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North America's leader in clean transportation



Natural Gas as a Low Carbon Transportation Fuel

Presentation to the Oregon Department of Environmental Quality

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Policy Momentum supports LCFS Adoption

- **National Policies Drive Worldwide Markets**
 - Energy Security and Greenhouse Gas reductions
 - “National Car Program” and “RFS Phase 2”
 - Economics – Green Energy Jobs creates Non-Transferable/Domestic Jobs
- **Regional Policies Drive US Policy**
 - State Petroleum Reduction Goals (CA’s AB 1007)
 - GHG legislation (WCI and CA’s AB 32 – Global Warming Solutions Act of 2006)
 - CA LCFS adoption and rule development in Mid-Atlantic/Northeast and Northwest Regions (Oregon and Washington States)
 - Government Fleet Rules Mandating Clean Fuels (South Coast AQMD)
- **Individual Business Strategies Promote Consumer Approval**
 - Trucking and Refuse Companies promoting green image
 - Airport taxi/shuttles provide emissions mitigation at airport hot spots
 - AT&T order for 8,000 CNG vans
- **U.S. finally recognizing a need for energy and GHG policies**
 - Energy Bills (i.e., HR 1835/S1403 – NAT GAS Act of 2009)
 - Climate Change Bills

Oregon LCFS v. Federal RFS2

Benefits of an Oregon LCFS

- Supports CA/WCI and Northeast/Mid-West Regional Markets
- Reduces regulator uncertainty, allowing greater investor confidence
- Provides incentive to reduce GHG emissions beyond the 60% qualification threshold for cellulosic biofuels in RFS2
- Creates disincentive to invest in high carbon fuels (tar sands, oil shale, CTL)
- Technology-neutral, allows any low carbon fuel to contribute towards compliance, such as CNG, electricity, hydrogen
- Encourages innovation of new fuels

Design Comparison	RFS2	LCFS
Technology Neutral	No	Yes
Performance Based	No	Yes
Transportation focused	No	Yes

Natural Gas Supply and Price vs. Oil

Fuel Prices

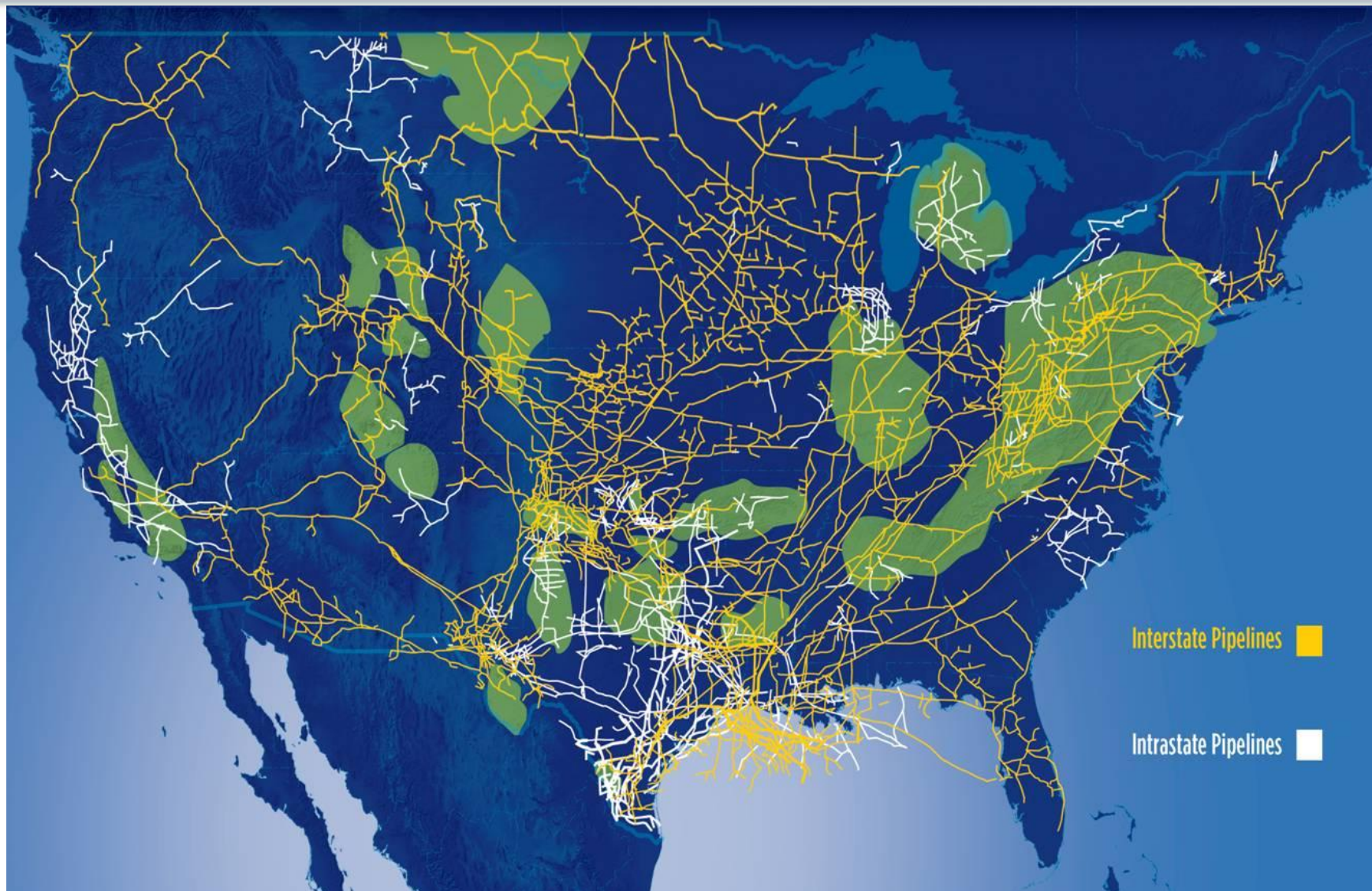
- Oil

- In 2007 - challenged use of EIA projections in CEC price forecasts
 - CEC began using more aggressive pricing model
 - EIA modified their numbers to show more aggressive pricing 2009
- World demand for oil driving prices up – oil supply can't track demand
- Worldwide recession still supporting \$80+/barrel oil
- What happens to oil prices when world pulls out of its recession and the world economy begins to heat up again?

- Natural Gas

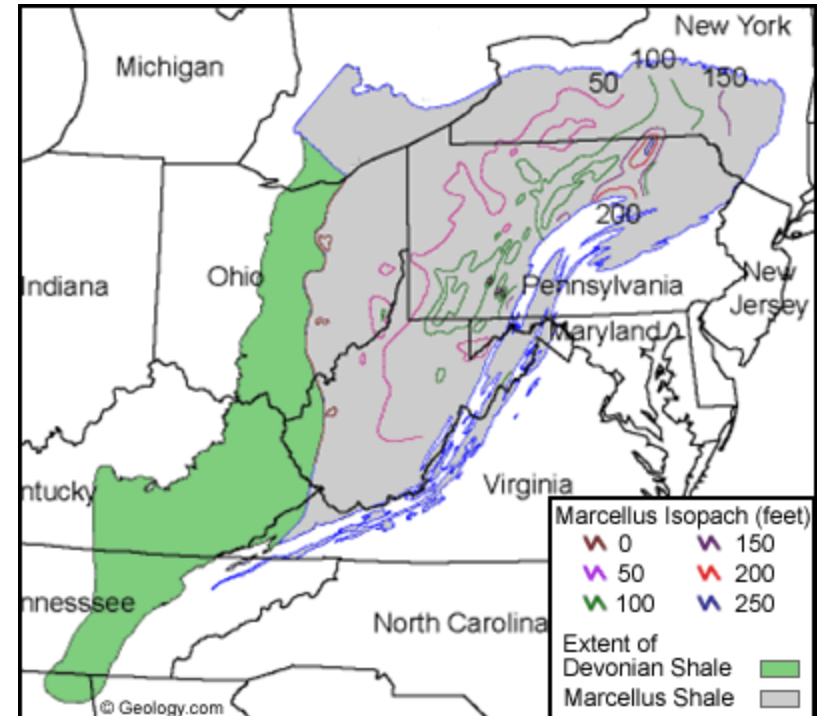
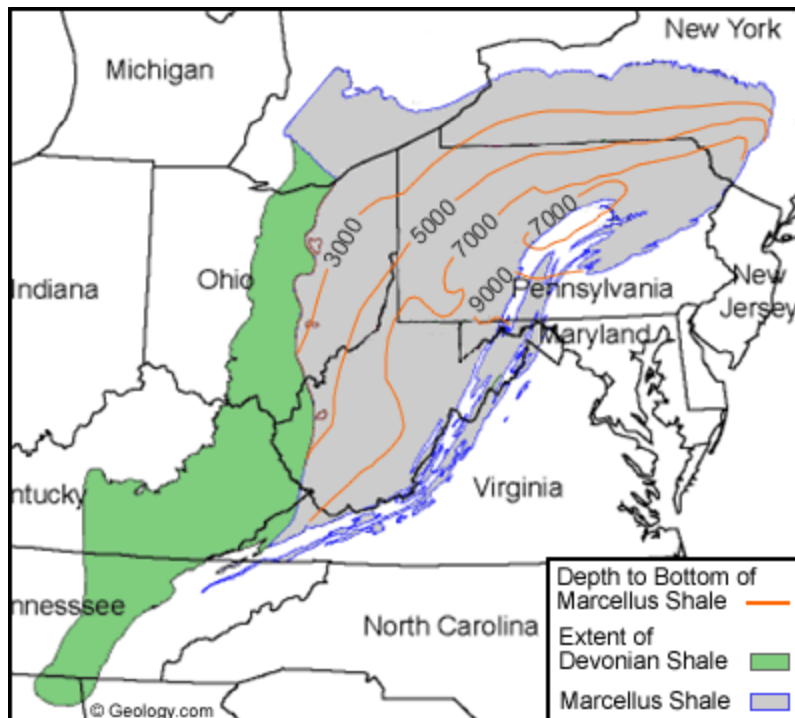
- 2008 first projections of what gas shale means for U.S.
- 120 – 200 year forecast of reserves
- Evaluation of gas reserves growing
- Estimates of recoverable gas growing
- Growing recognition that U.S. self sufficient in natural gas – use gas to displace foreign oil

Gas Shale Basins in U.S.



Marcellus Shale

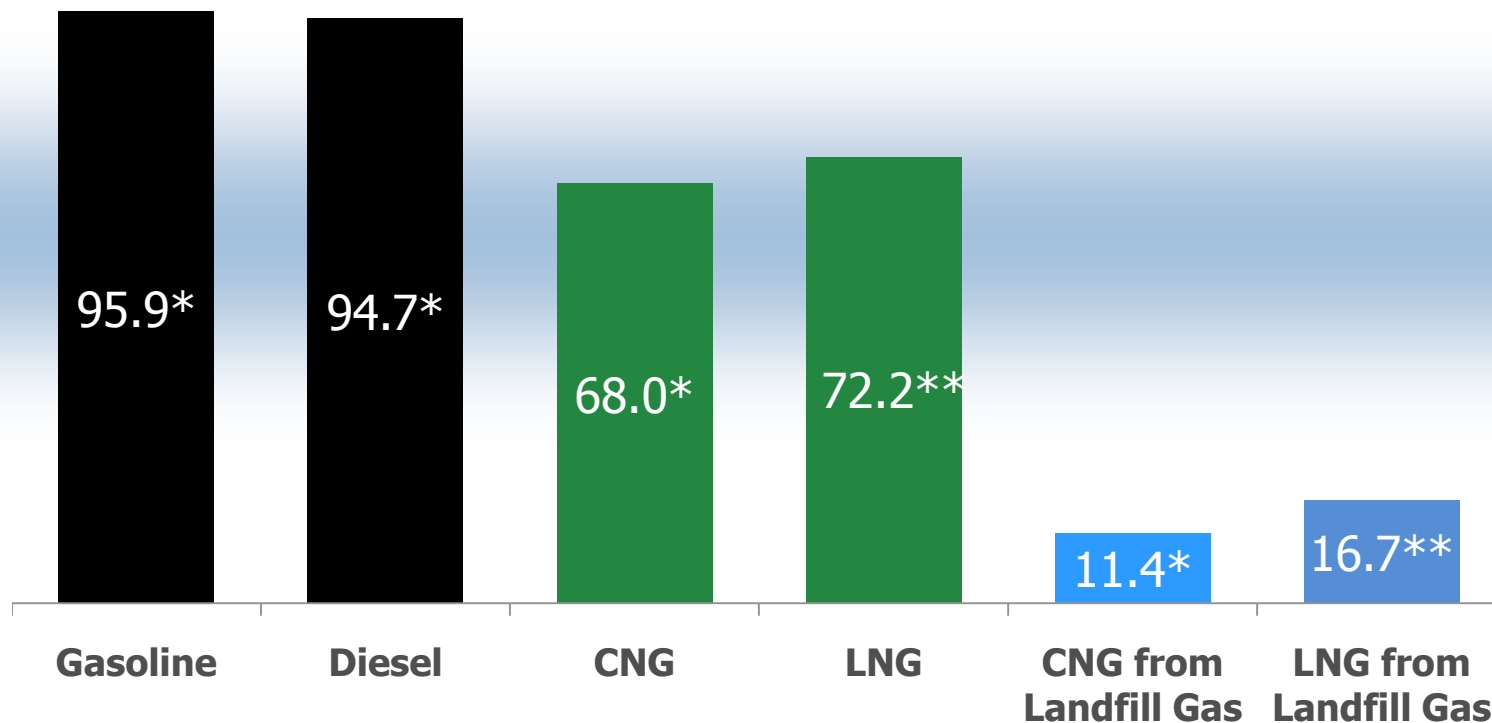
- Original projections of 50 TCF
- New (Oct 09) projections of 489 TCF



Landfill-based Biomethane

- 578 landfills that EPA monitors in Landfill Methane Outreach Program
- 422 landfill projects producing electricity
 - Difficulty in emission permits for electricity generation projects making electricity generation less attractive
 - Restrictions on power generation can't maximize biomethane use
 - Considering shifting to gas cleanup as more viable market
- **24 pipeline quality gas projects in U.S.**
 - Using a variety of cleanup technologies
 - Multiple projects under construction
 - New technologies emerging every day
 - Technology is becoming cost effective for smaller landfills

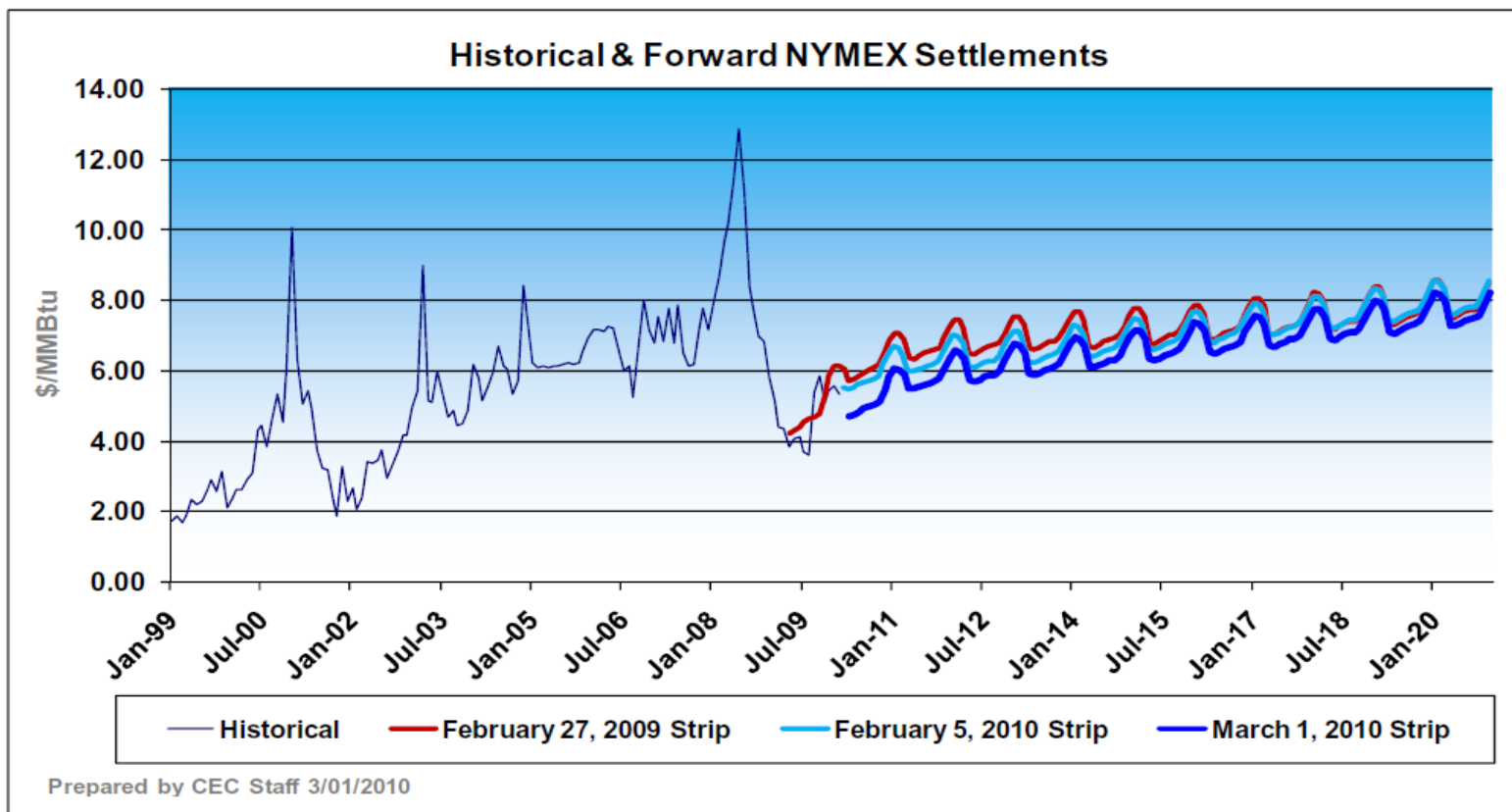
WTW Greenhouse Gas Emissions (in grams CO₂eq/MJ)



* CARB October 2009 Update on the CARB LCFS Program, WTW data on p. 22-23.

Gas Pricing

CEC Stakeholders Meeting March 4, 2010



- Gas Producers need \$6+/MM Btu to develop gas shale;
- Biomethane Producers need higher price point/MM Btu so they rely on policy (LCFS and RFS2) for stability and investor confidence;
- Supply and demand will trigger this type of limited cycling.

Natural Gas is Cheaper than Gasoline

Gasoline

$$\frac{5.4 \text{ MM Btu/barrel}}{125,000 \text{ Btu/GGE}^*} = 43.2 \text{ GGEs/barrel}$$

$$\frac{\$82.43^{**} \text{ per barrel}}{43.2 \text{ GGEs/barrel}} = \$1.91 \text{ /GGE}$$

Commodity Price

CNG

$$\frac{1 \text{ MMBtu}}{125,000 \text{ Btu/GGE}^*} = 8.0 \text{ GGEs/MM Btu}$$

$$\frac{\$4.02^{***} \text{ per MMBtu}}{8.0 \text{ GGEs/MMBtu}} = \$0.502 \text{ per GGE}$$

Commodity Price

* GGE = gasoline equivalent gallon (Btu content in higher heating value)

** Oil price as of March 30, 2010

*** Henry Hub Gas Prices March 24, 2010

Natural Gas is Cheaper than Diesel

Diesel Fuel

$$\frac{5.4 \text{ MM Btu/barrel}}{139,000 \text{ Btu/DEG}^*} = 38.85 \text{ DEGs/barrel}$$

$$\frac{\$82.43^{**} \text{ per barrel}}{38.85 \text{ DEGs/barrel}} = \$2.12 / \text{DEG}$$

Commodity Price

CNG

$$\frac{1 \text{ MMBtu}}{139,000 \text{ Btu/DEG}^*} = 7.19 \text{ DEGs/MM Btu}$$

$$\frac{\$4.02^{***} \text{ per MMBtu}}{7.19 \text{ DEGs/MMBtu}} = \$0.559 \text{ per DEG}$$

Commodity Price

* DEG = diesel equivalent gallon (Btu content in higher heating value)

** Oil price as of March 30, 2010

*** Henry Hub Gas Prices March 24, 2010

Competitive Fuel Pricing

- Energy pricing
 - Natural gas energy pricing ~ \$0.50 per gallon
 - Oil energy pricing ~ \$2.00 per gallon
 - Nearly \$1.50 per gallon differential
- Pump price
 - Natural gas less than \$2.25 -2.50 per gallon
 - Gasoline/diesel \$3.00 per gallon
- Natural gas economically competes with gasoline/diesel even with:
 - Intensive capital program to build infrastructure
 - Capital program to build LNG facilities
 - Intensive market development activities
 - Overhead and profit

NGV Industry

- Gas Producers formed America's Natural Gas Alliance 2009
 - Promote the availability of natural gas
 - Identify new markets for natural gas
 - Promote federal legislation to support new NG markets
- NGV America (U.S. NGV Coalition) announced weeks ago
 - 30 major gas producers joining NGV America
 - Several natural gas utilities rejoining NGV America
 - Consolidation of all NGV market development committees under NGV America
 - Goal: Promote natural gas as a transportation fuel
- Efforts to promote Nat Gas Act
 - Substantially increase tax credits for HD NGVs
 - Major effort to displace petroleum in the trucking sector
 - Encourage OEM product development

Product

Heavy-Duty Product



- Kenworth, Peterbilt, Freightliner offer HD trucks
- Volvo/Mack will offer NG
- Volvo/Mack developing 13L engine for Class 8 trucks
- **International** to develop and market NG engines and trucks
- All refuse truck manufacturers offer natural gas
- All transit bus manufacturers offer natural gas (including **Gillig** last US mfg to come to table)
- Wider variety of natural gas engines being developed (displacement)

Light-Duty Products



- AT&T announcement of 8,600 NGVs got OEM's attention
- All U.S. OEMs evaluating market entry options for NGVs
- Ford working with SVMs – BAF a Clean Energy Company only recognized Ford product converter
- GM initiating early entry and internal OEM programs
- VPG offering MV-1 a new taxi product in 2010
- Offshore OEMs still encouraged to bring their NGV products to U.S.

- LNG imports – March 4 CEC Stakeholder Meeting
 - Momentum for import terminals is gone
 - Too much domestic natural gas
 - LNG imports can't compete with domestic NG prices
 - Market prices higher elsewhere
 - U.S. gas producers looking at the potential to export natural gas
 - Convert import terminals to export terminals
 - Politically unacceptable to export NG if we can displace imported oil
- LNG production for West Coast Transportation
 - CE 240,000 gal/d plant in Boron, CA
 - CE 80,000 gal/d plant in Houston, TX
 - ALT 80,000 gal/d plant in Topoc, AZ
 - 45,000 gal/d plant in Ehrenberg, AZ
 - Discussions with gas producers to build LNG production at gas processing facilities

Expanding Products and Markets

- NGV technology exists worldwide (60+ makes/models in EU)
- Number of engines & OEM products in US expanding
- Technology advancing to new engines and vehicle platforms
- NGV technology looking to hybrid platforms to up efficiencies
 - DOE \$14.5 mm Research Grant to advance NGV engines



Leadership in Hydrogen Development: LAX, Translink, and CA Fuel Cell Partnership



Blending and co-location of ultra low carbon fuels w/ NG:
A) Biomethane
B) Hydrogen

- Partnership with GM to support Equinox FCV (LAX)
- Support Translink HCNG (ICE) Bus Fleet (Vancouver)
- Believe in strong bridging connection between NG/Biomethane and H₂



Clean Energy Investment

Clean Energy (CLNE) Statistics

Largest Alternative Transportation Fuel Provider

360+
Fleet
Customers

17,500+
Natural Gas
Vehicles

200+
Natural Gas
Fueling Stations

Compressed Natural Gas (CNG)



Taxis



Government
Vehicles



Airport
Transit

Liquefied Natural Gas (LNG)



Regional
Trucking



Public
Transit



Refuse
Hauling

Clean Energy (CLNE) Investment 2007-2010

- Building ~ 30 stations per year -- \$30 million/yr
- LNG plant in Boron - \$75 million with \$25 million expansion in 2010
 - Bring capacity to 240,000 gal/day
- Own and operate BAF Technologies – only Ford approved NG conversions of Ford product
 - Entire F Series pickups (F150/250/350/450)
 - Entire E Series vans (E150/250/350/450)
 - Ford Transit Connect
- Purchase of McCommas landfill in Dallas TX for Biomethane
 - \$18 million in acquisition cost
 - \$25 million in expansion (2010-2011)
 - 35,000 gallons/day biomethane – expandable to
- Employee growth from 100 to over 300 people

NGV Market Development

- Develop core infrastructure via fleets and vocational markets
 - Class 8 Trucks ~15,000 to 20,000 gallons/yr/vehicle
 - Transit ~10,000 to 15,000 gallons/yr/vehicle
 - Refuse ~10,000 gallons/yr/vehicle
 - Taxis ~ 5,000 - 7,500 gallons/yr/vehicle
- Fill in network with strategic additions
 - Address airports to suburbs (taxis)
 - Address regional needs (AT&T)
 - Expand goods movement
 - Port trucking
 - Regional trucking
 - Interstate trucking
- Expanding networks address multiple fleets
- Can further grow and adapt to consumers



Clean Energy (CLNE) Fuel Infrastructure



Regional Trucking

- Don't have to replicate existing infrastructure
- Need HD truck fueling ~ 250 miles
 - 1,000 to 2,000 stations on right routes
- Clean Energy expanding trucking corridors in Calif.
 - N-S length of CA with plans to extend to Washington
 - W-E to Phoenix, Las Vegas, Salt Lake City
 - Expandable by steps to ultimately provide coast to coast trucking corridors



Oregon Potential Fleet Customers

- Goods Movement Trucking Fleets:
 - 1,700 registered fleets;
 - Top 100 have ~ 19,000 trucks registered in Oregon (Class 6, 7 and 8);
 - Numbers do not include trucks working in, but registered out of, the state.
- Refuse Trucks
 - Approx. 800 working in the Tri-County Region
- Transit Buses
 - Approximately 860 transit buses operating in Tri-County Region
- Other Fleet Vehicles
 - Airports and Shuttles
 - Government Fleets
 - Customer Service Fleets

Conclusions

- NGV story keeps improving and can provide immediate reductions in fuel carbon intensity on a mass scale
- North American natural gas is abundant and affordable while biomethane presents a renewable opportunity with lowest carbon outcome
- Natural gas performance can improve with hybrid-/plug-in hybrid drive platforms, and biomethane or hydrogen blending.
- NGV Industry focused to deploy NGVs in key markets to leverage economies of scale and develop comprehensive fueling infrastructure.
- Clean Energy supports Oregon's adoption of a LCFS
 - RFS Phase 2 and National Car Program will not solve the country's need for low carbon fuels without a LCFS.
 - Regional leadership will encourage LCFS action at the national level

Thank you

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