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

**Project Overview:** 
*Who are we*

**Grupo Almae**

- **CMF**
  - Mining Solutions
  - Biogas Solutions

- **CMF**
  - LNG Unit
    - CBM to LNG

- **CMF**
  - LNG Unit
    - Biogas to LNG

- **Solensa**

- **Waste Clean Energy**

- **PEMEX**

- **Mobil Re-gasification Unit**
- **Fix Re-gasification Unit**
- **LCNG Refuel Station Unit**

**Gas Supply**

**LNG Supply**

**Ownership**
### Non Conventional Gas Characteristics

| Concept: High Monetization of NC. Gas |

**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

- Affordable land
- Competitive Energy
- Local Labor

- Life wellness
- Local Economy
- Local Employment

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 $-260 \, ^\circ F$ ($-160 \, ^\circ C$) 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

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

- **Industrial park or private gas network**
  - Virtual Natural Gas connection
  - Competitive Energy vs LP Gas, Diesel, or H. Fuel
  - Competitive land price

- **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

<table>
<thead>
<tr>
<th>Gas Flow:</th>
<th>1.00 MMcf/d</th>
<th>Capex USD</th>
<th>Unit Sold per day</th>
<th>Fuel Cost / unit Sold</th>
<th>Total Prod Cost / Unit Sold</th>
<th>Gross Margin</th>
<th>Mcf Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Avg CH4 Content:</td>
<td>90%</td>
<td>Well to Pipeline *</td>
<td>200,000</td>
<td>0.95 MMcf/d</td>
<td>$0.11/mmbtu</td>
<td>$0.11/mmbtu</td>
<td>$5.39/mmbtu</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Well to Electricity Std **</td>
<td>2,652,044</td>
<td>94,968 kWe</td>
<td>$0.02/kw</td>
<td>$0.04/kw</td>
<td>$0.03/kw</td>
</tr>
<tr>
<td>Gas Extraction Cost:</td>
<td>$2.00 per Mcf</td>
<td>Well to Electricity Hef **</td>
<td>4,423,641</td>
<td>129,481 kWe</td>
<td>$0.02/kw</td>
<td>$0.02/kw</td>
<td>$0.05/kw</td>
</tr>
<tr>
<td>Distance to customer:</td>
<td>400 km round trip</td>
<td>Well to CNG</td>
<td>1,617,048</td>
<td>0.88 MMcf/d</td>
<td>$0.28/mmbtu</td>
<td>$3.27/mmbtu</td>
<td>$7.73/mmbtu</td>
</tr>
<tr>
<td>Typical Freight Cost:</td>
<td>17.0 pesos per km</td>
<td>Well to LNG</td>
<td>3,730,000</td>
<td>0.79 MMcf/d</td>
<td>$0.57/mmbtu</td>
<td>$1.09/mmbtu</td>
<td>$9.31/mmbtu</td>
</tr>
<tr>
<td>Std Efficiency Genset:</td>
<td>38%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>High Efficiency Genset:</td>
<td>53%</td>
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</tbody>
</table>

**Note:**
- * Pipeline Capex does not include cost of Pipeline and inter-connection to Pemex Pipeline
- ** Pipeline Capex assumes that all electricity is auto-consumed (No Inter-conection to CFE)

USD/Pesos Exchange Rate: **13.00**

### Key Sale Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Resale to Pemex</td>
<td>$5.50 per Mmbtu</td>
</tr>
<tr>
<td>Electricity Resale Price</td>
<td>0.90 pesos per kwh</td>
</tr>
<tr>
<td>Gas to Alternative Market</td>
<td>$11.00 per Mmbtu</td>
</tr>
</tbody>
</table>
Our Development: **Progress**

**High Efficiency Power Generation**

*Plant Design concept is completed first plant schedule for 2010.*
High Efficiency Power Generation

Typical Application: Turbine exhaust heat recovery
15-25% global electrical efficiency increase.
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 CO2 cleaning and Control patented technology
- High efficiency 0.8 to 1.1 gal/kw depending site configuration