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North America's leader in clean transportation



Natural Gas Fueling Infrastructure

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CEC Workshop on Natural Gas and Propane Vehicles

Long Beach CA



September 18, 2009

2007 vs. Today



	Jan 2007	Sept 2009
World Vehicles	5.6 Million*	9.8 Million*
World Stations	10,500*	14,700*
World Fuel Sales	NA	NA
World Ratio veh/stations	533 veh/station	667 veh/station
U.S. Vehicles	146,000*	100,000*
U.S. Stations	1,600*	816*
U.S. Fuel Sales	NA	300 million GGE***
U.S. Ratio veh/station	91	122
California Vehicles	28,000**	31,000**
California Stations	400**	420** (135PA)
California Fuel Sales	110 million GGE**	145+ million GGE**
Calif. Ratio veh/station	60	64

* GVR database ** CNGVC/utility data *** DOE transportation fuel use

Infrastructure vs Vehicles

- No “build it and they will come” strategy
- Infrastructure requires co-development of stations and vehicles
 - Start with stations to serve high fuel use fleets
 - Baseload station with sufficient load for station to be profitable (3-4 yr)
 - Design in sufficient fueling capacity to expand fuel sales
 - **Provide public access to allow expansion to other fleets**
 - Expand station throughput by adding fleets
- Market growth eventually leads to network of stations where greater penetration of vehicles can take place with or without stations growth

High Fuel Use Fleets – Where it Begins

- “Profitable” target throughput >1,000 DEG/GGE per day
 - Class 8 truck 20,000 DEG/yr 14 veh/station
 - Transit bus 15,000 DEG/yr 21 veh/station
 - Refuse Truck 10,000 DEG/yr 26 veh/station
 - Taxi/shuttle 7,500 GGE/yr 48 veh/station
- “Profitable” – throughput justifies
 - Capital expense
 - O&M costs
 - Overhead & profit
 - Offering a competitive fuel price and savings to customers
- Combined with Public Access
 - Allows expansion to collateral markets

Clean Energy Station Capacity

- “Old” design criteria - size stations for specific customer needs
 - Custom design for each system
 - Smaller compressors
 - No compressor redundancy – reliability issues
 - Minimum public access capability
- Today – Modular, redundant, high capacity systems
 - Prefab systems in cargo containers
 - Repetitive design from suppliers
 - Large compressors
 - High capacity (800-1000 SCFM total capacity)
 - Capacity to add multiple dispensers

Fast Fill Stations



Time Fill Stations



Stages of Market Development

- Stage 1 – Greenfield
 - Focus on high fuel use fleets
 - Growing vehicles/load to be profitable
 - Example: Chicago - airports
- Stage 2 – Some limited market
 - Focus on identifying new fleets and synergies with existing stations
 - Example: Sacramento
- Stage 3 – Good penetration of NGVs
 - Target major corporations/fleets
 - Target OEMs to offer more product
 - Example: Los Angeles, San Francisco Bay area

Adding “Dots” to a Map

- Working with world manufacturers to identify small package concepts for adding network capacity
- Galileo Nanobox is one concept
 - Self contained system
 - Offers 100 GGE/hr capacity
 - Add to fuel islands anywhere
- Opportunity to penetrate existing retail fueling market
- Demos planned for 4th quarter



Regional NGV Development – Los Angeles

- 65 Stations in greater Los Angeles area
- Plus over 200 additional private stations
- Opportunity to grow regional trucking
- Can support additional light-duty vehicles
- California Infrastructure 400+ stations is the largest in the U.S.



Expanding Heavy-duty Trucking



- Regional trucking out of ports of California can be accommodated with minimum LNG infrastructure
- Can be expanded to intrastate
- Eventual expansion to major N-S and E-W routes out of California
- Ultimately throughout the U.S.



Conclusions

- Incentives for vehicle purchases more important than incentives for building stations
- Lions share of DOE Clean Cities Grants are for vehicles – not stations
 - Some awardees already seeking to switch vehicles from one alt fuel to CNG
- Stations w/o commitment for vehicles/load won't work
- Recommend half of station funding allocation be switched to vehicles (LD and HD)
 - Market pull for vehicles will create infrastructure
- Recommend that some infrastructure funding go toward developing Best Practices for maintenance facilities for CNG and LNG vehicles