



# Non Conventional Gas High Monetization Technology

EPA –Methane to Market - Jan, 2009 - Monterrey



## *Concept - High Monetization of Non Conventional Gas*

- *Characteristics of Non Conventional Gas*
- *How to maximum Value of your CMM and CBM resource*

## *Our Vision – The virtual Pipe Concept*

- *Access to high Value Market*
- *CNG and LNG Virtual Pipe*

## *Cost Modeling – Monetization Technology Comparison*

- *Technology evaluated*
  - *Well to Energy (standard and High efficiency Genset)*
  - *Well to CNG*
  - *Well to LNG*
- *Simulation and Sensibility analysis*

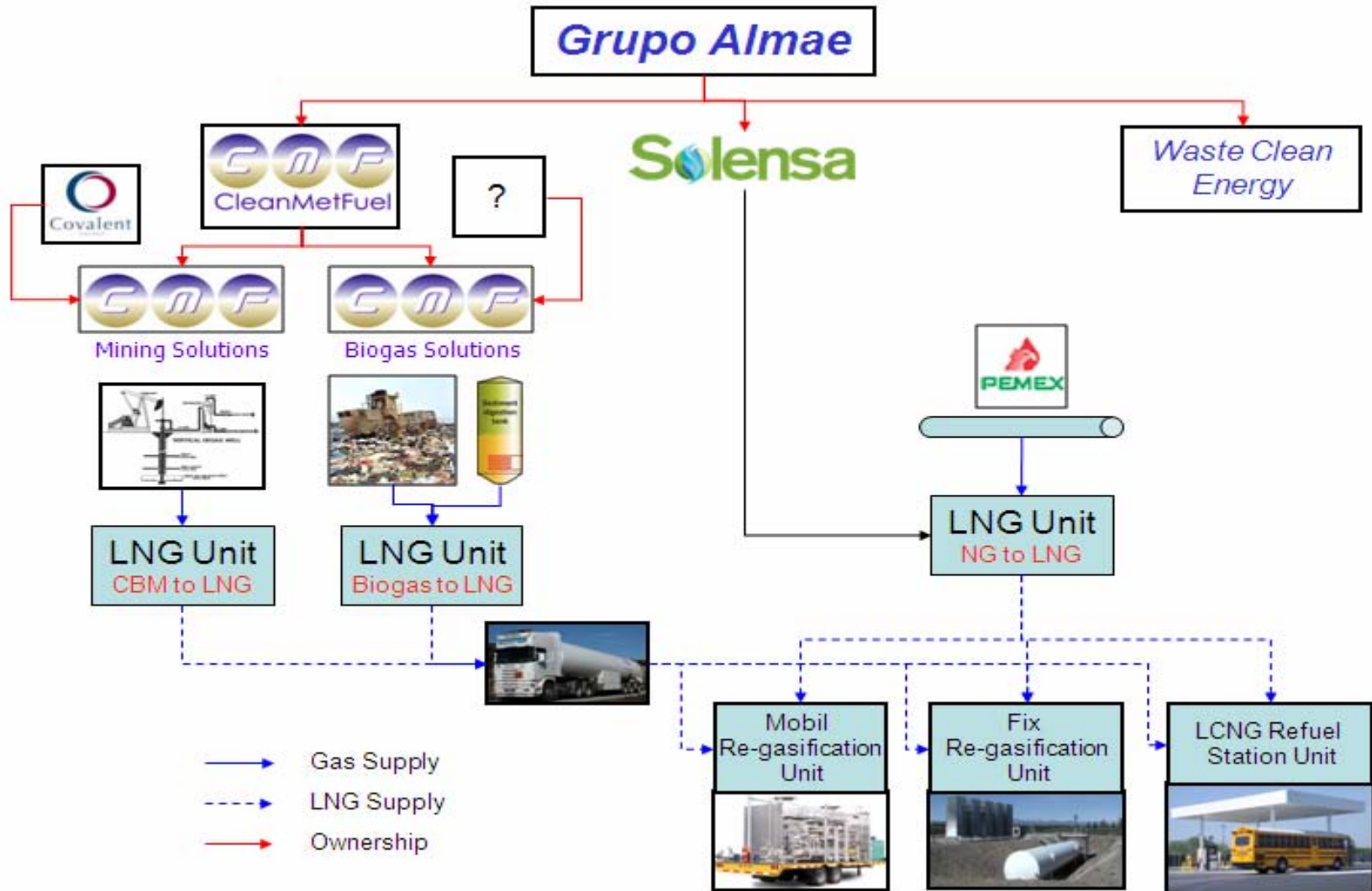
## *Our Development – Progress*

- *High efficiency Power Generation (CCL Cycle)*
- *CNG Fast Loading system*
- *Low Cost, Small Scale Liquefier*



# Project Overview: *Who are we*

*CMF, part of Grupo Almae Corporate Group has been created to support the development of new Technology for High Monetization of Non Conventional Gas.*





# Concept: *High Monetization of NC. Gas*

## *Non Conventional Gas Characteristics*

*Small Scale:* *Infrastructure investment is Limited*

*In Sabinas Basin current Total CMM/CBM production represents less than 1/3 of one typical Natural Gas Well prod.*

*Isolated:* *Disconnected from end user market*

*There is no city or Industry close enough from productive mines and no pipeline to be connected to National Gas Distribution System*

*Consequence:* *Resource Value is limited*





# Concept: *High Monetization of NC. Gas*

*How to Maximize value of your Non Conventional Gas*

*“Connect the Resource to the High Value Market”*

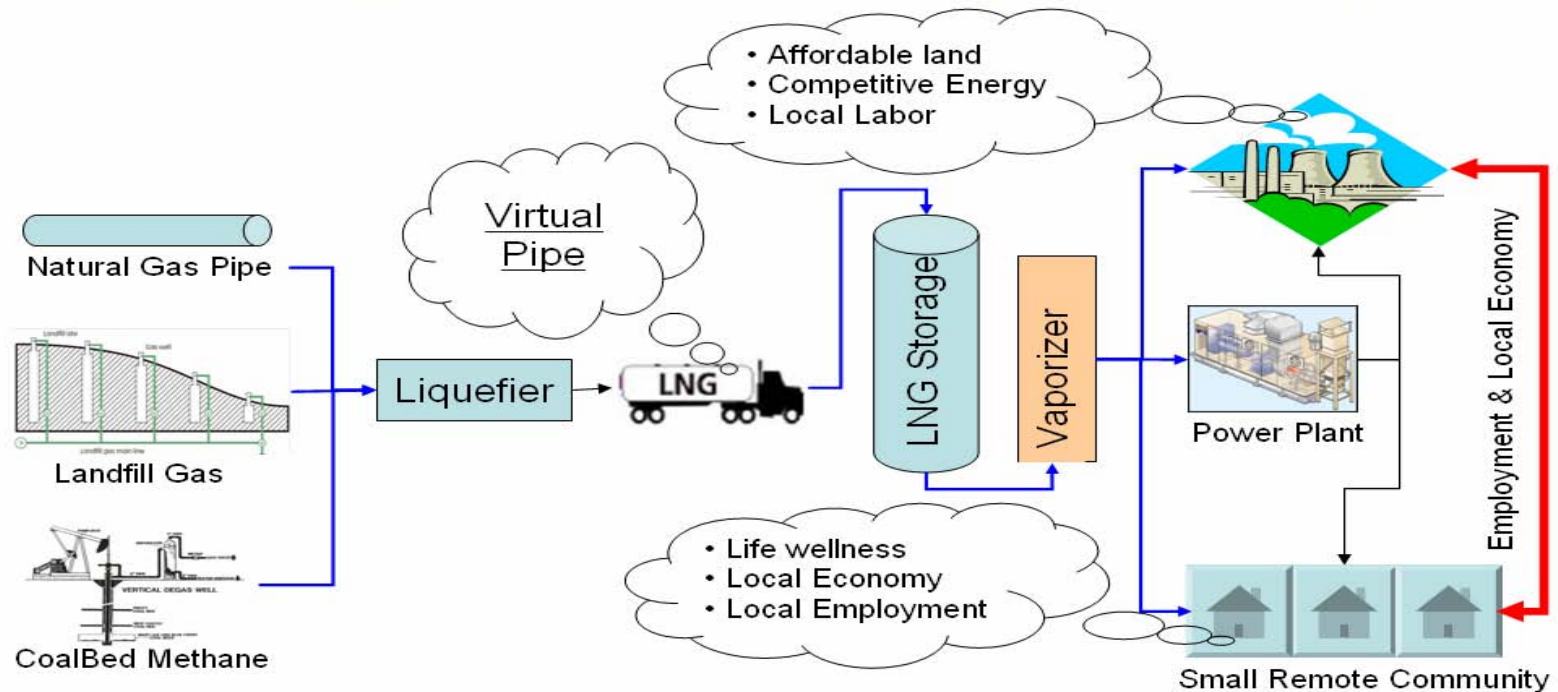
*Logistic issue*

- *Connect the resource to a distribution System:* \$ ??
- *Create a local demand:* Industry?
- *Move your resource to the Market* How ??

# Our Vision: The Virtual Pipeline Concept

## How to connect your resource to High Value Market

Liquid Gas: Competitive Clean Fuel for Community sustainable development



## Transportability transforms Resource in Commodities

- Reduce Infrastructure Cost
- Respond to Market Offer and Demand
- Flexibility to focus on best market





# *Our Vision : What is LNG?*

## *LNG facts*

- ✓ When natural gas is cooled to a temperature of approximately  $-260\text{ }^{\circ}\text{F}$  ( $-160\text{ }^{\circ}\text{C}$ ) at atmospheric pressure it condenses to a liquid called liquefied natural gas (LNG).
- ✓ One volume of LNG takes up about **1/614th the volume** of natural gas.
- ✓ LNG is only about **45% the density of water**. LNG is odorless, colorless, non-corrosive, and non-toxic.
- ✓ LNG depending composition and Quality has a calorific power of **84,000 Btu/gal** compare to LP gas (94,000 btu)
- ✓ When vaporized it burns only in concentrations of 5% to 15% when mixed with air.
- ✓ Safe: Neither LNG, nor its vapor, can explode in an unconfined environment.
- ✓ Truck transport of LNG is a well proven technology fully normalized in Europe & US.
- ✓ The liquefaction process removes the oxygen, carbon dioxide, sulfur compounds, and water. The process can also be designed to **purify the LNG to almost 98% methane**.



# *Our Vision: Virtual Pipeline Applications*

## *LNG or CNG Commercial applications*

*Once you get CNG or LNG, you have an affordable, environment friendly and transportable commodity.*

*Because LNG or CNG is relatively easy to store and transport we have the flexibility to serve a large variety of business and applications*

### *Isolated Industry*



*Clean Energy  
Cheaper than LP gas or Diesel  
Dedicated Service*

### *Industrial park or private gas network*



*Virtual Natural Gas connection  
Competitive Energy vs LP Gas , Diesel, or H. Fuel  
Competitive land price*

### *Isolated Power Plant*



*Clean and friendly Energy  
Virtual NG connection  
Cheaper than LP gas or Diesel  
Turbine technology*

### *Gas Vehicular*



*Competitive price vs Gasoline and LP gas  
Environment friendly  
Supply both LNG and CNG vehicles  
Low Tax*





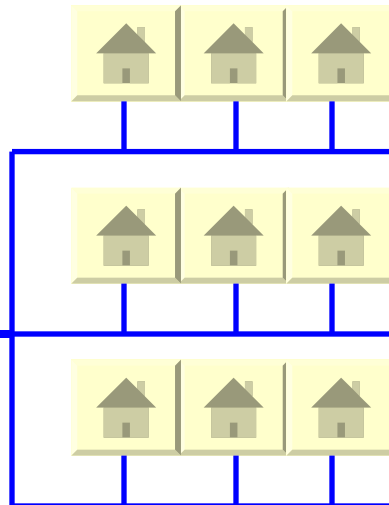
# Our Vision: Virtual Pipeline Applications

## Private Gas Distribution Network Concept

Create a private Natural Gas distribution Network disconnected to the main National Distribution System supplied by a “LNG virtual pipeline”

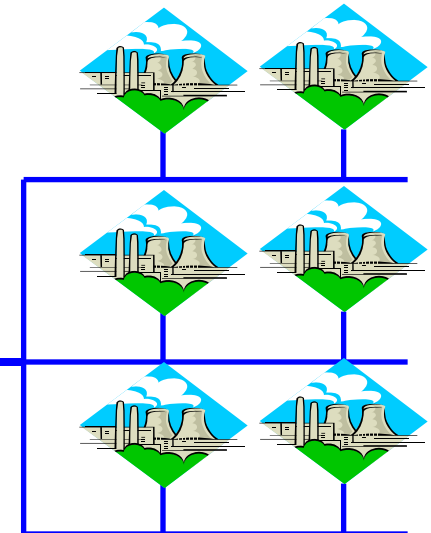
### Real State & Social Housing Development

#### Re-gasification Unit



### Industrial Park Development

#### Re-gasification Unit



## Advantages

- ✓ Develop rural economic activity
- ✓ Provide a clean energy
- ✓ Provide a competitive energy (10-20% less expensive than Gas LP)

- ✓ Take advantage of low Cost land
- ✓ Improve life wellness
- ✓ Decentralization of the economic activity



# Cost Modeling: *Technology Comparison*

## *Technology evaluated*

### ***High Efficiency Power Generation:***

*Low Cost Field Turbine associated with a Waste to Energy Close Cascade Loop Cycle to recover energy from the Exhaust gas*

### ***CNG virtual pipeline:***

*Compression and transport of Natural gas using a fast low operation cost loading system*

### ***LNG virtual pipeline:***

*Liquefaction and transport of Natural gas using a small scale, low operation cost liquefier and customer dedicated small regasification unit*



# Cost Modeling: Technology Comparison

## Simulation Results

Gas Flow:	1.00	MMcfd		Capex USD	Unit Sold per day	Fuel Cost / unit Sold	Total Prod Cost / Unit Sold	Gross Margin				Mcf Value
Gas Avg CH4 Content:	90%		Well to Pipeline *	200,000	0.95 MMcfd	\$ 0.11 /mmbtu	\$ 0.11 /mmbtu	\$ 5.39 /mmbtu	1.76	mm\$/y		4.83 \$/Mcf
	945	btu/cf	Well to Electricity Std **	2,652,044	94,968 kWd	\$ 0.02 /kw	\$ 0.04 /kw	\$ 0.03 /kw	1.15	mm\$/y		3.15 \$/Mcf
Gas Extraction Cost:	\$ 2.00	per Mcf	Well to Electricity Hef **	4,423,641	129,481 kWd	\$ 0.02 /kw	\$ 0.02 /kw	\$ 0.05 /kw	2.21	mm\$/y		6.06 \$/Mcf
Distance to customer:	400	km round trip	Well to CNG	1,617,048	0.88 MMcfd	\$ 0.28 /mmbtu	\$ 3.27 /mmbtu	\$ 7.73 /mmbtu	2.35	mm\$/y		6.45 \$/Mcf
Typical Freight Cost:	17.0	pesos per km	Well to LNG	3,730,000	0.79 MMcfd	\$ 0.57 /mmbtu	\$ 1.09 /mmbtu	\$ 9.91 /mmbtu	2.69	mm\$/y		7.37 \$/Mcf
	1.3	USD per Km										
Std Efficiency Genset	38%		Note:	* Pipeline Capex does not include cost of Pipeline and inter-connection to Pemex Pipeline								
High Efficiency Genset	53%			** Pipeline Capex assumes that all electricity is auto-consumed (No Inter-connection to CFE)								
				USD/Pesos Exchange Rate:		13.00						

### Key Sale Parameters

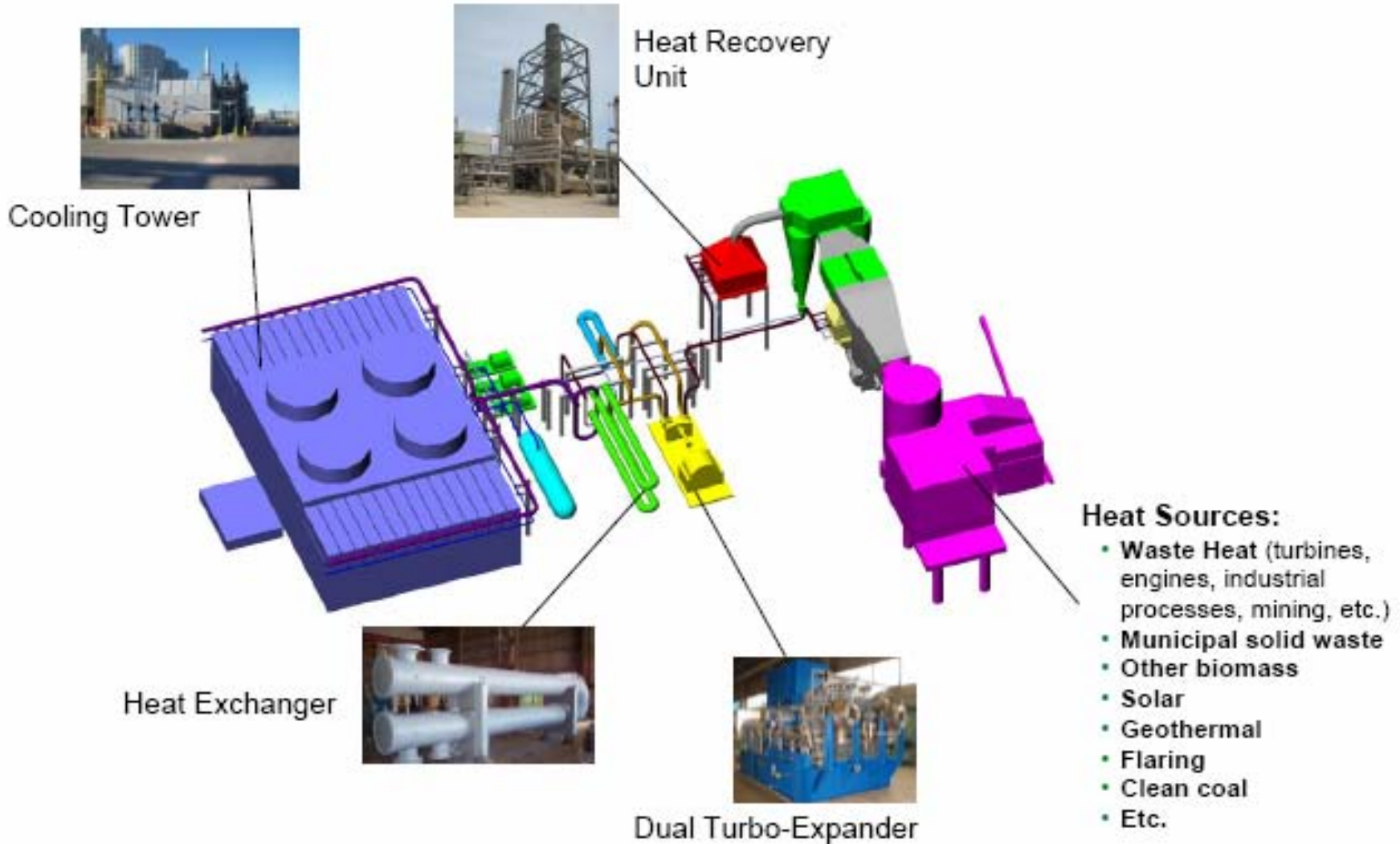
Gas Resale to Pemex:	\$ 5.50	per Mmbtu
	\$ 5.82	per scf
Electricity Resale Price	0.90	pesos per kwh
	0.07	USD per kwh
Gas to Alternative Market	\$11.00	per Mmbtu
	\$11.64	per scf



# Our Development: *Progress*

## High Efficiency Power Generation

*Plant Design concept is completed first plant schedule for 2010.*

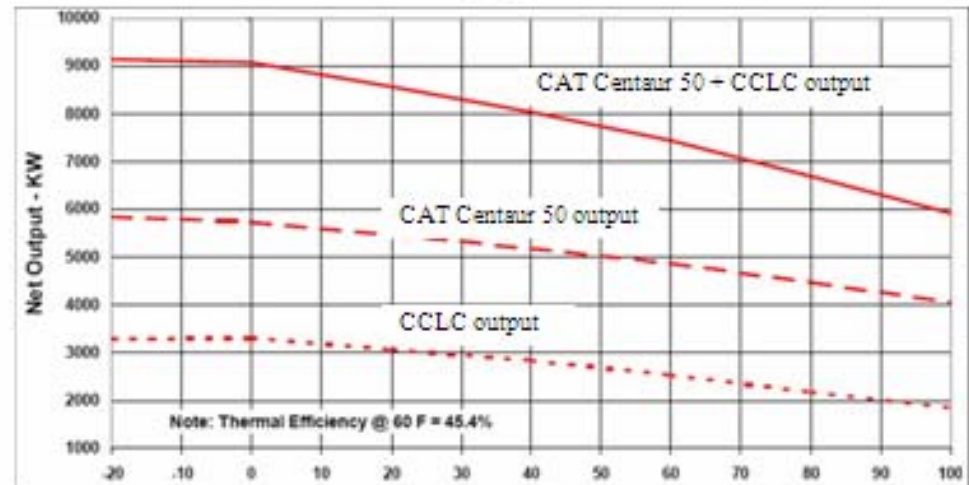
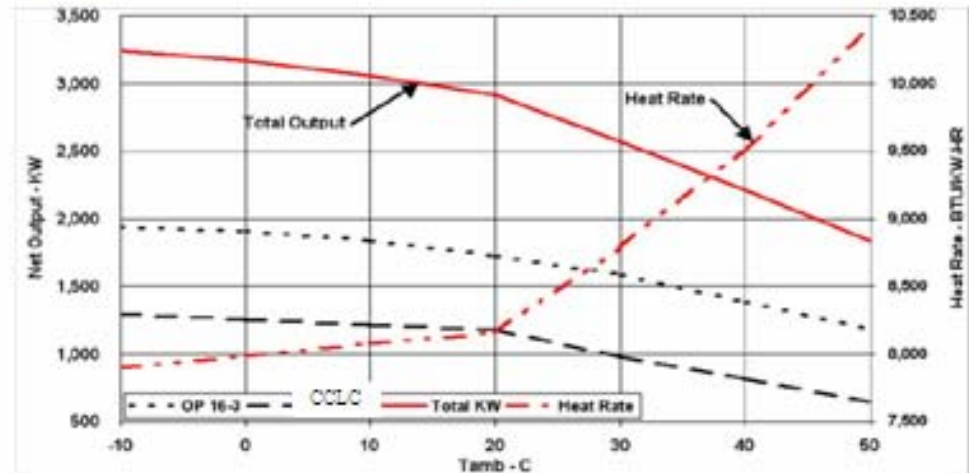




# Our Development: Progress

## High Efficiency Power Generation

Typical Application: Turbine exhaust heat recovery  
 15-25% global electrical efficiency increase.





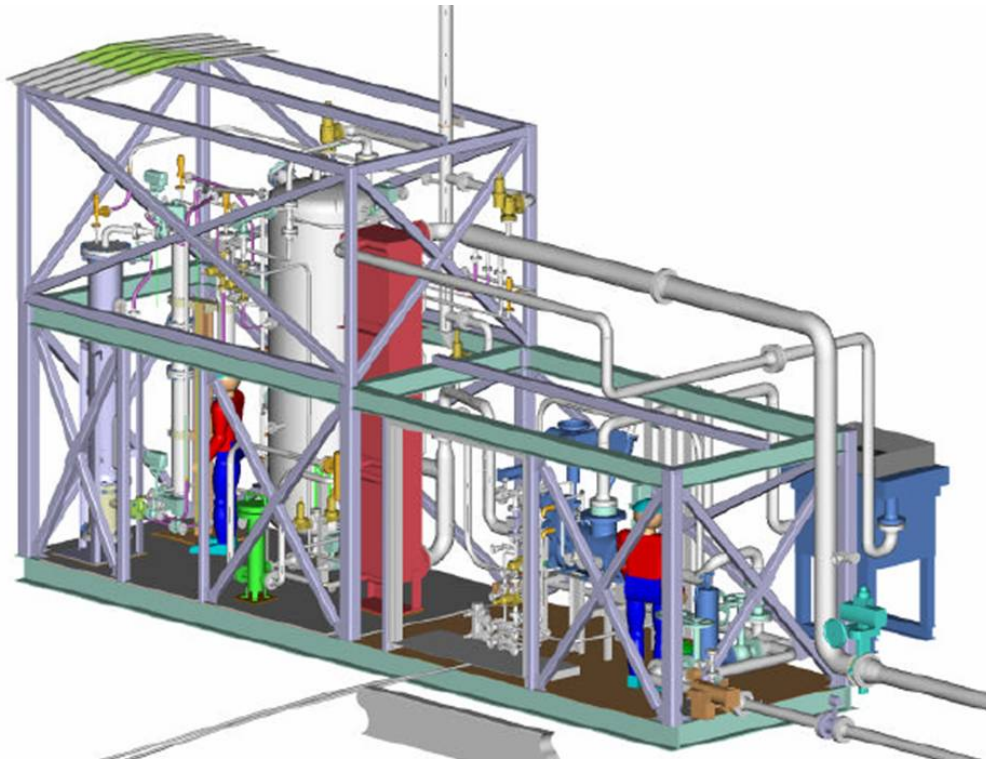


# *Our Development: Progress*

## *Small Scale, Low Cost Liquefier*

*Technology Transfer from INL Laboratory has been successfully completed thanks to EPA Methane to Market grant*

*First plant for Natural Gas Liquefaction is in construction and will be installed in Nov 2009 in Monterrey*



- *Compact Modular Mobile Design*
- *Low Capital Cost*
- *Integrated CO<sub>2</sub> cleaning and Control patented technology*
- *High efficiency 0.8 to 1.1 gal/ kw depending site configuration*