PROMETHEUSenergy

bioLNG: The Prometheus Experience

September 18, 2009 – Erik Montague, Business Development

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Mini LNG Business Model

LNG Development → **Plant Operation & Fuel Distribution** → **Product Sales**

Biomethane

Coalmine methane

Remote well gas

Pipeline gas

Vehicle fuel

Industrial usage

Remote communities

Utility demand

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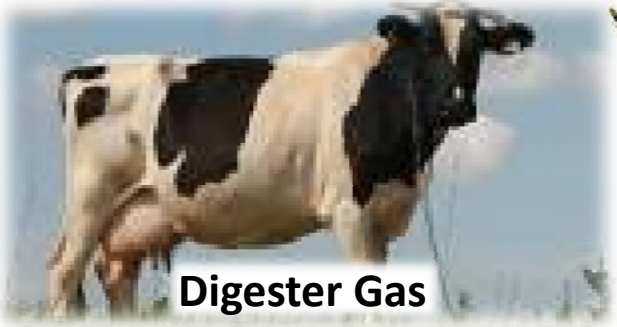
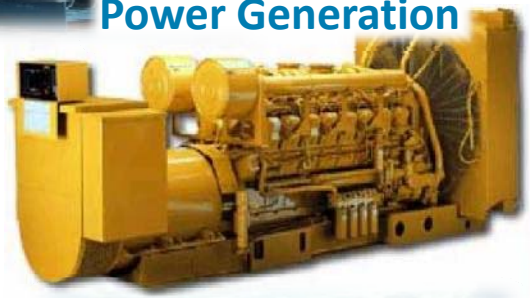
Biomethane Development Options



Direct Use, Medium BTU

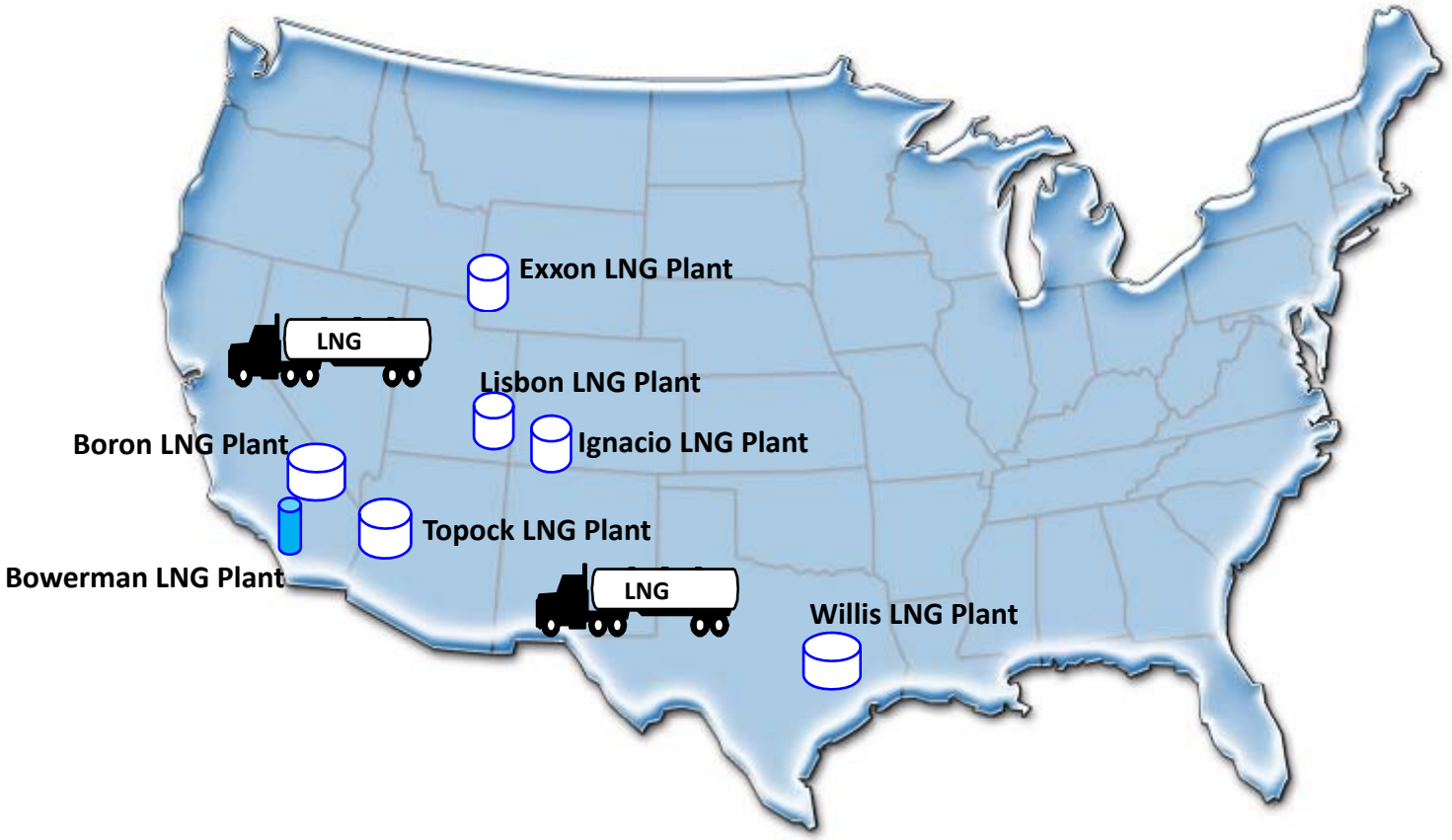
Power Generation



Pipeline Injection, High BTU

bioLNG

The Western US LNG Market: Conventional Sources & bioLNG



→Existing LNG Market Production Capacity of 700 tpd / 450,000 gpd

→Bowerman bioLNG Plant represents approximately 1% of market production capacity

→Promise of more to come….both traditional & bio-based

Frank R. Bowerman Landfill

- Located in Irvine, California
- Landfill is owned/operated by Orange County Integrated Waste Management Department
- Landfill site is 725 acres
- Max permitted daily acceptance rate is 8,500 tons/day
- 10 MMscfd of LFG is flared each day

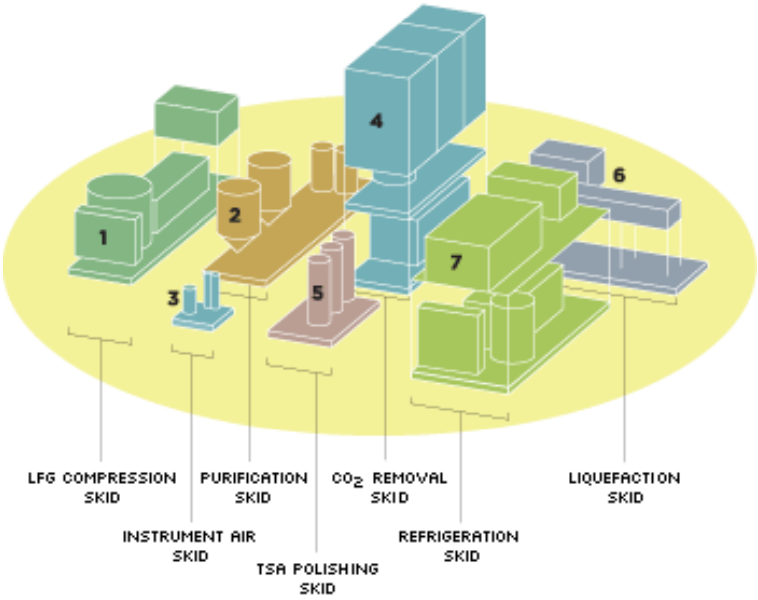
bioLNG Project Design Basis

LANDFILL GAS CONDITIONS

- PRESSURE: 14.8 PSIA
- TEMPERATURE: 90 ^{O}F (AMBIENT)
- FLOW:
  - 1,238,000 scfd = 860 scfm
  - 3,801 lbs/hr
- COMPOSITION:
  - 46% METHANE
  - 36.4% CO2
  - 12.5% NITROGEN
  - 1% OXYGEN
  - SAT. WATER (@ 14.8 PSIG)
  - OTHER STUFF

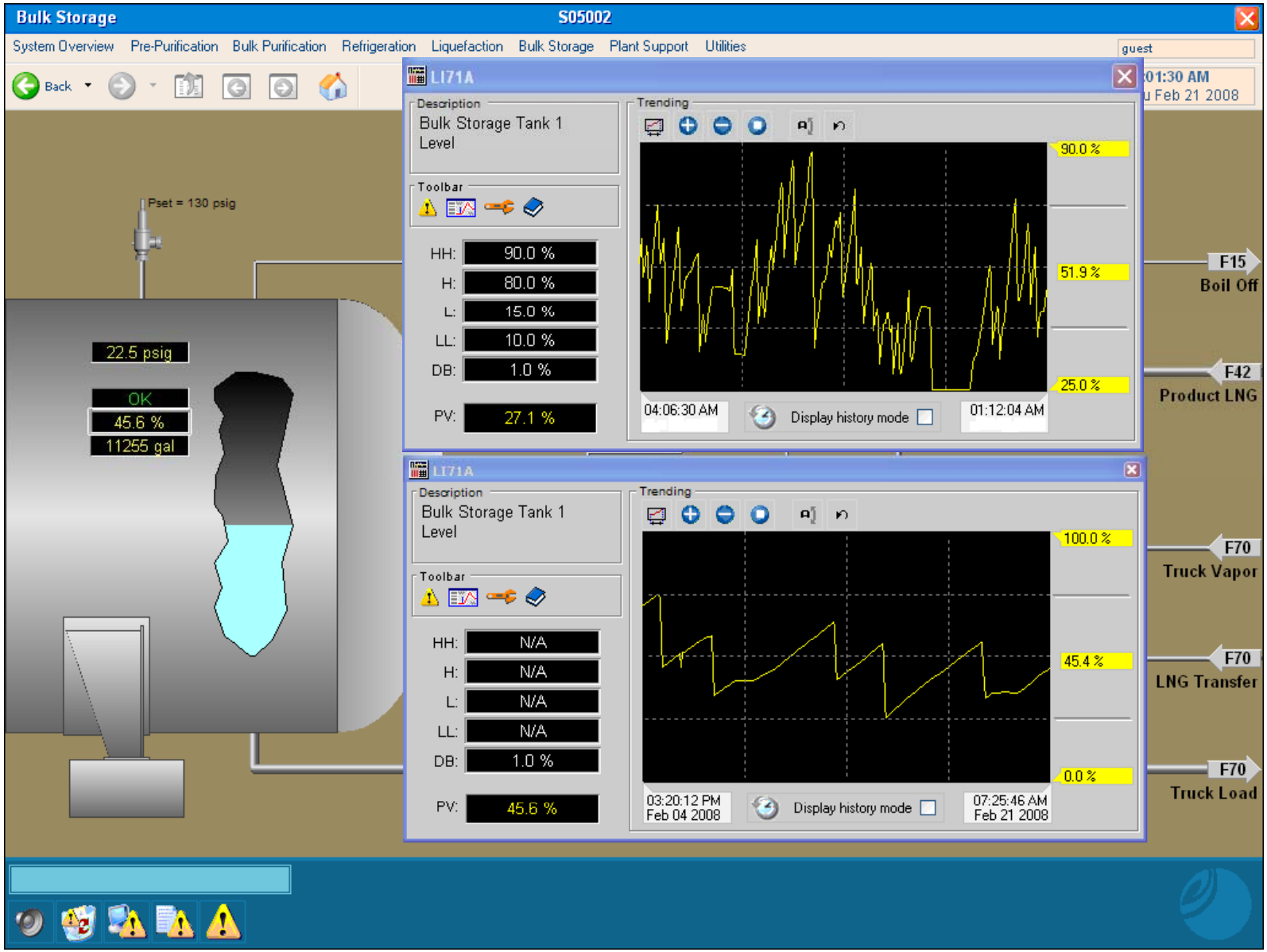
LNG PRODUCT CONDITIONS

- PRESSURE: 34.6 PSIA
- TEMPERATURE: -255 ^{O}F
- FLOW:
  - 3.5 GPM, 785 lbs/hr
- COMPOSITION:
  - ≥97.3% METHANE
  - 1.8% NITROGEN
  - 0.9% OXYGEN



Bowerman Landfill bioLNG Plant

LNG Storage & Tanker Loadouts



LNG Tanker Loadouts & Logistics

Trailers Loaded & Off To Market

bioLNG Product Quality

EPA Method 3C & 10B

Analyte		Hydrogen	Oxygen	Nitrogen	CO	Methane	CO2
Client ID	AAC ID	%	%	%	%	%	ppmv
Sample Bottle #7	080817-36659	<PQL	0.63	1.14	<PQL	98.2	< 10 ppmV

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	Sample Bottle			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	090251-38051				
Date Sampled	04/16/2009				
Date Analyzed	04/20/2009				
Can Dilution Factor	3.75				
	Result	Qualifier	Analysis DF		
Benzene	<SRL	U	1.0	1.9	0.5
Carbon Tetrachloride	<SRL	U	1.0	1.9	0.5
Cyclohexane	<SRL	U	1.0	1.9	0.5
1,2-Dichloropropane	<SRL	U	1.0	1.9	0.5
Bromodichloromethane	<SRL	U	1.0	1.9	0.5
1,4-Dioxane	<SRL	U	1.0	1.9	0.5
Trichloroethene	<SRL	U	1.0	1.9	0.5
2,2,4-Trimethylpentane	<SRL	U	1.0	1.9	0.5
Heptane	<SRL	U	1.0	1.9	0.5
cis-1,3-Dichloropropene	<SRL	U	1.0	1.9	0.5
4-Methyl-2-Pentanone (MiBK)	<SRL	U	1.0	1.9	0.5
t-1,3-Dichloropropene	<SRL	U	1.0	1.9	0.5
1,1,2-Trichloroethane	<SRL	U	1.0	1.9	0.5
Toluene	<SRL	U	1.0	1.9	0.5
2-Hexanone	<SRL	U	1.0	1.9	0.5
Dibromochloromethane	<SRL	U	1.0	1.9	0.5
1,2-Dibromoethane	<SRL	U	1.0	1.9	0.5
Tetrachloroethylene	<SRL	U	1.0	1.9	0.5
Chlorobenzene	<SRL	U	1.0	1.9	0.5
Ethylbenzene	<SRL	U	1.0	1.9	0.5
m- & p-Xylenes	<SRL	U	1.0	3.7	1.0
Bromoform	<SRL	U	1.0	1.9	0.5
Styrene	<SRL	U	1.0	1.9	0.5
1,1,2,2-Tetrachloroethane	<SRL	U	1.0	1.9	0.5
o-Xylene	<SRL	U	1.0	1.9	0.5
4-Ethyltoluene	<SRL	U	1.0	1.9	0.5
1,3,5-Trimethylbenzene	<SRL	U	1.0	1.9	0.5
1,2,4-Trimethylbenzene	<SRL	U	1.0	1.9	0.5
Benzyl Chloride	<SRL	U	1.0	1.9	0.5
1,3-Dichlorobenzene	<SRL	U	1.0	1.9	0.5
1,4-Dichlorobenzene	<SRL	U	1.0	1.9	0.5
1,2-Dichlorobenzene	<SRL	U	1.0	1.9	0.5
1,2,4-Trichlorobenzene	<SRL	U	1.0	1.9	0.5
Hexachlorobutadiene	<SRL	U	1.0	1.9	0.5
BFB-Surrogate Std. % Recovery	91%				70-130%

U - Compound was analyzed for, but was not detected at or above the SRL.

Total Reduced Sulfur Compounds Analysis by ASTM D-5504

Client ID	Sample Bottle		SRL (RLxDF's)	Reporting Limit
AAC ID	090251-38051			
Canister Dil. Fac.	1.0			
Analyte	Result	Analysis Dil. Fac.		
Carbonyl Sulfide	<SRL	1.0	0.010	0.01
Hydrogen Sulfide	<SRL	1.0	0.010	0.01
Carbon Disulfide	<SRL	1.0	0.010	0.01
Sulfur Dioxide	<SRL	1.0	0.010	0.01
Methyl Mercaptan	<SRL	1.0	0.010	0.01
Ethyl Mercaptan	<SRL	1.0	0.010	0.01
Thiophene	<SRL	1.0	0.010	0.01
Dimethyl Sulfide	<SRL	1.0	0.010	0.01
Isopropyl Mercaptan	<SRL	1.0	0.010	0.01
n-Propyl Mercaptan	<SRL	1.0	0.010	0.01
tert-Butyl Mercaptan	<SRL	1.0	0.010	0.01
iso-Butyl Mercaptan	<SRL	1.0	0.010	0.01
sec-Butyl Mercaptan	<SRL	1.0	0.010	0.01
n-Butyl Mercaptan	<SRL	1.0	0.010	0.01
3-Methylthiophene	<SRL	1.0	0.010	0.01
Dimethyl Disulfide	<SRL	1.0	0.010	0.01
Diethyl Sulfide	<SRL	1.0	0.010	0.01
2-Ethylthiophene	<SRL	1.0	0.010	0.01
2,5-Dimethylthiophene	<SRL	1.0	0.010	0.01
Tetrahydrothiophene	<SRL	1.0	0.010	0.01
Diethyl disulfide	<SRL	1.0	0.010	0.01
Benzothiophene	<SRL	1.0	0.010	0.01
Total Unidentified Sulfurs as H_2S	<SRL			0.01
Total Reduced Sulfurs as H_2S	<SRL			0.01

All compound's concentrations expressed in terms of H_2S (TRS does not include COS and SO_2)
Sample Reporting Limit (SRL) is equal to Reporting Limit x Canister Dil. Fac. x Analysis Dil. Fac.

Where to next?

→Project development consideration should include contracting for/leveraging multiple methane feedstocks

→Project size, location and technical approach key criteria for successful end result

→Patience, curiosity and problem solving spirit a must

→Biomethane development opportunities plentiful