



Alternate Fuel Refuse and Recycling Trucks

Leading the Way to Energy Independence and a Cleaner Environment

Mack Trucks, Inc. History in Heavy Duty Natural Gas Engine Refuse Trucks + Scenarios for The Next Ten Years

- utilizing NG from conventional, non-renewable sources (gas wells)
- AND
- renewable, “non-conventional” sources of biomass/biogas
- in CA, NJ, PA, GA, MI, other US and international venues

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OUTLINE

- 1.0 What is the Going-Forward Goal of Today's Conference
 - What Should WE Try to Make Happen?
 - I-M-P-L-E-M-E-N-T-A-T-I-O-N
- 2.0 History and Serendipity in the MSW and HD Refuse Truck Industries +
“As the World Turns”
- 3.0 Harmony Among the 5 E's
[Economics, Energy, Engineering, Education and Environment]
- 4.0 The Total Solution for the Customer = Refuse Truck Hauler
 - Optimal Scenario for the US (at least) and the World
 - = Cooperative Competition
- 5.0 Epilogue for Today's Conference
 - Y2005 Energy Policy Act and Tax Credit Extensions for Conventional Sourced NG
 - AND
 - Municipal-Created Waste/Biogas [=Renewable Energy Source]

1.0 What is the Going-Forward Goal of Today's Conference

- What Should WE Try to Make Happen?

I-M-P-L-E-M-E-N-T-A-T-I-O-N

Perspective

- Energy Independence – NO; not likely BUT - YES
 - Diversify sources of energy from a concentration in politically unstable regions that don't exactly like the US
 - WE need energy for several basic uses
 - 1 electric power
 - 2 residential and commercial heating and cooling
 - 3 industrial processes
 - 4 transportation

Our greatest vulnerability is in 4 transportation and the importation and use of liquid fuels

- Alternate Fuel – can be beneficial for the environment but it should, most assuredly, help to diversify sources for transportation fuel

(1.0 continued)

Let's Do the Math

140,000	Refuse Trucks (US Fleet – Class 8)
<u>x10,000</u>	Diesel gallons per year
1.4	Billion diesel gallons per year
<u>x 60%</u>	Conversion to LNG/CNG engines
0.84	Billion diesel gallons per year
<u>X 2.0</u>	[2 LNG gallons = 1 diesel gallon of energy]
1.68	Billion gallons of LNG

Questions

- How many LNG/CNG trucks have to be produced and bought?
- Who will supply the NG fuel?
- Who will build the infrastructure for delivery, storage and dispensing?
- How many in audience are within five years of signing-up for Medicare?
- What do the numbers 2002, 2004, 2007, 2010 mean to you?

(1.0 continued)

Sum of all the Questions =

Need to infuse sizeable long-term capital investments into the market linkages for the supply, distribution and consumption of natural gas used as transportation fuel.

[There is no simple, painless way to displace imported crude oil and liquid fuels.]

How to Do it? [more to follow]

**2.0 History and Serendipity in the MSW and HD Refuse Truck Industries +
“As the World Turns”**

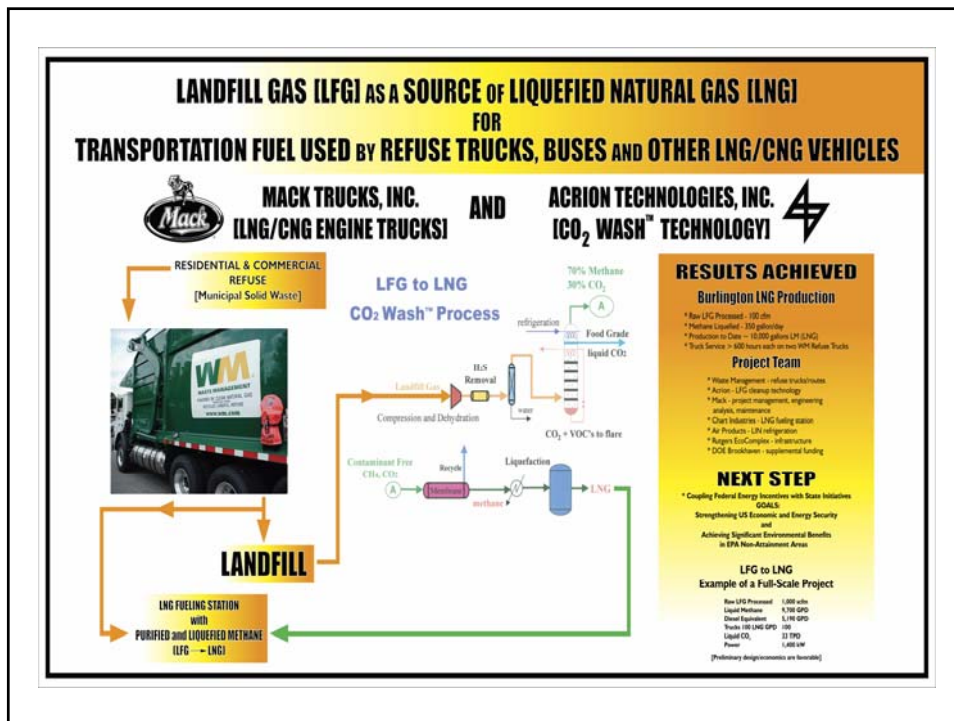
Brief History of Mack’s Two Venture Capital Investments

- Engineering Development, Market Introduction and Sale of 450 LNG/CNG E7G Engine Refuse Trucks
- Six Year Joint Venture Project/Licensing Agreement with Acion Technologies, Inc.
- Recent Volvo Technology Transfer AB “Partnership” with Mack

TIMELINE

- 1995 – 1997 Mack investment in E7G natural gas engine and Washington PA project at WM landfill (7 trucks)
- 2000 – 2002 E7G product launch; 120 LNG truck order with WM/CA; NYC CNG order
- 2002 Acion agreement signed with Mack [Diesel Gallon Price ~ \$1.50]
- 2003 – 2006 Warranty claims surface; continued development on E7G to achieve 2010 emissions standards

- 2004 – 2005 Successful completion of NJ EcoComplex project - 10,000 gallons of LNG fuel from LFG; two LNG WM refuse trucks accumulate 600 hours each - no degradation of engines; no contaminants found in LFG/LNG fuel
- 2005 – 2007 Feasibility studies with LF customers – very favorable
- 2005 – 2007 Uncertainty in decision RE natural gas engine for Mack refuse truck market
- 2007 Cummins-Westport LNG engines ordered by Mack
- 2006 - 2007 Discussions with VTT AB result in working relationship between Mack and VTT to exploit opportunity to sell Mack LNG/C-W engine refuse trucks and LFG/LNG fuel facilities to customers under two separate agreements
- Initial projects pursued in US and Sweden
- 2008 Generation of orders for trucks and full-scale LFG/LNG transportation fuel facilities [Diesel Gallon Price ~ \$3.50-4.00]
- 2008+ What will prices and availability of all fuels be in the next 10 years?



3.0 Harmony Among the 5 E's

[Economics, Energy, Engineering, Education and Environment]

- Conflicts and Cooperation Among Vested/Entrenched Interests and Entrepreneur/Intra-Preneur Marriages
- Domination by One or Several (But Not All) of the Interests Stops the Realistic Evolution toward

I-M-P-L-E-M-E-N-T-A-T-I-O-N

Conflict Examples:

Economics – Whose “Bottom Line?”

1. Customer (generator of refuse) – You and Me as individuals
2. Landfill Operator/Owner/Governing Boards/Shareholders
3. Hauler
4. Capital Equipment infrastructure providers
5. Mack Trucks/Acrion/Volvo Group
6. Other

Energy – “Just Right” Price of Natural Gas from Conventional Sources

Too Low – Recovery of LFG not economical

Too High – Sell the LFG to LNG product (don't use for LNG refuse trucks)

Engineering – “Right-Sized” LFG to LNG liquefaction modules may have to be designed versus re-design of BIG-BIG chemical and oil refinery liquefaction designs

Education – Who is latest “In-Charge” voice in Washington – EPA, DOE?

- Does the public want to become knowledgeable and change individual behavior?

Environment – Within the Harmony Quest let's try to

Maximize Benefits to the Environment

Reduced LFG Greenhouse Emissions: CH₄, CO₂

Reduced Vehicle Emissions: NOX, CO₂

Reduced Use of (New) Fossil Fuel by Recovery of BTUs

4.0 The Total Solution for the Customer = Refuse Truck Hauler
- Optimal Scenario for the US (at least) and the World
= Cooperative Competition

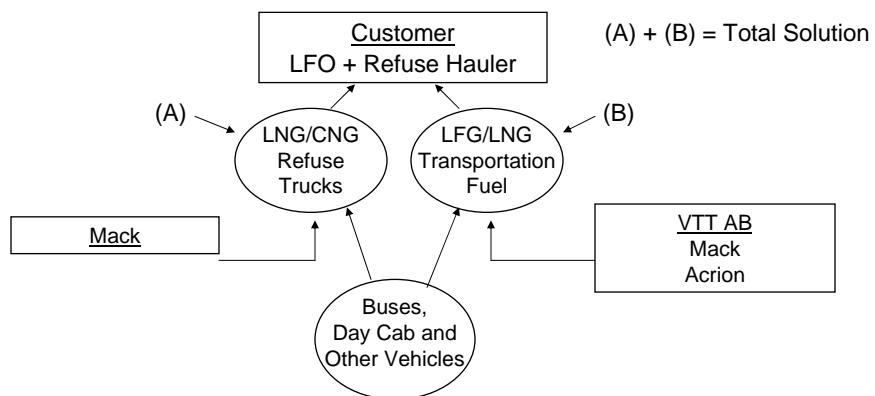
Some More Math

Realistic Target = Displace 60% of diesel fuel used by Refuse Trucks
= 16.8 Billion gallons of LNG Annually

Q: What can Mack/Acrion/VTT AB do for the refuse truck hauler?

Landfill Gas (LFG) to Purified & Liquefied Natural Gas (LNG) Transportation Fuel

[Proposed Project]



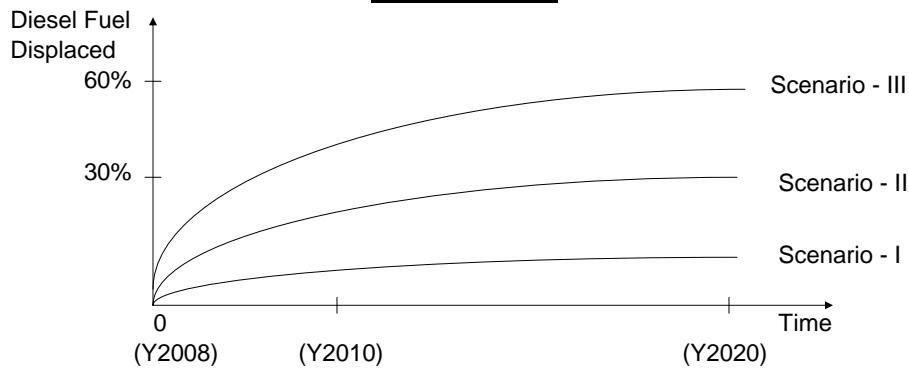
More Math/Reality Check

One good size LF = 10,000 gpd LNG = 3.5 million LNG GP year
 $\frac{1.68 \text{ Billion Gallons LNG}}{3.5 \text{ Million Gallons LNG per LFG/LNG Facility}} = 480 \text{ installations}$

Good Target/Next 5 Years = $10\% \times 480 = 48$
~ \$0.7 Billion in Capital Investment!

So?

Three Scenarios



Q: What Do You Think About The Scenarios?

Scenario I – Plain Old US Competition -

[Texas Hold-Um; Keep Your Cards Close to the Chest]
+ Lots of Trouble; World Economy; HD Engine Technology

Scenario II – Similar to I

[Belief That “Pure” Free-Market Forces Will Save the Day for US Energy Independence] + Less/Lots of Trouble

Scenario III – Cooperative Competition

The US needs an integration of interests to have—

A. HD Engine Market Embrace the Strategy to have (some) NG Vehicles in their Fleets [Refuse Trucks, Day Cab, Buses]

AND

B. Acceptable Legal/Regulatory/Competitor Cooperation among Natural Gas Suppliers (Conventional and Non-Conventional Sources) to build a unique US LNG Supply Infra-structure

5.0 Epilogue for Today's Conference

- Y2005 Energy Policy Act and Tax Credit Extensions for Conventional Sourced NG and Municipal-Created Waste/Biogas [=Renewable Energy Source]

We need to be PROACTIVE at the state and federal level – it won't happen without the E = Education!