SFPUC SFGreasecycle Program Summary Report

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List of Abbreviations

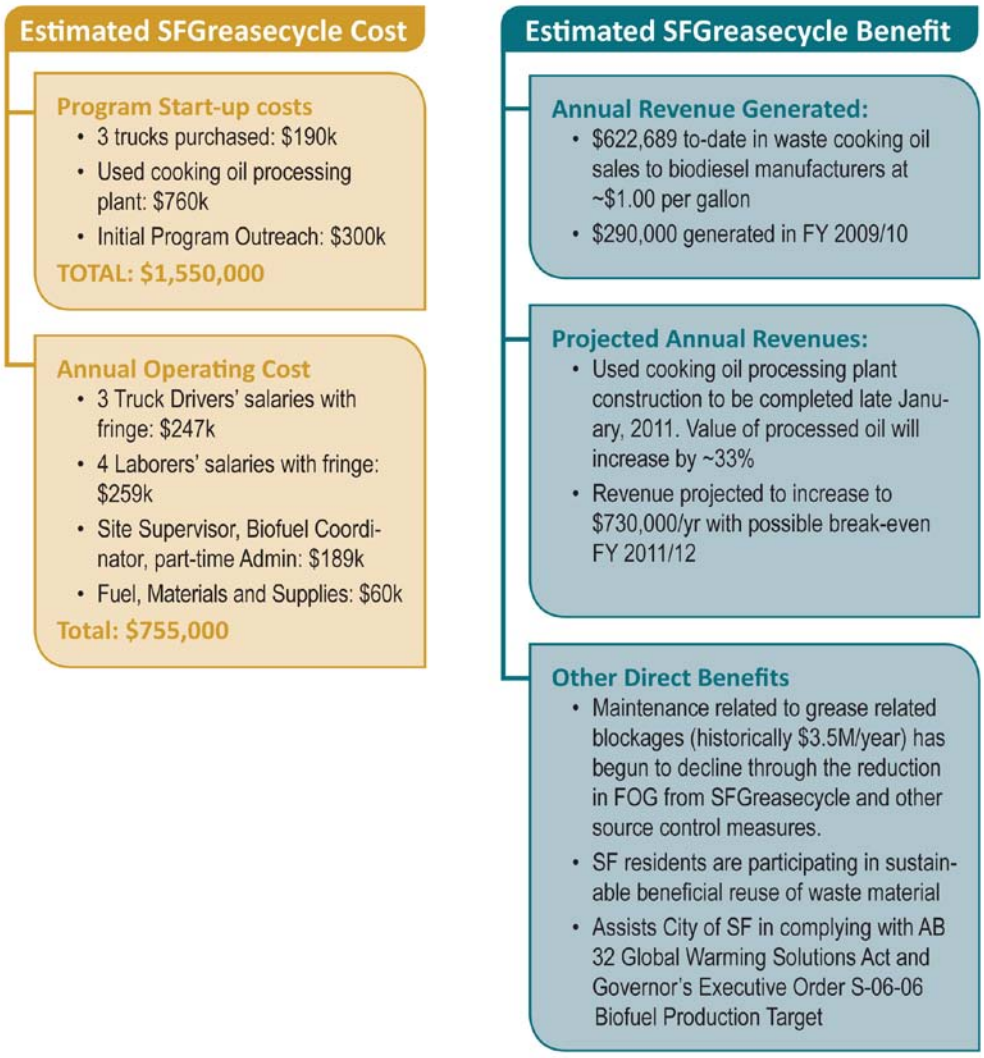
FOG	Fats, oils and grease
FSE	Food service establishment
SFPUC	San Francisco Public Utilities Commission
WWTP	Waste Water Treatment Plant
SSO	Sanitary sewer overflow
CCO	Combined sewer overflow
BMP	Best management practices
VOC	Volatile organic compound
RWQCB	Regional Water Quality Control Board
SSMP	Sanitary sewer management plans
EPA	Environmental Protection Agency
WPCP	Water Pollution Control Plant
CEC	California Energy Commission

Chapter 1 Introduction

The purpose of this report is to present a practical summary and snap shot of the results of the San Francisco Public Utilities Commission (SFPUC) SFGreasecycle Program. As its name implies, SFGreasecycle is a program that involves the collection and processing of waste grease and cooking oil in San Francisco, California. The goal of the SFGreasecycle Program is to minimize the amount of fats, oils, and grease (FOG) discharged to the sewer system, while also providing a valuable resource, which can be marketed to offset some of the program costs. Currently, the SFGreasecycle program collects 300,000 gallons of waste grease from more than 1,000 food serve establishments (FSE) and 3,700 gallons of waste grease from residents each year. More specifically, the SFGreasecycle program has:

- Achieved the primary goal of reducing the amount of FOG discharged to the sewer system.
- Demonstrated that the impacts of enacting a FOG control ordinance can be minimized or offset by providing a FOG collection and drop-off program for FSE's and residents, including a focus public outreach effort.
- Demonstrated that a waste grease collection and recycling program can be cost effective (expected to be cost neutral by 2012) and provide a net benefit (See **Figure 1-1**).

Figure 1-1: SFGreasecycle Estimated Cost Benefit Summary

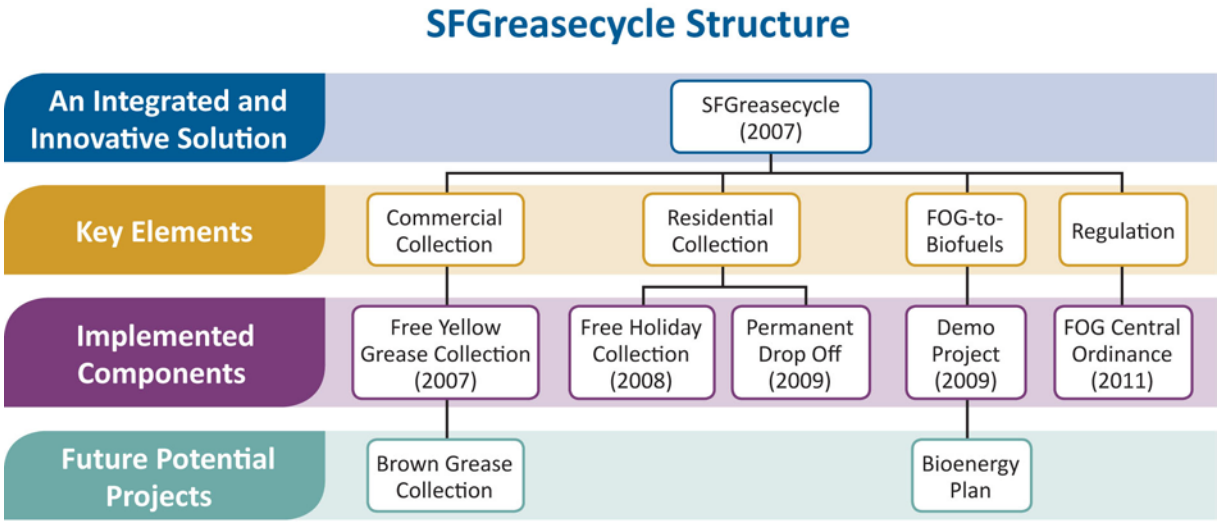


Strategies to address institutional issues and implementation challenges are provided in this summary. Lesson learned during the development of the SFGreasecycle Program are also included so that they may be used by other agencies that are considering implementing a similar program.

Chapter 2 SFGreasecycle Program

The SFGreasecycle program was developed to address both source control, through collection services and public outreach, and end use, through the production of biofuels from waste grease throughout the City of San Francisco. The SFGreasecycle program is comprised of four major program elements that include: a FOG control ordinance, free pickup of waste grease from commercial establishments, free drop-off services of waste grease for residents, and a technology demonstration project to convert FOG to biodiesel at one of the City's Water Pollution Control Plants (WPCP). Currently, waste grease collected is sold to local biodiesel manufacturers for the production of biodiesel. The SFGreasecycle program has evolved since it was enacted in 2007; **Figure 2-1** shows the structure of the major components that make up the program.

Figure 2-1: SFGreasecycle Structure and Timeline



2.1 Issues Addressed by the Program

The discharge of FOG into the sanitary sewer system can result in significant cost and environmental impacts due to increased sewer cleaning and blockages leading to overflows. The practice disposing of waste grease into the sewer system is relatively common for both residents and FSEs who lack the appropriate information regarding the impacts of FOG and the availability of cost effective disposal alternatives. Municipalities often address the issue of FOG through enforcement and inspection efforts leaving many FSEs choosing between non-compliance penalties, high cost disposal options or the simplest and most inexpensive methods that involve illegally disposing of grease in the trash. Waste grease can also be converted into biofuels that provide a cleaner burning alternative to fossil fuels; however, by discharging waste grease to the sanitary sewer the opportunity to produce biofuel is missed. The following information highlights the key issues facing San Francisco's municipality, businesses and residents.

2.1.1 Municipal

A significant problem with discharging grease to the sanitary sewer is that it can accumulate and restrict flow in wastewater collection systems and other pipelines. The SFPUC, who operates the city's sanitary

sewer system, in a 2007 SFPUC Collection Division Study, estimated that 50 percent of sanitary system work orders in the city are related to backups caused by grease blockages. The blockages, if not addressed, result in sanitary sewer overflows (SSO)s or combined sewer overflows (CSO)s (CSOs are associated with overflows that occur in combined stormwater and sanitary sewer systems, like those found in the City of San Francisco). The historical cost of clearing blockages is approximately $3.5 million per year and does not include the additional cost of maintenance and repair required to keep the system functioning properly (SFGreasecycle Website, 2011).

2.1.2 Commercial (i.e. Food Service Establishments)

One of the major contributors of waste grease that ends up in the sewer system are FSEs that do not dispose of their waste grease appropriately. In San Francisco, before the city enacted a new approach to FOG control, many FSEs were stricken with the difficult decision of how to deal with their waste grease. Depending on the relative quality of the grease, less degraded grease being referred to as "yellow" grease and highly degraded grease mixed with greywater usually referred to as "trap" grease, FSEs had to pay a rate for grease haulers to pick up grease or pump out grease traps (grease traps are receptacles that capture or "trap" grease from kitchen wastewater before it enters the sanitary sewer system). Commercial grease haulers were charging $45 per service to collect a few gallons of grease. The few options available to FSEs were often cost prohibitive, especially for smaller operations.

Small scale FSEs were, for the most part, overlooked by grease hauling companies who focused their efforts primarily on larger operations, such as restaurant chains and hotels, in order to maximize grease yield and minimize pick up time. The lack of available disposal options created a market failure for the service of these smaller FSEs. Many of these operations would then turn to more environmentally damaging alternatives to deal with the grease including discharging it to the sanitary sewer, contributing to the city's CSO problem. Some small restaurants would stockpile jugs of used oil in basements and backyards once they realized pouring oil down drains was clogging their pipes and they had no real plan for disposal. Additionally, the city maintained a limited FOG control program, emphasizing inspection and enforcement actions penalizing FSEs for non-compliance of grease disposal.

2.1.3 Residents

Similar to the commercial sector issues, residents who are unaware of the impacts that FOG can have on the sanitary sewer system, generally dispose of grease down the drain. Without an appropriate disposal alternative, residents choose between discharging grease to the sanitary sewer, or disposing of grease in the trash or in the compost. As described previously, discharging grease to the sanitary sewer contributes to the significant issues related to FOG buildup in sewers which eventually results in sewer backups and overflows. Disposal of grease in the trash does not impact the sewer system, however it contributes to the growing waste in landfills. Pouring grease into compost bins is also not a sustainable option for residential grease disposal. Although, composting is an environmentally sound method to dispose of food scraps, the process of composting FOG produces harmful volatile organic compound (VOC) emissions. VOCs are a regulated air pollutant and considered a significant problem for the City's composting program.

2.1.4 Regulation

Recently enacted regulations are also a driving force to keeping grease out of the sanitary system. In the State of California, new electronic reporting requirements have been enacted for CSOs and SSOs. The State Assembly passed Assembly Bill (AB) 1333 (2005) which outlaws improper grease disposal and decanting, requiring full pump-out of grease inceptors. Similarly, AB 1065 authorizes the Department of Food and Agriculture to establish a manifest system for tracking transportation of inedible kitchen grease. At the regional level, new oversight was recently enacted by the Regional Water Quality Control Board (RWQCB) for the development of sanitary sewer management plans (SSMP)s that include requirements for addressing CSOs and SSOs. The City of San Francisco has also issued Mandate B20, which called for

the city's diesel vehicles to use a diesel mixture of 20 percent biodiesel by the end of 2007 leading the way for programs that promote biodiesel technologies. A table of relevant water quality laws, regulations and codes can be found in **Appendix A**.

2.2 Program Development and Policy Options

To address the significant impact of FOG related sewer overflows, the City of San Francisco developed a range of potential policy options. The following policy components were evaluated and considered.

- **Do Nothing Alternative**

  By maintaining the status quo the city would continue to pay $3.5 million annual in responding to grease related back-ups as well as ignore the other issues associated with these overflows such as the potential public health risk, environmental impacts and non-compliance with new regulations.

- **Create stricter FOG enforcements and increase inspections**

  Enhanced enforcement regulations, emphasizing inspections and penalties for non-compliance, would only be applied to FSEs and would not address the issue of household grease disposal. Also, the effectiveness of the city's inspection program would suffer due to the limited number of inspectors available to investigate the 2,600 FSEs throughout the city.

- **Develop a city-wide waste cooking oil "franchise" agreement**

  Developing a "franchise" agreement similar to the San Francisco single trash hauler permit, where large oil generators (hotels) subsidize small scale FSEs, would force all 2,600 restaurants in the City to use one designated hauler. The implications of creating a grease haulers monopoly are unpopular and politically challenging.

After evaluating various policy options, the city developed a comprehensive FOG control program titled SFGreasecycle. In developing this program the city focused on preserving the interests of key stakeholders including commercial grease haulers, FSEs, residents, biofuel producers and municipal government officials. Also, the city narrowed the scope of the program to providing essential public services including: protecting public health, fueling public vehicles and to incentivize and facilitate business through market mechanisms rather than a tax and penalize approach. The SFGreasecycle current consists of four program components: 1) Commercial Collection, 2) Residential Collection, 3) FOG-to-Biofuels and 4) Regulation.

2.3 Commercial Collection (2007)

In 2007, SFPUC launched the SFGreasecycle commercial collection program to service FSEs throughout the city. The vision for the collection program was that it would fulfill an essential role for FSEs by providing a free pick-up service for waste grease that would eventually be transformed into useful energy products, such as biodiesel and biomethane. In addition to the free pick-up service, SFPUC initiated an outreach program to educate restaurants and businesses on best management practices (BMP)s for FOG control and disposal.

The free grease pick-up service consists of SFPUC staff hand collecting used oil from participating businesses. The oil is then taken to the City's Southeast WWTP where it is processed, by removing water, trash and grit, into high quality "yellow grease". The final product is then sold to biodiesel producers for biodiesel feedstock, promoting a local economy of biofuel production. In the near future, the SFPUC hopes to buy back this biodiesel, made locally, to help run the city's diesel fleet including the SFGreasecycle trucks which run on 100% biodiesel as known as B100.

2.3.1 Outreach

To promote the free pick-up service and help educate FSEs on proper FOG disposal methods, SFPUC undertook a citywide marketing campaign. As part of the public outreach efforts SFPUC held a press conference in 2007 when the program was implemented and included SFGreasecycle information in water and sewer bills. They also provided SFGreasecycle information during sewer and public health inspections, demonstrating a strong relationship between compliance and appropriate disposal methods. SFPUC established a multilingual website which provides information about the program including an online sign up page for the free pick-up service, to reach out to a wide and diverse audience.

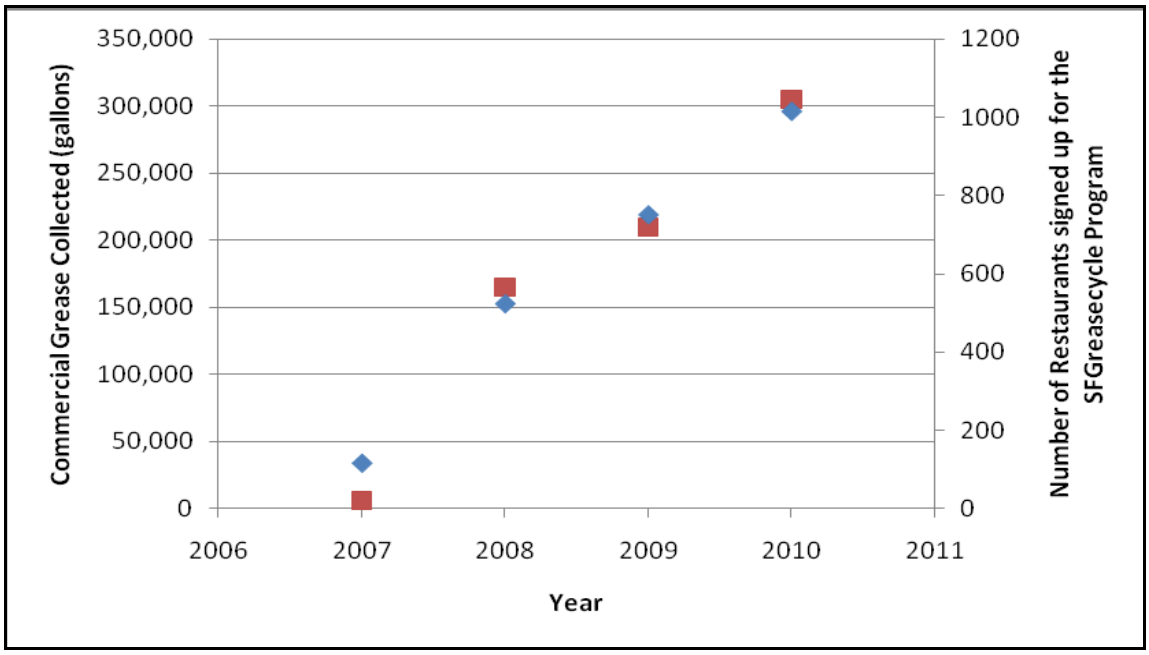
The free pick up service has also created a platform to share information to the public. While collecting grease from FSEs, SFPUC has provided information about BMPs and grease trap installation which helps prevent waste oils and grease from entering drains. The impacts of this program are continually expanding through the public outreach efforts and the services provided.

The SFGreasecycle free grease pick-up has had an impact on “mom and pop” establishments which were underserved by conventional grease hauling operations. Conventional grease haulers continue to service larger establishments. Also, by effectively serving the community, the program has transformed the dynamic between the government and businesses, promoting a less adversarial relationship where private companies work together with SFPUC to keep grease out of the sewer system. As a result, SFGreasecycle staff are more welcome in restaurant kitchens, which helps them suggest best management practices for keeping other forms of grease away from the drain.

2.3.2 Tangible Impacts

Since the program was implemented in 2007, over 1,000 participating establishments including restaurants, hotels, hospitals, synagogues, churches and schools have signed up for the free grease pick-up service. The establishments participating in the program represent approximately 40% of the total number of FSEs in the area. The amount of oil collected from commercial FSEs started at around 6,000 gallons in 2007 and today that number has reached over 300,000 gallons per year and continues to grow. A graphical representation of the growth of the commercial grease collected and number of FSEs participating in this program can be seen in **Figure 2-2** below.

Figure 2-2: Annual Commercial Grease Collected (in gallons) and Annual Number of Restaurants signed up for the SFGreasecycle Program (2007-2010)



2.4 Residential Collection System (2008)

The key targets for the free grease pick-up program are FSEs. However, the U.S. EPA estimates that households collectively produce the same amount of waste grease as restaurants. Residents also represent a much more diffuse source of used cooking oil with no practical solution to collect from all the various users. To provide a more sustainable disposal alternative to households, the SFGreasecycle program, in partnership with local grocery stores and community centers, has established designated grease drop-off locations throughout the City.

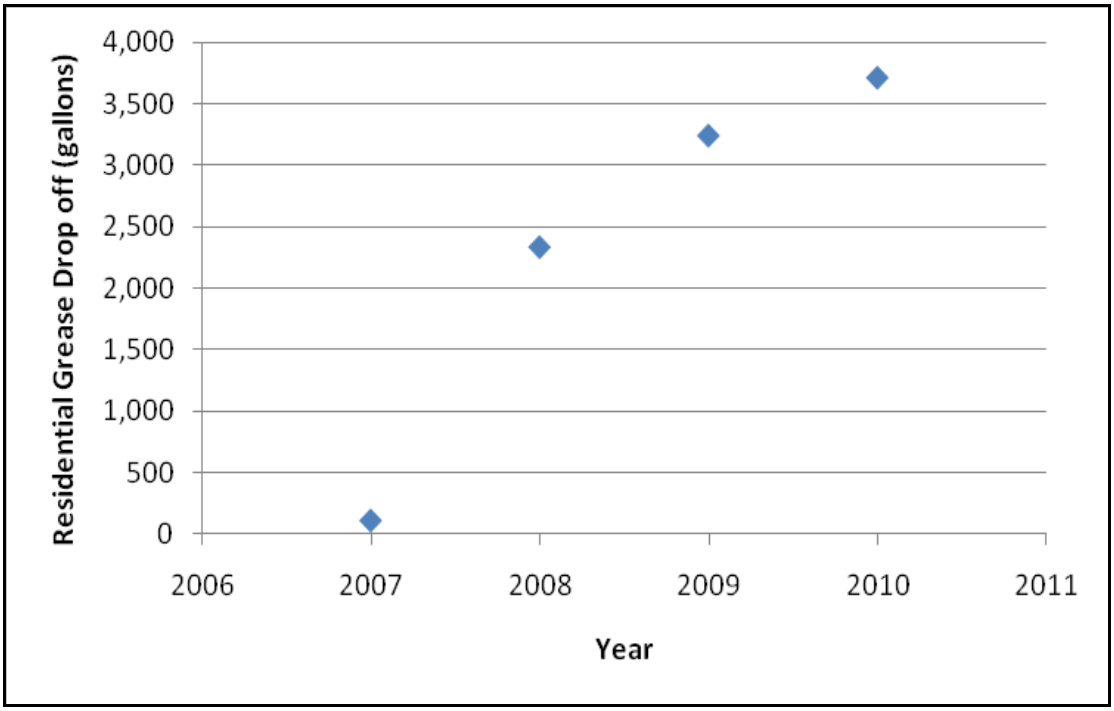
2.4.1 Outreach

Many of the same outreach activities established to connect with businesses were used to reach residential households in order to provide information about the impact of FOG in the City's sewer system. As part of these activities, SFGreasecycle information was included in water and sewer bills and residents were encouraged to visit a multilingual website providing SFGreasecycle program information. To provide residents with a sustainable disposal alternative, SFPUC organized a grease collection event in November of 2007, where residents dropped off over a ton of cooking oil after the Thanksgiving holiday. A similar grease drive conducted in late 2008 collected nearly double, approximately 1,200 gallons, of used household kitchen grease. Due to the success of the holiday drop off events, in terms of grease collected and residents' participation, the program administration established permanent drop-off locations for residents in the summer of 2009.

2.4.2 Tangible Impacts

The efforts made through the SFGreasecycle program to reach out to residents helps to reassure the public that SFPUC is protecting their assets and taking key steps toward a sustainable future. The amount of grease collected from residential households has increased from 115 gallons in 2007 to 3,710 gallons in 2010. This grease would have otherwise found its way in the sanitary pipes or a landfill. The growth of the residential collection efforts can be seen in **Figure 2-3** below.

Figure 2-3: Annual Residential Grease Drop Off (in gallons)



2.5 FOG-to-Biodiesel Demonstration Project (2009)

The free grease pick-up and the permanent residential drop off programs focus on high quality "yellow" grease from the deep frying process. An additional source of waste grease in the sewer system comes from FOG that has been commingled with kitchen wastewater, or graywater, in dishwashing sinks and drainage systems, referred to as "trap" grease. According to the "Urban Waste Grease Resource Assessment" (Hyams & Pampillo, 2009) the average urban American produces 8.87 lbs per year of yellow grease and 13.37 lbs per year of trap grease, where 50 percent of trap grease is generated by restaurants. Studies have shown that on average, 25 percent of trap grease from restaurants can be recovered from grease traps (SFPUC & URS, 2010). Historically, trap grease was collected and transferred to an incinerator or landfill but new technology allows for more environmentally sound and beneficial processing.

To address trap grease source control issues, the FOG-to-Biodiesel technology demonstration project was implemented as part of the SFGreasecycle program. The project uses innovative technologies to process waste trap grease from restaurants and generate a feedstock for biodiesel production. The objectives of the FOG-to-Biodiesel project include the following:

- Demonstrate technologies for the recovery and conversion of trap grease into biodiesel

- Demonstrate the feasibility of co-locating the project elements including a trap grease recovery and biodiesel production facility at a municipal WPCP
- Work with other municipalities for fast-track implementation
- Develop a reproducible business model applicable to other municipalities

To accomplish these objectives, SFPUC in collaboration with the California Energy Commission (CEC), Department of Energy (DOE) and the U.S. EPA, developed a Work Plan that describes five key tasks related to the Grease-to-Biodiesel project. The tasks in the Work Plan include:

1. Assess the State of the Waste-Grease-to-Biodiesel Industry
2. Undertake a Greenhouse Gas Inventory
3. Conduct a Socioeconomic Analysis
4. Implement Public Relations and Extend Project Findings
5. Develop a Business Model

The SFPUC, in collaboration with URS, generated two reports titled: "Wastewater Sector State of the Industry Report: Conversion of Trap Grease to Biofuel" (2010) (Industry Report) and the "Financial Feasibility and Socioeconomic Effects Associated with a FOG to Biodiesel Refinery at a Municipal Wastewater Treatment Plant" (2010) (Feasibility Report). These reports include analysis of the five tasks required in the Work Plan. These reports are described below.

SFPUC approved BlackGold Biofuels (formerly known as Philadelphia Fry-o-Diesel) of Philadelphia, PA, to be the technology provider for the city's demonstration-scale biodiesel plant. The demonstration facility was constructed at the SFPUC's Oceanside Water Pollution Control Plant (OWPCP) in San Francisco and was designed to process 10,000 gallons per day of waste trap grease and convert it to biodiesel and biomethane. The major funding for this project comes from the SFPUC, along with grants from the CEC, U.S. EPA West Coast Collaborative and the Department of Energy.

Production of biofuels from trap grease feedstock is anticipated to have long-term indirect cost savings for the City as a result of reductions in sewer maintenance and overflows. The co-location of the processing plant and the City's WPCP is expected to be advantageous to both facilities. The biodiesel plant can utilize the existing WPCP infrastructure (e.g. transportation corridors, latent heat, existing permitting, hot water) and process (anaerobic digestion) to provide beneficial disposal of waste streams (e.g., glycerin and wet methanol) that can be treated in the plant's anaerobic digesters. Treating the biodiesel waste streams in the anaerobic digesters offers the benefit of increasing biomethane production and energy generation at the WPCP. Additionally, the City would generate a new revenue stream associated with tipping fees from accepting waste trap grease from restaurants. The biodiesel plant is fully automated and continuous and therefore requires little training to run and could be operated with minimal staff attention.

The three different types of alternative energy sources that will be produced by the biodiesel plant include: vehicular high-grade ASTM-quality biodiesel, lower grade boiler fuel, and additional biomethane gas from the existing WPCP anaerobic digesters.

2.5.1 Developing a Business Model: State of the Industry

To develop a business model for full scale implementation of a biodiesel plant SFPUC compiled an assessment of the state of the trap grease industry as it is currently, where municipal WWTPs are using trap-waste-derived grease for biofuel production. In the Industry Report, SFPUC identifies numerous examples where trap waste has been utilized for increased digester gas production. The report also highlights a project by the East Bay Municipal Utility District (EBMUD) which established a pilot plant

in Oakland, California in 2004, to produce biodiesel from trap grease in a two stage process. It was determined that the costs of production vary considerably depending on the scale of production.

2.5.2 Developing a Business Model: Feasibility Analysis

A feasibility analysis was performed to assess the financial feasibility and socioeconomic effect of a for full scale FOG-to-Biofuels production process. In the feasibility analysis report (SFPUC & URS, October 2010), SFPUC utilized conceptual cost and revenue data to provide an indication of the cost-effectiveness of the proposed facility, estimate local job creation, and other social and environmental effects. The feasibility report is intended as a Technology Transfer Report including both a business plan and greenhouse gas analysis, to promote the rapid implementation of these technologies in other Publically Owned Treatment Works (POTWs).

The feasibility analysis report outlines three implementation steps needed to support transition of the current technology demonstration project to commercial scale application. These objectives include: upgrade of the technology pilot project to demonstrate successful processing of multiple feedstocks, expansion and development of feedstock programs, planning and permitting for the commercial scale facility and development of a business case from the demonstration project applicable to other WPCPs.

Two scenarios were examined for the financial feasibility analysis including a base case (represented "without" the refinery) and a second scenario (represented "with" the refinery). Without building a refinery, current trap grease waste from restaurants would continue to fill up landfills and clog up the sewer system. For the case with the construction of the refinery, a detailed cost analysis was developed for trap grease recovery, associated energy costs to heat and dewater the trap waste, transportation to the biodiesel facility and biodiesel production. The annual operating cost for trap grease recovery was calculated to be $145,000 per year. The feasibility analysis report also includes the revenue associated with trap grease collections related to tipping fees charged to grease trap haulers by utility operators to receive and treat grease trap waste.

A cost benefit analysis was developed to quantify the feasibility of a biodiesel refinery to both public and private entities. The analysis undertaken was conceptual in that the majority of the variables used in the analysis were not known with any certainty. The analysis showed that under the stated assumptions for revenues and costs the production of biodiesel could be cost effective. It is anticipated that the pilot study underway at the Oceanside WPCP will reduce the uncertainty in many of the variables.

Socioeconomic effects

Additional benefits not captured in the cost-benefit analysis, including dealing with the 'public good', were defined in the report. The benefits associated with reduced sewer blockages were significant for both residences and FSEs related to reducing public health risk, improved amenity and reduction of compliance charges as well as other benefits mentioned in the report.

GHG Analysis

As part of the feasibility analysis report, the net change in GHG emissions and toxic air pollutions emissions associated with the construction and operation of the refinery were calculated. A reduction of GHG emissions was estimated to be 11,400 CO_2 equivalents per year. Also, included in the report is an analysis of the potential benefits to air pollution reduction where a net change in air quality is likely to be associated with the conversion of diesel to biodiesel. However, given the volume of biodiesel that will be produced from the commercial facility, it is likely that air quality impacts will be negligible.

2.6 FOG Control Ordinance (2011)

As part of the comprehensive approach of the SFGreasecycle program, new regulations were enacted to reduce sewer maintenance activities associated with FOG and to promote the capture and disposal of waste grease. Specifically, the city passed a new FOG control ordinance in 2011, intended to set new

requirements on how FSEs handle and dispose of waste grease. The ordinance provides new prohibitions, limitations and requirements for the discharge of FOG into the wastewater collection system by FSEs. New tougher BMPs are being mandated by the FOG control ordinance including the requirement to dry-wipe pots and pans and monitor grease hauled away from FSEs.

One of the major elements of the new ordinance is the installation of Automatic Grease Removal Devices (AGRD)s at all significant grease-discharging FSEs that have no existing grease capturing equipment. The AGRDs are rated for as high as 95 percent FOG recovery and produce grease with much higher quality than by traps or interceptors due to the removal of solids and reduction in water content as part of the AGRD design. AGRD systems currently cost around $2,300 but are expected to drop in price to around $1,500 due to competition and higher manufacturing volumes (San Francisco Fights FOG, mswmag.com). Further, in an effort to promote early compliance and offset equipment costs, the SFPUC offers all FSEs a 14.2% reduction in their sewer bills upon installing and maintaining an AGRD.

2.7 Community Outreach

Since the inception of the SFGreasecycle program, there has been extensive media coverage and a laudatory response from the community. To date there have been over 50 articles generated from multimedia sources including the New York Times, History, Green Planet and Discovery Channels, and CBS.

In 2007, the SFPUC held a press conference to announce the SFGreasecycle program and the announcement received national attention. The media attention combined with public outreach efforts helped make a November residents grease drop off event a success by drawing in over 1 ton of used kitchen grease. A similar event in 2008 managed to take in nearly double the amount of the previous year.

The Asian Week (February 5, 2009) highlights the grass roots level of outreach made by the city when it describes how the San Francisco Board of Supervisors and SFPUCs participation in a merchant walk in Chinatown. To follow up their efforts, SFPUC hosted a booth at the Chinatown Community Street Fair (2009) which doubles as both an information booth and collection site.

The media attention for the SFGreasecycle program assists in the public outreach efforts by the city to attract businesses to participate in the program. Also, by shedding light on the issues of FOG related overflows, news outlets are contributing to educating businesses and residents about sustainable disposal methods.

2.8 Future Programs

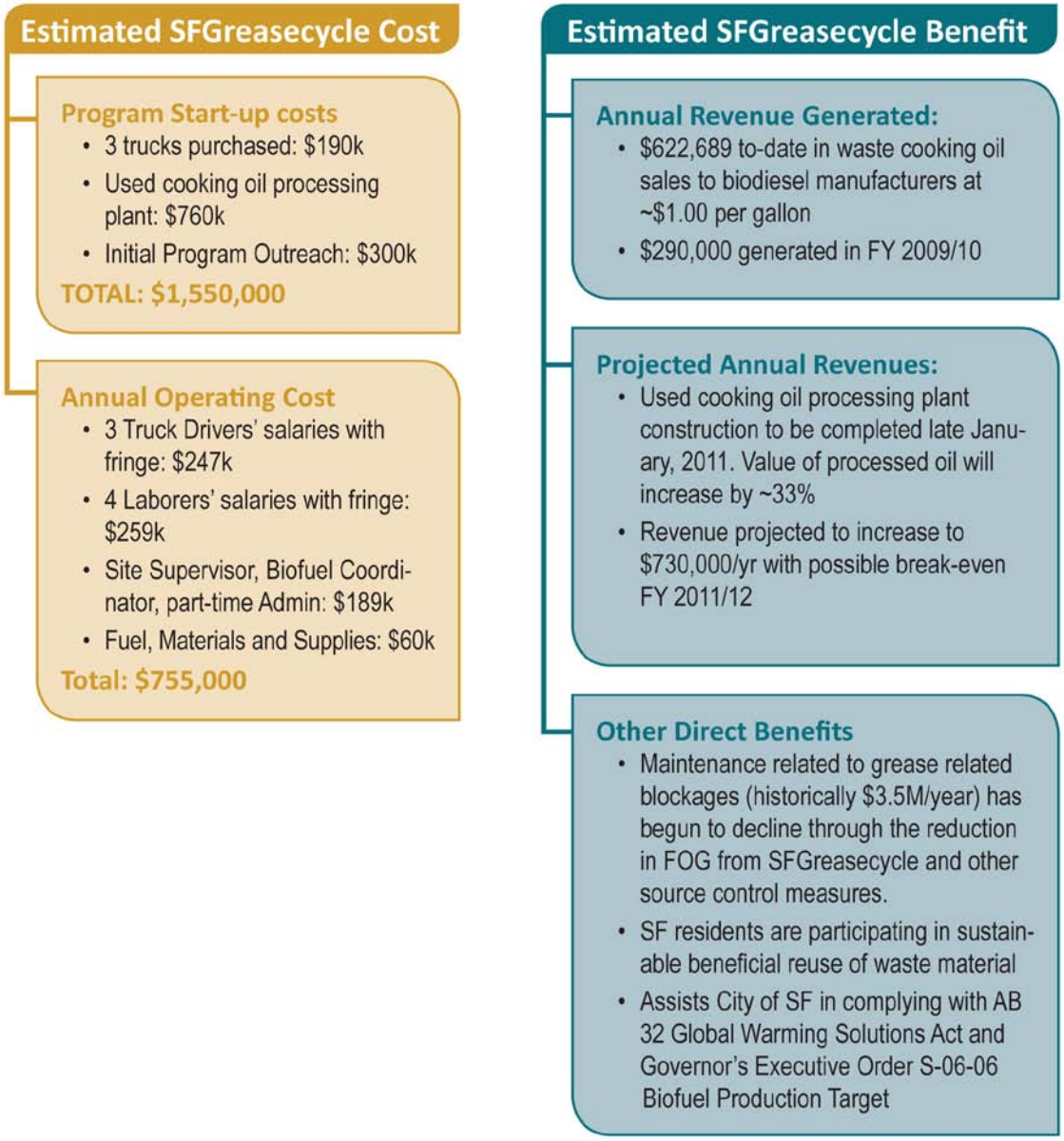
As part of the SFPUC's continuing efforts to enact sustainable policies they are developing a working "Bioenergy Plan" that uses the SFGreasecycle program in conjunction with the demonstration project (both described above) to provide a foundation for future bioenergy programs. The scope of future work for this program includes the exploration of concepts such as the potential conversation of food waste or the organic fraction of municipal solid waste to produce biomethane gas, pelletization of biosolids as a renewable energy feedstock, and conversion of digester biogas to compressed biogas for use in fleet vehicles. A conceptual drawing was created in the Industry Report and is included in **Appendix C**.

Chapter 3 Program Outcomes

3.1 Cost/Benefit Analysis

A major factor in the implementation of FOG control programs by other POTWs is related to cost. In order to get support for this program from policy makers, it is important that there is an understanding of the costs and benefits of the project. To help other POTWs, SFPUC prepared a cost-benefit analysis related to the free commercial grease pick up, which has been summarized in **Figure 3-1** below. Note that the figure does not include the cost or revenue from the biodiesel producers.

Figure 3-1: Cost-Benefit Analysis for the SFGreasecycle Program



The major cost associated with the commercial grease collection is the 1.5 million dollar start-up costs related to grease processing, vehicles and outreach. Once the program is established, the operating costs are approximately $755,000, which is partially covered by the sale of waste cooking oil to biodiesel manufactures. The operating costs are expected to break even by 2012, once the City has completed construction of a used cooking oil processing plant.

What has not yet been quantified is the extent of the cost savings associated with a reduction in grease related blockages. The $3.5 million that is currently spent annually by SFPUC dealing solely with unblocking pipes, is expected to decrease due to that the 300,000 gallons of used cooking grease is collected by the SFGreasecycle program and prevented from entering the sanitary system. Other indirect benefits not yet quantified include the reduction in greenhouse gases and improved relationships between the SFPUC and the City's restaurants.

3.2 Strategies and Lessons Learned

A FOG control program that integrates various elements including biodiesel production can be particularly challenging for middle management to sell to policy makers. Allocation of limited resources, such as employee time, is also a significant challenge.

The following strategies and lessons learned from the SFGreasecycle Program related to the program's design and management helped reduce the costs of collection and processing as well as connect with the community. These measures can be used by other POTWs create a successful FOG control program and provide a roadmap for moving forward with implementation.

Program Design and Development

Strategies and lessons learned related to program design and development, include the following:

- The extent of improper disposal of waste oil and grease on the city's sanitary sewer system should be investigated to determine the need for and assess the market for FOG collection. It is essential that the dynamics of the local FOG collection market be evaluated.
- Involve all stakeholders in the program design process
- Engage the public and FSEs through public outreach and education programs such as best management practices of FOG for restaurants. These activities will help keep waste FOG out of the sewers and ensure that grease collected is maintained by the restaurant at the highest quality.
- Use incentives to attract business participation by offering free collection and pick up services.
- Connect and open lines of communication with the local biofuels community before implementation.
- Use co-location of the waste transfer facility with the municipal waste water treatment facility to capitalize on the synergies.
- Purchase a range of vehicle sizes for waste oil collection to match the needs of FSE and residents.

Program Management

Strategies and lessons learned related to program management, include the following:

- Establish local partnerships with grocery stores and community centers for residential waste oil and grease drop off.
- Reach out to smaller restaurant establishments that often go underserved by private haulers due to smaller amounts of generated waste grease, language and logistical barriers.
- Create compliance requirements (e.g. minimum recovery standards) for the implementation of grease traps in FSEs to reduce FOG in sewers and minimize collection costs.

3.2.2 Implementation in other Cities

Policy makers and municipal authorities should consider the following when evaluating the appropriateness of a FOG control program.

- Initially, policy makers will need to assess tangible monetary impacts FOG has on linear assets, sewer service crews, treatment plant operations as well as private sector impacts from interrupted service of restaurants due to grease related blockages.
- Policy makers need to research and quantify the availability of sufficient quantities of used cooking oil to ensure program cost-effectiveness. Opportunities for savings realized by a municipality as a large fuel consumer must also be considered.
- Policy makers need to have a holistic understanding of the waste-grease-to-biodiesel value chain in order to appropriately determine the most effective role for government.

- Policy makers need to be committed to making appropriate investments for equipment and staff to establish relationships with local FSEs to ensure the program's success.
- The local authorities and policy makers should create a long term vision for where the program is going and is required to incorporate all key stakeholders.

Although there are various challenges to implementing an effective and comprehensive FOG control program, other cities can potentially benefit from a reduction in FOG in the sewers and the production of biofuels from waste grease as demonstrated by the SFGreasecycle Program.

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Biodiesel Magazine, “Brown Grease Demo Biodiesel Plant Start Up”, September 20, 2010

Appendix A - Overview of Relevant Water Quality Laws, Regulations and Codes

Table 5-2: Overview of Energy and Clean Air Regulations and Codes Relevant to Biofuels

Authority	Name	Regulation	Description
Federal			
Waxman-Markey Bill	American Clean Energy and Security Act of 2009		This bill would establish an emissions trading plan. The bill was approved by the House in 2009 and is still in consideration in the Senate.
U.S. Department of Energy (DOE)	American Recovery and Reinvestment Act of 2009 (ARRA)		$3.1 billion for the U.S. DOE State Energy Program to help states invest in energy efficiency and renewable energy
U.S. Department of Energy (DOE)	Energy Independence and Security Act of 2007		The Act mandates that 32 billion gallons of biofuels be generated by 2022.
U.S. Department of Energy (DOE)	Energy Policy Act of 2005 (EPAct)	Public Law 109-58	Promotes alternative fuel vehicles for all public fleets
U.S. Environment Protection Authority (EPA)	Clean Air Act Amendments (1990)		Sets limits on certain air pollutants
Regional			
Collaboration of seven U.S. governors and four Canadian Premiers	Western Climate Initiative (WCI)		Program to establish a market-based cap & trade system. Recommendations released by the WCI in September 2008 have suggested the system begin in 2012 to obtain GHG emissions 15% below 2005 levels by 2020.
State			
California Air Resources Board	California Global Warming Solutions Act of 2006	AB 32	Reduce GHG emissions to 20% below 1990 levels by 2020 within California.
California Energy Commission	State Alternative Fuels Plan	AB 1007	A Plan to increase the use of alternative fuels in California
California Energy Commission	Low Carbon Fuels Standard	Executive Order S-01-07	Calls for a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020
Cal Recycle	Organics Policy Roadmap		The goals of this Organics Roadmap include the operation of 50 to 100 facilities that produce biofuels to reduce organic material disposed of in landfills by 50 percent by 2020.
Local			
City of San Francisco	Mayor Newsom Directive		Directive to use B20 in the City of San Francisco's fleet

Reference: SFPUC & URS Corporation, "Wastewater Sector State of the Industry Report: Conversion of Brown Grease to Biofuel", December 2010

Appendix B - Summary of Trap Grease to Biogas Industry

Table 4-1: Summary of Brown Grease to Biogas Industry (URS 2007)

POTW	Average flowrate, mgd	Scale of Operation	Trap Waste Input, gal/d	Feedstock	Total Biogas Production, ft^3/d[1]	Biogas Production from Trap Waste, ft^3/d
EBMUD, Oakland, CA	86	Pilot project and full-scale digester	35,000	Grease Trap Waste	3,900,000	350,000
Millbrae, CA	1.8	Full-scale digester	3,000	Grease Trap Waste	66,000	37,000
Oxnard, CA	32	Full-scale digester	3,000[2]	Grease Trap Waste	370,000	7,142
Riverside, CA	33	Pilot project and full-scale digester	20,000 to 30,000	Grease Trap Waste	650,000	~264,000
SBSA, Redwood City, CA	24	Full-scale digester	3,800	Grease Trap Waste	312,000	72,000[3]
Watsonville, CA[4]	7	Full-scale digester	5,850	Grease Trap Waste	173,000	60,000
Duisburg-Kasslerfeld, Germany	32	Full-scale digester	7,400 to 10,000	Grease Trap and Rendered Waste	484,000	92,000

[1] This includes digesters used as the control, without any brown grease injection

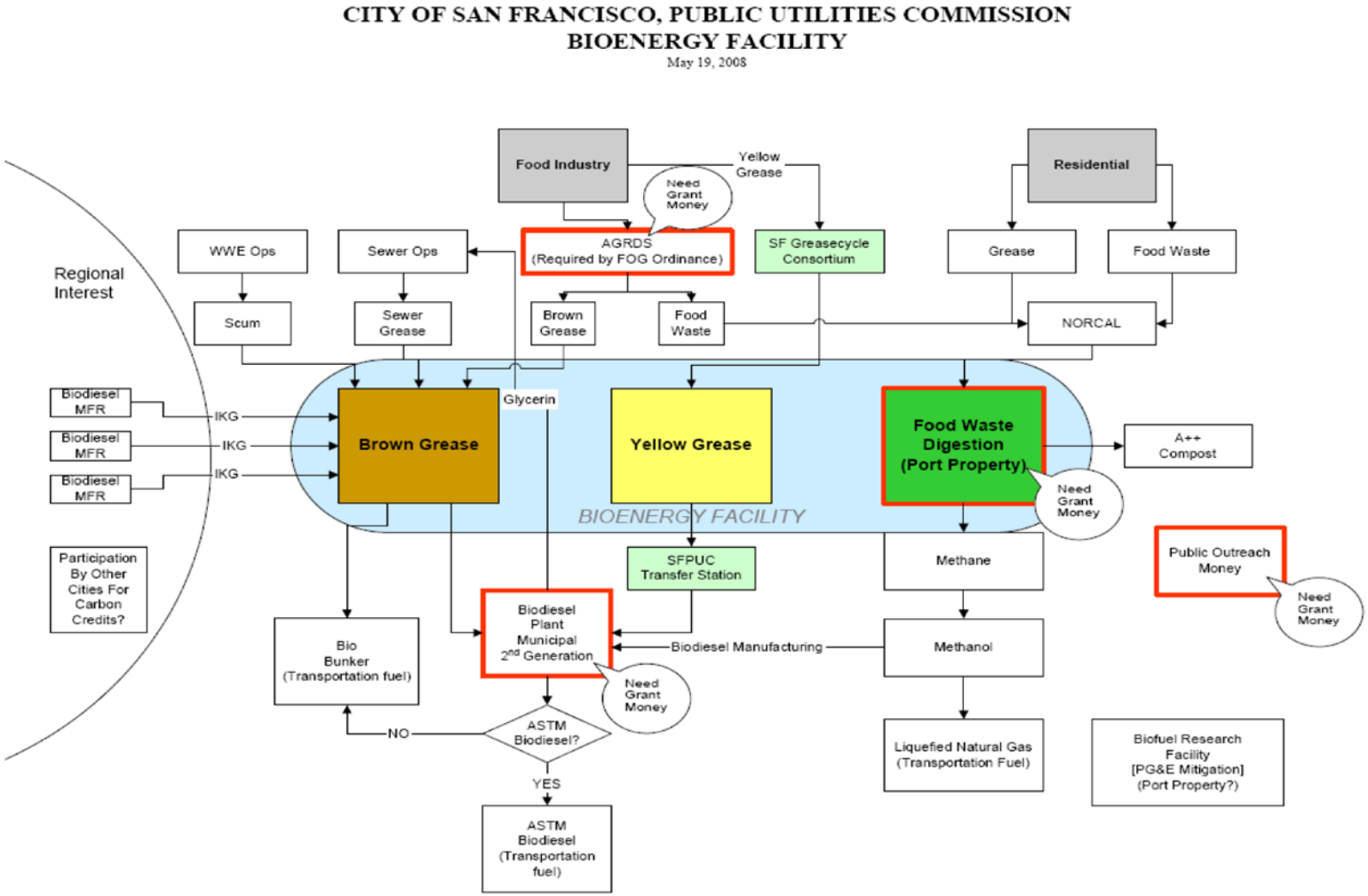
[2] Four days a week

[3] The control digester had a 25,000 ft^3/d increase in biogas over same time period

[4] Average of 2004 and 2005 values

Reference: SFPUC & URS Corporation, "Wastewater Sector State of the Industry Report: Conversion of Brown Grease to Biofuel", December 2010

Appendix C - Conceptual Bioenergy Facility and Summary of Funding Needs



Reference: SFPUC & URS Corporation, "Wastewater Sector State of the Industry Report: Conversion of Brown Grease to Biofuel", December 2010