City of San Mateo
Biogas to CNG

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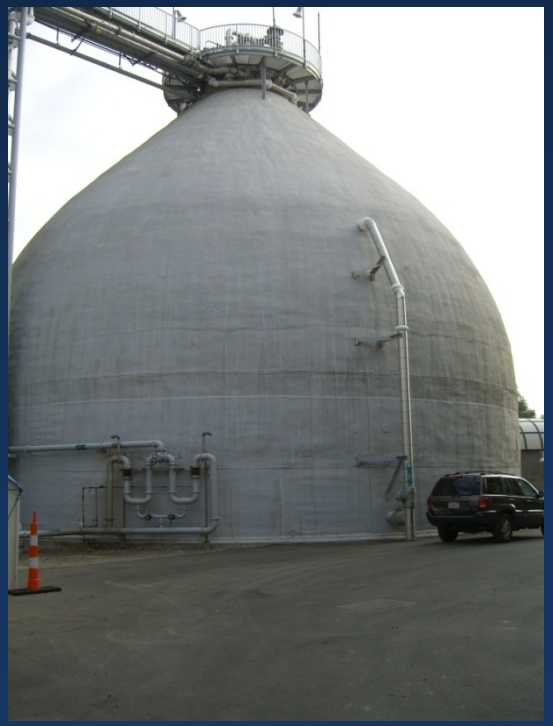
San Mateo WWTP

- **Wastewater solids from WWTP with ADWF of 11.6 mgd**
- **Two egg shaped digesters**
- **1.2 million gallon capacity each**
- **100 cfm of digester gas available**



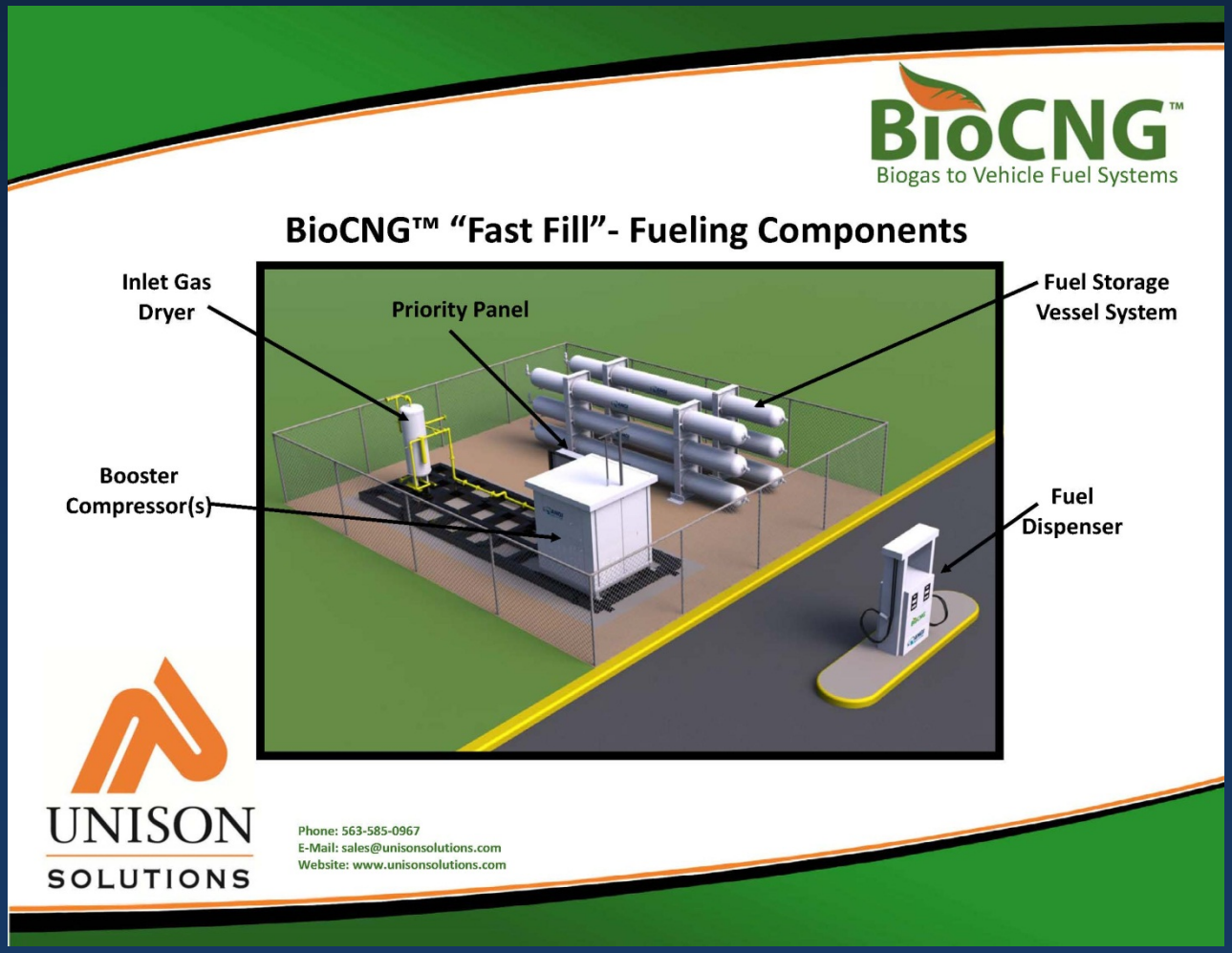
Project Goals/Questions

- **Develop project to use beneficially use the energy from the 100 cfm of digester gas**
- **Assess cost-effectiveness of CNG production for vehicle fueling**
- **Assess potential for increased gas production by adding high strength waste**

Modifications Needed

- **Digester gas treatment**
  - **Moisture**
  - **Siloxane**
  - **Carbon dioxide**
- **Gas storage**
- **Gas system controls**
- **Vehicle fuel storage and dispensing**
- **Converted vehicles to CNG**

Vehicle Fueling Layout



Findings from the Study

- **Digester capacity for high strength waste**
- **Can produce 500 GGE**
- **Existing utility vehicles could use about 280 GGE**

Alternatives Financial Comparison

Alternative	Biogas	Project Cost	Annual O&M Costs	Annual Savings	Simple Payback
Do Nothing		-	-	-	-
Gas from WW solids only	100 cfm	$4.7	$0.21	$0.61	7.8 yrs
Gas from WW Solids & FOG	200 cfm	$8.0	$0.38	$1.81	4.4 yrs

Key Variables for Successful Project

- **Reliable gas treatment**
- **Vehicle conversion to CNG**
- **Need to use 500 GGE per day**
- **Contract for FOG or other high strength waste**

Existing Gas Treatment Examples

West Lafayette, IN

Clean World Facility, CA

Existing CNG Storage Examples

Clean World Facility

City of Millbrae

GMC CNG Vehicle

Express/Savana CNG Cargo Van

A Complete, Integrated CNG Solution

Whether it's meeting company-wide initiatives or government standards, fleet managers face many challenges. GM offers the Express/Savana Compressed Natural Gas (CNG) option for fleet and commercial customers. The option is available for ordering on Express/Savana 2500 and 3500 Cargo Vans.

EASY ORDERING

- Ordering is easy — just choose a three- or four-tank system and your sales consultant checks the order box. FHZ is the regular production option for compressed natural gas.
- The vehicle is built with a gaseous fuel-ready engine. The fuel delivery/storage systems are added using a dual-stage, single-invoice process. The ordering system allows you to then take advantage of the many upfitters available for cargo management solutions or other customization.
- GM is the only manufacturer with a fully integrated solution for vans.

ENGINEERED BY GM

- Express/Savana use a proven, 6.0L Vortec V-8 engine with factory-installed hardened exhaust valves and intake/exhaust valve seats. These components are engineered to GM durability standards for gaseous fuel use.
- Two systems are offered:
  - (UFM) Three-tank system provides a range of up to approximately 200 miles. Allows for use of complete cargo area.
  - (UFP) Four-tank system provides a range of up to approximately 300 miles. This system adds a single tank in the driver's side of the cargo area, just inboard of the wheel well.
- Meet rigorous GM standards for safety, reliability, and durability.

BACKED BY GM

- All major components will have GM service part numbers for broad availability, providing you peace of mind that parts will be available to keep your fleet on the road.
- Express/Savana have a comprehensive 5-Year/100,000-Mile Transferable Powertrain Limited Warranty.[1]
- Backed by the largest dealer network in the U.S.
- Express/Savana are the only full-size vans with available factory OnStar[2] including a Live Advisor for help when you need it.

To learn more, visit gmfleet.com.

GM Fleet & Commercial
CHEVROLET • BUICK • GMC • CADILLAC

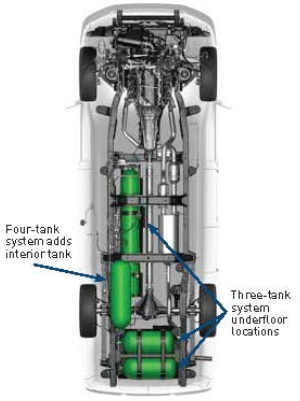
[1] Whichever comes first. See dealer for details.
[2] Visit onstar.com for coverage map, details, and system limitations.

CNG Cargo Van Specifications

	Regular Wheelbase (135-inch) or Extended Wheelbase (155-inch) Cargo Vans only
	2500: 8,600 GVW
	3500: 9,600 GVW
	(LC8) 6.0L Gaseous Fuel-Ready Engine
	282 hp @ 4800 rpm SAE Net
	320 lb-ft @ 4400 rpm SAE Net
	6-Speed Automatic
	EPA: BIN 5
	CARB: LEV2 - SULEV
	Certified in all 50 states
	23%
	Regular Wheelbase:
	Three-Tank - 2500: 2,673 lb; 3500: 3,628 lb
	Four-Tank - 2500: 2,373 lb; 3500: 3,328 lb
	Extended Wheelbase:
	Three-Tank - 2500: 2,458 lb; 3500: 3,433 lb
	Four-Tank - 2500: 2,158 lb; 3500: 3,131 lb
	Three-Tank - 15.8 GGE
	Four-Tank - 23.1 GGE
	Three-Tank - 200 miles
	Four-Tank - 300 miles
	Three-Tank System: Dual tanks aft of the rear axle (underbody, replaces the spare tire), single midship (underbody, replaces the gas tank)
	Four-Tank System: Same as Three-Tank System, plus a single interior tank in the driver's side of the cargo area
	5-Year/100,000-Mile Transferable Powertrain Limited Warranty[2]
	3-Year/36,000-Mile Limited Bumper-to-Bumper Warranty[2]
Emissions Warranty	Subject to individual state regulations
Options Required	(FHZ) Monofuel Compressed Natural Gas (CNG) Fuel Package
	(LC8) 6.0L Gaseous Fuel-Ready Engine
	(UFP) Four-Tank System or (UFM) Three-Tank System
	(Z82) Trailering Equipment
	(ZX9) Spare Tire and Jack Delete
	(V10) Cold Climate Package

Compressed Natural Gas

Tank Locations



[1] Gas Gallon Equivalent (GGE). The vehicles may be filled at either a 3,600-psi or 3,000-psi station. Note: Filling at a 3,000-psi station will result in a reduced amount of dispensed fuel and resulting loss of range. Based on individual driving habits, your range may be less.
[2] Whichever comes first. See dealer for details.

Next Steps-General

- Confirm use of 500 GGE/day
- Consider addition of high strength waste to produce 1000 GGE/day
- Identify vehicles
  - San Mateo vehicles
  - County transit
  - School buses
  - Neighboring cities
- Consider Environmental impacts (CEQA)

Next Steps-Schedule

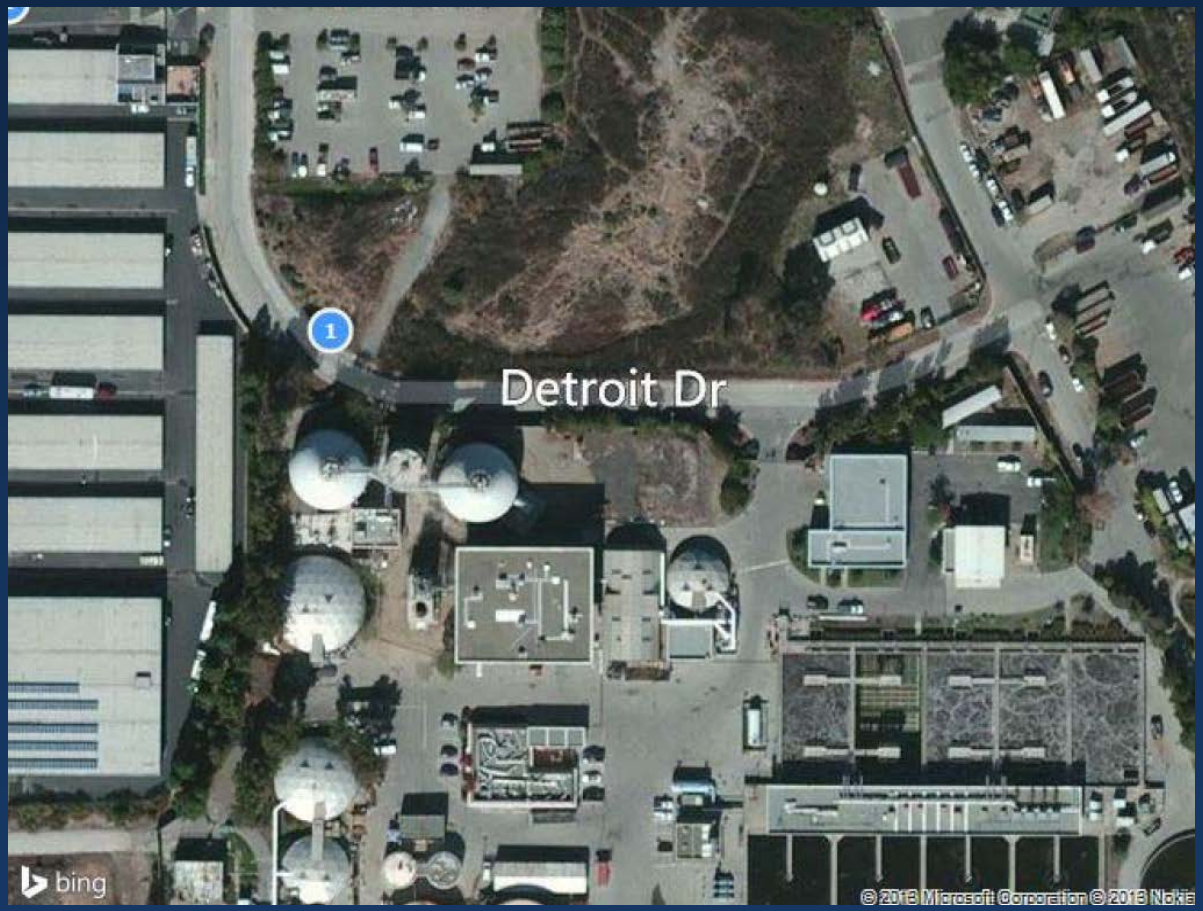
- **Separate project**
  - **Design-build**
    - **12 months**
    - **Quick reviews by City**
  - **Design-Bid-Build**
    - **15-18 months**
    - **Typical review process**
- **Include with Corp Yard project**

Next Steps-Predesign

- Gas system control (supply vs. demand)
- Assess need for gas storage
- Location of modifications
- Refine cost and payback

Questions?

General info slides

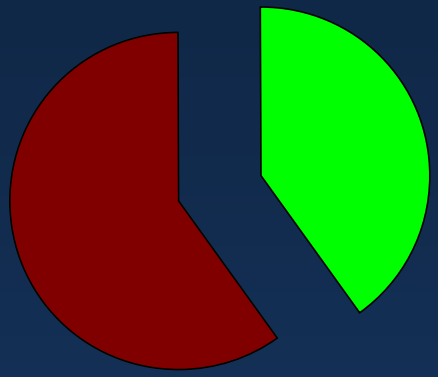


How Much Grease is Out There?

- **Some Trap Grease Production Rates*:**
  - **National Avg. = 13.4 lbs/year/person**
  - **Sacramento, CA Avg. = 11.2 lbs/year/person**
  - **Provo, UT Avg. = 26.6 lbs/year/person**

* Source: Wiltsee, G. “Urban Waste Grease Resource Assessment.” NREL. November 1998

Food Waste



40% not eaten

Food Waste

29 Million tons per year

17% of landfill volume

Food Waste

- Greenhouse gas emissions - methane and carbon dioxide
- 23% of methane emissions (2nd largest)
- Lost opportunity