

# FOG-to-Biodiesel Demonstration Project

Presentation For:

Be Sewer Smart Summit

October 25<sup>th</sup>, 2011



San Francisco  
**Water**  
**Power**  
**Sewer**



**URS**

# Fiscal Drivers

---

- ❑ **FOG in San Francisco Sewers is a \$3.5M Problem**



# Regulatory Drivers

---

- Federal
  - **Clean Water Act**
  - **U.S. EPA**
    - Requires elimination of dry weather stoppages (i.e., FOG blockages)
    - CMOM – grease control program
- California State Laws
  - **Statewide WDR**: requirement to develop SSMP to reduce SSOs
  - **AB 1333**: outlaws improper grease disposal & decanting; requires full pump-out of interceptors
  - **AB 1065**: authorize Depart of Food & Agriculture to establish a manifest system for tracking transportation of inedible kitchen grease
  - **AB 32**: Global Warming Solutions Act of 2006
  - **AB118**: Alternative & Renewable Fuel & Vehicle Technology Program

# Project Objectives

---

- ❑ Project Energy Objectives: Recover energy value of FOG & reduce greenhouse gas emissions
- ❑ Project Technical Objectives: Recover brown grease at <2% MIU; Convert brown grease to ASTM quality biodiesel; Establish engineering design standards
- ❑ Project Economic Objectives: Develop business model to enable project to be replicated by other municipal agencies

# FATS, OIL AND GREASE (FOG) TO BIODIESEL PROJECT

## Goal 1

Demonstrate that co-location of FOG-to-biodiesel facility and Wastewater Treatment Plant (WWTP) provides unique advantages.

## Goal 2

Demonstrate that brown grease can be recovered cost-effectively from waste FOG and concentrated to 99% purity.

## Goal 3

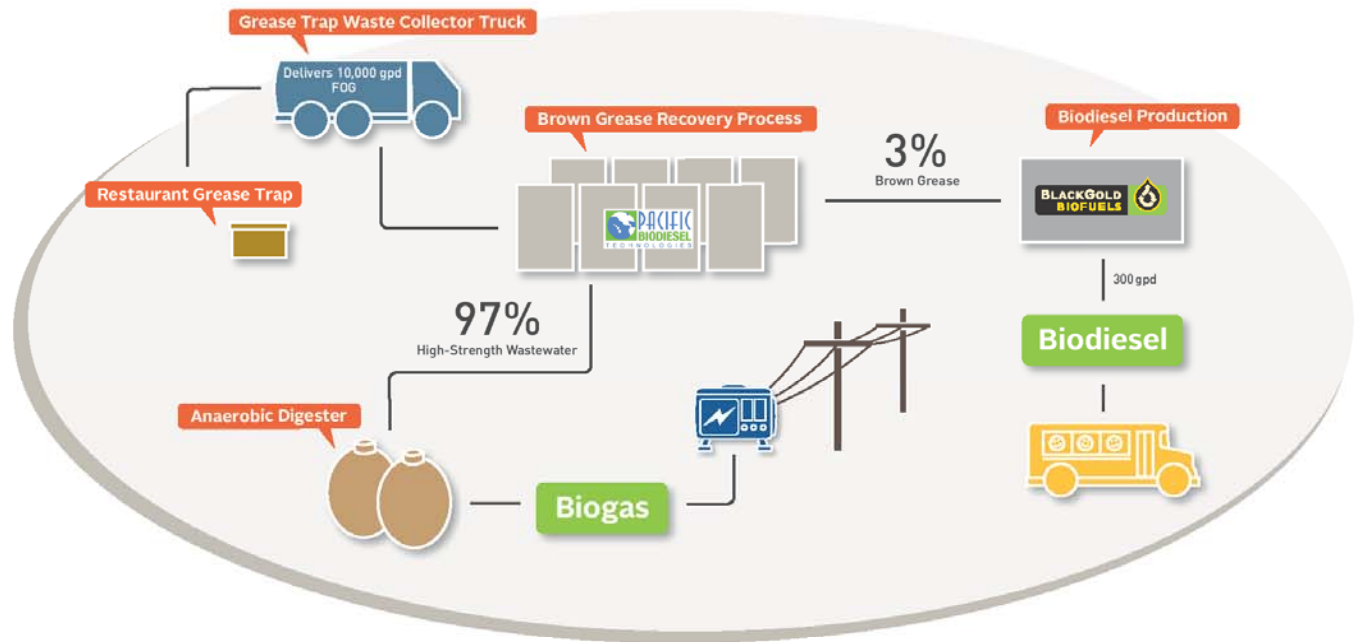
Demonstrate that locally sourced energy can be produced from low quality urban grease.

### Promise of the Project:

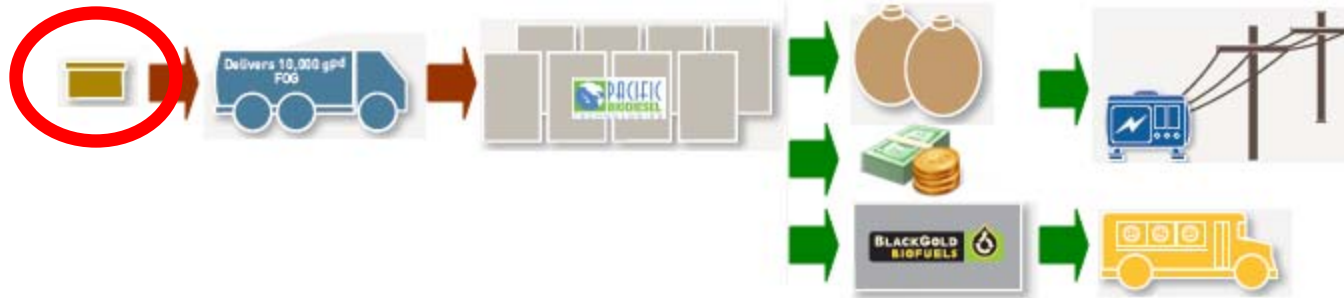
Refined brown grease has been demonstrated to produce 60% more biogas in anaerobic digesters.

Onsite management of wastes from FOG-to-biodiesel project can be provided with no negative impacts to the WWTP's process.

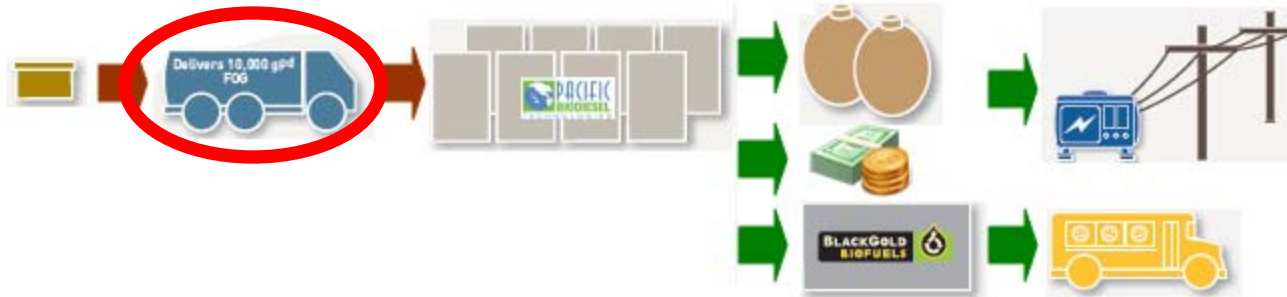
Technologies demonstrated have potential to "close the grease loop", transforming a waste stream into a local energy resource.



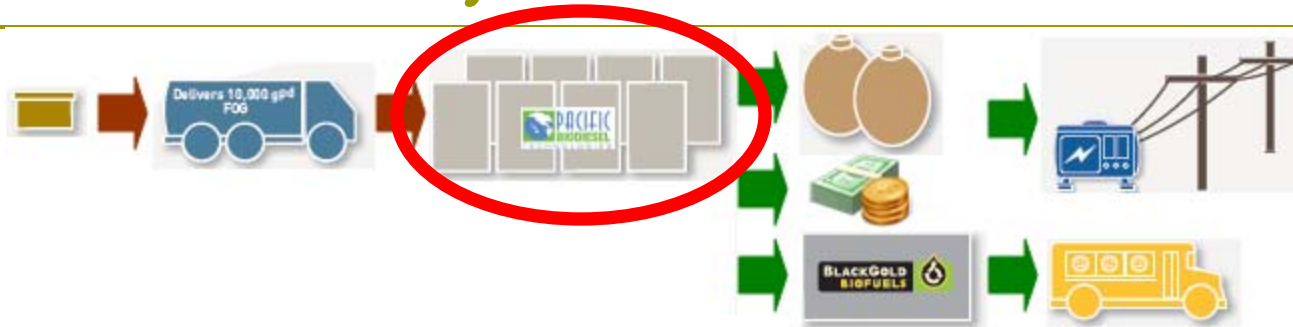
# Grease Trap Waste



# Grease Trap Hauler Unloading



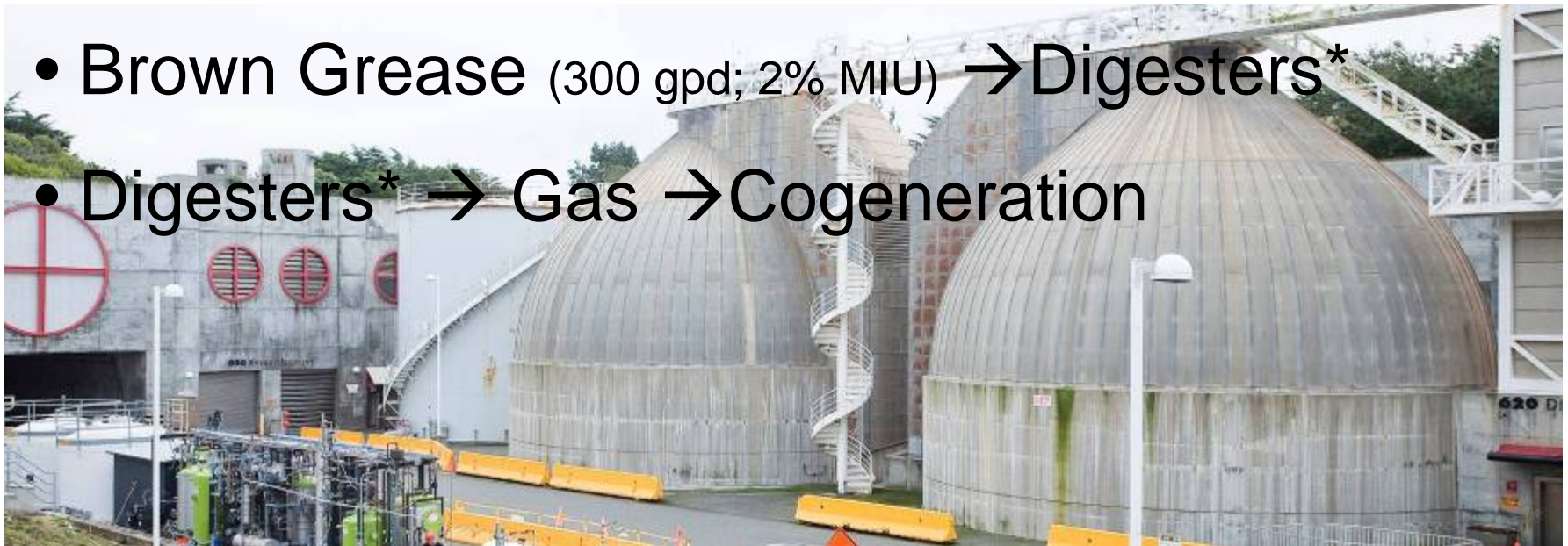
# FOG Recovery



# Energy Generation



- White Water (~9,700 gpd; 1% FOG) → Digesters\*
- Brown Grease (300 gpd; 2% MIU) → Digesters\*
- Digesters\* → Gas → Cogeneration



\* Digesters = Anaerobic Digesters

# Energy Generation (cont)



- Brown Grease Sales
- Cogeneration
- Boiler Fuel:
  - ✓ Arizona, Hawaii, Oregon, and Nevada
  - ✗ California



# Biodiesel Production



*Converting our Crudest Wastes into our Cleanest Fuels*



# Commercial Impact of BlackGold's Breakthrough



100% Triglyceride  
0% FFA  
High Quality, Price



0% Triglyceride  
100% FFA  
Low Quality, Price

**Fats, Oils, & Greases**

Soybean Oil,  
1% FFA

Poultry Fat, 3%  
FFA

Fier Grease, 15% FFA

Sewer Greases,  
85% FFA

Conventional Technology (0-15%  
FFA)

**BlackGold Technology (0-100% FFA)**

# Toolbox for New Sites

---

- ❑ Business Case Report - Assess market situation and calculate feasibility
- ❑ GHG Report - Inventory GHG emissions
- ❑ State of the Industry Report - Approach technology providers
- ❑ Outreach Plan - Inform the public
- ❑ Performance Certification Test Plan – Performance certification
- ❑ Final Report - Lessons-learned



# Energy Commission Reports

---

- ❑ Baseline Report – inventory of plant data prior to project
- ❑ Performance Certification Test Plan – monitoring and analysis plan to assess demonstration units' performance
- ❑ Final Report – Summary of demonstration project, findings and conclusions
- ❑ Technology Transfer Report – Summarizes communications and outreach activities to disseminate the demonstrated technology



# State of the Industry Report

---

- ❑ Summarizes the state of the brown grease recovery in California and waste grease to biodiesel industry worldwide
- ❑ Main use for brown grease is still direct digester supplement
- ❑ Conversion of brown grease into biodiesel is nascent technology, with technology providers coming and going. Promising solid-state catalyst technology looms at the horizon.

# Greenhouse Gas Inventory Report

---

- ❑ Inventories the greenhouse gas emissions reductions of successful demonstration and regional-scale FOG to Biodiesel projects
- ❑ Landfill diversion and petroleum diesel replacement are main contributors to projected GHG reductions
- ❑ Regional scale project GHG emission reduction equivalent to power use emissions from 32,000 San Francisco households.

# GHG Emissions Reduction

San Francisco's current FOG control program GHG emissions

**Baseline:**  
760 tonne CO<sub>2</sub>e/yr

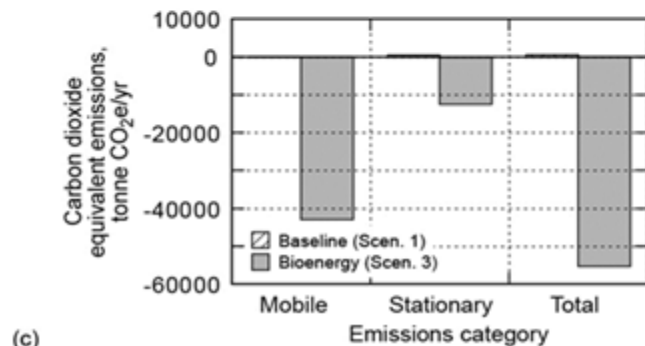
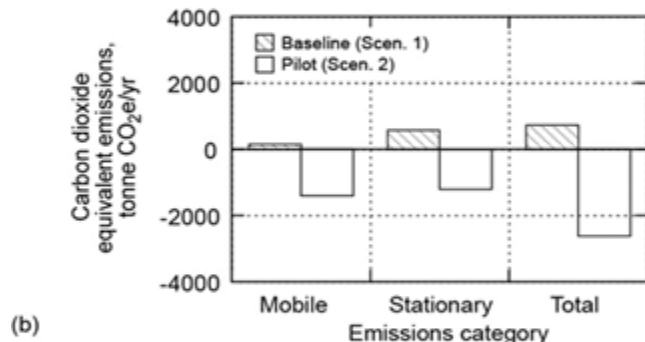
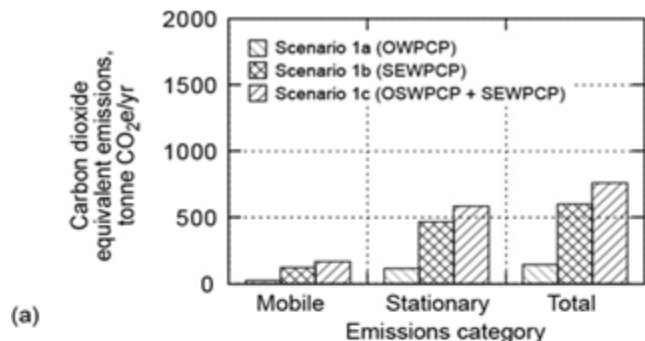
Demonstration project:  
Impact to GHG emissions

**Change from Baseline:**  
-3,350 tonne CO<sub>2</sub>e/yr

Commercial FOG-to-biodiesel  
facility: Impact to GHG emissions

**Change from Baseline:**  
-56,080 tonne CO<sub>2</sub>e/yr

**The equivalent of GHG emissions from electricity use by 32,000 San Francisco households.**



# Socio-Economic Analysis

---

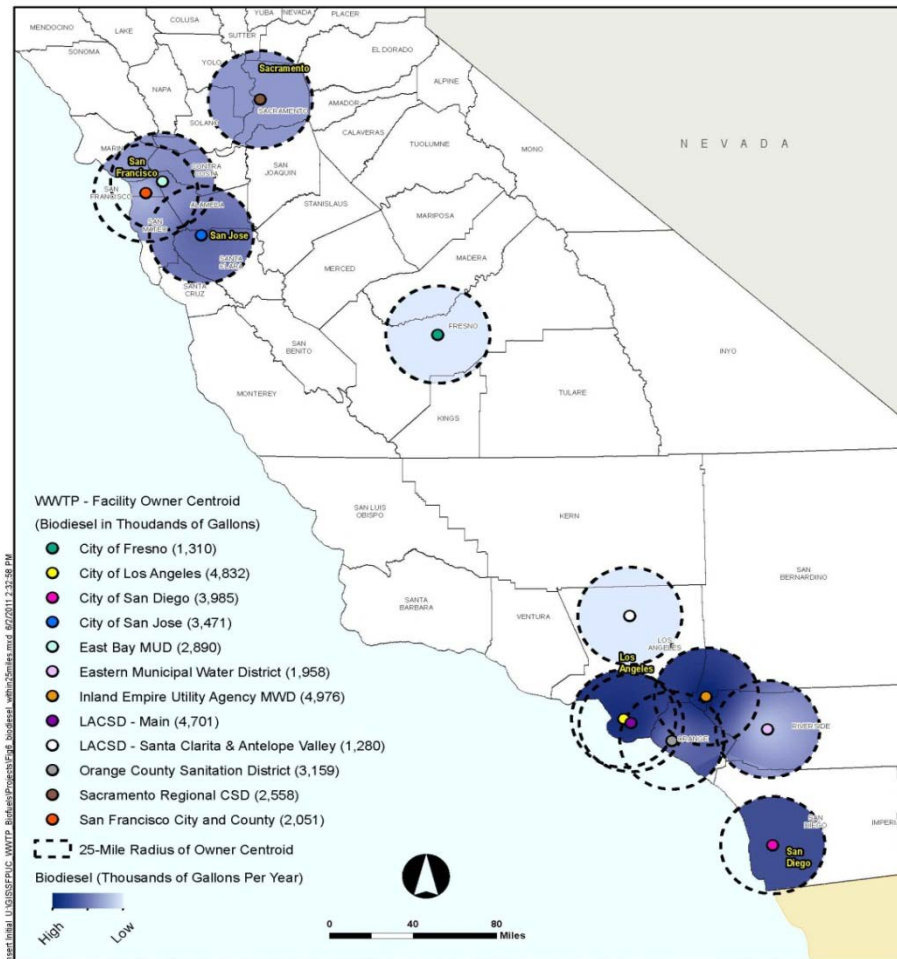
- ❑ Provides inputs for the business case (regional facility)
- ❑ Break-even diesel price approx. \$3.50
- ❑ Permanent green jobs: 44
- ❑ Recommends to proceed with the design of a regional facility
- ❑ Recommends to expand conversion technology into multi-feedstock technology (brown, yellow, algae)

# Business Case Report (under construction)

---

- ❑ California has the potential to generate 30 MGY biodiesel annually (brown and yellow grease feedstock combined)
- ❑ Satellite trap waste dewatering at wastewater treatment facilities, 10,000 + gal/day
- ❑ Two to three centralized biodiesel conversion plants, co-located at refineries, 10 – 20 MGY
- ❑ Competition with direct digestion

# California FOG to Biodiesel Potential



# Revenue Opportunity for WWTP

---

## Example:

Processing 5 million gallon trap waste per year (4 large tanker trucks per day)

At 5% grease content, BG production = 0.25 million gallons/yr  
Biodiesel production = 0.25 million gallons/yr

Revenue from Brown Grease Recovery = \$675,000/yr

- Tipping Fee 5 ct per gallon = \$250,000/yr

- Brown Grease market value = 50 ct/lb = \$425,000/yr

Revenue from Biodiesel Production = 1,575,000/yr

- Tipping Fee 5 ct per gallon = \$250,000/yr

- Biodiesel Market Value \$5.30/gal = \$1,325,000/yr

# Compatibility with WWTP Operations

---

## Collection and separation of brown grease :

- ❖ Disposal of white water
- ❖ Recycled process water
- ❖ Spill containment / cleanup
- ❖ Tipping Fees
- New process
- Night-time / early morning deliveries

## Biodiesel conversion:

- ❖ Disposal of waste streams
- ❖ City/County vehicle fleet
- ❖ Diesel Sales Revenue
- Chemical Processing
- Hazardous Chemicals
- Economy of Scale

# Questions



# Definitions

---

- ❑ Brown grease – Waste fats, oils, and grease recovered from grease trap waste
- ❑ Concentrated brown grease – Brown grease at 2% MIU
- ❑ FOG – Fats, oils, and grease
- ❑ GHG – Greenhouse gas
- ❑ Grease trap – Device that intercept fats, oils, grease, and solids before entering sanitary sewers
- ❑ Grease trap waste – Waste from kitchen grease trap
- ❑ MIU – Moisture, insolubles, and unsaponifiables
- ❑ Raffinate – Homogenized FOG and white water component from grease trap waste
- ❑ White water – Water component from grease trap waste
- ❑ Yellow grease – Used fryer grease