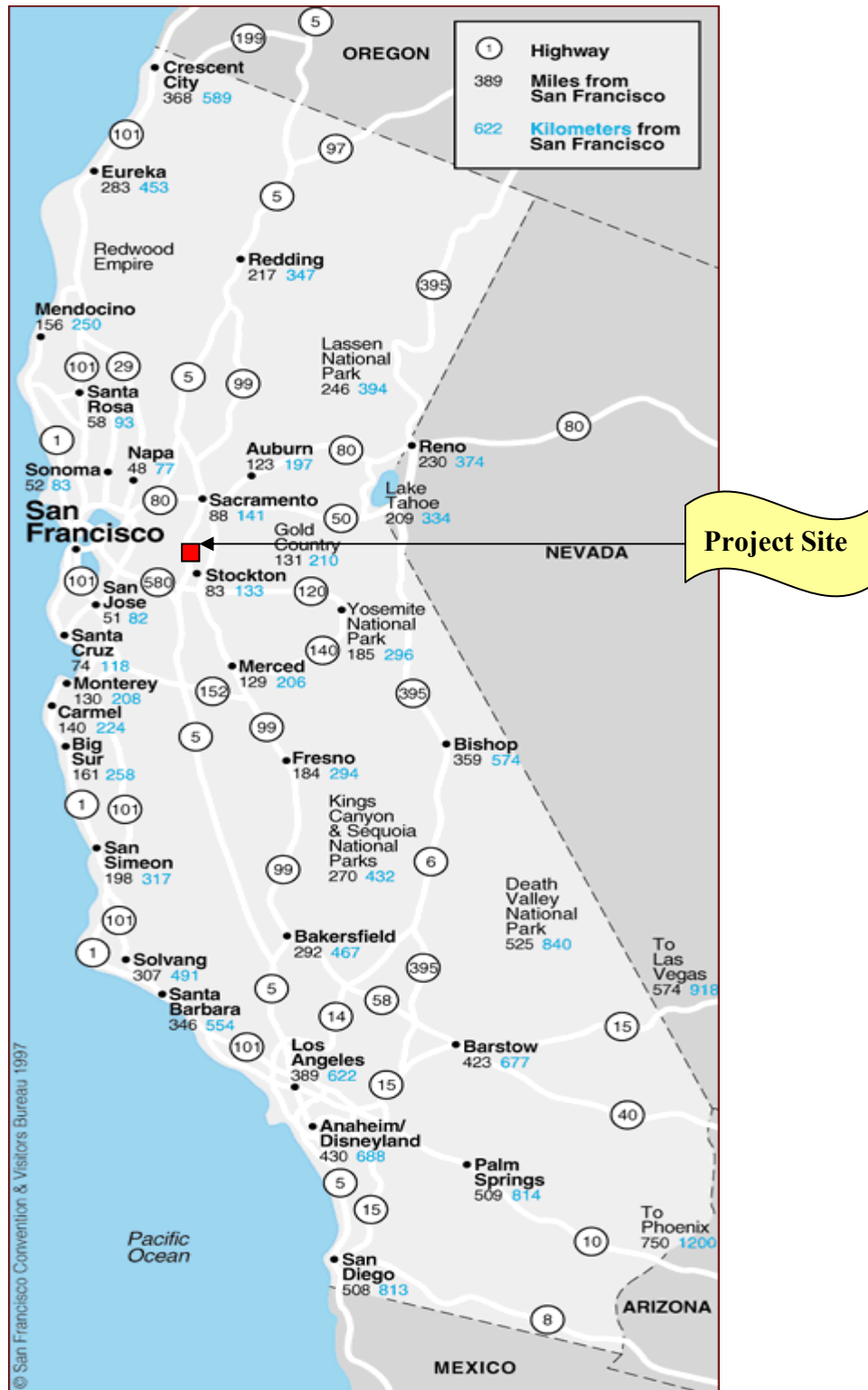


Table of Contents

EXECUTIVE SUMMARY.....	5
Project Management.....	7
<i>ENERGY, ENVIRONMENTAL AND BALANCE OF TRADE BENEFITS</i>	8
<i>CASH FLOW PROJECTIONS</i>	9
<i>ANAEROBIC DIGESTION GENERAL DESCRIPTION</i>	11
<i>TYPICAL PROJECTS</i>	11
<i>THE ANAEROBIC REACTOR</i>	13
Reverse Osmosis Unit.....	14
Methane Compression and Storage.....	15
Biosolids.....	15
Liquid Nutrients.....	15
Insulation.....	15
Safety Features.....	15
<i>ANAEROBIC REACTOR CAPACITY</i>	17
<i>ENERGY REQUIRED TO HEAT THE ANAEROBIC REACTOR</i>	18
<i>BIOGAS AND OTHER PRODUCTS</i>	20
<i>LAND REQUIRED</i>	21
<i>POWER PLANT</i>	22
Generator Sets.....	22
Generator.....	22
Heat Recovery System.....	23
Main Control System.....	23
Switchboard.....	23
Office, Shop, and Storage Building.....	24
<i>CASH FLOW ANALYSIS</i>	25
<i>POWER RATE ANALYSIS</i>	31
<i>DAIRY MARKET ANALYSIS</i>	32
<i>BioWasteEnergy Qualifications, Capabilities, and Experience</i>	33

EXECUTIVE SUMMARY

Project Description

The proposed project is a Dairy Waste (Manure) remediation and Power Production Facility. The project will be located at Exel's Dairy, 20002 North Thornton Road, Lodi, California 95242. The project will supply recycled water to the dairy's wash and parlor water requirements. Co-products such as liquid fertilizer, soil additives, and carbon dioxide will be sold in the open market. Methane will be used as fuel to power the electrical generators. The power will be sold through the California Power Exchange or directly to commercial and/or industrial purchasers under the existing deregulated energy environment. The project will be constructed on a Build, Own, and Operate (BOO) basis by BioWasteEnergy, A Division of WaterSmart Environmental, Inc. BioWasteEnergy will provide the technology, turnkey construction, operation, and maintenance. Exel will provide project financing, land, and biowastes.

The methane produced by anaerobic digestion will generate over 6,500 mega watt-hours (MWh) of electric power annually. The power plant will be based on reciprocating spark-fired engines capable of continuous operation on biogas produced by the anaerobic reactor. These engines are a standard product of companies such as Caterpillar, Cummins, Waukesha, Wartsila and others.

There are 231,265 dairy cows in San Joaquin and Stanislaus Counties of California. The turnkey project cost of the 10% of this market is over \$32 million. California and US dairy populations are 1,469,577 and 9,156,000 respectively. Similarly, turnkey project cost of the 10% of this market is over \$154 million and 1.28 billion, respectively.

Description of Waste Processing Technology

The proposed facility will recycle or dispose of the waste by applying environmentally benign methodology. In order to control odor and air emissions the entire process will be closed loop with no liquid or solids discharge to the environment. Power plant exhaust air emissions will comply with EPA and local regulations. Quality of recycled water for dairy use will be carefully monitored in compliance with the "Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse", National Water Research Institute, December 2000. Liquid fertilizer concentrate will be sold to fertilizer distributors. Best Available Technology (BAT) will be consistently applied to system design.

The technology of controlled anaerobic reaction is selected to efficiently process the liquid and solid wastes into usable **methane, carbon dioxide, organic fertilizer, and liquid fertilizer concentrate**. Revenue from the sale of these commodities will considerably reduce the biowaste disposal cost to the dairy farmer. Anaerobic digestion is an environmentally safe, well-proven, and naturally occurring biological phenomenon. Methane produced by controlled microbiological reactions will be used to power electric generators. Therefore, anaerobic reactions convert biowaste into a number of usable co-products (see Project Description), including methane gas.

Purified and pathogen free effluent water from the anaerobic reactor is continuously recycled. This reuse supplies parlor water for sprinkle, livestock washing, livestock drinking, and equipment washing requirements. The reused water is then discharged back to the anaerobic reactor. Livestock manure waste flush water is recycled to the maximum extent possible. Pathogen free treated water is used as a final flush water rinse thereby significantly improving existing sanitation practices in the dairy industry.

Project Capital Cost Structure

The total estimated capital cost of the Project is \$3,325,000 utilizing new process equipment and reciprocating engines. The major components of the capital cost are as follows:

Item Description -----	Cost in \$
Cogeneration Plant-----	810,000
Anaerobic Reactor -----	950,000
Reverse Osmosis -----	270,000
CO ₂ Equipment -----	300,000
Equalization Tank-----	50,000
Methane compression and Storage -----	45,000
Finance Charges-----	55,000
Interest During Construction -----	140,000
Administration/Legal -----	55,000
Permitting -----	10,000
Technology & Development Cost -----	575,000
Working Capital-----	65,000
Total-----	<u>3,325,000</u>

The financing will be structured as follows:

Developer Equity as Technology, 30% -----	575,000
Investor Equity as Cash, 70% -----	825,000
Finance -----	1,925,000
Loan Term, Years-----	7
Interest Rate -----	10%

Developer will contribute 30% equity in the Project as the value of technology. Investor will contribute \$825,000 cash and the balance will be financed.

Biowaste Disposal Fee, Generation Cost, and Power Rate

The biowaste disposal fee will be \$0.08/day/standing head or \$29.20/yr./standing head. The estimated cost of operation and maintenance is 1.71 \$/wet-ton. A 3% increase per year in operation cost is assumed. The disposal fee will be increased accordingly.

The power plant generation cost has been calculated for the first twenty years. The value of the plant and equipment has been depreciated on a straight-line basis over a ten-year period. The estimated average power rate is 4.88 cents/kWh. This is consistent with the prevailing power rates in California as confirmed by the California Power Exchange's average rate. The Power Plant operation and maintenance is 1.15 cents/kWh generated. This is an industry average for this type of power generation and is confirmed by various equipment manufacturers and power plant operators. A 3% increase per year in operation cost is assumed. The electric rate is increased accordingly.

The power generated will qualify, as **GREEN POWER** because it is produced by a renewable fuel source. GREEN POWER is sold at a premium. However, this premium is not accounted for in our economic analysis. *A six-dollar per barrel oil equivalent credit is included.* 1.00 cents/kWh California and a potential 1.75 cents/kWh federal tax credits (Senate Bill S. 249) are not included in the economic analysis. The power sale price will be maximized through a combination of long-term, short-term, spot, and time-of-the-day contracts.

Organic Fertilizers are in great demand in California's Central Valley where "Adobe" nature of the soil requires continuous application of soil conditioners. Usage of biosolids as bedding material is a normal practice in Iowa, California and other parts of the country. In Iowa these biosolids are sold to the dairy for \$10.00/cubic yard. Additionally, Class A biosolids when dried to 16-18% moisture makes a perfect mulch material. Perfect in that it is of the proper moisture content as well as the micronutrients of copper, zinc, manganese, iron, and calcium. These micronutrients are in great demand in the organic fertilizer marketplace.

Liquid Fertilizer Concentrates have very active market in the region. The basic fertilizer U32 as a 10% solution retails at 200.00 \$/ton.

Carbon Dioxide is extensively used as a preservative in packaging meats, vegetable and fruit. There are a great number of food packagers including canneries and wineries within 5 to 35 miles of the project location. Therefore, Carbon Dioxide market is active and demand high.

Project Management

The Project will be constructed and managed by a team headed by BioWastEnergy. Qualified personnel and contractors will be used to construct and operate the facility. O & M will be provided by BioWastEnergy.

BioWastEnergy will set up a comprehensive operation and maintenance (O&M) plan for the project to ensure smooth and cost-effective operation. This will be made possible by using a team of capable and experienced personnel and technicians well versed in the operation and maintenance of such facilities.

The **power rates are highest** during peak demand periods. Therefore, the objective is to maximize net income by providing very high availability and high kW output capability during peak demand periods. A conservative maintenance program during off-season will ensure high availability during the on-peak season that, in turn, will maximize profits.

ENERGY, ENVIRONMENTAL, AND BALANCE OF TRADE BENEFITS

	2k Cow Dairy	Market Share	
		20% CA Dairies	20% US Dairies
Wastewater Recycled	100%	100%	100%
Waste or Treated Water Discharge	Zero	Zero	Zero
Net Electricity Output, MW	0.850	125	778
Net Electricity Production, MWH/yr.	7,446	1,094,247	6,817,558
Electricity Supply for Number of Family Residences	850	124,914	778,260
CO ₂ Production, Tons/yr.	1,825	268,198	1,670,970
Liquid Fertilizer Production, Tons/yr.	2,393	351,670	2,191,031
Organic Fertilizer Production, Tons/yr.	2,368	347,996	2,168,141

Energy Produced & Saved Equal to Barrels Oil:

Natural Gas (Methane) production, mmbtu/yr.	93,655	13,763,323	85,750,518
Natural Gas Saved by Liquid Fertilizer production, mmbtu/yr.	24,050	3,534,281	22,019,860
Natural Gas Saved by CO ₂ Production, mmbtu/yr.	38,216	5,616,062	34,990,112
Total Natural Gas Produced & Saved, mmbtu/yr.	155,920	22,913,667	142,760,489
Equivalent Oil Saved, barrels/yr.	26,883	3,950,632	24,613,877

US Balance of Trade Deficit Reduction:

Oil Price, \$/barrel	25.00	25.00	25.00
Balance of Trade Reduction, \$/yr.	672,070	98,765,804	615,346,937

Environmental and Economic Benefits:

Solid Waste Discharge	Zero	Zero	Zero
Liquid Waste Discharge	Zero	Zero	Zero
Air Emissions, Greenhouse Effect Reduction	727%	727%	727%
Permanent Jobs Created	5	600	3,700

Notes:

1. Manure, if left in the open to biodegrade will produce Methane gas. Methane, a greenhouse gas, is 20 times more harmful than CO₂. Methane is burned in gas engine generators and turbines to produce electricity. The Methane fuel combustion process produces CO₂. 1.00 lb. of Methane burned produces 2.75 lbs. of CO₂. One pound of Methane gas discharged into the atmosphere produces a greenhouse effect equal to 20 pounds of CO₂. After combustion, however, one pound of Methane gas produces but 2.75 pounds of CO₂ achieving a reduction of 20/2.75 or 727% greenhouse effect.
2. Market Share 20% CA Dairies and 20% US Dairies: 20% market capture of California and US total dairy cow population.

CASH FLOW PROJECTIONS

Waste Disposal		Scenario 'A'	Scenario 'B'	Scenario 'C'	Scenario 'D'
Cost:	Cost to Dairy, \$/day/head	0.080	0.080	0.080	0.080
	Avg. Milk Production, cwt/day/head	0.85	0.85	0.85	0.85
	Cost, \$/cwt of Milk Produced	0.094	0.094	0.094	0.094
	Milk Price, Avg., \$/cwt	10.00	11.00	12.00	13.00
	Disposal Cost % of Milk Sell Price	0.94%	0.86%	0.78%	0.72%
FIRST YEAR CASH FLOW PROJECTIONS					
Power Plant:	Engine Generator Efficiency, %	35%	35%	35%	35%
	Power Production Summer, kWh	987	987	987	987
	Power Production Winter, kWh	987	987	987	987
	Facility Power Usage, %	14%	14%	14%	14%
	Facility Power Usage, kWh	138	138	138	138
	Power for Sale, Summer, kWh	849	849	849	849
	Power for Sale, Winter, kWh	849	849	849	849
	Power Plant Installed Capacity, kW	1,480	1,480	1,480	1,480
	Power Sell Rate, Summer, cents./kWh	6.00	6.25	8.75	8.17
	Power Sell Rate, Winter, cents./kWh	2.50	3.50	5.25	3.03
	Cash Flow, Summer, \$/yr.	223,011	232,303	325,224	303,836
	Cash Flow, Winter, \$/yr.	92,921	130,090	195,135	112,524
	Operation & Maintenance, cents./kWh	1.15	1.15	1.15	1.15
	Operation & Maintenance, \$/yr.	85,488	85,488	85,488	85,488
	Power Plant, Net Cash Flow, \$/yr.	230,445	276,905	434,871	330,873
Waste Disposal:	Disposal Cost, \$/Ton (13.5% Solids)	1.37	1.37	1.37	1.37
	Waste (Wet), Tons/yr.	42,705	42,705	42,705	42,705
	Disposal Cost, \$/yr.	58,400	58,400	58,400	58,400
	Operation & Maintenance, \$/Ton	1.06	1.06	1.06	1.06
	Operation & Maintenance, \$/yr.	45,267	45,267	45,267	45,267
	Waste Disposal Cash Flow, \$/yr.	13,133	13,133	13,133	13,133
Biosolids:	Organic Fertilizer Production, Tons/Yr.	2,368	2,368	2,368	2,368
	Sell, \$/Ton	8.00	8.00	8.00	8.00
	Organic Fertilizer Revenue, \$/yr.	18,943	18,943	18,943	18,943
	O & M, \$/yr.	4,736	4,736	4,736	4,736
	Organic Fertilizer Cash Flow, \$/yr.	14,207	14,207	14,207	14,207
Liquid Fertilizer:	Fertilizer Available, Tons/yr.	2,393	2,393	2,393	2,393
	Wholesale price, \$/Ton	110	110	110	110
	Fertilizer Revenue, \$/yr.	263,267	263,267	263,267	263,267
	Fertilizer O & M, \$/yr.	23,933	23,933	23,933	23,933
	Liquid Fertilizer Cash Flow, \$/yr.	239,333	239,333	239,333	239,333
Carbon Dioxide:	CO ₂ Production, Tons/yr.	1,848	1,848	1,848	1,848
	Sell, \$/Ton	75	75	75	75
	CO ₂ , Revenue, \$/yr.	138,634	138,634	138,634	138,634
	O & M, \$/yr.	27,727	27,727	27,727	27,727
	CO₂, Cash Flow, \$/yr.	110,908	110,908	110,908	110,908
	Total Cash Flow, \$/yr.	608,025	654,486	812,452	708,453

Investment	Total Project Investment, \$	2,750,000	2,750,000	2,750,000	2,750,000
Summary:	Cash Investment 30%, Finance Balance, \$	825,000	825,000	825,000	825,000
	Rate of Return w/Federal Credit	36%	39%	51%	43%

Notes:

1. The cash flow is for first year operation
2. Power Rates:

Scenario 'A'- Very conservative,

Scenario 'B'- Conservative,

Scenario 'C'- Includes 1.0 cent/kWh California Credit and 1.75 cents/kWh Federal Tax credit per Senate Bill S. 249,

Scenario 'D'- 1999/2000 California Power Exchange average



Exel Dairy Flush Lane

ANAEROBIC DIGESTION GENERAL DESCRIPTION

Anaerobic digestion is a biological process that produces a gas consisting principally of methane (CH₄) and carbon dioxide (CO₂), otherwise known as **biogas**. These gases are produced from **organic wastes** such as livestock manure, food processing waste, sanitary wastewater, municipal solid wastes, landfill leachate, etc.

Anaerobic processes can either occur naturally or in a controlled environment such as an anaerobic reactor. Organic waste such as livestock manure and various types of bacteria are transferred into an airtight container called a digester or reactor where the process can occur in a controlled environment. Depending on the waste feedstock and the system design, biogas is typically 55 to 75 percent pure methane. State-of-the-art systems such as the proposed method produce biogas in two separate streams with more than 95 percent pure methane and carbon dioxide.

The process of anaerobic digestion consists of three biological steps.

The first step is the decomposition (hydrolysis) of plant or animal matter. This step breaks down the organic material into usable-sized molecules such as sugar. The second step is the conversion of decomposed matter into organic acids. Finally, the acids are converted into methane gas.

The process temperature affects the rate of digestion and will be maintained in the thermophilic range (135 to 145 degrees F).

TYPICAL PROJECTS

At **Royal Farms No. 1 in Tulare, California**, hog manure is slurried and transferred to a Hypalon®-covered lagoon for biogas generation. The collected biogas fuels a 70 kilowatt (kW) engine-generator and a 100 kW engine-generator. The electricity generated on the farm is able to meet monthly electric and heat energy demands.

Given the success of this project, three other swine farms (**Sharp Ranch, Fresno and Prison Farm**) have also installed floating covers on their lagoons. The **Knudsen and Sons project in Chico, California**, treated wastewater which contained organic matter from fruit crushing and wash down in a covered and lined lagoon. The biogas produce is burned in a boiler. At **Langerwerf Dairy in Durham, California**, cow manure is scraped and fed into a plug flow digester. The biogas produced is used to fire an 85 kW gas engine. The engine operates at a 35 kW capacity level and drives a generator to produce electricity. Electricity and heat generated is able to offset all dairy energy demand. The system has been in operation since 1982. Source: California Energy Commission

A PROVEN TECHNOLOGY

Anaerobic Digester Technology has a long successful record.

Data Source: CALIFORNIA ENERGY COMMISSION

OPERATIONAL POWER PLANTS IN CALIFORNIA (100 kilowatts and above) 11/1/99

Plant Name (Alias)	Technology	Online (MW)	Gross (MW)	Date Online	County Ca
Aliso Water Management Agency	Digester Gas/Municipal	1.20	1.20	6/6/83	Orange
Chino Basin Municipal Water District	Digester Gas/Municipal	0.58	0.58	12/28/92	San Bernardino
City Of Palm Springs	Digester Gas/Municipal	0.25	0.25	5/5/83	Riverside
City Of Tulare	Digester Gas	0.41	0.41	11/6/92	Tulare
Co. San. Dist. lbs32 Of La Co. (Valencia)	Digester Gas/Municipal	0.50	0.50	9/22/87	Los Angeles
Ebaymud (Oakland)	Digester Gas (Cogen)	4.00	6.00	10/20/91	Alameda
Monterey Regional Water Control	Digester Gas (Cogen)	1.74	1.74	8/26/88	Monterey
Orange County Sanitation District Plant 1	Gas-Fueled Reciprocating Engine	4.50	4.50	6/16/93	Orange
Orange County Sanitation District Plant 2	Digester Gas/Other	12.00	12.00	7/27/93	Orange
Roy Sharp Jr.	Digester Gas	0.10		11/22/91	Fresno
Royal Farms lbs1 & lbs2	Digester Gas/Other	0.10	0.10	3/26/87	Tulare

THE ANAEROBIC REACTOR

A dairy farmer can do something about rising waste management cost. The modern dairyman must be concerned as he/she is mandated to dispose of waste (manure) in an environmentally safe and responsible manner. Therefore, well-established technology should be applied to place a cap on rising environmental compliance costs.

Anaerobic digestion is the most cost-efficient technology of converting cow manure into energy. The anaerobic reactor produces biogas (methane) from cow wastewater (manure). This gas is used to generate electricity.

The Anaerobic Reactor provides:

- **Electricity from methane gas;**
- **Carbon Dioxide;**
- **Organic Fertilizer;**
- **Liquid Fertilizer;**
- **Bedding material;**
- **Odor Control;**
- **And Methane.**

Process Enhancement

1. Process Separation:

The anaerobic treatment process methane digestion (fermentation) consists of two distinct biological steps, each of which operates best at significantly different environmental conditions.

First Stage: *Hydrolytic* and *acidogenic* bacteria convert dispersed and dissolved organics into aldehydes, alcohols, acids and carbon dioxide (acetogenesis). This stage is optimized within the pH range of 5.0 to 6.0 at an ORP (Oxidation/Reduction Potential) of +200 to +300mV environment.

Second Stage: Methanogenic bacteria convert the first phase intermediates into mostly methane gas (methanogenesis). Sulfur compounds, if present, are converted into insoluble sulfide salts. This stage is optimized within the pH range of 7.2 to 8.2 at an ORP of -400 to -450mV environment.

In a traditional single stage digester (reactor), both biological steps are carried out within a single vessel where, for obvious reasons, at least one biological process must occur at less than optimal conditions. **In our proprietary and patented technology, by separating these biological processes, the process efficiency of each can be optimized - thus greatly enhancing overall system performance.** Additionally, separation of the process into two phases also separates to a great extent the generation of carbon dioxide and methane **and hence greater intrinsic value of both products.** By comparison, conventional digesters where the generated gases are automatically commingled, the methane gas content generally averages only about 65 percent.

2. Attached versus Suspended Growth Bacteria

Suspended growth bacteria are used in traditional anaerobic treatment. In our proprietary technology, fixed film surfaces (attached growth) bacteria are utilized. Suspended growth bacteria move randomly through the slurry and with the digester flow, while attached growth bacteria prefers to live on fixed surfaces which results in the formation of much larger resident colonies. Attached growth bacteria populations could be as much as **five times** the population of suspended growth bacteria. The higher numbers of bacteria proportionally increase the digestion rate and by attachment to a surface are permanently retained in the digester. Additionally, initial system start-up is accomplished much faster due to the rapid colonization of fully acclimated bacteria.

3. Thermophilic versus Mesophilic Bacteria

Mesophilic bacteria are used in traditional anaerobic treatment. Mesophilic bacteria operates best at 38°C (100°F). We use thermophilic bacteria in our patented anaerobic treatment process. Thermophilic bacteria perform best at about 59°C (138°F) and are capable of metabolizing organics at **four times** the rate of Mesophilic bacteria. The faster reaction rate of thermophilic bacteria reduces the hydraulic retention time for the process and permits a generous reduction in the size and cost of the digestion equipment.

The anaerobic reactor receives wastewater from the equalization tank through a heat exchanger where it is heated to a temperature of about 140°F. The heated wastewater is transferred into the reactor where methane gas and co-products are produced. The methane is fed into an engine/generator where electricity is produced. Hot water from the engine heat recovery system is recirculated to provide and maintain the reactor temperature at about 140°F.

KEY FEATURES

Equalization Tank

Dairy flush water is gravity fed into the equalization tank twice a day. The equalization tank wastewater is continuously pumped from the bottom into the anaerobic reactor. Some of the water from the top of the equalization tank is recycled as flush water. This operation is followed by a pathogen free treated water rinse. A pump continuously travels on the surface of the equalization tank and transfers any floating scum into the anaerobic reactor. Equalization tank is sized to hold one day's wastewater discharge.

Reverse Osmosis Unit

A slip-stream of the anaerobically treated nutrient rich pathogen free water is passed through reverse osmosis membranes to remove nutrients. The permeate is disinfected with ultraviolet light and used as parlor sprinkle water, cow wash water, and livestock drinking water. See Material Flow Schematic. The concentrate from the reverse osmosis unit is sold as a liquid fertilizer concentrate.

Methane Compression and Storage

Methane from the reactor is dried, compressed, and stored in an approved storage tank. Methane from the storage tank is supplied to the electric power generator engine/turbine.

Carbon Dioxide Compression, Liquefaction, and Storage

Carbon dioxide from the reactor is purified, dried, compressed, liquefied, and stored in an approved storage tank. Carbon dioxide from the storage tank is supplied to wholesale typical users: greenhouses, welding supply, food processing, dry ice producers, and many others.

Biosolids

Pathogen free bio-solids are dried and sold as a soil conditioner or amendment. It may also be used as a bovine bedding material.

Liquid Nutrients

Liquid rich pathogen free nutrient concentrate is stored in a concentrate tank and supplied to fertilizer manufacturers or directly to farmers for land application.

Insulation

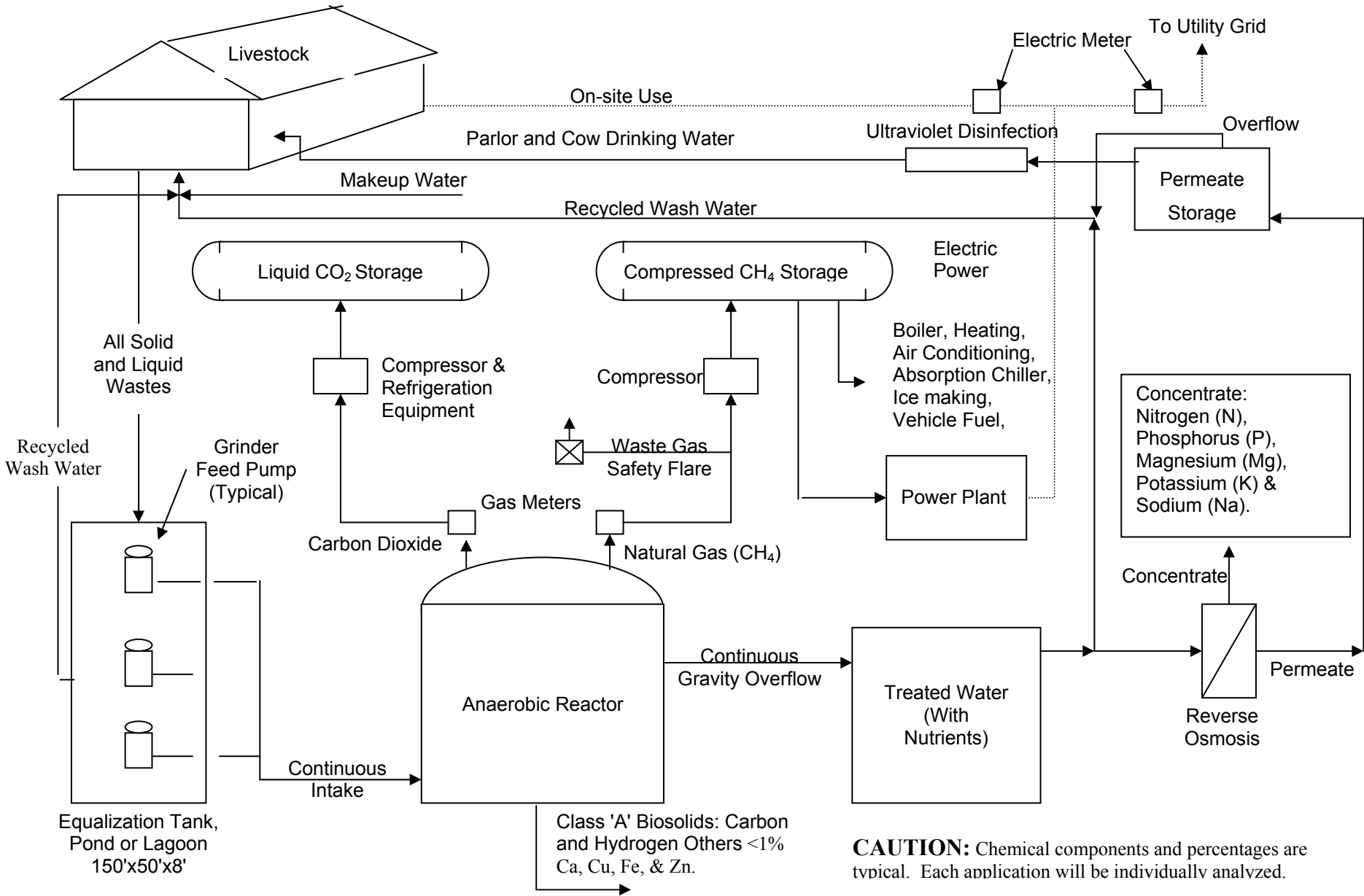
A layer of 2" polyurethane foam spread over the surface of the anaerobic reactor, piping, and heat exchangers to aid in the reduction of heat losses. The average reactor temperature is maintained at about 140 degrees F.

Safety Features

Gas handling devices to prevent hazardous pressure or accidental combustion are a feature essential to the design. Other safety devices include but are not limited to safety flare equipment and pressure regulators for continuous uniform use of the produced gas.

Engine/Generator Capabilities

Engine/Turbine generator sets designed to produce electricity from the biogas have been included. The waste heat from the engine/turbine is used to heat the anaerobic digestion process. The specifications of commercial units are available. See **POWER PLANT** section for details. Interconnect devices, electric switchgears, and safety devices have been designed to interconnect the generator with local public utilities. The electric power will be sold through the California Power Exchange or to the consumers directly. A favorable rate structure will be developed for electricity supplied to the participating waste generator.



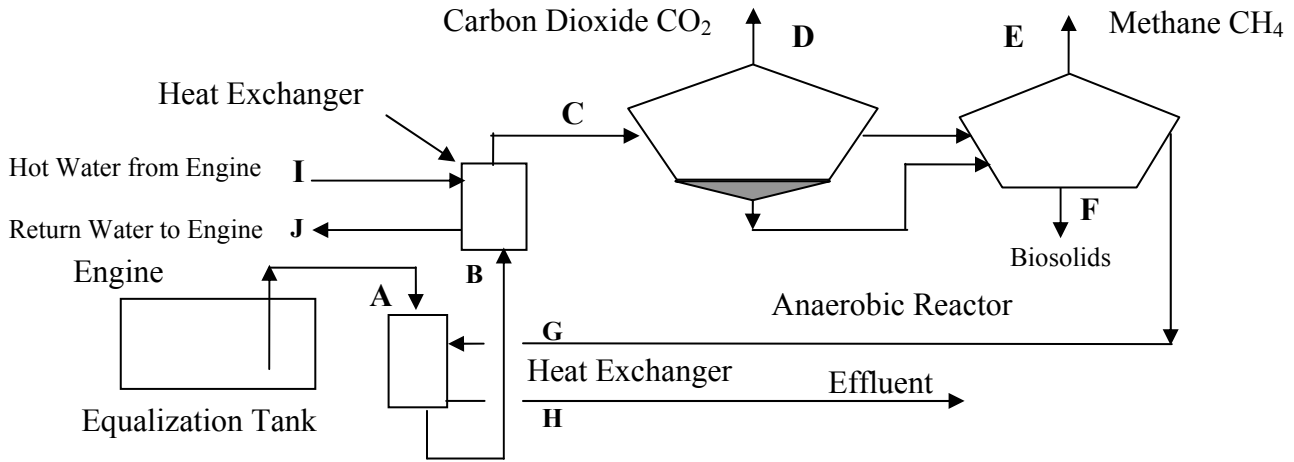
CAUTION: Chemical components and percentages are typical. Each application will be individually analyzed.

Material Flow Schematic

ANAEROBIC REACTOR CAPACITY

Per Head Methane, CO₂, and Biosolids Production Calculations:			
Average Weight, lbs	1,300	2,866	kg/day
Total Waste, lbs/day	9%	9%	
Average Wet Waste, lbs/day	117	257.94	kg/day
Total Solids % of Wet Waste	13.5%	13.5%	
Total Solids, lbs/day	15.80	7.16	kg/day
Volatile Solids, %	75%	75%	
Volatile Solids (VS), lbs/day	11.85	5.37	kg/day
Volatile Solids (VS) Reduction	95.0%	95.0%	
Volatile Solids (VS) Reduction, lb/day	11.25	5.10	kg/day
Methane Yield, ft ³ /lb VS Removed	12	0.340	m ³ /kg
Methane Density, ft ³ /lb at 20° C	24.00	0.680	m ³ /kg
Methane Production, ft ³ /day	135.05	3.82	m ³ /kg
Methane Production, lbs/day	5.63	2.55	kg/day
CO ₂ Production, lbs/day	5.63	2.55	kg/day
Biosolids Production, lbs/day	4.54	2.06	kg/day
Total Methane, CO₂, and Biosolids Production Calculations:			
Total Standing Head	2,000		
Total Methane production, ft ³ /day	270,095	7,649	m ³ /kg
Total Methane production, lbs/day	11,254	5,105	kg/day
Total CO ₂ Production, lbs/day	11,254	5,105	kg/day
Total Solids Reduction, lbs/day	22,508	10,210	kg/day
Total Biosolids Production, lbs/day	9,082	4,120	kg/day
Digester Size Calculations:			
Volatile Solids (VS), lbs/day	23,693	10,747	kg/day
VS/COD	2		
COD, lbs/day	47,385	21,494	kg/day
Organic Loading, lbs/COD/day/ft ³	6	0.37	kg/COD/day/m ³
Digester Size, ft ³	7,898	224	m ³
Digester Size, gallons	59,081	224	m ³
Safety Factor	1.50	2	
Digester Size With Safety Factor, gallons	88,622	335	m ³
Digester Diameter, ft	30	9.14	
Digester Height, ft	20	6.10	
Actual Digester Volume, ft ³	14,130	400	m ³
Actual Digester Volume, gallons	105,707		
Actual Useful Capacity, gallons	100,421	380	
Estimated Cost, \$/gallon	9.00	2,377.80	m ³
Estimated Total Cost, \$	951,359		

ENERGY REQUIRED TO HEAT THE ANAEROBIC REACTOR



A		Metric	E		Metric
Solids, Dry, lbs/hr.	1,316.3	598	Volatile Solids (VS), Estimate	75%	
Solids	1.00%		VS Reduction	95%	
Water	99.00%		VS Reduction, lb/hr.	938	426
Total Wet, lbs/hr.	131,625	59,830	CH ₄ Production,		
Temperature, °F	40	4.44	cu.ft/lb of VS Removed	13.55	
Energy, btu/lb	8	18.57	CH ₄ , cu.ft/lb	24.00	
Total Energy, btu/hr.	1,053,000	1,110,915	CH ₄ Generated, lbs/hr.	530	241
B			Temperature, °F	140	60.00
			Energy, btu/lb	108	250.67
Mass, lbs/hr	131,625	59,830	Total Energy, btu/hr.	57,203	60,349
Temperature, °F	118	47.93			
Energy, btu/lb	86	200.26	F		
Total Energy, btu/hr.	11,356,605	11,981,218	Mass, dry, lb/hr.	378	172
C			Moisture	80%	
			Mass, Total, lb/hr.	1,892	860
Mass, lbs/hr	131,625	59,830	Temperature, °F	140	60.00
Temperature, °F	140	60.00	Energy, btu/lb	108	250.67
Energy, btu/lb	108	250.67	Total Energy, btu/hr.	204,348	215,587
Total Energy, btu/hr.	14,215,500	14,997,353			
D					
Mass, lbs/hr.	408	186	US Units	Metric Units	
Temperature, °F	140	60.00	Pounds, lbs	kilogram, kg	
Energy, btu/lb	108	250.67	btu	kilojoule, kJ	
Total Energy, btu/hr.	44,083	46,507	Fahrenheit, °F	Celsius, °C	

G		Metric	Fuel Input, kWh	2,867	
Mass, lbs/hr.	128,795.06	58,543	Power Plant, kWh	987	34%
Temperature, °F	140	60.00	Jacket Water	1,202	42%
Energy, btu/lb	108	250.67	Exhaust Gas	566	20%
Total Energy, btu/hr.	13,909,867	14,674,909	Atmosphere	112	4%
			Recoverable Energy:		
H			Jacket Water	1,202	100%
Mass, lbs/hr.	128,795	58,543	Exhaust Gas	311	55%
Temperature, °F	60	15.56	Recoverable Energy, kWh	1,513	
Energy, btu/lb	28	64.99	Recoverable Energy, btu/hr.	5,164,176	
Total Energy, btu/hr.	3,606,262	3,804,606	Note: Energy distribution per Caterpillar, Tolerance (+/- 10%)		
I			Conclusion:		
Mass, lbs/hr.	95,297	43,317	Recoverable heat energy available is more than the heat energy required by the reactor. Therefore, no additional energy from other sources is required.		
Temperature, °F	230	110.00			
Energy, btu/lb	198	459.56			
Total Energy, btu/hr.	18,868,707	19,906,486			
			Note:		
			Moisture and heat recovery in CO ₂ and CH ₄ have not been included. However, these items will be recovered and recycled.		
J			Uses of Balance of Recovered Energy		
Mass, lbs/hr.	95,297	43,317	Energy Available to Heat or Cool, kWh		
Temperature, °F	200	93.33			
Energy, btu/lb	168	389.93	This Energy Could Provide:		
Total Energy, btu/hr.	16,009,812	16,890,352			
Energy I-J, btu/hr.	2,858,895	3,016,134	467		
Energy I-J, btu/lb	30	13.64	Hot Water Temp, °F, °C		
Energy Required to Heat the Reactor			Water Gal./day, M ³ /day		
btu/hr.	2,858,895	3,016,134	140	60	
kWh	838		or		
			Cold Water Temp, °F, °C		
			Water Gal./min., M ³ /min.		
System Losses (Estimate)		5%	50	10.00	
System Losses, btu/hr.		710,775	or		
System Losses, kWh		208.26	Air Conditioning, Tons, kW		
Total Energy Required, btu/hr.		3,569,670	84	294	
Total Energy Required, kWh		1,046	or		
			Ice, Tons/day, MT/day		
			49	45	
Energy Balance:			Mass Balance:		
	btu/hr.	kJ/hr.		lbs/hr.	kg/hr.
Energy input at "C"	14,215,500	14,997,353	Mass input at "C"	131,625	59,830
Energy output at "D"	44,083	46,507	Mass output at "D"	408	186
Energy output at "E"	57,203	60,349	Mass output at "E"	530	241
Energy output at "F"	204,348	215,587	Mass output at "F"	1,892	860
Energy output at "G"	13,909,867	14,674,909	Mass output at "G"	128,795	58,543
Total Energy output	14,215,500	14,997,353	Total Mass output	131,625	59,830

BIOGAS AND OTHER PRODUCTS

The biogas produced from our enhanced and patented anaerobic reactor is 95-98% pure methane.

Biogas Production Calculations

SUMMER

WINTER

	U.S. Units	Metric Units	U.S. Units	Metric Units	
Total Head	2,000	2,000	2,000	2,000	
Average Wet Waste, lbs/day/cow	117	53	117	53	kg/day/cow
Total Wet Waste, lbs/day	234,000	106,142	234,000	106,142	kg/day
Average Solids Content	13.50%	13.50%	13.50%	13.50%	
Total Solids Dry, TS, lbs/day	31,590	14,329	31,590	14,329	kg/day
Total Solids Dry, TS, Tons/day	15.80	14.33	15.80	14.33	MT/day
Total Solids Dry, TS, Tons/yr.	5,765	5,230	5,765	5,230	MT/Yr.
Volatile Solids, VS, %	75%	75%	75%	75%	
Volatile Solids, VS, lbs/day	23,693	10,747	23,693	10,747	kg/day
VS Reduction, %	95%	95%	95%	95%	
VS Reduction, lbs/day	22,508	10,210	22,508	10,210	kg/day
CH ₄ Production/VS Reduction ft ³ /lb	12	192	12	192	kg/M ³
CH ₄ Production, ft ³ /day	270,095	7,649	270,095	7,649	M ³ /day
CH ₄ Production, ft ³ /hr.	11,254	319	11,254	319	M ³ /hr.
CH ₄ Heat Value, HHV, Btu/ft ³	950	35,389	950	35,389	kJ/M ³
CH ₄ Heat Value, LHV, Btu/ft ³	855	31,851	855	31,851	kJ/M ³
CH ₄ Production, Btu/hr. (LHV)	9,622,117	10,151,333	9,622,117	10,151,333	kJ/hr.

Carbon Dioxide:

CO ₂ Production, lbs/day	11,254	CO ₂ Price, \$/lb	0.0375
CO ₂ Production, Total, Tons/day	5.63	CO ₂ Revenue \$/day	380.00
Safety Factor	90%	CO ₂ Revenue \$/yr.	138,634.00
Estimated Production, lbs/day	10,129	CO ₂ O & M, \$/lb	0.0075
Estimated Production, Tons/day	5.06	CO ₂ O & M, \$/day	76.00
		CO ₂ O & M, \$/yr.	27,727.00
		CO ₂ Cash Flow, \$/yr.	110,908.00

Organic Fertilizer

SUMMER

WINTER

	U.S. Units	Metric Units	U.S. Units	Metric Units	
Grade "A" Biosolids Dry, Tons/yr.	1,657	1,504	1,657	1,504	MT/yr.
Organic Fertilizer Moisture Content	30%	30%	30%	30%	
Organic Fertilizer, Tons/yr.	2,368	2,148	2,368	2,148	MT/yr.
Organic Fertilizer O & M, \$/Ton	2.00				
Organic Fertilizer Price, \$/Ton	8.00				
Organic Fertilizer, \$/yr.	18,943				
Organic Fertilizer O & M, \$/yr.	4,736				

Liquid Fertilizer:

		% Solution		
N, Pounds/yr./cow, dry	450	18.80%	Wholesale, \$/ton	110.00
P, Pounds/yr./cow, dry	92	3.84%	Revenue \$/yr.	263,267
K, Pounds/yr./cow, dry	127	5.31%	O & M, \$/Ton	10.00
Mg, Pounds/yr./cow, dry	28	1.17%	O & M, \$/yr.	23,933
Na, Pounds/yr./cow, dry	21	0.88%	Unit Conversion Factors:	
Total Dry, lbs/yr./cow	718	30.00%	3.28	Meter/Foot
Total Dry tons/yr.	718		35.31	Cu. Meter/Cubic ft.
Total Liquid tons/yr.	2,393		2.20	lb/kg
Available for Sale, %	100%		1.10	US Ton/Metric Tonne
Available for Sale, tons/yr.	2,393		1.055	kJ/Btu

LAND REQUIRED

A 2,000 cow dairy wastewater disposal facility with the associated power plant and auxiliaries will require an area of about 2 acres.

POWER PLANT

General

The power plant will consist of three methane-fired reciprocating engines connected to electric power generators. The packaged generator sets plus switchgear and other accessories will make a complete power plant. Caterpillar, Waukesha or equal engines will power the packaged generator sets. Heat recovery units will capture engine water and exhaust heat energy. The recovered heat will be used to heat the anaerobic process in the reactor.

Generator Sets

The reciprocating engines will be the spark-ignited type designed to operate on biogas produced in the anaerobic digesters. The total capacity of the power plant will be 5,000 kW continuous at the project site ambient conditions. The engine cooling system will have a back up when heat is not required by the digesters. Following are the Engine operating parameters:

Rating, Mechanical -----	1.5 Megawatt
RPM -----	1,800
Fuel pressure booster -----	Engine Driven
Fuel Filters -----	Dry Type
Cooling -----	Heat Exchanger
Exhaust Silencer -----	Residential Grade Sound Attenuation

Generator

The generator is the synchronous type air-cooled, capable of handling the full continuous power of the reciprocating engines at any ambient temperature throughout the operating range. The generator includes a brushless excitation system with a permanent magnet generator. The generators will be capable of operating in parallel with the utility grid.

Following are the generator's operational parameters:

Rating, Total -----	1.5 Megawatt
Power Factor -----	0.8
Voltage -----	480 Volts
Revolutions -----	1,800 RPM
Cycles -----	60 Hz
Phase -----	3
Number of Poles -----	4
Excitation Type -----	Brushless
Voltage Regulator -----	Automatic
Cooling System -----	Air Cooled

Heat Recovery System

Water Heating System Using Exhaust and Jacket Water Heat:

Jacket Water and Exhaust Gas Heat will be used to produce hot water. In this system, water is pumped through the engine jacket and the exhaust gas heat recovery unit in series where it is heated to the required use temperature.

When the available heat exceeds the system requirements, the excess heat is removed by the heat exchanger or a radiator. Control is maintained by a temperature control valve that regulates the amount of water bypassed in order to maintain a constant return water temperature.

This type of heat recovery unit is manufactured by a number of companies including Riley-Beard and Vapor Phase.

Main Control System

Operator Interface Unit.

Digital Control Station.

Engineering Workstation.

Miscellaneous Equipment

Exhaust Silencers.

Engine Safety Alarms and Shutdowns.

Switchboard

Medium and low voltage switchgear and motor control centers.

Substation Transformers - 2,000 kVA

Two (2) three phase oil immersed or dry type power transformers.

Rated Capacity, Total -----	2,000 kVA
High Voltage -----	13,800 Volt
Tappings -----	$\pm 2,5 \pm 5 \%$
Low Voltage -----	480 Volt
Frequency -----	60 Hertz
Cooling -----	ONAN
Max. temperature rise oil/winding -----	50/55 °C
Impedance Voltage -----	6 %
Standard -----	NEMA for outdoor installation

Accessories and Fittings:

Corrugated tank is hermetically sealed with filling pipe.

- Device for oil draining and sampling.
- Thermometer pocket.
- Grounding connection.
- LV-side porcelain bushings according to NEMA standard.
- HV-side porcelain bushings according to NEMA standard.
- Off-load tap changer to be operated on cover.
- Bi-directional rollers.
- Hauling and fastening lugs.
- Dial type thermometer with 2 contacts.
- Rating plate.

Painting - Rust-inhibiting primer followed by two color coatings of final coating.

Transformer oil according to NEMA standard.

Office, Shop, and Storage Building

The plant will be provided with approximately 1,000 square feet of buildings to be used for power plant, control area, shop area, and warehouse storage area. The buildings will be of the pre-engineered type or site built and will be provided with all of the required utilities.

CASH FLOW ANALYSIS

Turnkey Capital Cost, \$M	2.503	Investor Equity+ Finance, \$M	2.750	Capacity, Megawatt	1.50
Finance, 2 % of Capital Cost, \$M	0.055	Capital Cost, \$M	3.325	Average Load Factor	57.33%
Administration/Legal, \$M	0.055	Developer Contribution, \$M	0.575	Heat Rate, Btu/kWh	11,339
Interest During Construction, \$M	0.138	First year of Operation	2,002	Fuel LHV, Btu/cu. ft.	855
Project Take Out Cost, \$M	(2.750)	Construction No. of Years	1.00	Fuel, cu. Ft./kWh	13.26
Equity, % of Project Cost	30%	Income Tax	35%	Fuel Required, mmbtu/hr	9.75
Investor, \$M	(0.825)	Capital Escalation Rate/yr.	-	Fuel Required, cu. ft.(000)/hr	11.41
Finance Amount, \$M	(1.925)	O & M Escalation/yr.	3%	Energy (Fuel Cost), cents/kWh	-
Total Project Cost, \$M	(2.750)	Property Tax Escalation, yr..	-	Power Plant O & M, cents./kWh	1.15
Interest Rate, %	10%	Fuel Escalation Rate/yr.	0%	1st.Yr. Average Rate, cents/kWh	4.88
Loan Period, yr..	7	Plant Life, yr.	20		
Depreciation, yr..	10				
Depreciation Renewable Energy, yr.	5	Investor IRR, Before Taxes	39%	Wet Biowaste, Tons/yr.	42,705
Debt Coverage Ratio	1.66	Investor IRR, After Taxes	36%	Biowaste Disposal Cost, \$/Ton	1.37
				Biowaste Disposal Cost, \$/yr.	58,400
Federal Tax Credit, \$/barrel*	6.00	Project IRR, Before Taxes	15%	Organic Fertilizer O & M, \$/yr.	4,736
Crude Oil, mmbtu/barrel*	5.80	Project IRR, After Taxes	12%	Carbon Dioxide O & M, \$/yr.	27,727
* IRS code Rule 29				Liquid Fertilizer O & M, \$/yr.	23,933
		Investor NPV @20%, M\$	0.94		
Biogas Production, mmbtu/hr	10.69	Federal Tax Credit, \$/yr. M	0.097		
Biogas equivalent to barrel/hr	1.84	IRS section 29			
Biogas equivalent to barrel/yr.	16,147	Fed.Tax Credit, cents/kWh	1.75		
		Senate Bill S.249 (Not included in analyses)			

CASH FLOW PROJECTIONS

Year	1	2	3	4	5	6	7	8	9	10
Revenue:										
Power Rate, \$/kWh	0.049	0.049	0.050	0.050	0.050	0.051	0.051	0.051	0.052	0.052
Power, \$ M (millions)	0.367	0.370	0.373	0.375	0.378	0.381	0.384	0.387	0.390	0.394
Waste Disposal, \$/Ton	1.368	1.399	1.432	1.466	1.501	1.536	1.573	1.611	1.650	1.691
Waste Disposal, \$ M	0.058	0.060	0.061	0.063	0.064	0.066	0.067	0.069	0.070	0.072
Soil Conditioner, \$ M	0.019	0.019	0.019	0.019	0.020	0.020	0.020	0.020	0.020	0.020
Carbon Dioxide, \$ M	0.139	0.139	0.140	0.141	0.142	0.143	0.144	0.145	0.146	0.147
Liquid Fertilizer, \$ M	0.263	0.271	0.279	0.288	0.296	0.305	0.314	0.324	0.333	0.344
Total Revenue, \$ M	0.847	0.859	0.873	0.886	0.900	0.915	0.929	0.945	0.961	0.977
Expenses:										
Power Plant O & M, \$ M	0.087	0.089	0.092	0.095	0.098	0.100	0.103	0.107	0.110	0.113
Digester O & M, \$ M	0.045	0.047	0.048	0.049	0.051	0.052	0.054	0.056	0.057	0.059
Soil Conditioner O & M, \$ M	0.005	0.005	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006
Carbon Dioxide O & M, \$ M	0.028	0.029	0.029	0.030	0.031	0.032	0.033	0.034	0.035	0.036
Liquid Fertilizer O & M, \$ M	0.024	0.025	0.025	0.026	0.027	0.028	0.029	0.029	0.030	0.031
Total O & M Expenses, \$ M	0.188	0.194	0.200	0.206	0.212	0.218	0.225	0.232	0.239	0.246
Debt Service, \$ M	0.395	0.395	0.395	0.395	0.395	0.395	0.395	-	-	-
Cash Flow from Operations, \$ M	0.263	0.270	0.277	0.285	0.293	0.301	0.309	0.713	0.722	0.731
Depreciation, 5/10 Yr. Straight Line, \$ M	0.499	0.499	0.499	0.499	0.499	0.166	0.166	0.166	0.166	0.166
Interest on Debt, \$ M	0.193	0.172	0.150	0.125	0.098	0.069	0.036	-	-	-
Taxable Income, \$ M	(0.033)	(0.006)	0.024	0.056	0.091	0.461	0.502	0.547	0.556	0.565
Taxes Paid, \$ M	-	-	0.008	0.020	0.032	0.162	0.176	0.191	0.195	0.198
Income After Taxes, \$ M	(0.033)	(0.006)	0.016	0.037	0.059	0.300	0.327	0.356	0.361	0.367
Cash Before Principal, \$ M	0.466	0.493	0.514	0.535	0.558	0.466	0.493	0.522	0.528	0.533
Principal on Debt, \$ M	0.203	0.223	0.246	0.270	0.297	0.327	0.359	-	-	-
Federal Tax Credit, \$ M	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097
Net Cash Flow, \$ M	0.360	0.367	0.366	0.362	0.358	0.236	0.230	0.619	0.624	0.630

CASH FLOW PROJECTIONS

Year	11	12	13	14	15	16	17	18	19	20
Revenue:										
Power Rate, \$/kWh	0.0527	0.0532	0.0536	0.0541	0.0546	0.0552	0.0557	0.0563	0.0568	0.0574
Power Rev., \$ M (millions)	0.397	0.401	0.404	0.408	0.412	0.416	0.420	0.424	0.428	0.433
Waste Disposal Fee, \$/Ton	1.732	1.775	1.819	1.864	1.911	1.959	2.009	2.060	2.112	2.166
Waste Disposal Revenue, \$ M	0.074	0.076	0.078	0.080	0.082	0.084	0.086	0.088	0.090	0.093
Soil Conditioner, \$ M	0.021	0.021	0.021	0.021	0.021	0.022	0.022	0.022	0.022	0.023
Carbon Dioxide, \$ M	0.148	0.149	0.150	0.152	0.153	0.154	0.155	0.157	0.158	0.160
Liquid Fertilizer, \$ M	0.354	0.364	0.375	0.387	0.398	0.410	0.422	0.435	0.448	0.462
Total Revenue, \$ M	0.994	1.011	1.029	1.047	1.066	1.085	1.105	1.126	1.147	1.169
Power Plant Opera. & Maintenance, \$ M	0.116	0.120	0.124	0.127	0.131	0.135	0.139	0.143	0.147	0.152
Digester Operation & Maintenance, \$ M	0.061	0.063	0.065	0.066	0.068	0.071	0.073	0.075	0.077	0.079
Soil Conditioner O & M, \$ M	0.006	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.008	0.008
Carbon Dioxide O & M, \$ M	0.037	0.038	0.040	0.041	0.042	0.043	0.044	0.046	0.047	0.049
Liquid Fertilizer O & M, \$ M	0.032	0.033	0.034	0.035	0.036	0.037	0.038	0.040	0.041	0.042
Total O & M, M	0.253	0.261	0.268	0.277	0.285	0.293	0.302	0.311	0.321	0.330
Debt Service, \$ M	-	-	-	-	-	-	-	-	-	-
Cash Flow from Operations, \$ M	0.741	0.750	0.760	0.770	0.781	0.792	0.803	0.814	0.826	0.839
Depreciation, 10 Yr. Straight Line, \$ M	-	-	-	-	-	-	-	-	-	-
Interest on Debt, \$ M	-	-	-	-	-	-	-	-	-	-
Taxable Income, \$ M	0.741	0.750	0.760	0.770	0.781	0.792	0.803	0.814	0.826	0.839
Taxes Paid, \$ M	0.259	0.263	0.266	0.270	0.273	0.277	0.281	0.285	0.289	0.293
Income after Taxes, \$ M	0.481	0.488	0.494	0.501	0.508	0.515	0.522	0.529	0.537	0.545
Cash Before Principal, \$ M	0.481	0.488	0.494	0.501	0.508	0.515	0.522	0.529	0.537	0.545
Principal on Debt, \$ M	-	-	-	-	-	-	-	-	-	-
Federal Tax Credit, \$ M	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097
Net Cash Flow, \$ M	0.578	0.584	0.591	0.598	0.604	0.612	0.619	0.626	0.634	0.642

Investment Analysis:

Investment Analysis Criteria: Rate of Return Over 18%

Year	1	2	3	4	5	6	7	8	9	10
Cash Flow, Before Taxes										
Investor Includes Fed. Tax Credit, 70%, \$ M	0.2808	0.2859	0.2910	0.2964	0.3019	0.3075	0.3134	0.5961	0.6023	0.6087
Developer, 30%, \$ M	0.0788	0.0810	0.0832	0.0855	0.0879	0.0903	0.0928	0.2140	0.2166	0.2193
Project Cash Flow, \$ M	0.3597	0.3669	0.3743	0.3819	0.3897	0.3978	0.4061	0.8101	0.8189	0.8280
Payback, Investor Balance, \$ M	(0.54)	(0.26)	0.03	0.33	0.63	0.94	1.25	1.85	2.45	3.06
Investor Return, Investment	34.04%	34.65%	35.28%	35.92%	36.59%	37.28%	37.98%	72.26%	73.01%	73.78%
Investor Return on Balance, \$	34.04%	52.54%	0.00%	0.00%						

	11	12	13	14	15	16	17	18	19	20
Cash Flow, Before Taxes										
Investor Includes Fed. Tax Credit, 70%, \$ M	0.6152	0.6220	0.6290	0.6361	0.6435	0.6511	0.6589	0.6670	0.6753	0.6839
Developer, 30%, \$ M	0.2222	0.2251	0.2280	0.2311	0.2343	0.2375	0.2409	0.2443	0.2479	0.2516
Project Cash Flow, \$ M	0.8374	0.8471	0.8570	0.8672	0.8778	0.8886	0.8998	0.9113	0.9232	0.9354
Payback, Investor Balance, \$ M	3.67	4.30	4.93	5.56	6.20	6.86	7.51	8.18	8.86	9.54
Investor Return, Investment	74.58%	75.39%	76.24%	77.11%	78.00%	78.92%	79.87%	80.85%	81.86%	82.89%

Investor IRR Before Taxes: **38.97%** Project IRR Before Taxes: **15.14%**

Cash Flow, After Taxes										
Investor Includes Fed. Tax Credit, 70%, \$ M	0.2808	0.2859	0.2851	0.2826	0.2795	0.1945	0.1903	0.4621	0.4662	0.4703
Developer, 30%	0.0788	0.0810	0.0807	0.0796	0.0783	0.0418	0.0400	0.1565	0.1583	0.1600
Project Cash Flow, \$ M	0.3597	0.3669	0.3658	0.3622	0.3578	0.2363	0.2303	0.6187	0.6244	0.6303
Payback, Investor Balance, \$ M	(0.54)	(0.26)	0.03	0.31	0.59	0.78	0.97	1.44	1.90	2.37
Investor Return, Investment	34.04%	34.65%	34.56%	34.25%	33.88%	23.57%	23.06%	56.02%	56.50%	57.00%
Investor Return on Balance, \$	34.04%	52.54%	0.00%	0.00%						

Cash Flow, After Taxes										
Investor Includes Fed. Tax Credit, 70%, \$ M	0.4338	0.4382	0.4427	0.4474	0.4522	0.4571	0.4622	0.4675	0.4729	0.4784
Developer, 30%, \$ M	0.1444	0.1463	0.1482	0.1502	0.1523	0.1544	0.1566	0.1588	0.1611	0.1635
Project Cash Flow, \$ M	0.5782	0.5845	0.5910	0.5976	0.6045	0.6115	0.6188	0.6263	0.6340	0.6419
Payback, Investor Balance, \$ M	2.81	3.24	3.69	4.13	4.59	5.04	5.51	5.97	6.45	6.92
Investor Return, Investment	52.58%	53.12%	53.66%	54.23%	54.81%	55.41%	56.03%	56.66%	57.32%	57.99%

Investor IRR After Taxes: **33.91%** Project IRR After Taxes: **11.92%**

Dairy Waste Remediation & Power Production Facility, Lodi, California

Sell and Lease Back Scenario:

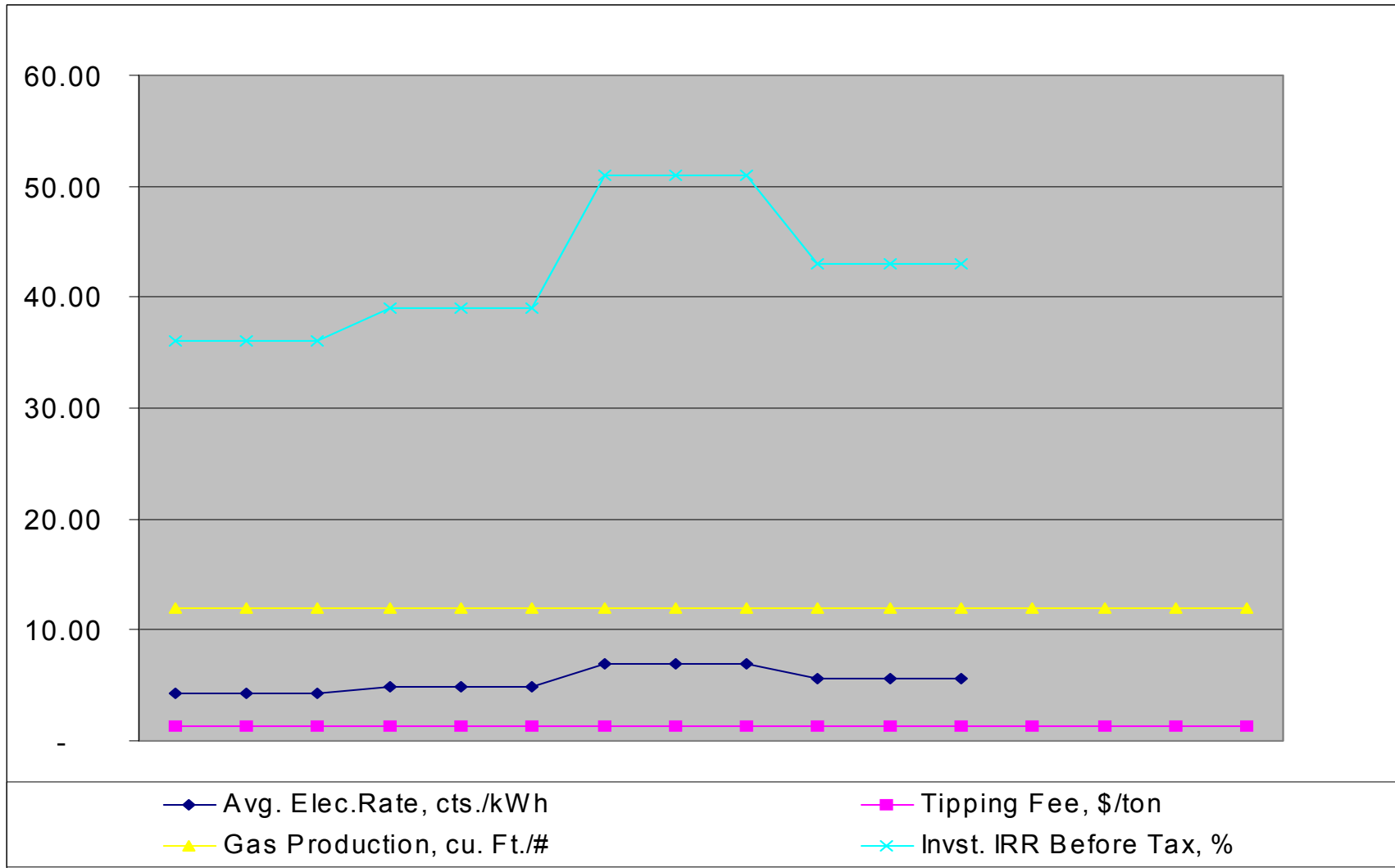
Investor Share of Cash Flow	-	Sell & Lease Back, \$ M	825,000
Developer Share of Cash Flow	100%	Fair market value at the end of 10 Yrs.	25%
Lease Term, yrs.	10	Fair Market value at the end of 10 Yrs., \$	687,500
Lease Interest Rate	10.0%		

Year	1	2	3	4	5	6	7	8	9	10
Lease Payment, \$ M/yr.	(91,127)	(91,127)	(91,127)	(91,127)	(91,127)	(91,127)	(91,127)	(91,127)	(91,127)	(91,127)
Net Cash Flow Before Taxes, \$ M	171,674	178,854	186,250	193,867	201,713	209,794	218,117	622,096	630,927	640,022
Investor, \$ M	-	-	-	-	-	-	-	-	-	-
Developer, \$ M	171,674	178,854	186,250	193,867	201,713	209,794	218,117	622,096	630,927	640,022
Balance, \$	825,000	816,373	806,882	796,443	784,960	772,328	758,434	743,150	726,337	707,843
Principal Received, \$	8,627	9,490	10,439	11,483	12,632	13,895	15,284	16,813	18,494	20,343
Interest Income, \$	82,500	81,637	71,629	65,366	58,476	50,897	42,560	33,390	23,302	12,206
Project Income, \$	-	-	-	-	-	-	-	-	-	-
Depreciation 5/10 year, \$	498,750	498,750	498,750	498,750	498,750	166,250	166,250	166,250	166,250	166,250
Taxable Net income, \$	(416,250)	(417,113)	(427,121)	(433,384)	(440,274)	(115,353)	(123,690)	(132,860)	(142,948)	(154,044)
Investor Income Tax Rate	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Income Tax, \$	(166,500)	(166,845)	(170,848)	(173,354)	(176,110)	(46,141)	(49,476)	(53,144)	(57,179)	(61,618)
Income After Taxes, \$	249,000	248,482	242,478	238,719	234,586	97,038	92,036	86,534	80,481	73,824
Federal Tax Credit, \$	96,885	96,885	96,885	96,885	96,885	96,885	96,885	96,885	96,885	96,885
Total Income After Taxes, \$	345,885	345,367	339,362	335,604	331,470	193,923	188,921	183,419	177,366	170,708
Income After Taxes Cumulative, \$	345,885	691,252	1,030,614	1,366,218	1,697,689	1,891,612	2,080,533	2,263,951	2,441,317	2,612,026
Rate of Return After Tax, \$	41.93%	42.31%	42.06%	42.14%	42.23%	25.11%	24.91%	24.68%	24.42%	24.12%
Equivalent Before Tax Rate of Return	69.88%	70.51%	70.10%	70.23%	70.38%	41.85%	41.52%	41.14%	40.70%	40.19%
Equivalent Before Tax Income, \$	576,475	575,612	565,604	559,340	552,450	323,205	314,868	305,698	295,610	284,514
Equivalent Before Tax Cumu. Income, \$	576,475	1,152,086	1,717,690	2,277,031	2,829,481	3,152,686	3,467,554	3,773,252	4,068,862	4,353,376

Depreciation: Fifty percent of the capital has been allocated to renewable energy. Renewable energy equipment has five year depreciation period balance ten year.

Miscellaneous IRR and NPV Scenarios	IRR	NPV @	NPV @	NPV @	Plant Value	% of Cap.	Total	Investor	Developer
		20%	15%	10%	End of		\$ M	\$ M	\$ M
		\$ M	\$ M	\$ M	Year	Cost		70%	30%
Investor, IRR and NPV, 20 yrs.	38.97%	0.95	1.68	3.04	20	10%	0.28	0.19	0.03
Investor, IRR and NPV, 15 yrs.	38.67%	0.83	1.43	2.44	15	25%	0.69	0.48	0.08
Investor, IRR and NPV, 10 yrs.	37.55%	0.61	1.02	1.64	10	50%	1.38	0.96	0.15
Investor, IRR and NPV, 5 yrs.	35.28%	0.32	0.52	0.79	5	60%	1.65	1.16	0.18
Investor, IRR and NPV, 2 yrs.	15.96%	0.30	0.43	0.59	2	70%	1.93	1.35	0.21

Sensitivity Analysis



POWER RATE ANALYSIS

Northern California PX (Power Exchange) Day-Ahead Market

		Average	Maximum	Minimum	Avg. Peak 6AM-10PM	Avg. Peak 10AM-7PM	Summer Revenue	Winter Revenue
Year	Month	\$/MWh	\$/MWh	\$/MWh	\$/MWh	\$/MWh	Avg. \$	Avg. \$
2000	August	141.67	494.25	42.32	168.98	197.26	71,555	
	July	86.08	499.67	17.92	102.02	121.11	43,478	
	June	125.73	1,099.99	25.04	165.33	228.27	61,456	
	May	47.20	469.84	8.58	59.50	67.18	23,840	
	April	26.45	48.93	-	29.74	31.54		14,599
	March	28.25	48.11	6.00	30.66	N/A		16,112
	February	29.97	40.01	19.96	31.94	N/A		15,990
	January	31.38	80.00	19.69	34.36	N/A		17,897
	December	29.75	55.51	14.00	32.06	N/A		16,968
1999	November	37.90	120.88	11.11	44.16	N/A		20,919
	October	55.76	725.00	27.69	65.74	N/A	28,163	
	September	33.91	199.24	N/A	37.00	N/A	16,575	
Summer, May-Oct.		81.73			99.76		Total	245,067
Winter, November-April		30.62			33.82		\$/kWh	0.08175
2,000 Cow Project			Week-day	Week-end		Revenue	R-Bonus	-
Summer			Rate, \$/MWh	Rate, \$/MWh	hr./week	\$/week	Total	0.0817
Average kWh			679	63.75	48	2077.22	Total kWh/day	16,293
Hours/day			24				Total kWh, 10P-6A	2,716
kWh, 10PM-6AM			339	63.75	40	865.51	Total kWh, 6A-10P	13,578
kWh, 6AM-10PM			849	99.76	80	6772.59	Avg. Rate, \$/MWh	85.18
Summer Revenue, Average \$/wk.						9715.31		
Winter								
Average kWh			767	26.94	48	991.39	Total kWh/day	18,398
Hours/day			24				Total kWh, 10:6	3,066
kWh, 10PM-6AM			383	26.94	40	413.08	Total kWh, 6:10	15,332
kWh, 6AM-10PM			958	33.82	80	2592.60		
Winter Revenue, Average \$/wk.						3997.06	Avg. Rate, \$/MWh	31.04
Summer:				Winter:				
Average Rate Cents/kWh				8.52	Average Rate Cents/kWh			3.10
Bonus for Renewable Fuel, Cents/kWh				0.00	Bonus for Renewable Fuel, Cents/kWh			0.00
Average for Renewable Fuel, Cents/kWh				8.52	Average for Renewable Fuel, Cents/kWh			3.10
To be on the conservative side and compensate for the uncertainties of the market, we have used a summer average rate of 6.25 cents/kWh and a winter rate of 2.50 cents/kWh in our projections.								
Data Source: California Power Exchange operated by California Independent System Operator (ISO).								

DAIRY MARKET ANALYSIS

United States Dairy Market

Dairy Cows (1999)	9,156,000	9,156,000	9,156,000
Market Capture	10%	20%	25%
No.of Cows/Dairy, Average*	500	500	500
Turn Key/Project, \$	700,000	700,000	700,000
Total Number of Projects	18,312	18,312	18,312
Total Gross Sale, \$	1,281,840,000	2,563,680,000	3,204,600,000

* Calculated Value

California Dairy Market

Dairy Cows (1999)	1,469,577	1,469,577	1,469,577
Total Dairies (1999)	2,214	2,214	2,214
Market Capture	10%	20%	25%
No.of Cows/Dairy, Average	664	664	664
Turn Key/Project, \$	700,000	700,000	700,000
Total Number of Projects	221	443	554
Total Gross Sale, \$	154,700,000	310,100,000	387,800,000

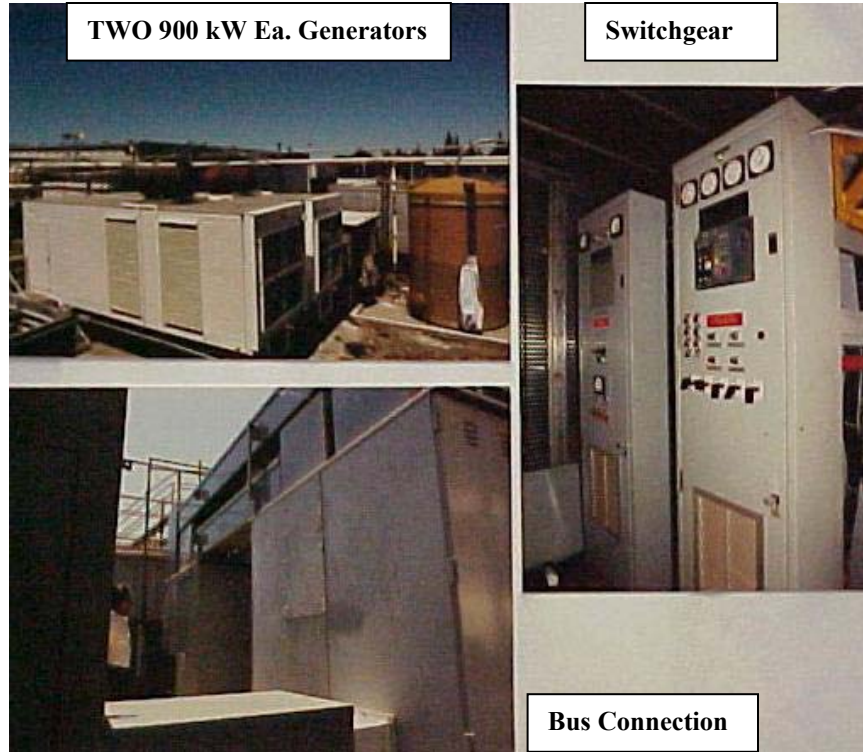
San Joaquin & Stanislaus Counties Dairy Market

Dairy Cows (1999)	231,265	231,265	231,265
Total Dairies (1999)	465	465	465
Market Capture	10%	20%	25%
No.of Cows/Dairy, Average	514	514	514
Turn Key/Project, \$	700,000	700,000	700,000
Total Number of Projects	47	93	116
Total Gross Sale, \$	32,550,000	65,100,000	81,375,000

Other Potential Markets:

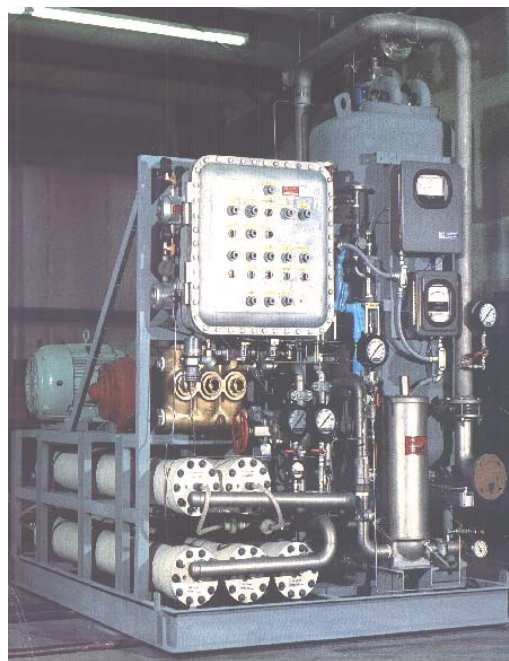
- | | |
|------------------------------|----------------------|
| 1 Municipal Wastewater | 8 Grain Processing |
| 2 Hog Farms | 9 Landfill Leachate |
| 3 Meat, Fish and Poultry | 10 Organic Chemicals |
| 4 Breweries and Distilleries | 11 Pharmaceuticals |
| 5 Chemical Plants | 12 Pulp and Paper |
| 6 Food Processing | 13 Potato Processing |
| 7 Fruit/Vegetable Canning | 14 Sugar Factories |

Data Source: California Department of Food & Agriculture and USDA



BioWastEnergy

Qualifications, Capabilities, and Experience



WaterSmart Environmental

Equipment Fabrication

WaterSmart Environmental provides complete equipment design and manufacturing services as well as system process engineering. The company's experience includes the fabrication, assembly, and factory testing of several skid mounted treatment systems for EPA Superfund Sites and industrial facilities. The manufacturing requirements for this dairy treatment application are quite similar to several past-completed projects.

Marketplace Experience

WSE has designed, pre-piped, pre-wired, and factory tested skid mounted water treatment plants for over 15 years, most of which were subsequently installed at US Government facilities. Some 50 custom design skids have been built over this time span with the eight largest 8' x 8' x 40' long. The skid experience includes the design and building of a specialized 50 GPM reverse osmosis system for a nuclear power plant to separate dissolved silica from boric acid. In excess of 2,000,000 gallons of radioactive water were processed.

Plant start-up and operator training are routine services provided to support equipment sales. WSE maintains an inventory of spare parts to rapidly respond to field maintenance requirements as and when they occur. The company has and maintains 9-page Welding Manual Procedure (WSE Publication 0190) and a 21-page Quality Assurance Plan (WSE Publication 0791). In addition, WSE publishes over fifty Engineering Data Sheets covering a wide variety of water and wastewater treatment applications and processes.

Regulatory Agencies

Environmental compliance represents a substantial and growing burden on many businesses. If compliance issues are not addressed, severe consequences are sure to follow—eventually. In today's society, everyone must absolutely manage the wastes they produce in an environmentally acceptable manner or suffer regulatory agency fallout. If one does not make their wastes innocuous to others, liability will likely be imposed in due course. With this backdrop, the company sees great potential for managing the waste of others in a manner that generates an economic profit to the operator.

Mission

The company's steadfast mission is to design reliable, cost-effective, and simple to operate water and wastewater treatment equipment: then to build that equipment to perform as represented and as required for each and every project. WSE is unequivocally dedicated to provide the very best treatment technology available with maximum benefit to its customers as well as the environment. Generating profits from wastes represents a great worldwide business opportunity to those capable of achieving successful results on a consistent basis.

