
Final Report

**Feasibility Study of Digester
Grease/Food Waste Injection
System
Wastewater Treatment Plant
Process Improvements Pre-Design**

Contract No. 3009

Prepared for



City of Gresham, Oregon

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Acronyms and Abbreviations

BETC	Business Energy Tax Credit
BOD	biochemical oxygen demand
Btu	British thermal unit
COD	chemical oxygen demand
cp	centipoise
ELA	engineering, legal, and administrative
FOG	fat, oil, and grease
hp	horsepower
HRT	hydraulic retention time
kW	kilowatt
kWh	kilowatt-hour
lb	pound
mgd	million gallons per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NREL	National Renewable Energy Laboratory
SCF	standard cubic feet
SWD	side water depth
TSS	total suspended solids
VS	volatile solids
VSS	Volatile suspended solids
VS/TS	volatile solids per total solids
WWTP	Wastewater Treatment Plant

Executive Summary

Purpose

The feasibility of developing an electrical cogeneration system at the Gresham Wastewater Treatment Plant (WWTP) using fat, oil, and grease (FOG) and food waste from restaurants and food processors in the Portland metropolitan area was evaluated to determine if the project would be economically viable.

FOG discharges can be categorized as brown or yellow FOG. This study addresses the codigestion of brown FOG with primary sludge and thickened waste activated sludge in existing anaerobic digesters at the Gresham WWTP. Brown FOG is collected in grease traps after food waste enters the wastewater stream. Brown FOG typically contains 90 to 97 percent water. Yellow FOG is waste material collected before it enters the wastewater stream and is a high value waste because it can be readily recycled into biodiesel. Yellow FOG is generally not available for codigestion with WWTP biosolids.

The City of Gresham completed this evaluation in partnership with the Oregon Business Development Department, who provided a grant for this study.

Findings

A new cogeneration system fueled by digester gas produced from the codigestion of FOG and food waste would be economically viable based on a combination of avoided power costs, tipping fees, Business Energy Tax Credit (BETC), and Energy Trust incentive payments, if at least 7,000 to 11,000 gallons of FOG were codigested each day at the Gresham WWTP, BETC tax credits were available from a pass-through partner, and a tipping fee of at least \$0.03 per gallon was collected. The project is estimated to have a simple payback period of 7 years or less.

A FOG receiving station with a 395 kW cogeneration facility receiving and processing a total volume of 17,000 gallons of FOG and food/dairy waste per day is estimated to cost \$3.7 million to construct and \$60,000 to operate annually (2009 dollars), with maintenance expenditures of \$200,000 at years 10, 20, and 30. The \$ 3.7 million includes the FOG receiving station, additional cogeneration capacity (assumed use of internal combustion engines) inside a new building, and electrical improvements that would enable use of the additional generated electricity in the upper plant.

The existing digesters have sufficient hydraulic and volatile solids capacity to accept 17,000 gallons of additional waste per day. The existing digesters are currently loaded at approximately 50 percent of their capacity (without redundancy – both digester tanks in operation). The FOG additions would increase solids loading by 40 percent, resulting in the load increasing to 70 percent of total digester capacity. Effective mixing will be essential to assure dispersal of FOG throughout the digester. The digester mixing system improvements

being undertaken by the City under a separate project are essential for the successful codigestion of FOG in the existing digesters.

Codigestion of 17,000 gallons of FOG and food waste daily is estimated to produce between 77,400 standard cubic feet (SCF)/day and 140,000 SCF/day of additional digester gas, depending on volatile solids content. The lower estimate is based on a volatile solids concentration of 2.7 percent and the higher estimate is based on a volatile solids content of 6.7 percent. Combined with the estimated 29,100 SCF/day excess digester gas currently being flared, total estimated digester gas production available to power a new cogeneration unit is between 106,500 SCF/day and 169,100 SCF/day. The fuel value of the digester gas measured by Gresham is 575 Btu/SCF. At the lower volatile solids content, methane produced by codigestion of FOG would probably fuel a 250 kW cogeneration unit. At the higher concentration, the codigestion of FOG would probably fuel a 395 kW cogeneration unit.

Codigestion of FOG and high fat food waste may have little impact on biosolids production at the Gresham WWTP. Some research shows that codigesting high fat wastes with primary and secondary sludge results in more efficient digestion and slight reductions in biosolids production.

The impact on greenhouse gas emissions from the WWTP resulting from receiving and digesting FOG is anticipated to be negligible assuming that the majority of the methane produced is contained and utilized to produce electricity and/or heat. Net overall greenhouse gas emissions (including outside of the WWTP fence line) are expected to decrease because the emissions that would have resulted from the FOG and food waste processing and disposal (typically to a landfill) would not occur.

Market Survey

A market survey was conducted to determine the volume of FOG available to Gresham for codigestion. The market survey included interviews with six FOG haulers and analysis of ten samples collected by Gresham staff for this study. The two largest of the six haulers declined to provide estimates of the quantities of FOG those haulers process to prevent the release of competitive data. The remaining four haulers estimate that they collect 330,000 gallons of FOG monthly, which is approximately 11,000 gallons per day. In addition for FOG, substantial quantities of high fat content liquid wastes are produced by dairies and similar food processing facilities in the Portland Metropolitan area. These food wastes could supplement the FOG that is available. Most FOG and dairy waste is dewatered and then landfilled. The haulers reported paying tipping fees of \$0.06 to \$0.15 per gallon. It is assumed that 6,000 gallons per day of food waste would supplement the 11,000 gallons of FOG for a total of 17,000 gallons per day.

Sampling conducted by Gresham for this study showed that the availability and strength of FOG are highly variable. For example, the average volatile solids concentration of the ten samples collected for this study was strongly affected by one sample, which raised the average from 2.7 to 6.7 percent. CH2M HILL measured similar FOG strengths in studies conducted for the Hampton Roads Sanitation District in Virginia and Johnson County Wastewater in Kansas. In those studies, the total solids content of FOG averaged 4 to 5

percent and the solids were almost all volatile solids. In both studies, the volume of FOG available each day and solids content of the FOG varied substantially from day-to-day.

Gresham has been contacted by a FOG hauler interested in constructing a FOG receiving station at no cost to the City of Gresham in exchange for exclusive use of the facility. The hauler indicated that its market study indicated that quantities similar to those estimated for this study would be available to Gresham for codigestion.

The quantity of FOG and similar food wastes available for codigestion is likely to increase as regulations prohibiting the discharge of FOG are more stringently enforced. Nationally, most successful FOG codigestion programs are coupled with strong enforcement of regulations prohibiting the discharge of FOG to sanitary sewers.

Financial Analysis

Financial analyses of 26 cogeneration alternatives were completed to determine the sensitivity of the project to FOG availability and strength, avoided power costs, Oregon Business Energy Tax Credits, tipping fees, and Energy Trust Biomass-to-Energy incentive payments. In addition, the impact of having a private entity construct and contribute a FOG receiving station was evaluated. From this evaluation it was determined it is likely to be economically feasible to produce up to 395 kW of additional electrical power and hot water containing 60 million British thermal units (MMBtu)/day of additional heat at the Gresham WWTP by codigesting FOG and food waste in the existing anaerobic digesters. The largest positive impacts on financial viability were produced by tipping fees and ability to use tax credits.

The effect of FOG availability on financial viability of the project was evaluated by calculating the net present value for two FOG concentrations bracketing the range of solids concentrations measured in the samples collected by Gresham; FOG volumes of 6,000 gallons per day (gpd), 11,000 gpd, and 17,000 gpd; pass-through BETC; sale of renewable energy certificates; and a tipping fee of \$0.03 per gallon. Figure ES-1 shows the results of that evaluation. For this combination of revenue sources, the threshold volume of FOG making the project economically viable was 7,000 to 11,000 gallons per day.

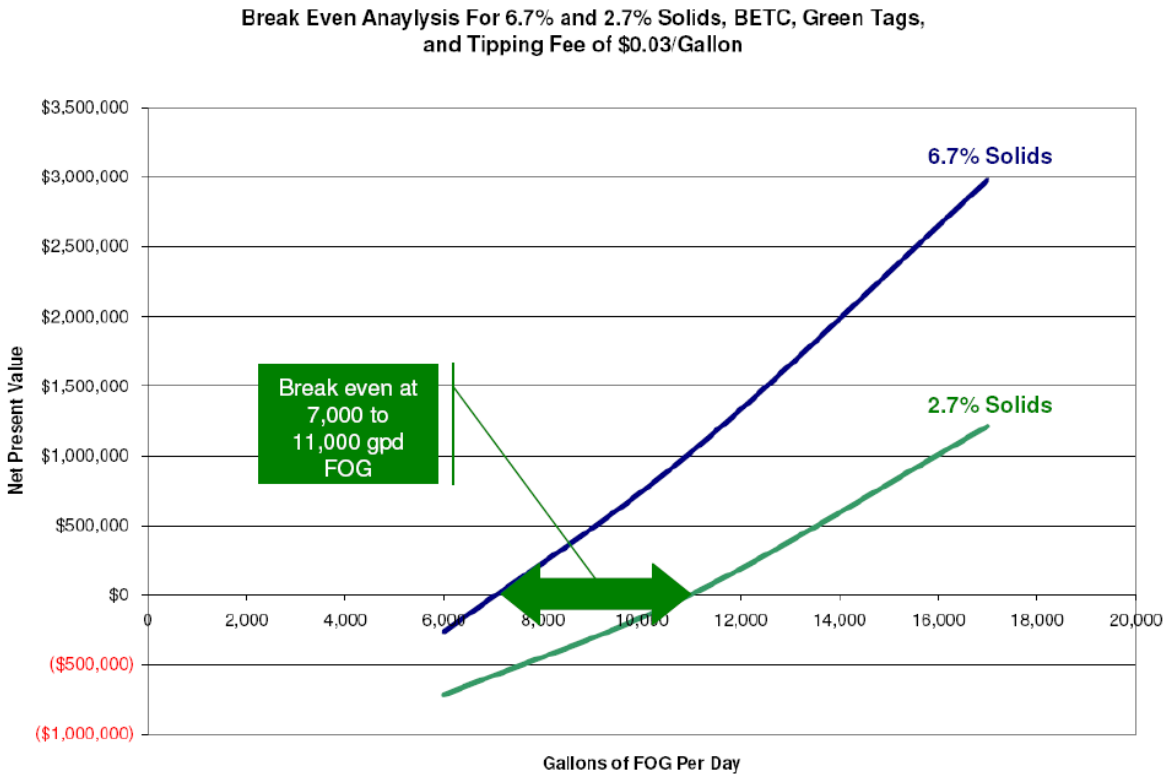


FIGURE ES-1
Impact of FOG Availability on Financial Viability

The FOG receiving station and cogeneration unit could be financed from a combination of sources including avoided power costs, tipping fees paid by FOG haulers, Oregon BETC, sale of renewable energy certificates, and Energy Trust biomass-to-energy incentive payments covering above-market costs. The avoided electrical power cost is estimated to be approximately \$190,000 per year in 2009 dollars. A 250 kWh cogeneration unit would generate slightly less power, producing an avoided power cost of \$130,000 per year.

FOG haulers in the Portland Metropolitan area currently pay tipping fees of \$0.06 to \$0.15 per gallon for the disposal of FOG. FOG haulers have indicated that the choice of disposal sites is driven by price and logistics. The financial analyses indicate that a tipping fee of \$0.03 per gallon or more, coupled with tax credits and sale of renewable energy certificates, would make the project financially viable.

The Oregon BETC allows organizations who pay taxes to take a tax credit of up to 50 percent of allowable costs for biomass-to-energy project. A municipality can pass the tax credit through to a business partner in exchange for a lump sum payment. The lump sum payment is 42.5 percent of eligible project costs as of January 1, 2010. The financial analyses conducted for this study show that the BETC pass-through is an important part of financing the new cogeneration unit.

The new cogeneration unit produces renewable energy. The above-market cost of renewable energy is traded using renewable energy certificates. The market for renewable energy

certificates is currently quite volatile and varies with the sources of renewable energy. Kip Pheil of the Oregon Department of Energy estimates that biomass-to-energy renewable energy certificates currently can be sold for \$6 to \$7 per megawatt-hour, for estimated total annual revenue of \$20,800 per year for the 395 kW cogeneration unit.

Energy Trust may contribute an incentive payment covering above market costs for biomass-to-energy projects. The amount of the incentive payment is determined on a case-by-case basis based on analysis of project revenues, tax credits, and costs. In initial discussions, Energy Trust representatives indicated that additional discussions would be needed to determine the amount and timing of a possible incentive payment and therefore no Energy Trust incentive payment has been included in the financial scenarios.

Table ES-1 summarizes the financial analysis of the project based on a tipping fee of \$0.03 per gallon, BETC, avoided power costs, and sale of renewable energy tax credits. Based on these factors, the project is estimated to have a payback period of 7 years or less.

TABLE ES-1

Project Financial Summary—FOG Receiving Station and Cogeneration Unit

395 kW Cogeneration Unit and FOG Receiving Station, 17,000 gallons FOG and Food Waste/day, 6.7% Solids

Item	Value
Estimated capital cost (2009 dollars, accuracy of +50% to -30%)	(\$3,700,000)
Possible Business Energy Tax Credit	<u>\$1,573,000</u>
Net capital cost after BETC	(\$2,127,000)
Estimated power cost savings (based on avoiding purchase of 3,014,000 kWh annually at \$0.063/kWh)	\$190,000
Estimated annual tipping fees at \$0.03/gallon	\$133,000
Estimated annual sale of renewable energy credits	<u>\$20,800</u>
Net annual income	\$343,800
Estimated annual operating cost	(\$60,000)
Periodic maintenance at years 10, 20, and 30	(\$200,000)
Simple payback period	7 years

Recommendations

Based on the favorable preliminary findings of this evaluation, the City of Gresham should continue to investigate the possibility of codigesting FOG and food waste in its existing digesters. Because the availability and strength of FOG and food waste are highly variable, Gresham should consider proceeding in phases. The first phase would construct the FOG receiving facility to verify the availability, strength, and handling characteristics of the waste before committing to the electrical/cogeneration system improvements that would be necessary to take advantage of the additional digester gas production. Subsequent phases

would design and construct a cogeneration system using gas production data obtained by operating the receiving station.

Initially, to encourage FOG haulers to bring their waste to the WWTP, it may be advisable for the city to charge a reduced, below-market tipping fee. Gresham should also investigate the possibility of forging agreements with FOG haulers to establish regular and reliable sources of FOG. In the future, after the program has gained some footing and its acceptance among food waste producers is better known, the City may wish to increase tipping fees that can be adjusted based on how it affects the supply of FOG to the WWTP.

If Gresham implements a FOG and food waste cogeneration program, it will be important to prevent unwanted material from being discharged to the FOG receiving system. Gresham should limit FOG deliveries to grease trap pumpage collected by haulers participating in the Preferred Pumper Program. In addition, the hauler should be required to maintain written records indicating the source of the waste for each load.

SECTION 1

Purpose

The City of Gresham is committed to economically viable, sustainable, “green” asset management as well as an overall goal of attaining energy independence from grid power within the WWTP fence line. Based on these commitments, the WWTP is making significant strides in reducing its reliance on outside energy by improving energy efficiency and implementing renewable energy opportunities. The City’s goal for the WWTP is to go beyond reducing the need for purchased power to achieve energy independence. To realize this ambitious goal, the City of Gresham is considering creative and innovative approaches, such as cogeneration powered by FOG and food waste.

This report documents an evaluation of the feasibility of expanding the existing cogeneration system at the Gresham WWTP by receiving and anaerobically digesting FOG and food wastes produced by restaurants, cafeterias, fast-food outlets, dairies, bakeries, and other food processors. The Gresham WWTP currently anaerobically digests biosolids to produce methane, which is used to generate electrical energy for use inside the plant, and hot water, which is used to heat the digesters and other facilities at the plant. Existing digester capacity at the Gresham WWTP would be used to produce additional methane gas supplying a new cogeneration unit, producing additional electrical energy and hot water.

The City of Gresham is working in partnership with the Oregon Business Development Department, who provided a grant for this study, to complete the evaluation.

SECTION 2

FOG and Food Waste Available to the Gresham WWTP

This section summarizes the quantities and characteristics of FOG and food waste available in the Portland metropolitan area for cogeneration at the Gresham WWTP.

2.1 FOG from Grease Traps and Grease Interceptors

FOG discharges from restaurants, fast food outlets, and food processors are controlled by installing grease traps. Trap contents are pumped into tank trucks for disposal. According to a survey conducted by the National Renewable Energy Laboratory (NREL) in 1998, in communities requiring grease traps, the average amount of FOG collected is 13.4 pounds per person. The second type of FOG consists of petroleum-based oil and grease discharges to wastewater collection systems; these discharges are controlled by pretreatment programs and are not part of this evaluation.

FOG discharges from restaurants, fast food outlets, and food processors can be categorized as yellow or brown FOG. Yellow FOG is waste material collected before entering the wastewater stream. Yellow FOG is collected and utilized by biodiesel producers. Brown FOG is material that has been discharged to sanitary sewers. Brown FOG contains water and other contaminants.

Historically, when brown FOG was discharged to wastewater collection systems it caused blockages, sewage spills, and back-ups. FOG entering wastewater treatment plants potentially caused foaming, coating of equipment, and degradation of process performance. All of this drained budgets, manpower, and other resources. However, with current approaches, what was once a problem for wastewater treatment plants is being turned into a viable and sustainable energy resource. FOG collected from grease traps can be fed directly into anaerobic digesters at a wastewater treatment plant to produce methane, which can be used to power a cogeneration system.

Using the per capita FOG generation estimated by NREL in 1996, restaurants within the City of Gresham could generate 1.34 million pounds of FOG annually, based on its population of 100,000. Depending on its strength, FOG from Gresham could produce 5 to 16 million cubic feet of digester gas annually, with fuel value of up to 9.7 billion Btu. This is enough fuel for a 100 kW or larger cogeneration unit at the WWTP. Gresham could potentially draw on FOG produced in the eastern part of the metro area to increase the energy produced from FOG. However, CH2M HILL has found that the NREL estimates overstate the quantities of FOG actually generated by a community. Since FOG availability and concentration vary, local information about the strength and availability of FOG is essential to evaluate the viability of a FOG cogeneration project.

How FOG is managed varies from municipality to municipality. Some cities have rigorous FOG programs, others none at all. On the east coast, FOG is often collected and disposed of

at the local wastewater treatment facility. The FOG is either routed directly to the headworks, incinerated, or used as part of a composting program. In California, several municipalities have successfully installed FOG and food waste receiving facilities and are feeding FOG and food waste to digesters to increase biogas production. Riverside, Millbrae, Oxnard, and East Bay Municipal Utility District (MUD) are among the municipalities that successfully codigest FOG with wastewater treatment plant sludge.

2.2 Plumbing Code Requirements and the Preferred Pumper Program

Food establishments are required by code to have grease traps and/or interceptors installed downstream of all kitchen sinks to collect FOG and also to regularly clean and maintain these traps. But, these codes have not always been enforced. Recently, sanitary districts and municipalities are beginning to understand and, more importantly, quantify the costs and disadvantages associated with the lack of enforcement. Five wastewater providers in the metro area, Wilsonville, Troutdale, Gresham, Clean Water Services, and Clackamas Water Environment Services, have formed the Preferred Pumper Program (PPP) to establish criteria for companies that clean and maintain grease traps/interceptors. These companies are occasionally referred to as haulers or pumpers. The goal of this program is to minimize FOG discharged to wastewater collection systems. Although the City of Portland is currently not part of the PPP, they actively monitor the program and may join in the future.

In addition to establishing requirements for the FOG pumpers, FOG program coordinators and inspectors from the districts and municipalities have been tasked to educate food establishments regarding the importance of best management practices to minimize FOG in the sanitary collection system as well as enforce the existing plumbing codes. In Gresham, there are currently 314 food establishments within the city limits. Approximately 130 of these food establishments (40 percent) do not have grease traps and or grease interceptors and discharge FOG to the wastewater collection system. As these restaurants change owners, expand, or renovate, the City of Gresham requires installation of grease traps and grease interceptors. However, this process takes time and it will take several years of monitoring, educating, and enforcement to establish a more inclusive FOG program. Nationally, most successful FOG programs depend on strong enforcement of ordinances prohibiting the discharge of FOG to sanitary sewer systems.

The six major grease trap/interceptor pumpers in the Portland metro area are part of the PPP and have agreed to follow the requirements outlined in the program. The companies in the PPP include Pro-Pump Sanitary Solutions, Metro Rooter Plumbing, Darling International, Baker Commodities, Oregon Oils, and River City Environmental. These FOG haulers have clean-out contracts across the region and are not limited to just the Portland metro area. As a member of the PPP, the companies are promoted and recommended in the metro area to new and existing food establishments by the FOG program coordinator and inspectors.

2.3 FOG Quantities

Currently in the Portland Metro area, each grease trap/interceptor pump-out company is responsible for disposing the FOG it collects. In the Metro area, local wastewater treatment plants do not typically accept FOG for treatment and the disposal methods are not regulated. Consequently, each business attempts to minimize the costs associated with FOG disposal and each has a slightly different approach.

As part of this study, six clean-out contractors in the PPP were contacted to discuss current disposal methods, estimated quantities, and to gauge its interest in a local FOG receiving station. Several of the contractors were willing to discuss their business operations, while others chose not to discuss their business models for proprietary reasons.

Four of the six major FOG pumpers have their own treatment facilities, while two of the pumpers truck their waste to Pacific Powervac for disposal. Pacific Powervac operates wastewater treatment facilities in Portland, Oregon, and in Tacoma, Washington. Waste materials from wastewater treatment operations, industrial operations, and commercial operations are treated, processed, and discharged directly to the City of Portland sanitary sewer system.

Table 2-1 presents information obtained from the FOG haulers, including the contractor name, quantities (if provided), current treatment approach, and costs (if provided). The four pumpers who were willing to provide quantities pump an estimated total of 330,000 gallons of FOG from grease traps each month in the Metro area. Less than 5 percent of the FOG collected in the Metro area is estimated to come from Gresham.

2.4 Competition for FOG

Until recently, trap grease has been a waste to be disposed of, but municipalities and the private sector are becoming interested in developing beneficial uses for FOG. In the Portland area, Gresham, Clean Water Services, and Water Environment Services are evaluating construction of FOG receiving stations. Wastewater providers with available digester capacity or plans to build digesters see the collection of FOG waste as an easy way to increase biogas production. Because there may be competition for FOG, it is critical to maintain contact with FOG pumpers to develop strategies and methods that will entice them to bring their FOG waste to the City of Gresham. The key driver for FOG pumpers is cost of disposal as measured by the tipping fee.

TABLE 2-1
FOG Hauler Details

Criteria	Pro-Pump	MRP	Darling	Baker	River City	Oregon Oils
Dewatered?	Yes, with lime and polymer	Yes, with lime and polymer	Yes, with lime and polymer	Yes, with lime and polymer	No	No
Current Disposal Method	Landfill (sent to Metro South Transfer Station in Oregon City)	Landfill ((sent to Metro South Transfer Station in Oregon City)	Portion used for biofuel, portion landfilled	Trucked to Seattle for internal uses	Trucked to Pacific Powervac for treatment	Trucked to Pacific Powervac for treatment
Treatment Costs	\$0.06/gallon	\$0.08/gallon	NA	\$0.09/gallon	~ \$0.15/gallon	~ \$0.12/gallon
FOG Collection: % of Business	> 95%	~ 35%	NA	10 to 15%	~ 35%	NA
Mixed Loads?	No	Yes	No	No	No	No
Monthly Quantity	80,000 gallons	80,000 gallons	NA	120,000 gallons	50,000 gallons	NA
Open to a FOG Receiving Station?	Yes	Yes	Yes	No	Yes	No
% of Business in Gresham	< 5%	< 5%	NA	< 5%	< 5%	NA

2.5 FOG Characteristics

The physical and chemical characteristics of FOG are highly variable. FOG waste characteristics were evaluated by collecting five samples from each of two grease trap pumpers in June 2009. In total, ten samples were collected by Paul Kramer of the City of Gresham. The difficult nature of FOG is illustrated by the Figure 2-1 photographs of samples being collected at Pro-Pump and Darling. Columbia Analytical Services analyzed the samples for total solids, volatile solids, chemical oxygen demand, pH, total oil and grease, nonpolar oil and grease, and viscosity. In addition, three samples were obtained of dewatered FOG produced at each of the two pumpers. The samples were collected at the pumpers' facilities as the trucks were being unloaded.



At Pro-Pump

At Darling

FIGURE 2-1

Collecting FOG Samples

Photographs courtesy of Paul Kramer, City of Gresham Wastewater Division

Table 2-2 summarizes sampling results for FOG before it was dewatered and also provides values for comparison from a literature survey and from sampling for a project being designed for Johnson County (Kansas) Wastewater by CH2M HILL. The composition of FOG samples collected by Gresham varied substantially from truckload to truckload and even within a single truckload. For example, in 10 truckloads of FOG, total solids concentrations ranged from 0.1 percent to 41.8 percent. (Where multiple samples were taken from a single load, the analytical results were averaged per truckload.) The variation between truckloads was assessed by averaging the data with and without the high values for total solids. One sample with a total solids concentration of 41.8 percent increased the average total solids concentration by a factor of 2.4 from 2.74 to 6.65 percent. The variation in concentration in a single truckload was assessed by collecting samples at the beginning, midway, and end of discharge at the receiving facility. Total solids concentrations varied by a factor of three in one truckload, from 27,600 to 89,200 milligrams per kilogram (mg/kg) during the course of discharging 3,000 gallons of FOG. Total solids concentrations varied by

a factor of four in a second truckload, from 20,500 to 93,200 mg/kg during the course of discharging 3,000 gallons. A FOG receiving station should include facilities to receive, store, blend or fractionate, and transfer FOG to the digesters, equalizing the peaks and valleys in volume and concentration from load-to-load. After fractionating into FOG-rich and FOG-lean fractions, the FOG-rich fraction can be fed to the digesters and the FOG-lean portion can be combined with wastewater entering the plant.

TABLE 2-2
Gresham FOG Sample Results June 2009—Before Dewatering

Constituent	Values Reported in Literature	Johnson County Wastewater (Average, Minimum, Maximum)	Gresham FOG Samples Before Dewatering ^{a, b, c, d, e} (Average, Minimum, Maximum)
Total solids	5.4%	4% average 0.9 to 7.8%	6.65% average 0.1 to 41% ^f
Volatile solids percent of total solids	90%	84.5% average 68.2 to 97%	91% average 84 to 99%
pH	-	4.5 average 3.6 to 4.8	5.1 median 4.2 to 6.5
COD	242,000 mg/L	112,500 mg/L average 14,600 to 203,400 mg/L	1,089,000 mg/kg average 2,070 to 2,220,000 mg/kg
Total oil and grease	-	> 22,500 mg/L average 4,390 to 61,000 mg/L	10,000 mg/L average 490 to 17,000 mg/kg
Nonpolar oil and grease	-		6,992 mg/kg average 10 to 45,967 mg/kg
Viscosity	-	1.7 cp median	1.59 cp median 1.4 to 249,000 cp

^aGresham collected five samples from Pro-Pump and five samples from Darling.

^bFOG came from grease traps and grease interceptors at restaurants, grocery stores, and assisted living facility

^cMultiple values for same truckload were averaged together.

^dSamples were collected as trucks discharged at receiving facility.

^eConsiderable variation was noted as trucks discharged. For example, total solids concentrations varied from 92,400 to 20,500 mg/kg in three samples collected from the same load as one truck discharged.

^fOne sample with total solids concentration of 418,000 mg/kg raised the total solids average from 2.74% to 6.65%.

cp = centipoise

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

Table 2-3 summarizes sampling results for FOG after it was dewatered by the FOG pumper. When compared to FOG that has not been dewatered, dewatered FOG generally has a much higher solids concentration and a slightly lower percentage of volatile solids. The pH of lime-treated FOG is much higher, chemical oxygen demand (COD) concentration are higher, oil and grease concentrations are much higher, and the material is more viscous. These characteristics indicate that dewatered material may be difficult to handle using pumps and piped conveyance. Lime-treated FOG may have a high proportion of inert material that may interfere with operation of the digesters.

TABLE 2-3
Gresham FOG Sample Results June 2009—Dewatered Samples Compared to Samples Before Dewatering

Constituent	Gresham Dewatered FOG Samples (Average, Minimum, Maximum)	Gresham FOG Samples Before Dewatering ^{a, b, c, d} (Average, Minimum, Maximum)
Total solids	31.1% average 14.7 to 61.0%	6.65% average 0.1 to 41%
Volatile solids per cent of total solids	81.0% average 75.3 to 89.6%	91% average 84 to 99%
pH	12.1 median 5.04 to 12.3	5.1 median 4.2 to 6.5
COD	2,265,833 mg/kg average 1,220,000 to 3,170,000 mg/kg	1,089,000 mg/kg average 2,070 to 2,220,000 mg/kg
Total oil and grease	274,600 mg/kg average 93,000 to 860,000 mg/kg	10,000 mg/L average 490 to 17,000 mg/kg
Nonpolar oil and grease	203,000 mg/kg average 79,000 to 620,000 mg/kg	6,992 mg/kg average 10 to 45,967 mg/kg
Viscosity	249,000 cp at 24.9°C median 249,000 cp to not readable	1.59 cp median 1.4 to 249,000 cp

^aGresham collected 3 dewatered samples from Pro-Pump and 3 dewatered samples from Darling

^bFOG was dewatered using pumper

^cHigh pH reflects lime treatment at Darling; Pro-Pump samples had pH of 5.04.

^dDewatered samples came from different loads than samples before dewatering.

cp = centipoise

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

2.6 Food Waste

Restaurants, cafeterias, grocery stores, bakeries, and dairies produce large quantities of food waste, which are disposed of in landfills or composted. An alternative to land filling is source separating and anaerobically digesting the waste using existing digester capacity at a wastewater treatment plant. The methane produced by the digesters can fuel a cogeneration facility. The U.S. Environmental Protection Agency (EPA) supports codigestion of food wastes using available digester capacity, and maximizing the energy recovery from waste food streams. The benefits of codigestion include increased biogas production, energy production, collection of tipping fees from waste haulers, and reduction in greenhouse gas emissions from landfills.

Food wastes vary greatly in their potential to produce methane when codigested with municipal wastewater sludge. Food wastes high in fats and oils, such as wastes from vegetable oil manufacturing and processing of foods with high oil concentrations such as salad dressings or mayonnaise, produce large volumes of methane when codigested with municipal wastewater sludge. Other food wastes, such as vegetable wastes, fruit wastes, and dairy whey are likely to produce smaller volumes of methane.

Food wastes vary in consistency and suitability for feeding to municipal WWTP anaerobic digesters. Depending on its physical characteristics, food waste may need to be processed by screening, grinding, emulsifying, blending with more liquid wastes, or dewatering, to prevent clogging of digester piping, pumps, and mixing equipment. Some wastewater treatment plants have had good success with source separation to remove metal, paper, and plastic items from food wastes before they are transported to the WWTP. If the food waste must be processed at the wastewater treatment plant, the processing adds a great deal of complexity. It would be better to limit food waste to pretreated liquids having near neutral pH. Liquid food wastes could be received, stored, and metered to the digesters similar to the methods used to feed FOG.

The quantity of residual biosolids produced after anaerobic digestion of food wastes also varies. For example, vegetable and fruit wastes tend to have more nondigestible inert solids, and wastes from vegetable oil producers and salad dressing manufacturers tend to have lower concentrations of inert material.

CH2M HILL has investigated the availability of sources of food waste in the Portland Metro area. The potential sources of food wastes other than FOG include:

- Food processing waste, such as that from Boyd Coffee and Townsend Farms
- Dairy waste
- Waste food from food distribution centers
- Institutional food waste

2.6.1 Food Processing Waste

CH2M HILL contacted Boyd Coffee and Townsend Farms to obtain information about the quantities of waste generated by the two firms.

Boyd Coffee operates a food processing facility immediately south of the Gresham WWTP. The wastes from the facility include citric acid, cocoa, sugars, milk solids, beef fat, and chicken fat. These wastes combine to form two waste streams, one from the citric acid, and another from the food production and cleaning wastes. Boyd Coffee staff indicated that the majority of the food production and cleaning waste is sugar. The waste stream containing citric acid is neutralized. Wastewater from the facility is stored in two 1,500 gallon tanks, one for each waste stream after passing through a coarse screen. The screened wastewater is tested for biochemical oxygen demand (BOD), total suspended solids (TSS), pH, metals, organics, and toxic chemicals before being discharged to a City of Gresham sanitary sewer. In 2008, daily wastewater discharge averaged 2,100 to 2,200 gallons containing approximately 47 pounds of suspended solids (2,600 to 2,700 mg/L) after screening. Boyd Coffee was unable to provide an estimate of the quantity of screenings discharged each day. Additional testing would be needed to assess methane production from the screenings.

Townsend Farms is a seasonal producer of food products. The wastewater discharge from the facility varied from a low of approximately 134 gallons per day to a high of 1.8 million gallons per day (mgd) in 2008. During the peak month, Townsend Farms discharged 13,500 pounds (lb) of BOD and 2,447 lb of suspended solids to the Gresham WWTP. The wastewater passes through a rotary screen with 0.02 inch openings. During the peak season, the facility produces approximately 3,000 lb/day of screenings that are removed and

disposed offsite by River City. The screenings are primarily fruit wastes. Additional testing would be needed to assess methane production from the screenings.

Methane production from codigesting food processing wastes depends on the waste being digested. Wastes from vegetable oil manufacturing plants and salad dressing manufacturing plants could generate as much methane per pound of solids as FOG. Food processing wastes containing mostly fruit peelings and pulp could be expected to generate about 25 percent to 50 percent of the methane generated by the same weight of FOG solids, and would also increase biosolids production. The impact on digested biosolids would need to be verified from actual operations.

2.6.2 Dairy Waste

Several dairies in the Portland area produce 2,500 to 3,000 gallons of waste sludge each day from the production of milk, cheese, and other dairy products. The waste is currently trucked for disposal in lagoons or landfills. Staff members at the dairies report that the sludge is high in milk fat, but the solids concentrations and fat content are unknown. The dairies have indicated that they would haul their wastes to a wastewater treatment plant for disposal if the disposal costs were lower than existing disposal options. There are several large dairies in the Portland area, including the Safeway Supply Operations Milk Facility in Clackamas, the Kroger Swan Island Dairy in Portland, the Alpenrose Dairy in Portland, Sunshine Dairy Products in Portland, and Yo Cream in Portland.

Dairy wastes vary in their fat content. For example, dairy waste might consist of whey from cheese manufacturing or wastes higher in fat produced by ice cream production or disposal of off-specification product. Whey contains proteins and lactose, but very little fat. The solids content of whey is about 6.5 percent. About 70 percent of the solids consist of lactose, 10 percent proteins, 11 percent minerals, 4 percent non-proteinaceous nitrogen compounds, 3 percent lactic acid, and 2 percent fats. In addition, whey is acidic with a pH of 4.5 to 6.6, and alkalinity may need to be added to raise pH and increase gas production. Dewatering whey may improve gas production. Dairy waste with higher fat concentrations is likely to produce more methane per pound of solids.

Since the fat and solids content of dairy waste is likely to vary substantially from dairy to dairy, sampling would be needed to determine the solids concentration and fat content of waste from a particular plant.

2.6.3 Waste Foods from Distribution Centers

Several grocery store distribution centers consolidate produce waste from their stores. Produce waste can be expected to produce about one-quarter to one-third of the methane per pound of solids that codigestion of FOG would produce. Produce waste is 100 percent solids, however. Produce waste would need to be processed to remove metal, plastic, and wood and would need to be ground and screened to reduce the material to a size that could be fed to Gresham's digesters. It would also need to be blended with other liquid wastes or water to facilitate feeding into the digesters. The codigestion of produce in Gresham's digesters is likely to increase biosolids production.

2.6.4 Institutional Food Waste

Several utilities successfully codigest food waste from institutional food service operations such as college cafeterias. The waste may contain plastic, paper, wood, and metal, which need to be removed from the waste stream before grinding the food waste and feeding it to the digesters. Food waste may also contain paper and cardboard. These materials can be removed by source separation or by screening and other separation processes installed as part of a food waste receiving station. The amount of methane produced by codigestion of institutional food waste and reported in literature waste varies from 50 percent to 100 percent of that produced by digesting a similar weight of FOG solids.

SECTION 3

Existing Gresham WWTP Facilities

FOG and food waste could be codigested using existing available capacity in anaerobic digesters and biosolids processing equipment at the Gresham WWTP. Addition of FOG and food wastes to the digesters may require the installation of mixing equipment in the secondary digester. Additional biosolids processing equipment is not likely to be needed, although existing equipment may need to be operated for longer periods each day, depending on the type and quantity of waste added to the digesters.

The codigestion of FOG is not likely to increase the production of residual solids from the digesters. The codigestion of food wastes may increase the production of residual solids from the digesters.

The WWTP employs a suspended media activated sludge process treating domestic, commercial, and industrial wastewater from incorporated areas of Gresham, Wood Village, and Fairview. Figure 3-1 is a diagram illustrating the process arrangement at the Gresham WWTP. Figure 3-2 shows the location of major unit processes at the WWTP.

Programs eliminating FOG discharges to the wastewater system often reduce the volume of scum collected in primary and secondary clarifiers. By separating FOG from wastewater at its source and injecting it directly into the digesters, wastewater treatment plant operations may be streamlined.

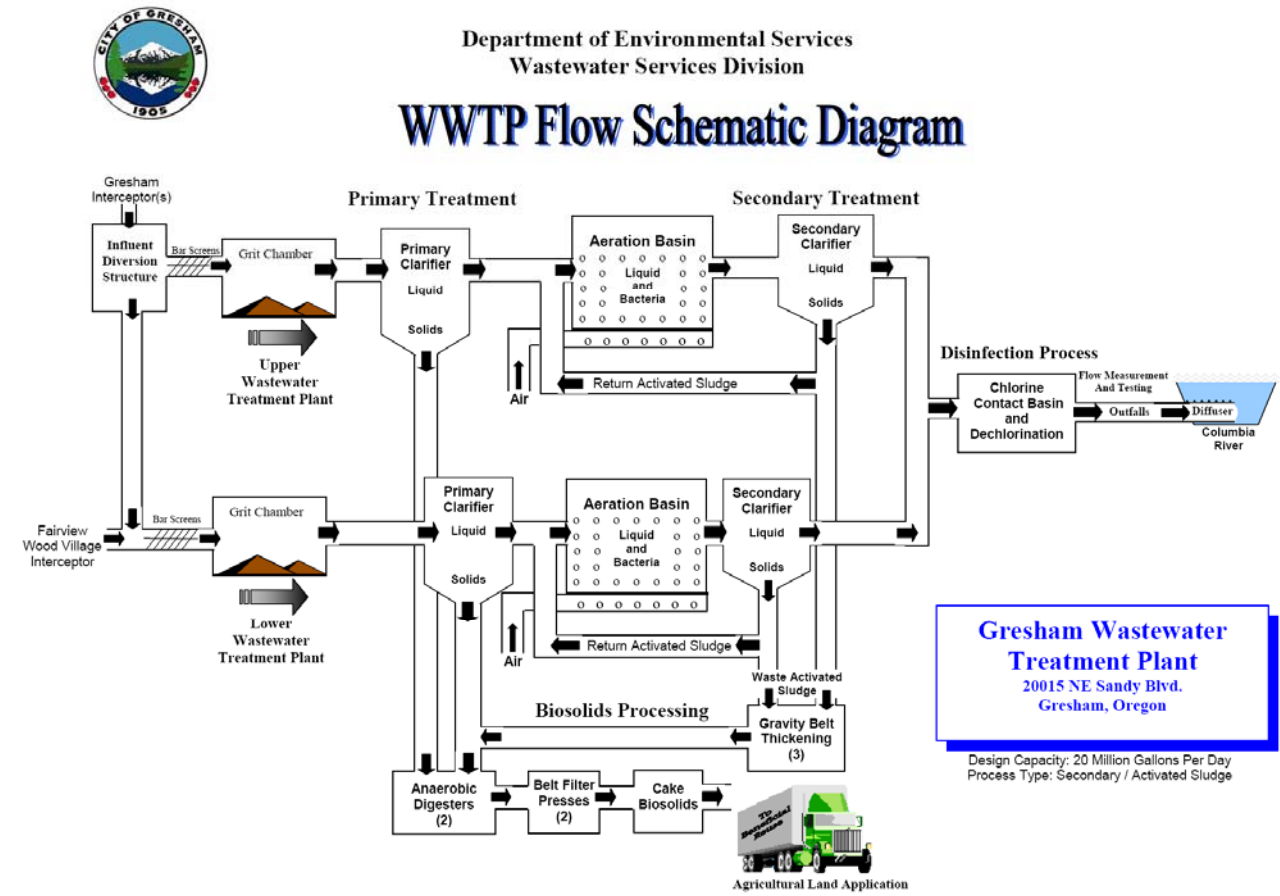


FIGURE 3-1
Gresham WWTP Flow Schematic Diagram



Key

- P₁ - Primary Clarifier 1-5
- A₁ - Aeration Basin 1-4
- S₁ - Secondary Clarifier 1-4
- C₁ - Chlorine Contact Basin 1-2
- PD - Primary Digester
- SD - Secondary Digester
- A - Administration Building

FIGURE 3-2
Gresham WWTP Site Layout

The WWTP is divided into upper and lower liquids process streams. Solids from the upper and lower plants are processed together. The major components of the existing treatment facilities include screening, grit removal, primary clarification, secondary aeration tanks, secondary clarification, disinfection using sodium hypochlorite, dechlorination, sludge thickening using gravity belt thickeners, anaerobic digestion, dewatering of digested sludge using belt filter presses, biosolids storage, and biosolids reuse by local land application.

Based on an analysis of unit processes at the plant performed by CH2M HILL for the 2004 Master Plan Update, the capacity of existing facilities at the Gresham WWTP is 23.7 mgd (maximum wet weather month), with the limiting unit processes at the plant being aeration basins and secondary clarification. The plant is permitted as a 20 mgd facility. The plant currently operates at approximately two-thirds of its capacity. For example, for the period from 2004 through 2008, the annual average influent flow rate ranged from 11.6 mgd in 2008 to 12.9 mgd in 2005, the average dry weather flow varied from 10.1 mgd to 12.9 mgd in 2005, and the wet weather average month varied from 13.0 mgd in 2004 to 15.4 mgd in 2006.

Solids from the treatment system are digested in primary and secondary anaerobic digesters. Table 3-1 summarizes operational data for the digesters. Primary sludge is pumped from the bottom of the primary clarifiers to the primary digester at solids concentration of approximately 5 percent to 7 percent and a volatile solids concentration of 80 percent to 87 percent. Activated sludge from the aeration basins, is routed to the secondary clarifiers for settling of the sludge. Waste activated sludge from the secondary clarifiers is pumped to gravity belt thickeners for dewatering and then pumped to the primary digester at 5 percent to 7 percent solids. Approximately 80 percent to 85 percent of the solids are volatile solids. The remainder of the activated sludge is returned directly to the aeration basins as return activated sludge. Primary sludge and thickened waste activated sludge are mixed in the primary digester where stabilization, volatile solids reduction, and methane production occurs. Hydraulic detention is currently 35 to 55 days, depending on the WWTP influent flow rate and waste activated sludge production. Temperatures in the primary digester range from 93 to 96 degrees Fahrenheit (°F). Current volatile solids reduction is 55 percent to 65 percent. The digesters are currently operated in series with the primary digester overflowing to the secondary digester. The primary digester operates at a constant level.

The secondary digester is normally used as a sludge holding tank to store sludge until it is sent to belt filter presses for dewatering and beneficial reuse. As a result, the operating level in the secondary digester varies. Only the primary digester is currently heated and mixed.

The digesters were designed to operate at a hydraulic retention time of 20 days and a volatile solids loading of 0.15 pound of volatile solids per cubic foot per day. Plant records show that the existing digesters processed approximately 42,000 gallons of biosolids each day with a solids concentration of 5 to 7 percent from April 2008 through May 2009. Based on the capacity of primary digester, hydraulic loading averaged 84 percent of design capacity and volatile solids loading averaged 98 percent of capacity. During this 12 month period, the volatile solids loading varied from a low of 71 percent to a maximum of 119 percent of the design capacity of the primary digester.

TABLE 3-1
Gresham WWTP Anaerobic Digester Information

Item	Value
Primary Digester —Mesophilic, fixed cover, fixed depth, overflow to secondary digester, completely mixed (gas mixing)	
Dimensions	80 ft diameter, 27 ft SWD operating depth
Primary digester operating volume	1,000,000 gallons
Operating temperature (monthly average May 2008 to April 2009)	90.7°F to 98.0°F
Capacity of primary digester at 0.15 lb VSS/ft ³ /day	20,053 lb VSS/day
Capacity of primary digester at detention times of 20 and 15 days	50,000 to 66,667 gallons/day
Secondary Digester —Floating cover; generally unheated but insulated roof; generally not mixed but mixing equipment is in place; used for storage, settling, and decanting supernatant	
Secondary digester operating SWD	14 to 26 ft, average 20 to 25 ft
Secondary digester operating volume	977,600 gallons
Operating temperature (monthly averages May 2008 to April 2009)	87.8°F to 94.4°F
Capacity of secondary digester at 0.15 lb VSS/ft ³ /day	19,600 lb VSS/day
Capacity of secondary digester at detention time of 20 to 15 days	48,880 to 65,173 gallons/day
Performance at Existing Loads	
Volatile solids removal (annual average)	60% average; 57.3% minimum; 64.7% maximum
Gas production per lb VSS removed	12 to 15 SCF/lb VSS removed
Solids concentration leaving digesters	2% average; 1.8% minimum; 2.6% maximum
Sum of capacities of digesters at 0.15 lb VSS/ft ³ /day	39,658 lb VSS/day
Sum of capacities of digesters at detention time of 20 to 15 days	98,800 to 131,840 gallons/day
Current Loadings (May 2008 through April 2009)	
Average primary digester HRT (from pant records)	24 days
Hydraulic load (calculated from reported HRT)	42,000 gallons/day
% of available capacity utilized based on hydraulic load and 20-day HRT if only primary is used	84%
% of available capacity utilized based on hydraulic load and 20-day HRT if primary and secondary are used	43%
Actual VSS load	19,637 lb/day average; 14,269 lb/day minimum; 23,762 lb/day maximum
% of available capacity based on VSS/day if only primary digester is used	98% average; 71% minimum; 119% maximum
% of available capacity based on VSS/day if sum of primary and secondary digester capacity is used	50% average; 36% minimum; 60% maximum
HRT = hydraulic retention time	
SCF = standard cubic feet	
SWD = side water depth	
VSS = volatile suspended solids	

If the total capacity of the two digesters is considered, the digesters were loaded at approximately 43 percent of their hydraulic design capacity and approximately 60 percent of their volatile solids design capacity. The secondary digester would need to be heated and mixed to fully utilize its capacity. The City is considering installing new mixing systems in the digesters. These improvements will aid in more complete digestion of the existing biosolids feed and future FOG/food waste streams.

The digested solids are dewatered using belt filter presses, and then stored and land applied. The belt filter presses are currently operated 8 hours each day. Additional biosolids processing equipment is not likely to be needed. The codigestion of FOG with primary sludge and thickened activated sludge often improves digestion and reduces the volume of biosolids produced by the digesters. The impact of codigesting FOG can best be assessed by operating a pilot program to verify the impact of FOG on biosolids production.

Codigestion of FOG and food wastes with primary sludge and thickened waste activated sludge in the existing digesters at Gresham will increase the volume being fed to the digesters from 42,000 gallons per day to 59,000 gallons per day, an increase of 40 percent. With the proposed project, the digesters will continue to operate within their design hydraulic and volatile solids loading. Good mixing will be essential in both digesters to prevent the FOG from forming a scum layer on top of the liquid in the digesters. The quantity of biosolids produced by the digesters may increase, depending on the nature of the material being processed. Some studies have indicated that the codigestion of FOG may increase the production of digester gas with minimal increases in residual solids volumes.

SECTION 4

Current Energy Use at the Gresham WWTP

Energy use and production at the Gresham WWTP from May 2008 through April 2009 is summarized in Table 4-1. The plant used a total of 5,790,000 kilowatt-hours (kWh) of electrical power during that period and 2,030 therms of natural gas. The existing cogeneration system produced 2,776,000 kWh of power during that period, using 53,200,000 cubic feet of digester gas. Plant staff estimates that approximately 9,000,000 cubic feet of the digester gas was flared during that same period. The cogeneration system produced 48 percent of the electrical power used at the WWTP during the period. The heat recovered from the cogeneration system was used to heat the digesters. The WWTP purchased the remainder of the electrical power from Portland General Electric Company (PGE) at an average cost of \$0.093 per kWh, which includes a voluntary wind power source fee of \$0.01 per kWh and demand charge. The energy cost component of electrical power purchases from PGE without wind power and demand charges is estimated to be approximately \$0.063 per kWh.

As part of its cogeneration operations, Gresham has measured the fuel value and CO₂ content of its digester gas. The fuel content of the gas is 575 Btu per cubic foot, which is consistent with values reported in other studies. The gas is approximately 36.6 percent CO₂.

TABLE 4-1
Energy Use and Production at Gresham WWTP—May 2008 to April 2009

Item	Value	
Total electrical power used at Gresham WWTP during 12-month period	5,790,000	kWh/12 months
Power produced by 395 kW cogeneration unit during 12-month period	2,776,000	kWh/12 months
Power purchased from PGE during 12-month period	3,014,000	kWh/12 months
Cost of power purchased from PGE during 12-month period	\$280,768	
Cost of natural gas purchased from NWN during 12-month period	\$2,482	
Natural gas purchased from NWN	2,030	therms
Digester gas used to power cogeneration unit during 12-month period	53,200,000	SCF/12 months
Digester gas flared	Unknown	
Gas use for cogeneration at full duty	174,500	SCF/day
Gas use per kWh (average)	20	SCF/kWh
Existing cogeneration unit running % of time (average)	88%	
Energy content of digester gas (measured)	575	Btu/SCF
CO ₂ content digester gas (measured average)	36.6%	

SECTION 5

Proposed FOG and Food Waste Receiving Station

With the proposed project, the FOG and food waste will be collected by commercial haulers and discharged to a receiving station at the Gresham WWTP. FOG waste can be difficult to handle due to potentially high viscosity, variations in solids content, presence of debris, and potential for odors. Liquid food wastes, such as dairy waste, have handling characteristics similar to FOG, but other food wastes might arrive in a solid form and need to pass through a grinder before being fed to the digesters. In addition, the quantity of FOG and food waste available to Gresham could vary depending on the tipping fee and convenience to FOG haulers.

Because of these uncertainties Gresham may want to construct a pilot-scale facility to verify the availability of FOG before committing to additional cogeneration and electrical facilities. The pilot-scale facility will be designed to be expandable as the supply of FOG develops and to accept FOG and liquid food wastes such as dairy wastes, but not solids, such as institutional food waste or vegetable and fruit processors.

During the design of a FOG receiving station for Johnson County Wastewater, CH2M HILL visited WWTPs with existing FOG receiving stations to identify the components needed for a successful installation. In addition, CH2M HILL reviewed the design of other facilities. Based on these investigations, it was determined that a FOG receiving station should be designed to temporarily mix and store FOG in heated tanks before being fed into the digesters at a steady, equalized rate. The station should provide grinding. Sufficient storage needs to be provided to accommodate variations in the frequency of delivery and to store FOG over weekends to even out loading on the digesters. Load tracking should be provided to make collection companies responsible for the quality of material delivered to the unloading station. The system should be designed to contain odors and route the collected air through an air treatment control system.

CH2M HILL has also reviewed design requirements for the FOG receiving station with Liquid Environmental Systems (LES), a FOG hauler interested in entering the Portland grease pumping market. LES favors a FOG receiving station with a large, unheated tank with a single chopper pump recirculating FOG. LES believes that using an unheated tank with a chopper recirculation pump results in FOG particles being dispersed throughout the storage volume.

Figure 5-1 is a process flow diagram showing the major components of the FOG receiving station. Figure 5-2 is an aerial photograph showing the proposed location of the FOG facility. The proposed design criteria and features of the pilot-scale FOG receiving station with expansion provisions include:

- **Design capacity** – The FOG facility will be designed to accept three 3,000-gallon truckloads each day, with provision for expansion to six 3,000-gallon truckloads each

day. While the total supply is estimated to be approximately 11,000 gallons per day, the delivery of FOG proved to be somewhat erratic during the sampling effort for this study. Some grease traps are pumped on a regular schedule and others are pumped only when needed. It will be necessary to accommodate the unloading schedule of the grease haulers to build and sustain a source of supply. A truck will be able to unload only when there is sufficient storage space available for the entire truckload. Initially, one 10,000-gallon tank and pumping system will be installed. A second 10,000-gallon tank and pumping system will be installed as the supply increases.

- **Materials that will be accepted** – The receiving station will be designed to accept FOG and other liquid wastes, such as dairy wastes.
- **Truck unloading pad** – The truck unloading pad will be a concrete pad big enough to contain a vacuum truck. It will be sloped to drain to the plant drain system. The loading area will allow unloading of one vehicle at a time, and will be open during the day shift, 5 days a week, with possible after hours discharge available on an emergency basis.
- **Quick-connect** – Trucks will unload by connecting to a quick-connect hose connection at the unloading station. The coupling will be protected by bollards.
- **Power washer** – The unloading station will be equipped with a dedicated power washer to wash down the truck and truck unloading area. The wash water will be collected by the sloped concrete pad and will drain to the plant drains system and will be conveyed to the headworks.
- **Grinding** – An in-line grinder will be provided to prevent debris, rags, and large grease balls from clogging the pumps and piping.
- **Transfer pumping and grinding** – 300 gallons per minute (gpm) at 20 feet total dynamic head (TDH) rotary lobe pumps will be provided to transfer the waste to storage tanks. The pump will also be used to circulate FOG through heat exchangers.
- **Storage** – One 15,000 gallon vertical insulated polyethylene or fiberglass storage tank will be provided with odor control on the tank vents. A second tank would be installed at a later time.
- **Mixing** – The tanks will be mixed by dual-purpose rotary lobe pumps. The pump will also be used for truck unloading. FOG will be circulated through heat exchangers and grinders using this pump. Flushing connections will be provided throughout the piping.
- **Heating** – Two heat exchangers using hot water from the cogeneration system will be provided to maintain the FOG at 80°F in the storage tanks.
- **Odor control** – A 55-gallon carbon canister will be used to control odors from the tank.
- **Digester feed pumps** – Variable speed progressive cavity pumps will be used to pump the wastes to the digesters. The capacity of each pump will be 2.5 to 40 gpm at 40 feet TDH.

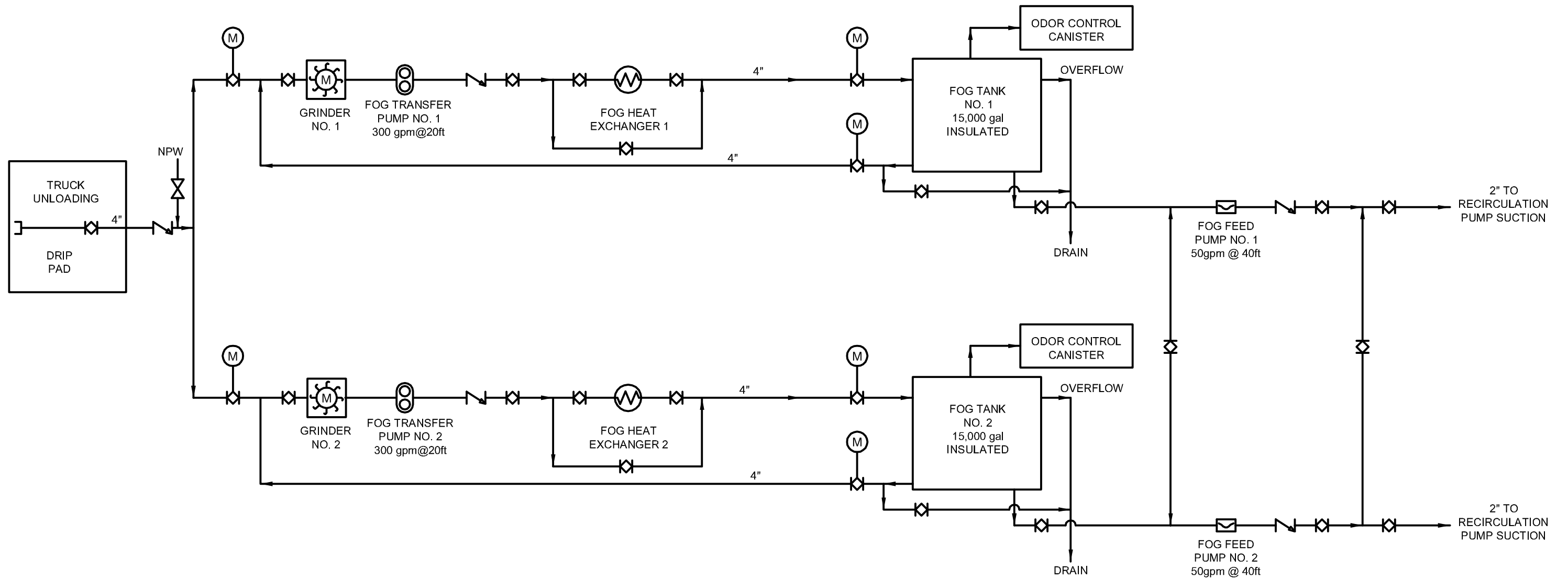
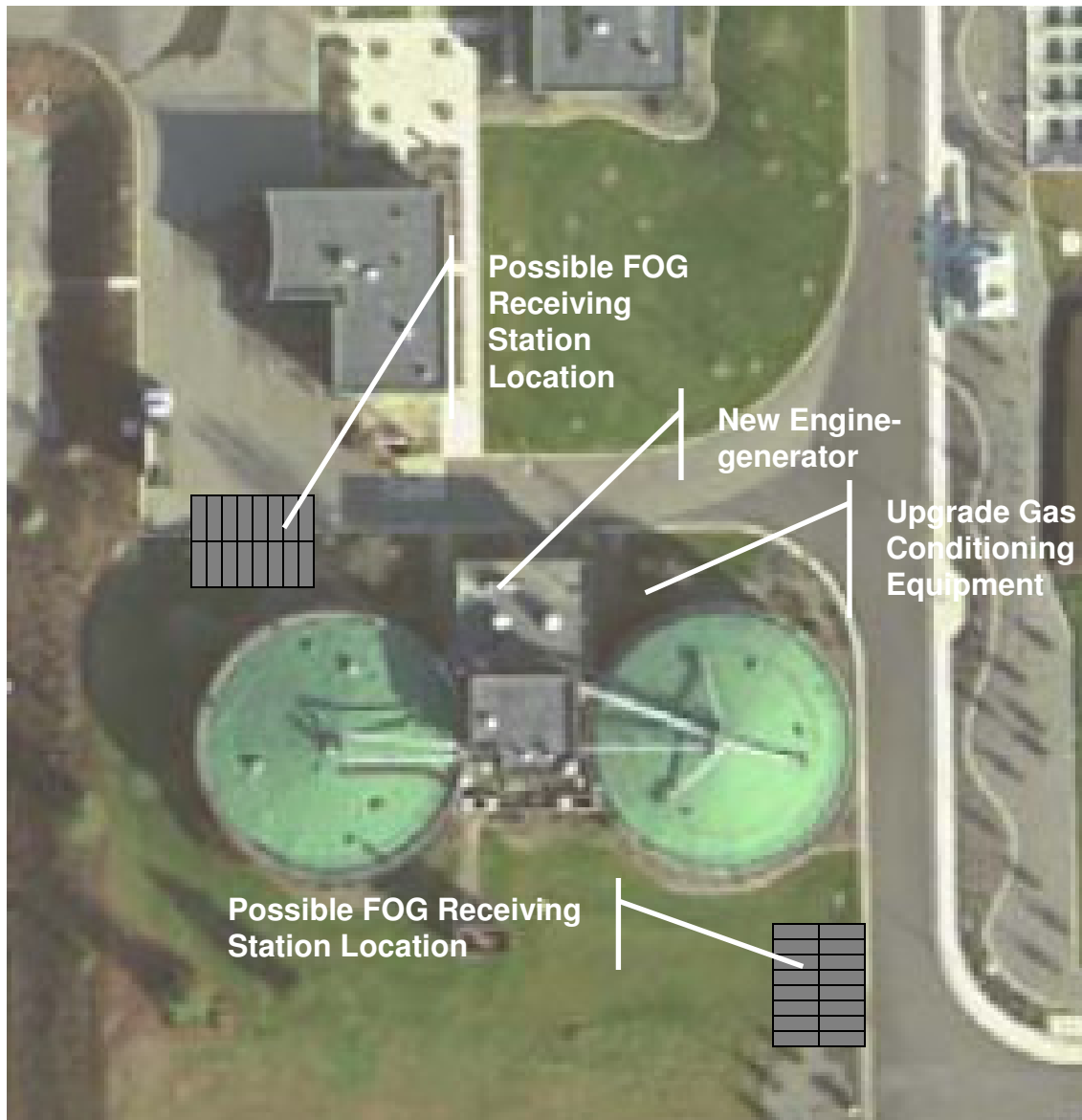


FIGURE 5-1
PROCESS FLOW DIAGRAM
FOR RECEIVING STATION



- FOG System Improvements Include:
- 50 ft X 26 ft Covered Truck Unloading Pad
 - Catch basin and drain
 - Quick-connects for unloading
 - Power washer
 - In-line grinders
 - 2 300-gpm Transfer pumps
 - 2 15,000-Gallon Storage Tanks
 - 395 kW Engine-Generator
 - Gas Conditioning Equipment
 - Switchgear
 - Instrumentation

Figure 5-2
Proposed FOG Codigestion System

- **Electrical and instrumentation**— Associated electrical, instrumentation, and controls will include a magnetic-strip card reader at the off-loading station for the drivers to activate the unloading station and provide load tracking information.
- **Building**— The unloading area, pumps, electrical and instrumentation equipment, heat exchangers, and storage tank will be housed under cover to provide weather protection for the equipment and to limit discharges to the plant drain system. The building will be a steel-framed canopy with a concrete floor slab with clearance of 15 feet for FOG trucks and the storage tanks. The floor slab will be approximately 50 feet by 26 feet. Heated enclosures will be provided for pumps. Piping will be insulated and heat traced.

A single, 6-inch quick connect hose fitting will be provided on the outside of the building for unloading FOG waste from the hauling trucks. A truck-size area around the fill station will be sloped to a catch basin underneath the hose connection, and a high pressure hose will be available for haulers to wash out the truck and surrounding area. Each potential FOG waste pumping company will be pre-approved by Gresham before being allowed onsite. Each driver will be issued a swipe card that will be used for each delivery. Swiping the card through a reader will be required before allowing an unloading cycle to begin. The card reader will record the delivery company, the particular driver, the date and time, and the amount of FOG waste unloaded. Once the card has been swiped and the truck discharge hose connected, the driver will push a button to begin an automated unloading cycle. A programmable logic controller (PLC) will check the beginning fluid level in the tank and determine if there is adequate volume in the tank for an assumed 3,000-gallon delivery. Once the system has verified that sufficient volume is available to unload the truck, the level will be recorded, the pump suction motorized valve will open, the tank recirculation motorized valve will close, and the influent pump will energize. A sensor, either low flow or low pressure, will signal the tank recirculation valve to open and the influent valve to close. The PLC will then record the final tank volume and calculate the volume delivered. An automatic flushing system using plant non-potable water will activate to clean the influent pipe.

Inside the building, an in-line grinder with an integral sediment trap and washout system coupled with a rotary lobe pump will draw FOG from the trucks to fill the storage tanks. A rotary lobe pump will not be subject to losing prime if air is sucked into the pipe from the delivery truck and can run dry. Both of these technical obstacles are problematic for centrifugal chopper type pumps, which were ruled out as an option for the feed pumps. The discharge from the pumps will go through a heat exchanger before entering a storage tank. Initially, there will be one system, consisting of a grinder and pump system, heat exchanger, and high density polyethylene (HDPE) storage tank. The 300 gpm pump will unload a delivery truck in approximately 10 minutes. The tank will provide enough capacity to hold three truckloads. The rotary lobe pumps will also be used for mixing the stored FOG waste. The tank will be fitted with a 2 1/2-inch fill nozzle angled tangentially to the inside wall and turned slightly up. This will accelerate the fluid to 20 feet per second and should provide good mixing regardless of water depth. The vent from each tank will be routed to a 55 gallon canister type odor control unit.

The heat exchangers will bring the FOG waste up to a temperature of 80°F over an 8 hour period. As the supply of FOG increases, additional tank systems can be added. The future capacity will help ensure adequate storage volumes for peak delivery days and allow

Gresham to pump FOG waste to the digesters during non-delivery days. Feed to the digesters will be provided by variable speed progressing cavity pumps with a range from 50 to 2.5 gpm. A suitable alternative to progressing cavity pumps would be rotary lobe type pumps. There will be two FOG waste effluent pipes to the digester, which will provide redundancy should one of the pipes become clogged. The pipes will be insulated, but since the distance from the FOG building to the digester building is short, heat tracing will not be required. Flushing connections will be placed throughout the FOG waste storage and feed system for cleaning.

Gresham may wish to consider alternatives for heating the tanks. Some plants heat FOG to a higher temperature to fractionate FOG into FOG-rich and FOG-lean components. The FOG-rich portion is fed to the anaerobic digesters. The FOG-lean solution is sent to the headworks and combined with wastewater entering the plant. Other plants do not heat the FOG and depend on the recirculation pump to break the FOG into small particles dispersed throughout the storage tank volume.

The unloading area, pumps, electrical and instrumentation equipment, heat exchangers, and storage tank will be housed under a canopy providing weather protection for the equipment and to limit discharges to the plant drain system.

SECTION 6

Potential Digester Gas Production

The gas supply to a new cogeneration system at the Gresham WWTP will draw on existing digester gas that is not currently utilized, gas produced from the codigestion of FOG, and gas that is produced by the codigestion of food wastes, such as dairy wastes. Four potential gas production scenarios are summarized in Table 6. The first scenario is based on using the excess gas that is currently flared plus gas produced by codigesting 6,000 gallons of FOG with a solids concentration of 6.7 percent each day. The second scenario is based on using the excess gas that is currently flared plus the gas produced by codigesting 6,000 gallons of FOG with a solids concentration of 6.7 percent and 3,000 gallons of dairy waste each day. The third scenario is based on codigesting 11,000 gallons of FOG with a solids concentration of 6.7 percent and 6,000 gallons of dairy waste each day. The fourth scenario is based on codigesting 11,000 gallons of FOG with a solids concentration of 2.74 percent and 6,000 gallons of dairy waste each day.

The gas production rates shown in Table 6-1 (provided on next page) are based on volatile solids removal and literature values for gas production for each pound of volatile solids removed. The combination of primary sludge and thickened waste activated sludge digested at the Gresham WWTP produces approximately 15 standard cubic feet (SCF) of digester gas per pound of volatile solids removed. FOG produces approximately 24 SCF of digester gas per pound of volatile solids removed. Dairy waste can be expected to produce approximately 15 SCF of digester gas per pound of volatile solids removed. The Gresham WWTP removes approximately 60 percent of the VSS entering the digesters in sludge from the WWTP. The removal rate for dairy solids is assumed to be similar. It should be noted that these volatile solids loading rates are based on anaerobic digestion of primary and thickened secondary sludge produced by a conventional activated sludge plant. Some studies have shown that the codigestion of FOG with municipal sludge can increase volatile solids loading rates by up to 30 percent if all of the additional volatile solids are derived from FOG.

Codigestion of 11,000 gallons of FOG and 6,000 gallons of dairy waste daily (Scenario 3) would probably produce enough digester gas to power a second 395 kW cogeneration unit at the Gresham WWTP if the average solids concentration of the waste were 6.7 percent. The calculation is sensitive to volume and solids concentration of FOG received at the WWTP. FOG production and concentrations are highly variable, as the sampling conducted by Gresham for this study demonstrated. An average of approximately 11,000 gallons of FOG is available daily for codigestion, but there may be days where no FOG is available, due to the haulers' pumping schedules.

TABLE 6-1
Digester Gas Production Estimates for Four Potential Scenarios with FOG at 6.7 Percent Solids

Scenario	Gas Production
Scenario 1	
Existing excess digester gas production (approximately 83% of existing gas production is used to power existing cogeneration unit)	29,100 SCF/day
Gas production from codigestion of 6,000 gallons of FOG (6.7% solids, 90% VS/TS, 80% removal, 24 SCF/lb VS removed)	58,000 SCF/day
Total estimated gas production for new cogeneration unit	87,100 SCF/day
Scenario 2	
Existing excess digester gas production (approximately 80% of existing gas production is used to power existing cogeneration unit)	29,100 SCF/day
Gas production from codigestion of 6,000 gallons of FOG (6.7% solids, 90% VS/TS, 80% removal, 24 SCF/lb VS removed)	58,000 SCF/day
Gas production from codigestion of 3,000 gallons of dairy waste (6.5% solids, 80% VS/TS, 90% removal, 15 SCF/lb VS removed)	17,000 SCF/day
Total estimated gas production for new cogeneration unit	104,100 SCF/day
Scenario 3	
Existing excess digester gas production (approximately 80% of existing gas production is used to power existing cogeneration unit)	29,100 SCF/day
Gas production from codigestion of 11,000 gallons of FOG (6.7% solids, 90% VS/TS, 80% removal, 24 SCF/lb VS removed)	106,000 SCF/day
Gas production from codigestion of 6,000 gallons of dairy waste (6.5% solids, 80% VS/TS, 90% removal, 15 SCF/lb VS removed)	34,000 SCF/day
Total estimated gas production for new cogeneration unit	169,100 SCF/day
Scenario 4	
Existing excess digester gas production (approximately 80% of existing gas production is used to power existing cogeneration unit)	29,100 SCF/day
Gas production from codigestion of 11,000 gallons of FOG (2.74% solids, 90% VS/TS, 80% removal, 24 SCF/lb VS removed)	43,400 SCF/day
Gas production from codigestion of 6,000 gallons of dairy waste (6.5% solids, 80% VS/TS, 90% removal, 15 SCF/lb VS removed)	34,000 SCF/day
Total estimated gas production for new cogeneration unit	106,500 SCF/day
Digester Gas Required to Power Cogeneration Units	
Digester gas required to power existing 395 kW cogeneration unit at 575 Btu/SCF	162,000 SCF/day
Digester gas required to power 250 kW cogeneration unit at 575 Btu/SCF	102,000 SCF/day

VS = volatile solids

VS/TS = volatile solids per total solids

Codigestion of 6,000 gallons of FOG and 3,000 gallons of dairy waste daily (Scenario 2) would probably produce enough digester gas to power a new 250 kW cogeneration unit at the Gresham WWTP if the average solids concentration of the waste were 6.7 percent.

Codigestion of 11,000 gallons of FOG and 6,000 gallons of dairy waste daily (Scenario 4) would probably produce enough digester gas to power a new 250 kW cogeneration unit at the Gresham WWTP if the average solids concentration of the waste were 2.74 percent.

Codigestion of 6,000 gallons of FOG and 6,000 gallons of dairy waste daily (Scenario 1) would probably produce enough digester gas to power a new 200 kW cogeneration unit at the Gresham WWTP if the average solids concentration of the waste were 6.7 percent.

SECTION 7

Proposed Cogeneration Unit and Electrical Improvements

The additional methane produced by codigesting FOG will be used to supply a new cogeneration unit. Gresham currently operates a 395 kW cogeneration unit powered by digester gas. The engine-generator is a Caterpillar G3508 with heat recovery. The digester gas passes through a gas conditioning system that removes hydrogen sulfide, siloxanes, and water, and boosts gas pressure. The system includes paralleling switchgear to start the cogeneration unit and switchgear allowing the generator to supply the lower plant without backfeeding the upper plant. The configuration of the existing system and the proposed modifications described below are shown on Figure 7-1.

The existing electrical power distribution system is configured so that the 395 kW Caterpillar biogas engine generator can be started, brought up to speed, synchronized with power from PGE at motor control center MCC-D, and the generator paralleling switchgear circuit breaker closed for operation of the generator in parallel with PGE on the WWTP power distribution system. If the generator power output exceeds the electrical load at MCC-D, the generated power is backfed through the blower building motor control center to the power distribution center (lower plant).

As the total electrical demand at the power distribution center drops below a preset minimum utility import (MUI) value of 20 kW, the output of the biogas engine generator is reduced to maintain the preset MUI level. If the electrical load at the power distribution center drops below the preset MUI, the biogas engine generator is shut down.

Power from PGE is always to flow into the power distribution center via the 2,000 amp main circuit breaker, and biogas engine generator power is never to flow out of the power distribution center into the WWTP 12.47 kV power distribution system.

The addition of a second engine-generator will allow the cogeneration system to serve the upper plant as well. The existing switchgear will be modified to allow power to be transferred back through the existing power circuit from the power distribution center through the existing 1,500 kVA (480-volt to 12.47 kV) transformer and 12.47 kV power distribution system to existing upper plant electrical loads using their existing 12.47 kV to 480-volt transformers.

It is assumed existing motor control center MCC-D has a 600 amp bus (consistent with the MCC-D main circuit breaker rating), which is the rated output of the existing 395 kW biogas engine generator. A new biogas engine generator could be connected at the power distribution center bus, which is assumed to be rated 2,000 amps (consistent with the power distribution center main circuit breaker rating) via a new free-standing "Biogas Engine Generator 2" paralleling switchgear circuit breaker and a power distribution center "Biogas Engine Generator 2" circuit breaker. The MUI setting at the existing power distribution center main circuit breaker intertie protection relay can be disabled to allow power to flow

to the upper plant with provisions to trip the power distribution center main circuit breaker if the PGE power source to the WWTP main fused switch is lost.

Though the combined maximum demand at the upper and lower plants will be slightly more than the combined ratings of the existing and new biogas engine generators, it is recommended that a shunt trip or motor operator and intertie protection relay be provided at the WWTP main fused disconnect switch. The intertie protection relay will:

- Detect a loss of PGE power to the WWTP.
- Open the WWTP main fused disconnect switch via the shunt trip/motor operator.
- Open the power distribution center main circuit breaker.

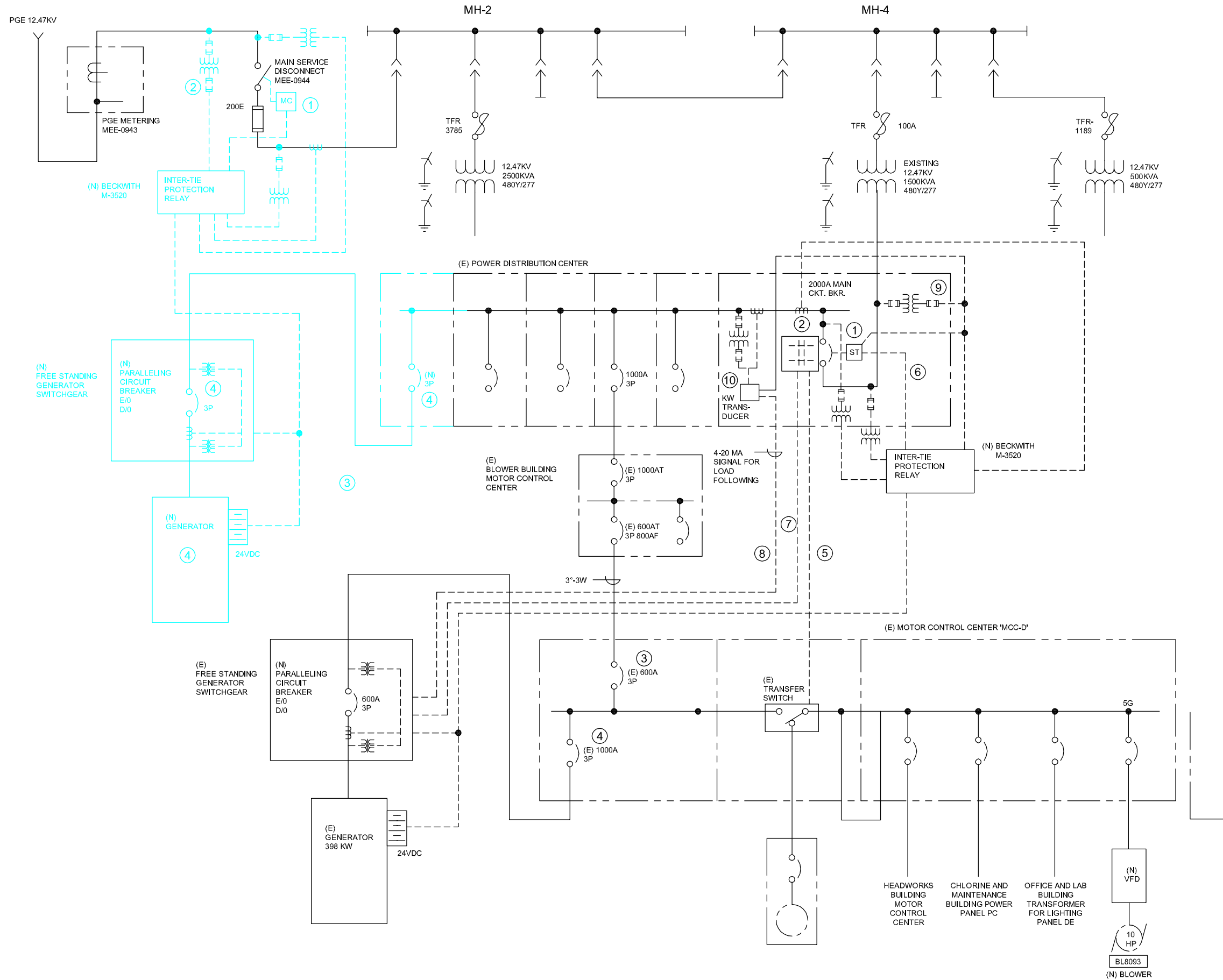
This scenario will allow the lower plant to keep operating, provided there is enough biogas to fuel the engine generator(s) for the current lower plant electrical load. If there is not enough biogas, the headworks, chlorine and maintenance building, and office and lab will be powered by the existing 230 kW standby engine generator. If there is enough biogas, the current lower plant electrical loads can be powered by the biogas engine generator(s). If there is more than enough biogas, upper plant electrical loads can be turned off, the power distribution center main circuit breaker closed, and upper plant electrical loads can be selectively started to the extent the biogas engine generator output rating(s) and the capacity of the available biogas are not exceeded. For the biogas engine generators to operate independent of electric utility power, a “compensation” control and interface needs to be provided between the two biogas engine generator switchgear lineups.

When PGE power to the WWTP is again available, the main fused switch intertie protection relay:

- After a short time delay, can open the power distribution center main circuit breaker, which will interrupt power to the upper plant.
- After a short time delay, close the WWTP main fused switch, which will provide PGE power to the upper plant.
- Ramp down biogas engine generator power output and open the biogas engine generator paralleling switchgear circuit breakers, which will interrupt power to the lower plant.
- After a short time delay, close the power distribution center main circuit breaker, which will provide PGE power to the lower plant.
- Initiate synchronizing the biogas engine generator outputs with the PGE power and closing the biogas engine generator paralleling switchgear circuit breakers for parallel operation of the biogas engine generators with PGE power at both the upper and lower plants.

Final design of the protective relays will need to consider the conversion to net metering that is being installed as part of the solar power installation at the WWTP.

PROPOSED POWER DISTRIBUTION ONE LINE DIAGRAM



NOTES:

- PROGRAM BECKWITH OUTPUT CONTACT TO OPEN MAIN SERVICE DISCONNECT SWITCH ON LOSS OF UTILITY.
- 480V TO 120V AC 200VA CONTROL POWER TRANSFORMER WITH PRIMARY AND SECONDARY FUSING, FOR POWER TO BECKWITH M-3520 AND MOTOR OPERATOR.
- ITEMS IN BLUE ARE NEW AND PART OF THE REVISIONS PROPOSED IN THE FOG FEASIBILITY STUDY.
- THE NEW BIOGAS ENGINE GENERATOR, PARALLELING SWITCHGEAR CIRCUIT BREAKER, AND FEEDER CIRCUIT BREAKER ARE CONNECTED TO THE EXISTING POWER DISTRIBUTION CENTER TO AVOID EXCEEDING THE CURRENT RATING OF THE EXISTING MOTOR CONTROL CENTER MCC-D BUS. ENGINE GENERATORS WITH THESE POWER AND CURRENT RATINGS AT 480V, 3-PHASE ARE BEING CONSIDERED:

RATED POWER	RATED KVA AT 0.8 PF	RATED CURRENT
200 KW	250 KVA	300 AMPS
400 KW	500 KVA	600 AMPS
600 KW	750 KVA	900 AMPS

FIGURE 7-1
PROPOSED GENERATION UNIT
AND ELECTRICAL IMPROVEMENTS

SECTION 8

Estimated Costs of Proposed Project

The capital cost of a new FOG receiving station with a capacity of 17,000 gallons of liquid waste and 395 kW cogeneration facility is estimated to be approximately \$3,700,000 (2009 dollars). This is an order-of-magnitude (Class 4) cost estimate as defined by the Association for the Advancement of Cost Engineering (AACE) and adopted by the American National Standards Institute. An estimate of this type is normally expected to be within +50 percent or -30 percent of the actual construction cost. The estimate is summarized in Table 8-1. The capital cost estimate includes 20 percent for contingencies, 25 percent for engineering, legal, and administrative costs (ELA); and 14 percent for management costs. Approximately 40 percent (\$1,400,000) of the total cost is for construction of the FOG receiving facility. If Gresham desired to construct just the FOG receiving facility to test the availability of FOG, the capital cost of a 9,000 gallon per day FOG receiving facility including canopy roof, automated card reader, and provisions for expansion is estimated to be \$1,000,000 (2009 dollars). A temporary FOG receiving facility suitable for testing the availability of FOG could probably be constructed for \$400,000.

TABLE 8-1
 Estimated Project Costs—FOG Receiving Station and 395 kW Cogeneration Unit
 (2009 Dollars, Budget-Grade Estimates with Expected Accuracies of +50%, -30%)

Item	Estimated Costs
FOG Receiving Station	
Building	
50-ft by 26-ft by 14-ft high steel canopy	\$130,000
50-ft by 26-ft by 8-inch concrete slab with grated catch basin and drain piping	\$20,000
Lighting panel, lights, and convenience outlets	\$8,000
Power washer	\$3,000
Pumps and piping	
Two 300 gpm @ 20 ft TDH rotary lobe pumps	\$40,000
Two Inline grinders	\$40,000
Two Heat exchangers	\$30,000
Progressing cavity pumps 2.5 to 50 gpm at 40 ft and variable frequency drive	\$50,000
Pump enclosures	\$10,000
Bollards	\$2,400
Tank fill and heat loop piping insulated and traced, 6 motor operated valves, valves and fittings (100 linear feet 4-inch steel)	\$40,000
Hot water piping to and from cogeneration unit (300 linear feet 3-inch insulated and traced)	\$18,000

TABLE 8-1 [CONTINUED]

Estimated Project Costs—FOG Receiving Station and 395 kW Cogeneration Unit
(2009 Dollars, Budget-Grade Estimates with Expected Accuracies of +50%, -30%)

Item	Estimated Costs
Digester feed piping insulated and traced (150 ft 3-in pipe insulated and traced)	\$9,000
Pump panel and electrical 480 V 3-phase (2@ 5-hp)	\$20,000
Two 15,000 gallon HDPE tanks insulated	\$30,000
Site electrical (200 ft branch in conduit, 200 ft instrumentation cable in conduit)	\$10,000
Instrumentation (Card reader, level sensing, pump controls, valve controls)	\$50,000
395 kW Cogeneration System (Assume Installation in 1,000 SF Expansion of Cogeneration Building)	
395 kW engine generator	\$350,000
Ancillary equipment	\$60,000
Heat recovery equipment	\$60,000
Paralleling circuit breaker	\$60,000
Intertie switchgear	\$200,000
Gas conditioning system (blower, 10-ton chiller, hydrogen sulfide removal vessel, siloxane SAG tanks, stainless steel gas piping, stainless steel heat exchangers, insulated and traced water piping, control panel, wiring and conduit to digester MCC breaker room)	\$120,000
Civil/site work	\$40,000
Project Subtotal	\$1,400,400
Contingencies at 45%	\$630,000
Subtotal	\$2,030,400
Contractor general condition, mobilization, demobilization, overhead, bonds, and profit at 27%	\$548,000
Estimated capital cost	\$2,578,400
Engineering, legal, and administration at 25%	\$645,000
Subtotal	\$3,223,400
Management at 14%	\$451,000
Total Estimated Project Costs (2009 dollars, +50% -30%)	\$3,674,000
Rounded	\$3,700,000

The capital costs for a FOG receiving station and 250 kW cogeneration facility are expected to be slightly lower, at \$3,200,000. The cost difference would primarily result from the lower price of a 250 kW cogeneration unit and paralleling switchgear. The cost of other electrical improvements and the FOG receiving station for a 250 kW unit are expected to be similar to the costs for a 395 kW unit.

SECTION 9

Financial Analysis

The net present values of 26 alternatives for codigesting FOG with sludge in Gresham's digesters were evaluated. The scenarios vary in FOG and food waste availability, tipping fee, and tax credits and incentive payments. In addition to the savings in energy purchases made possible by the cogeneration system, Gresham may be eligible for an Oregon Business Energy Tax Credit (BETC), incentive payments from an Energy Trust program for biomass-to-energy installations, and payments from the sales of carbon credits. A FOG hauler, Liquid Environmental Systems, has expressed an interest in constructing a FOG receiving station at no cost to Gresham in exchange for the exclusive right to use the FOG receiving station. Spreadsheets summarizing the present value analyses are included in Appendix A to this report.

Figure 9-1 and Table 9-1 summarize the estimated net present values of 26 alternatives for financing 250 kilowatt (kW) and 395 kW cogeneration facilities based on avoided power costs with and without Oregon Business Energy Tax Credits, tipping fees, and possible Energy Trust Biomass-to-Energy incentive payment. Operations and maintenance costs were estimated at \$60,000 per year, which is assumed to cover the costs of a 0.5 full-time-equivalent of an operator. In addition, the impact of having a private entity construct and contribute a FOG receiving station was evaluated. From this evaluation it was determined it is likely to be economically feasible to produce up to 395 kW of additional electrical power and hot water containing 60 million British thermal units (Btu)/day of additional heat at the Gresham WWTP by codigesting FOG and food waste in existing anaerobic digesters at the Gresham WWTP.

The analysis summarized in Figure 9-1 and Table 9-1 is based on codigesting a total of 17,000 gallons per day of FOG and high solids food processing waste similar to dairy waste. The analysis included two concentrations of FOG, 2.7 percent and 6.7 percent, bracketing the range of total solids concentrations measured in ten samples of FOG collected by Gresham staff for this study. The analysis period is 30 years and the interest rate was 5 percent. A net present value greater than zero indicates that revenue from the project exceeds project costs, including interest on borrowed money. Sixteen of the 26 alternatives had net present values greater than zero. Tipping fees and ability to utilize the BETC had the largest positive impacts on financial viability.

The BETC program provides a tax credit of 50 percent of eligible project costs for renewable energy resource generation projects constructed in Oregon. The tax credit is taken 10 percent each year over 5 years. Trade, business and rental property owners who pay taxes are eligible for the tax credit. A non-profit project owner can use the tax credit by partnering with an Oregon business or resident who has an Oregon tax liability. A non-profit project owner can transfer the tax liability to its partner for a lump sum payment. Eligible costs include all costs related directly to the project, including design, equipment, materials, supplies, and installation. The Oregon Department of Energy may assist a municipality to identify a business partner who can take advantage of the BETC tax credit. The availability

of business partners depends on the visibility of the project, the size of the project and business conditions at the time the project is constructed. The lump sum payment is based on the present value of the tax credit stream to the partner. As of January 1, 2010, Gresham would receive a lump sum payment equal to 42.5 percent of eligible costs.

Energy Trust may offer an incentive payment for biomass-to-energy projects for the above market cost of power produced by the project. Above market costs are the difference between what the power is worth at standard rates and what power from the project actually costs to generate. In its analysis, Energy Trust considers capital costs, yearly operations and maintenance costs, interest on debt, permitting, other upfront costs, and other yearly expenses. Revenues may include power sales, avoided power purchases, tax credits, sales of secondary contracts, and grants.

A biomass-to-energy project will produce carbon credits, which may be sold. The market for carbon credits is uncertain in the short run, with prices varying from \$6 to \$7 per mega-Watt-hour, (MWh) according to Kip Pheil of the Oregon Department of Energy. A 395 kW generator operating at 95 percent duty will produce approximately 3,200 MWh of energy annually.

The annual savings in electrical power usage were calculated for a 395 kW cogeneration unit and for a 250 kW cogeneration unit. A 250 kW cogeneration unit appears to be the smallest unit available that is powered by an internal combustion engine. Smaller cogeneration systems could use gas microturbines, Stirling engines, or fuel cells. The cogeneration units are assumed to be available 95 percent of the time and to operate at 100 percent load. The avoided cost of electrical power that would be produced by the cogeneration unit was assumed to be \$0.063 per kWh, which is the average cost paid by the WWTP for electrical energy purchased from PGE. The wind power and demand components of electrical power purchases from PGE were not included in the avoided costs. The wind energy charge is an elective payment representing an above-market charge. The impact of a biomass-to-energy project on demand charges at the Gresham WWTP is unpredictable. With 95 percent availability for the generators, the WWTP will continue to pay a demand charge based on the 5 percent of the time that the plant is purchasing power from PGE.

A 395 kW cogeneration unit could produce slightly more power than the 3,014,000 kWh the plant currently purchases from PGE, but for this analysis the production was capped at the current electrical power usage at the facility. A 395 kW cogeneration unit could reduce electrical energy purchases from PGE by 3,014,000 per year at an avoided rate of \$0.063 per kWh, saving up to \$190,000 per year (2009 dollars). A 250 kW unit could reduce power purchases from PGE by up to \$138,000 per year (2009 dollars).

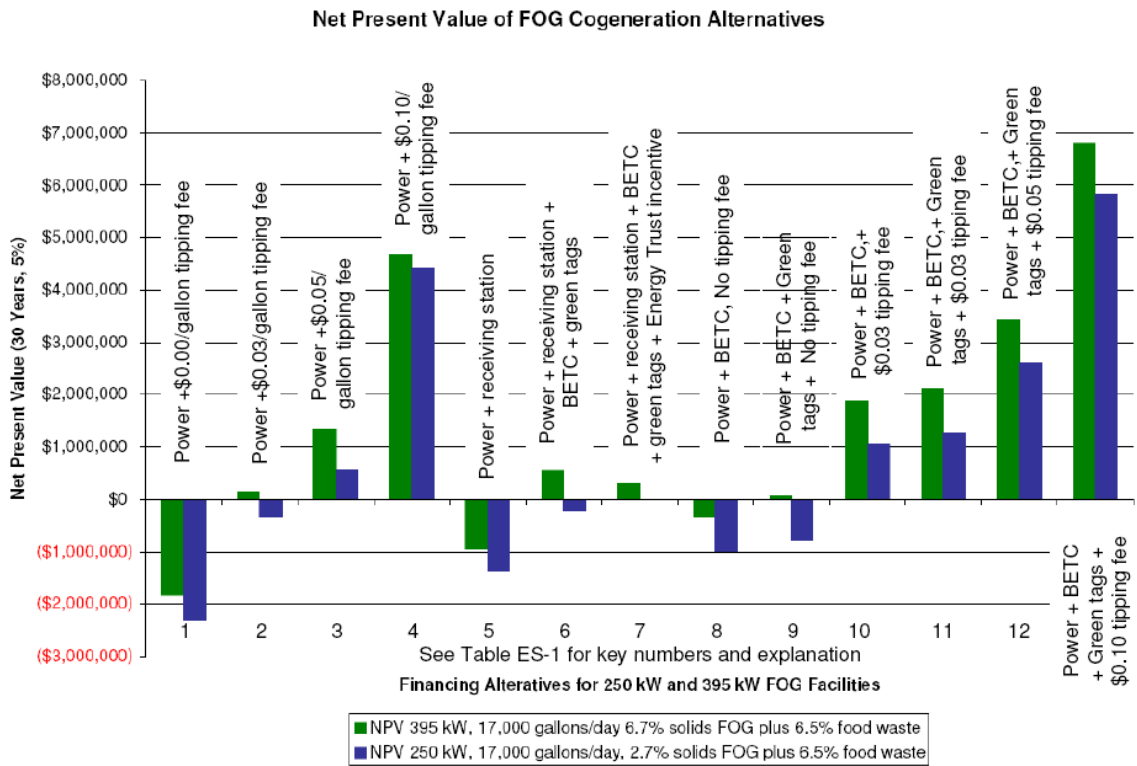


FIGURE 9-1
Comparison of Cost and Revenue Alternatives

TABLE 9-1

Estimated Net Present Values for Combinations of Avoided Power, Tipping Fees, BETC, Green Tag Sales, and Energy Trust Biomass-to-Energy Incentives

Key Number	Avoided Power Cost	Tipping Fee per Gallon	Contributed Fog Receiving Station	BETC	Green Tags	Energy Trust Incentive Payment	Net Present Value, 30 years @ 5%	
							17,000 Gallons/day 6.7% FOG Plus 6.5% Food Waste	17,000 Gallons/day 2.7% FOG Plus 6.5% Food Waste
Avoided Power Plus Tipping Fee Alternatives								
1	✓	\$0.00					\$1,824,000	(\$2,293,000)
2	✓	\$0.03					\$139,370	(\$330,000)
3	✓	\$0.05					\$1,498,294	\$576,000
4	✓	\$0.10					\$4,895,606	\$4,426,000
Avoided Power Plus Contributed Receiving Station Alternatives								
5	✓	\$0.00	✓				(\$946,000)	(\$1,368)
6	✓	\$0.00	✓	✓	✓		\$542,089	(\$216,000)
7	✓	\$0.00	✓	✓	✓	\$216,000	\$542,089	\$0
Avoided Power Plus BETC and Green Tag Alternatives								
8	✓	\$0.00		✓			(\$317,000)	(\$983,000)
9	✓	\$0.00		✓	✓		\$1,700	(\$783,000)
10	✓	\$0.03		✓			\$1,977,802	\$1,055,000
11	✓	\$0.03		✓	✓		\$2,297,000	\$1,255,000
12	✓	\$0.05		✓	✓		\$3,656,000	\$2,614,000
13	✓	\$0.10		✓	✓		\$6,796,000	\$5,812,000

Table 9-2 summarizes the financial analyses for a 395 kW cogeneration unit and FOG receiving station based on receiving 17,000 gallons of FOG and food waste per day at an average total solids concentration of 6.7 percent. Annual operating costs were estimated at \$60,000, with additional periodic maintenance costs of \$200,000 at 10 year intervals. Table 9-3 presents a year-by-year cash flow analysis for the project.

TABLE 9-2

Net Present Value—FOG Receiving Station and Cogeneration Unit

395 kW Cogeneration Unit and FOG Receiving Station, 17,000 gallons FOG and Food Waste/day, 6.7% solids

Item	Value
Estimated capital cost (2009 dollars, +50%, -30%)	(\$3,700,000)
Possible Business Energy Tax Credit	<u>\$1,573,000</u>
Net capital cost after BETC	(\$2,127,000)
Estimated power cost savings (based on avoiding purchase of 3,014,000 kWh annually at \$0.063/kWh)	\$190,000
Estimated annual tipping fees at \$0.03/gallon	\$133,000
Estimated annual sale of renewable energy credits	<u>\$20,800</u>
Net annual income	\$343,800
Estimated annual operating cost	(\$60,000)
Periodic maintenance at years 10, 20, and 30	(\$200,000)
Estimated annual principal and interest payment at 5% for 30 years	(\$120,400)
Estimated annual operating costs and principal and interest payments except years 10, 20, and 30	\$180,400
Simple payback period	7 years

TABLE 9-3
Gresham WWTP FOG Codigestion Cash Flow Analysis: BETC

Year	Expenditures					Avoided Costs, Income, and Tax Credits					Sum of Avoided Costs and Income	Net Income (Loss)	Present Value Factor	Present Value
	Capital Expenditure	Loan Receipt	Principal and Interest Payment	Annual operations and Maintenance Cost	Sum of Yearly Expenditures	Electrical Power Cost Avoided	BETC Tax Credit	Green Tags	Energy Trust Incentive Payment	Tipping Fee				
0	(\$3,700,000)	\$2,127,500		0	(\$1,572,500)	0	\$1,572,500.00		TBD	\$0.00	\$0.00	\$0	1	(\$2,127,500)
1	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.00		\$132,600.00	\$343,361.00	\$144,964	1	\$144,964
2	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
3	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
4	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
5	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
6	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
7	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
8	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
9	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
10	(\$200,000)		(\$138,396.93)	(\$60,000)	(\$398,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	(\$55,036)	1	(\$55,036)
11	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
12	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
13	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
14	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
15	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
16	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
17	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
18	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
19	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
20	(\$200,000)		(\$138,396.93)	(\$60,000)	(\$398,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	(\$55,036)	1	(\$55,036)
21	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
22	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
23	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
24	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
25	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
26	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
27	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
28	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
29	0		(\$138,396.93)	(\$60,000)	(\$198,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	\$144,964	1	\$144,964
30	(\$200,000)		(\$138,396.93)	(\$60,000)	(\$398,397)	\$190,000		\$20,761.20		\$132,600.00	\$343,361.20	(\$55,036)	1	(\$55,036)
Total														\$1,621,428

Assumptions:
Interest rate = 5%; tipping fee = \$0.03/gallon.
FOG/food waste quantity = 17,000 gpd; average total solids = 6.70%.
Cogeneration unit = 395 kW; power purchase avoided = 3,000,000 kWh/year.

Findings and Recommendations

10.1 Findings

From this evaluation it was determined that the Gresham WWTP could produce up to 395 kilowatts (kW) of additional electrical power and hot water containing 60 million British thermal units (Btu)/day of additional heat by constructing a FOG receiving and processing facility that feeds existing anaerobic digesters at the WWTP.

The financial viability of a FOG receiving station is affected by the portion of FOG in the Portland Metro area that can be captured, the volatile solids concentration of that FOG, unit sizes of electrical generation equipment, the amount of excess anaerobic digester capacity currently available to process FOG, the availability of tax credits to partially offset capital costs, and the tipping fee that FOG haulers are charged.

The existing digesters have sufficient hydraulic and volatile solids capacity to accept 17,000 gallons of additional waste per day. The existing digesters are currently loaded at approximately 50 percent of their capacity. The additions would be approximately 40 percent of the existing digester loading. Effective mixing is essential to assure dispersal of FOG throughout the digester.

The amount of methane generated by FOG will depend on its volatile solids content. The availability and strength of FOG are highly variable. During the sampling for this study, for example, 10 samples of FOG were collected and analyzed. The average volatile solids concentration of the ten samples was strongly affected by one sample, which raised the average from 2.7 percent to 6.7 percent.

10.2 Recommendations

Based on the favorable preliminary findings of this evaluation, it is recommended that City of Gresham continue to investigate the possibility of codigesting FOG and food waste in its existing digesters. Because the availability and strength of FOG and food waste are highly variable, Gresham should consider constructing a temporary FOG and food waste receiving facility to verify the availability, strength, and handling characteristics of the waste before committing to the construction of a permanent FOG receiving facility and cogeneration system.

Initially, to encourage FOG haulers to bring their waste to the WWTP, it may be advisable for the city to accept the waste without charging a tipping fee. Gresham should also investigate the possibility of forging agreements with FOG haulers to establish regular and reliable sources of FOG. In the future, after the program has gained some footing and its acceptance among food waste producers is better known, the city may wish to add a tipping fee that can be adjusted based on how it affects the supply of FOG to the WWTP.

If Gresham implements a FOG and food waste cogeneration program, it will be important to prevent unwanted material from being discharged to the FOG receiving system. Gresham should limit FOG deliveries to grease trap pumpage collected by haulers participating in the Preferred Pumper Program. In addition, a manifest indicating the source of the waste should be required for each load. The associated load tracking process could be automated using card keys and readers and data entry by the driver at the time a load is delivered.

10.3 Implementation

Implementation of the new cogeneration system should proceed in phases. The first phase should include additional market research, construction of a pilot FOG receiving station, monitoring of digester gas production, and continued discussions with the Oregon Department of Energy and Energy Trust. It would be desirable to have 6 months of operating data to verify FOG availability and characteristics.

The next phase would include finalizing the size of the FOG receiving station and cogeneration unit based on data obtained from operating the pilot facility, securing a business partner, and working with Energy Trust to determine the incentive payment based on above market costs.

The third phase would include design and construction of the permanent FOG receiving station and cogeneration unit.

APPENDIX A

Financial Analysis Spreadsheets

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, BETC, Green tags, No Tipping Fee
 Interest

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	(\$2,200,000)	0	(\$2,200,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$2,200,000)	1
1	0	(\$60,000)	(\$60,000)	\$130,000	\$220,000.00	\$13,000.00	\$0.00	\$0.00	\$363,000.00	\$303,000	0.952380952
2	0	(\$60,000)	(\$60,000)	\$130,000	\$220,000.00	\$13,000.00	\$0.00	\$0.00	\$363,000.00	\$303,000	0.907029478
3	0	(\$60,000)	(\$60,000)	\$130,000	\$220,000.00	\$13,000.00	\$0.00	\$0.00	\$363,000.00	\$303,000	0.863837599
4	0	(\$60,000)	(\$60,000)	\$130,000	\$220,000.00	\$13,000.00	\$0.00	\$0.00	\$363,000.00	\$303,000	0.822702475
5	0	(\$60,000)	(\$60,000)	\$130,000	\$220,000.00	\$13,000.00	\$0.00	\$0.00	\$363,000.00	\$303,000	0.783526166
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.746215397
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.71068133
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.676839362
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.644608916
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	(\$117,000)	0.613913254
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.584679289
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.556837418
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.530321351
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.505067953
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.481017098
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.458111522
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.436296688
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.415520655
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.395733957
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	(\$117,000)	0.376889483
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.358942365
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.341849871
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.325571306
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.31006791
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.295302772
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.281240735
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.267848319
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.255093637
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	\$83,000	0.242946321
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000.00	(\$117,000)	0.231377449

Net present value
 Interest rate 5%
 Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, BETC, No Tipping Fee
 Interest

rate 5% Tipping fee \$0.00 per gallon
 FOG/Food waste quantity 17,000 gpd Cogen unit 395 kW
 Average total solids 2.70% Power purchase avoided 2,000,000 kWh/year

Year	Expenditures			Income					Sum of avoided costs and income	Yearly income less expenditures	Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Grren tags	Energy Trust incentive payment	Tipping fee			
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	(\$3,200,000)	1
1	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$0.00	\$450,000.00	\$390,000	0.952380952
2	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$0.00	\$450,000.00	\$390,000	0.907029478
3	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$0.00	\$450,000.00	\$390,000	0.863837599
4	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$0.00	\$450,000.00	\$390,000	0.822702475
5	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$0.00	\$450,000.00	\$390,000	0.783526166
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.746215397
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.71068133
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.676839362
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.644608916
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	(\$130,000)	0.613913254
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.584679289
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.556837418
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.530321351
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.505067953
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.481017098
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.458111522
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.436296688
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.415520655
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.395733957
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	(\$130,000)	0.376889483
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.358942365
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.341849871
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.325571306
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.31006791
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.295302772
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.281240735
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.267848319
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.255093637
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.242946321
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	(\$130,000)	0.231377449

Net present value
 Interest rate 5% Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, BETC, \$0.10 Tipping Fee

Interest

rate 5%

FOG/Food waste quantity 17,000 gpd

Average total solids 2.70%

Tipping fee

Cogen unit

Power purchase avoided

\$0.10 per gallon

395 kW

2,000,000 kWh/year

Year	Expenditures			Income							Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green Tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$3,200,000)	1
1	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00		\$0.00	\$442,000.00	\$892,000.00	\$832,000	0.952380952
2	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00		\$0.00	\$442,000.00	\$892,000.00	\$832,000	0.907029478
3	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00		\$0.00	\$442,000.00	\$892,000.00	\$832,000	0.863837599
4	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00		\$0.00	\$442,000.00	\$892,000.00	\$832,000	0.822702475
5	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00		\$0.00	\$442,000.00	\$892,000.00	\$832,000	0.783526166
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.746215397
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.71068133
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.676839362
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.644608916
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$312,000	0.613913254
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.584679289
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.556837418
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.530321351
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.505067953
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.481017098
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.458111522
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.436296688
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.415520655
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.395733957
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$312,000	0.376889483
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.358942365
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.341849871
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.325571306
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.31006791
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.295302772
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.281240735
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.267848319
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.255093637
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.242946321
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00		\$0.00	\$442,000.00	\$572,000.00	\$312,000	0.231377449

Net present value
 Interest rate 5% Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, 0.10 Tipping Fee
 Interest

Year	Capital expenditure	Expenditures Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Income Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	(\$3,200,000)	1	(\$3,200,000)
1	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.952381	\$487,619
2	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.907029	\$464,399
3	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.863838	\$442,285
4	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.822702	\$421,224
5	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.783526	\$401,165
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.746215	\$382,062
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.710681	\$363,869
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.676839	\$346,542
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.644609	\$330,040
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$312,000	0.613913	\$191,541
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.584679	\$299,356
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.556837	\$285,101
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.530321	\$271,525
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.505068	\$258,595
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.481017	\$246,281
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.458112	\$234,553
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.436297	\$223,384
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.415521	\$212,747
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.395734	\$202,616
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$312,000	0.376889	\$117,590
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.358942	\$183,778
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.34185	\$175,027
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.325571	\$166,693
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.310068	\$158,755
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.295303	\$151,195
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.281241	\$143,995
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.267848	\$137,138
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.255094	\$130,608
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$512,000	0.242946	\$124,389
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$442,000.00	\$572,000.00	\$312,000	0.231377	<u>\$72,190</u>

Net present value \$4,426,259
 Interest rate 5%
 Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, BETC, Green tags, 0.05 Tipping Fee
 Interest

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$3,200,000)	1	(\$3,200,000)
1	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$221,000.00	\$684,000.00	\$624,000	0.952380952	\$594,286
2	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$221,000.00	\$684,000.00	\$624,000	0.907029478	\$565,986
3	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$221,000.00	\$684,000.00	\$624,000	0.863837599	\$539,035
4	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$221,000.00	\$684,000.00	\$624,000	0.822702475	\$513,366
5	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$221,000.00	\$684,000.00	\$624,000	0.783526166	\$488,920
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.746215397	\$226,849
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.71068133	\$216,047
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.676839362	\$205,759
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.644608916	\$195,961
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$104,000	0.613913254	\$63,847
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.584679289	\$177,743
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.556837418	\$169,279
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.530321351	\$161,218
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.505067953	\$153,541
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.481017098	\$146,229
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.458111522	\$139,266
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.436296688	\$132,634
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.415520655	\$126,318
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.395733957	\$120,303
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$104,000	0.376889483	\$39,197
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.358942365	\$109,118
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.341849871	\$103,922
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.325571306	\$98,974
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.31006791	\$94,261
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.295302772	\$89,772
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.281240735	\$85,497
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.267848319	\$81,426
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.255093637	\$77,548
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$304,000	0.242946321	\$73,856
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$221,000.00	\$364,000.00	\$104,000	0.231377449	<u>\$24,063</u>
										Net present value	\$2,614,222	
										Interest rate	5%	
										Years	30	

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, BETC, Green tags, 0.03 Tipping Fee
 Interest rate 5%

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$3,200,000)	1	(\$3,200,000)
1	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$132,600.00	\$595,600.00	\$535,600	0.952380952	\$510,095
2	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$132,600.00	\$595,600.00	\$535,600	0.907029478	\$485,805
3	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$132,600.00	\$595,600.00	\$535,600	0.863837599	\$462,671
4	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$132,600.00	\$595,600.00	\$535,600	0.822702475	\$440,639
5	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$132,600.00	\$595,600.00	\$535,600	0.783526166	\$419,657
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.746215397	\$160,884
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.71068133	\$153,223
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.676839362	\$145,927
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.644608916	\$138,978
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$15,600	0.613913254	\$9,577
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.584679289	\$126,057
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.556837418	\$120,054
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.530321351	\$114,337
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.505067953	\$108,893
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.481017098	\$103,707
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.458111522	\$98,769
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.436296688	\$94,066
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.415520655	\$89,586
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.395733957	\$85,320
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$15,600	0.376889483	\$5,879
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.358942365	\$77,388
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.341849871	\$73,703
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.325571306	\$70,193
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.31006791	\$66,851
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.295302772	\$63,667
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.281240735	\$60,636
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.267848319	\$57,748
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.255093637	\$54,998
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$215,600	0.242946321	\$52,379
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$132,600.00	\$275,600.00	\$15,600	0.231377449	\$3,609
Net present value											\$1,255,297	
Interest rate											5%	
Years											30	

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, BETC, Green tags, 0.05 Tipping Fee
 Interest rate 5%

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$3,200,000)	1	(\$3,200,000)
1	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.00	\$0.00	\$221,000.00	\$751,761.00	\$691,761	0.952380952	\$658,820
2	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.20	\$0.00	\$221,000.00	\$751,761.20	\$691,761	0.907029478	\$627,448
3	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.20	\$0.00	\$221,000.00	\$751,761.20	\$691,761	0.863837599	\$597,569
4	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.20	\$0.00	\$221,000.00	\$751,761.20	\$691,761	0.822702475	\$569,114
5	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.20	\$0.00	\$221,000.00	\$751,761.20	\$691,761	0.783526166	\$542,013
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.746215397	\$277,414
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.71068133	\$264,204
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.676839362	\$251,623
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.644608916	\$239,641
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$171,761	0.613913254	\$105,446
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.584679289	\$217,361
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.556837418	\$207,011
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.530321351	\$197,153
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.505067953	\$187,765
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.481017098	\$178,823
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.458111522	\$170,308
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.436296688	\$162,198
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.415520655	\$154,474
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.395733957	\$147,119
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$171,761	0.376889483	\$64,735
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.358942365	\$133,441
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.341849871	\$127,087
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.325571306	\$121,035
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.31006791	\$115,271
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.295302772	\$109,782
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.281240735	\$104,554
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.267848319	\$99,576
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.255093637	\$94,834
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$371,761	0.242946321	\$90,318
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$221,000.00	\$431,761.20	\$171,761	0.231377449	<u>\$39,742</u>

Net present value
 Interest rate 5% Years 30
 \$3,655,877

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, BETC, Green tags, 0.03 Tipping Fee
 Interest

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$3,200,000)	1	(\$3,200,000)
1	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.00	\$0.00	\$132,600.00	\$663,361.00	\$603,361	0.952380952	\$574,630
2	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.20	\$0.00	\$132,600.00	\$663,361.20	\$603,361	0.907029478	\$547,266
3	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.20	\$0.00	\$132,600.00	\$663,361.20	\$603,361	0.863837599	\$521,206
4	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.20	\$0.00	\$132,600.00	\$663,361.20	\$603,361	0.822702475	\$496,387
5	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$20,761.20	\$0.00	\$132,600.00	\$663,361.20	\$603,361	0.783526166	\$472,749
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.746215397	\$211,448
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.71068133	\$201,380
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.676839362	\$191,790
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.644608916	\$182,657
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$83,361	0.613913254	\$51,177
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.584679289	\$165,675
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.556837418	\$157,786
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.530321351	\$150,272
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.505067953	\$143,117
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.481017098	\$136,302
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.458111522	\$129,811
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.436296688	\$123,630
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.415520655	\$117,742
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.395733957	\$112,136
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$83,361	0.376889483	\$31,418
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.358942365	\$101,710
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.341849871	\$96,867
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.325571306	\$92,254
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.31006791	\$87,861
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.295302772	\$83,677
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.281240735	\$79,693
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.267848319	\$75,898
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.255093637	\$72,284
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$283,361	0.242946321	\$68,842
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$132,600.00	\$343,361.20	\$83,361	0.231377449	\$19,288

Net present value \$2,296,952
 Interest rate 5%
 Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, BETC, 0.03 Tipping Fee
 Interest rate 5%

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$3,200,000)	1	(\$3,200,000)
1	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$642,600.00	\$582,600	0.95238095	\$554,857
2	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$642,600.00	\$582,600	0.90702948	\$528,435
3	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$642,600.00	\$582,600	0.8638376	\$503,272
4	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$642,600.00	\$582,600	0.82270247	\$479,306
5	0	(\$60,000)	(\$60,000)	\$190,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$642,600.00	\$582,600	0.78352617	\$456,482
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.7462154	\$195,956
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.71068133	\$186,625
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.67683936	\$177,738
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.64460892	\$169,274
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$62,600	0.61391325	\$38,431
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.58467929	\$153,537
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.55683742	\$146,226
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.53032135	\$139,262
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.50506795	\$132,631
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.4810171	\$126,315
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.45811152	\$120,300
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.43629669	\$114,572
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.41552065	\$109,116
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.39573396	\$103,920
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$62,600	0.37688948	\$23,593
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.35894236	\$94,258
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.34184987	\$89,770
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.32557131	\$85,495
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.31006791	\$81,424
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.29530277	\$77,547
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.28124073	\$73,854
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.26784832	\$70,337
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.25509364	\$66,988
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.24294632	\$63,798
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$62,600	0.23137745	\$14,484
Net present value											\$1,977,802	
Interest rate											5%	
Years											30	

395 kW
 3460200 kWh/year
 3460.2 mWh/year
 \$6 per mWh
 \$20,761.20

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, BETC, 0.03 Tipping Fee
 Interest

rate 5% Tipping fee \$0.03 per gallon
 FOG/Food waste quantity 17,000 gpd Cogen unit 395 kW
 Average total solids 2.70% Power purchase avoided 2,000,000 kWh/year

Year	Expenditures			Income			Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags						
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$3,200,000)	1	(\$3,200,000)
1	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$582,600.00	\$522,600	0.952380952	\$497,714
2	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$582,600.00	\$522,600	0.907029478	\$474,014
3	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$582,600.00	\$522,600	0.863837599	\$451,442
4	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$582,600.00	\$522,600	0.822702475	\$429,944
5	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$0.00	\$0.00	\$132,600.00	\$582,600.00	\$522,600	0.783526166	\$409,471
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.746215397	\$151,183
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.71068133	\$143,984
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.676839362	\$137,128
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.644608916	\$130,598
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$2,600	0.613913254	\$1,596
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.584679289	\$118,456
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.556837418	\$112,815
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.530321351	\$107,443
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.505067953	\$102,327
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.481017098	\$97,454
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.458111522	\$92,813
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.436296688	\$88,394
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.415520655	\$84,184
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.395733957	\$80,176
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$2,600	0.376889483	\$980
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.358942365	\$72,722
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.341849871	\$69,259
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.325571306	\$65,961
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.31006791	\$62,820
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.295302772	\$59,828
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.281240735	\$56,979
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.267848319	\$54,266
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.255093637	\$51,682
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.242946321	\$49,221
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$2,600	0.231377449	\$602

250 kw
 2190000 kwh/year
 2190 mWh/year
 \$6 per mWh
 \$13,140 per year

Net present value \$1,055,455
 Interest rate 5%
 Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, 0.03 Tipping Fee
 Interest rate 5%

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	(\$3,200,000)	1
1	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.95238095
2	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.90702948
3	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.8638376
4	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.82270247
5	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.78352617
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.7462154
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.71068133
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.67683936
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.64460892
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$2,600	0.61391325
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.58467929
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.55683742
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.53032135
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.50506795
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.4810171
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.45811152
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.43629669
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.41552065
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.39573396
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$2,600	0.37688948
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.35894236
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.34184987
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.32557131
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.31006791
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.29530277
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.28124073
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.26784832
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.25509364
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$202,600	0.24294632
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$262,600.00	\$2,600	0.23137745

Net present value
 Interest rate 5%
 Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, No Tipping Fee, Contributed FOG Receiving Station

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	(\$2,200,000)	0	(\$2,200,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	(\$2,200,000)	1
1	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.952380952
2	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.907029478
3	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.863837599
4	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.822702475
5	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.783526166
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.746215397
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.71068133
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.676839362
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.644608916
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	(\$130,000)	0.613913254
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.584679289
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.556837418
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.530321351
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.505067953
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.481017098
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.458111522
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.436296688
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.415520655
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.395733957
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	(\$130,000)	0.376889483
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.358942365
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.341849871
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.325571306
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.31006791
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.295302772
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.281240735
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.267848319
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.255093637
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$70,000	0.242946321
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	(\$130,000)	0.231377449

Net present value
 Interest rate 5%
 Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, No Tipping Fee
 Interest

rate 5% Tipping fee \$0.00 per gallon
 FOG/Food waste 17,000 gpd Cogen unit 395 kW
 Average total solids 2.70% Power purchase avoided 3,014,000 kWh/year \$0.06 Avoided cost per kWh

Year	Expenditures			Income					Sum of avoided costs and income	Yearly income less expenditures	Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee			
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$3,200,000)	1
1	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.952380952
2	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.907029478
3	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.863837599
4	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.822702475
5	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.783526166
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.746215397
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.71068133
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.676839362
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.644608916
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	(\$130,000)	0.613913254
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.584679289
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.556837418
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.530321351
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.505067953
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.481017098
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.458111522
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.436296688
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.415520655
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.395733957
20	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.376889483
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.358942365
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.341849871
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.325571306
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.31006791
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.295302772
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.281240735
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.267848319
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.255093637
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	\$70,000	0.242946321
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00		\$0.00	\$0.00	\$130,000.00	(\$130,000)	0.231377449

Net present value
 Interest rate 5% Years 30

Gresham WWTP

FOG Codigestion Financial Feasibility Analysis

High Strength FOG, Avoided Power Cost, No Tipping Fee

Interest rate 5%

FOG/Food waste quantity 17,000 gpd

Average total solids 6.70%

Tipping fee

\$0.00 per gallon

Cogen unit

395 kW

Power purchase avoided

3,014,000 kWh/year

\$0.06 Avoided cost per kWh

Year	Expenditures			Income				Sum of	Yearly income	Present value	Yearly net
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee			
0	(\$3,653,000)	0	(\$3,653,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	(\$3,653,000)	1
1	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.952380952
2	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.907029478
3	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.863837599
4	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.822702475
5	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.783526166
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.746215397
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.71068133
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.676839362
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.644608916
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	(\$70,000)	0.613913254
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.584679289
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.556837418
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.530321351
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.505067953
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.481017098
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.458111522
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.436296688
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.415520655
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.395733957
20	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.376889483
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.358942365
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.341849871
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.325571306
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.31006791
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.295302772
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.281240735
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.267848319
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.255093637
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.242946321
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$0.00	\$190,000.00	(\$70,000)	0.231377449

Net present value

Interest rate Years

5%

30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, BETC, Green Tags, No Tipping Fee
 Interest

rate 5% Tipping fee \$0.00 per gallon
 FOG/Food waste quantity 17,000 gpd Cogen unit 395 kW
 Average total solids 2.70% Power purchase avoided 3,014,000 kWh/year

Year	Expenditures			Income			Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags						
0	(\$3,200,000)	0	(\$3,200,000)	0	\$0.00		\$0.00	\$0.00	\$0	(\$3,200,000)	1	(\$3,200,000)
1	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$0.00	\$463,000	\$403,000	0.952381	\$383,810
2	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$0.00	\$463,000	\$403,000	0.907029	\$365,533
3	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$0.00	\$463,000	\$403,000	0.863838	\$348,127
4	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$0.00	\$463,000	\$403,000	0.822702	\$331,549
5	0	(\$60,000)	(\$60,000)	\$130,000	\$320,000.00	\$13,000.00	\$0.00	\$0.00	\$463,000	\$403,000	0.783526	\$315,761
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.746215	\$61,936
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.710681	\$58,987
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.676839	\$56,178
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.644609	\$53,503
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	(\$117,000)	0.613913	(\$71,828)
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.584679	\$48,528
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.556837	\$46,218
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.530321	\$44,017
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.505068	\$41,921
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.481017	\$39,924
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.458112	\$38,023
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.436297	\$36,213
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.415521	\$34,488
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.395734	\$32,846
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	(\$117,000)	0.376889	(\$44,096)
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.358942	\$29,792
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.34185	\$28,374
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.325571	\$27,022
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.310068	\$25,736
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.295303	\$24,510
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.281241	\$23,343
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.267848	\$22,231
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.255094	\$21,173
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	\$83,000	0.242946	\$20,165
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$13,000.00	\$0.00	\$0.00	\$143,000	(\$117,000)	0.231377	(\$27,071)
Net present value												(\$783,090)
Interest rate											5%	Years
												30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, BETC, Green Tags, No Tipping Fee
 Interest

Year	Capital expenditure	Expenditures Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Income Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	(\$3,653,000)	0	(\$3,653,000)	0	\$0.00		\$0.00	\$0.00	\$0	(\$3,653,000)	1	(\$3,653,000)
1	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.20	\$0.00	\$0.00	\$576,061	\$516,061	0.952381	\$491,487
2	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.20	\$0.00	\$0.00	\$576,061	\$516,061	0.907029	\$468,083
3	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.20	\$0.00	\$0.00	\$576,061	\$516,061	0.863838	\$445,793
4	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.20	\$0.00	\$0.00	\$576,061	\$516,061	0.822702	\$424,565
5	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.20	\$0.00	\$0.00	\$576,061	\$516,061	0.783526	\$404,347
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.746215	\$112,500
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.710681	\$107,143
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.676839	\$102,041
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.644609	\$97,182
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	(\$49,239)	0.613913	(\$30,228)
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.584679	\$88,147
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.556837	\$83,949
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.530321	\$79,952
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.505068	\$76,145
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.481017	\$72,519
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.458112	\$69,065
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.436297	\$65,777
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.415521	\$62,644
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.395734	\$59,661
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	(\$49,239)	0.376889	(\$18,558)
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.358942	\$54,115
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.34185	\$51,538
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.325571	\$49,084
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.310068	\$46,746
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.295303	\$44,520
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.281241	\$42,400
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.267848	\$40,381
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.255094	\$38,458
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	\$150,761	0.242946	\$36,627
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.20	\$0.00	\$0.00	\$210,761	(\$49,239)	0.231377	(\$11,393)
										Net present value	\$1,691	
										Interest rate	5%	
										Years	30	

395

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, BETC, No Tipping Fee
 Interest

rate 5% Tipping fee \$0.00 per gallon
 FOG/Food waste quantity 17,000 gpd Cogen unit 395 kW
 Average total solids 6.70% Power purchase avoided 3,014,000 kWh/year

Year	Expenditures			Income			Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags				
0	(\$3,653,000)	0	(\$3,653,000)	0	\$0.00		\$0.00	\$0	(\$3,653,000)	1
1	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$0.00	\$0.00	\$555,300	\$495,300	0.952380952
2	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$0.00	\$0.00	\$555,300	\$495,300	0.907029478
3	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$0.00	\$0.00	\$555,300	\$495,300	0.863837599
4	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$0.00	\$0.00	\$555,300	\$495,300	0.822702475
5	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$0.00	\$0.00	\$555,300	\$495,300	0.783526166
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.746215397
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.71068133
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.676839362
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.644608916
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	(\$70,000)	0.613913254
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.584679289
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.556837418
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.530321351
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.505067953
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.481017098
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.458111522
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.436296688
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.415520655
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.395733957
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	(\$70,000)	0.376889483
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.358942365
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.341849871
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.325571306
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.31006791
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.295302772
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.281240735
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.267848319
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.255093637
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	\$130,000	0.242946321
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000	(\$70,000)	0.231377449

Net present value
 Interest rate 5% Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, BETC, Green Tags, No Tipping Fee

Year	Expenditures			Income				Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment				
0	(\$2,700,000)	0	(\$2,700,000)	0	\$0.00		\$0.00	\$0.00	\$0	(\$2,700,000)	1
1	0	(\$60,000)	(\$60,000)	\$190,000	\$270,000.00	\$20,761.00	\$0.00	\$0.00	\$480,761	\$420,761	0.952380952
2	0	(\$60,000)	(\$60,000)	\$190,000	\$270,000.00	\$20,761.00	\$0.00	\$0.00	\$480,761	\$420,761	0.907029478
3	0	(\$60,000)	(\$60,000)	\$190,000	\$270,000.00	\$20,761.00	\$0.00	\$0.00	\$480,761	\$420,761	0.863837599
4	0	(\$60,000)	(\$60,000)	\$190,000	\$270,000.00	\$20,761.00	\$0.00	\$0.00	\$480,761	\$420,761	0.822702475
5	0	(\$60,000)	(\$60,000)	\$190,000	\$270,000.00	\$20,761.00	\$0.00	\$0.00	\$480,761	\$420,761	0.783526166
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.746215397
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.71068133
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.676839362
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.644608916
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	(\$49,239)	0.613913254
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.584679289
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.556837418
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.530321351
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.505067953
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.481017098
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.458111522
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.436296688
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.415520655
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.395733957
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	(\$49,239)	0.376889483
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.358942365
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.341849871
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.325571306
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.31006791
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.295302772
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.281240735
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.267848319
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.255093637
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	\$150,761	0.242946321
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$0.00	\$210,761	(\$49,239)	0.231377449

Net present value
 Interest rate 5% Years 30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis

Interest rate		5%		Tipping fee		\$0.00 per gallon		FOG/Food waste quantity		17,000 gpd		Cogen unit		\$0.00 per gallon	
Average total solids		6.70%		Power purchase avoided		3,014,000 kWh/year		Average total solids		6.70%		Power purchase avoided		3,014,000 kWh/year	
Year	Expenditures			Income			Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor				
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Energy Trust incentive payment									
0	(\$2,700,000)	0	(\$2,700,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	(\$2,700,000)	1	(\$2,700,000)				
1	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.952381	\$123,810				
2	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.907029	\$117,914				
3	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.863838	\$112,299				
4	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.822702	\$106,951				
5	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.783526	\$101,858				
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.746215	\$97,008				
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.710681	\$92,389				
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.676839	\$87,989				
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.644609	\$83,799				
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	(\$70,000)	0.613913	(\$42,974)				
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.584679	\$76,008				
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.556837	\$72,389				
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.530321	\$68,942				
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.505068	\$65,659				
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.481017	\$62,532				
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.458112	\$59,554				
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.436297	\$56,719				
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.415521	\$54,018				
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.395734	\$51,445				
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	(\$70,000)	0.376889	(\$26,382)				
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.358942	\$46,663				
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.34185	\$44,440				
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.325571	\$42,324				
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.310068	\$40,309				
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.295303	\$38,389				
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.281241	\$36,561				
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.267848	\$34,820				
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.255094	\$33,162				
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	\$130,000	0.242946	\$31,583				
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$190,000.00	(\$70,000)	0.231377	(\$16,196)				
Net present value											(\$946,017)				
Interest rate										5%	Years				
											30				

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 Low Strength FOG, Avoided Power Cost, \$0.05 Tipping Fee

Interest rate 5%
 FOG/Food waste quantity 17,000 gpd (5-day week)
 Average total solids 2.70%
 Tipping fee \$0.0500 per gallon
 Cogen unit 395 kW
 Power purchase avoided 3,014,000 kWh/year

Year	Expenditures			Income				Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Sale of green tags	Energy Trust incentive payment					
0	(\$3,653,000)	0	(\$3,653,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	(\$3,653,000)	1	(\$3,653,000)
1	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.952380952	\$277,143
2	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.907029478	\$263,946
3	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.863837599	\$251,377
4	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.822702475	\$239,406
5	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.783526166	\$228,006
6	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.746215397	\$217,149
7	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.71068133	\$206,808
8	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.676839362	\$196,960
9	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.644608916	\$187,581
10	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$91,000	0.613913254	\$55,866
11	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.584679289	\$170,142
12	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.556837418	\$162,040
13	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.530321351	\$154,324
14	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.505067953	\$146,975
15	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.481017098	\$139,976
16	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.458111522	\$133,310
17	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.436296688	\$126,962
18	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.415520655	\$120,917
19	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.395733957	\$115,159
20	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$91,000	0.376889483	\$34,297
21	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.358942365	\$104,452
22	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.341849871	\$99,478
23	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.325571306	\$94,741
24	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.31006791	\$90,230
25	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.295302772	\$85,933
26	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.281240735	\$81,841
27	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.267848319	\$77,944
28	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.255093637	\$74,232
29	0	(\$60,000)	(\$60,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$291,000	0.242946321	\$70,697
30	(\$200,000)	(\$60,000)	(\$260,000)	\$130,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$351,000.00	\$91,000	0.231377449	<u>\$21,055</u>

Net present value \$575,947

Interest rate 5% Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, \$0.05 Tipping Fee

Interest rate 5% Tipping fee \$0.0500 per gallon
 FOG/Food waste quantity 17,000 gpd (5-day week) Cogen unit 395 kW
 Average total solids 6.70% Power purchase avoided 3,014,000 kWh/year

Year	Expenditures			Income							Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Sale of green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income				
0	(\$3,653,000)	0	(\$3,653,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	(\$3,653,000)	1	(\$3,653,000)	
1	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.952380952	\$334,286	
2	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.907029478	\$318,367	
3	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.863837599	\$303,207	
4	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.822702475	\$288,769	
5	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.783526166	\$275,018	
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.746215397	\$261,922	
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.71068133	\$249,449	
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.676839362	\$237,571	
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.644608916	\$226,258	
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$151,000	0.613913254	\$92,701	
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.584679289	\$205,222	
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.556837418	\$195,450	
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.530321351	\$186,143	
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.505067953	\$177,279	
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.481017098	\$168,837	
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.458111522	\$160,797	
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.436296688	\$153,140	
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.415520655	\$145,848	
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.395733957	\$138,903	
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$151,000	0.376889483	\$56,910	
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.358942365	\$125,989	
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.341849871	\$119,989	
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.325571306	\$114,276	
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.31006791	\$108,834	
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.295302772	\$103,651	
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.281240735	\$98,715	
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.267848319	\$94,015	
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.255093637	\$89,538	
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$351,000	0.242946321	\$85,274	
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$221,000.00	\$411,000.00	\$151,000	0.231377449	<u>\$34,938</u>	

Net present value \$1,498,294
 Interest rate 5%
 Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, \$0.03 Tipping Fee
 Interest rate 5%

gpd (5-day 17,000 week)
 Tipping fee \$0.0300 per gallon
 Cogen unit 395 kW
 Average total solids 6.70%
 Power purchase avoided 3,014,000 kWh/year

Year	Expenditures			Income							Yearly income less expenditures	Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income			
0	(\$3,653,000)	0	(\$3,653,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	(\$3,653,000)	1	
1	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.952380952	
2	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.907029478	
3	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.863837599	
4	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.822702475	
5	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.783526166	
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.746215397	
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.71068133	
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.676839362	
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.644608916	
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$62,600	0.613913254	
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.584679289	
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.556837418	
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.530321351	
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.505067953	
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.481017098	
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.458111522	
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.436296688	
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.415520655	
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.395733957	
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$62,600	0.376889483	
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.358942365	
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.341849871	
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.325571306	
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.31006791	
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.295302772	
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.281240735	
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.267848319	
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.255093637	
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$262,600	0.242946321	
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$132,600.00	\$322,600.00	\$62,600	0.231377449	

Net present value
 Interest rate 5%
 Years 30

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, BETC, Green Tags, \$0.10 Tipping Fee
 Interest rate 5%

gpd (5-day 17,000 week)
 Tipping fee \$0.10 per gallon
 Cogen unit 395 kW
 Average total solids 6.70% Power purchase avoided 3,014,000 kWh/year

Year	Expenditures			Income							Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income				
0	(\$3,653,000)	0	(\$3,653,000)	0	\$0.00		\$0.00	\$0.00	\$0.00	(\$3,653,000)	1	(\$3,653,000)	
1	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.00	\$0.00	\$442,000.00	\$1,018,061.00	\$958,061	0.95238095	\$912,439	
2	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.00	\$0.00	\$442,000.00	\$1,018,061.00	\$958,061	0.90702948	\$868,990	
3	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.00	\$0.00	\$442,000.00	\$1,018,061.00	\$958,061	0.8638376	\$827,609	
4	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.00	\$0.00	\$442,000.00	\$1,018,061.00	\$958,061	0.82270247	\$788,199	
5	0	(\$60,000)	(\$60,000)	\$190,000	\$365,300.00	\$20,761.00	\$0.00	\$442,000.00	\$1,018,061.00	\$958,061	0.78352617	\$750,666	
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.7462154	\$442,327	
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.71068133	\$421,264	
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.67683936	\$401,204	
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.64460892	\$382,099	
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$392,761	0.61391325	\$241,121	
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.58467929	\$346,575	
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.55683742	\$330,072	
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.53032135	\$314,354	
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.50506795	\$299,385	
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.4810171	\$285,128	
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.45811152	\$271,551	
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.43629669	\$258,620	
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.41552065	\$246,304	
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.39573396	\$234,576	
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$392,761	0.37688948	\$148,027	
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.35894236	\$212,767	
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.34184987	\$202,635	
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.32557131	\$192,986	
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.31006791	\$183,796	
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.29530277	\$175,044	
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.28124073	\$166,709	
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.26784832	\$158,770	
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.25509364	\$151,210	
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$592,761	0.24294632	\$144,009	
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$20,761.00	\$0.00	\$442,000.00	\$652,761.00	\$392,761	0.23137745	\$90,876	
										Net present value	\$6,796,311		
										Interest rate	5%		
										Years	30		

Gresham WWTP
 FOG Codigestion Financial Feasibility Analysis
 High Strength FOG, Avoided Power Cost, \$0.10 Tipping Fee

Interest rate	5%	Tipping fee	\$0.10 per gallon
FOG/Food waste quantity	17,000 gpd (5-day week)	Cogen unit	395 kW
Average total solids	6.70%	Power purchase avoided	3,014,000 kWh/year

Expenditures

Income

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	(\$3,653,000)	0	(\$3,653,000)	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	(\$3,653,000)	1	(\$3,653,000)
1	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.952380952	\$544,762
2	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.907029478	\$518,821
3	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.863837599	\$494,115
4	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.822702475	\$470,586
5	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.783526166	\$448,177
6	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.746215397	\$426,835
7	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.71068133	\$406,510
8	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.676839362	\$387,152
9	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.644608916	\$368,716
10	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$372,000	0.613913254	\$228,376
11	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.584679289	\$334,437
12	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.556837418	\$318,511
13	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.530321351	\$303,344
14	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.505067953	\$288,899
15	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.481017098	\$275,142
16	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.458111522	\$262,040
17	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.436296688	\$249,562
18	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.415520655	\$237,678
19	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.395733957	\$226,360
20	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$372,000	0.376889483	\$140,203
21	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.358942365	\$205,315
22	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.341849871	\$195,538
23	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.325571306	\$186,227
24	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.31006791	\$177,359
25	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.295302772	\$168,913
26	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.281240735	\$160,870
27	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.267848319	\$153,209
28	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.255093637	\$145,914
29	0	(\$60,000)	(\$60,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$572,000	0.242946321	\$138,965
30	(\$200,000)	(\$60,000)	(\$260,000)	\$190,000	\$0.00	\$0.00	\$0.00	\$442,000.00	\$632,000.00	\$372,000	0.231377449	\$86,072

Net present value \$4,895,606
 Interest rate 5%
 Years 30