COMPETITION AS A DRIVER OF CHANGE: WINNING THE 21st CENTURY FUEL CHALLENGE

Challenge: Reduce North America's unsustainable dependence on petroleum for transportation prior to severe petroleum shortages or fuel price escalation.

Solution: Promote diversity of sustainable, available alternative fuels in the marketplace using creative, competitive marketplace partnerships.

BACKGROUND:

Spiraling costs of crude oil to North American consumers and agencies in the recent past continue to substantially impact the transportation sector. While forecasted ceilings for crude oil vary, there is relative agreement among industry experts that a return to prices well under the current $60/barrel is unlikely. Contemporaneously, growing energy appetites in industrializing countries such as China and India will continue to increase market pressures globally, especially as limited, finite global oil resources are depleted over the next twenty-five to fifty years. Combining increasing demands with decreasing supplies of crude will almost certainly result in an economic train wreck in industrialized nations—unless viable alternative energy and fuel options, particularly for the transportation sector, are available and functioning in the marketplace prior to oil exhaustion. Without viable, available alternative fuel options under such a scenario, western economies will be crippled with recurrent failures to move goods and people daily.

In order for alternative transportation fuel options to be successful, they must be economical, reliable, and readily available. Certain alternative fuel technologies, such as natural gas used in heavy-duty

vehicles, have evolved primarily over the past decade and are now a relatively mature, reliable, cost-effective transportation means. Yet despite these attributes and energy security benefits that will become more important as oil reserves are depleted, challenges to the fleet manager for compressed-natural gas (CNG) and liquefied natural gas (LNG) vehicles have traditionally included potent concerns for stable, long-term, and secure fuel costs, along with affordable refueling dispensing equipment that rivals diesel equipment for ready availability and dependability. Historically, fleet managers have had almost no ability to secure long-term, fixed alternative fuel prices, nor the security of knowing that their fueling infrastructure would be affordably amortized over the life of their vehicles and within the contracted fuel price.

To answer these considerable challenges, a "partnership" model was initially developed by the alternative fuel industry in the United States a number of years ago, and has now been adapted to the Canadian market. This partnership approach provides the broader benefits of a turnkey approach – infrastructure design and construction without capital cost commitment by the end user, multi-year fixed-price refueling station operation and maintenance (O&M) contracts, long-term fixed-price fuel contracts, royalty revenues from segregated public-access refueling, federal and/or provincial grant application support, and certified low-emission engine technology. The economic stability of this successful partnership model delivers a competitive advantage to its adopters while limiting the risks associated with volatility in the energy sector and diversification from their core business. It also allows longer-term fuel security in the event of marketplace disruptions to diesel cost and supply.

Substantial environmental benefits have also been realized through the deployment of new lower-emitting alternatively-fueled engine technology. Natural gas engines manufactured by Cummins Westport and John Deere for 2007 will be certified to the California Air Resources Board (CARB) 2010 emission standard of 0.2 g/bhp-hr NOx (as compared to 1.2 g/bhp-hr NOx for diesel) – an 83% reduction of these key pollutants that result in ozone air pollution or

"smog", acid rain, and are associated with global warming and greenhouse gas effects. Total greenhouse gas emissions of these ultra-clean performers are expected to be 17% lower than the cleanest diesel engine available.

Energy security, economic prosperity, and environmental protection attributes can all be achieved simultaneously through the implementation of a natural gas alternative fuel "partnership" approach, and this approach will limit costs and risks for fleet managers who have traditionally been confronted with fuel cost uncertainty, high fueling station acquisition and maintenance costs, and "hit or miss" availability of natural gas low-emission, heavy-duty buses and trucks.

Historical Perspective of Canadian Alternative Fuels

Canada was an early adopter of gaseous fuel technology for transportation, over a decade ago. As with all emerging technologies, the first generation of commercialized engines and vehicle platforms experienced problems with reliability, life cycle costs (LCC), and incremental procurement costs. Additional difficulties arose with infrastructure responsibilities -- fleet managers were faced with operating and maintaining a refueling station, traditionally not a part of their core business but nevertheless critical to its success. Fragmented industry alliances from early industry leaders had the practical effect of limiting the support available to these early alternative fuel vehicle adopters. Because of these less-than-favorable initial experiences, many early adopters would eventually abandon their commitment to alternative fuels, even despite sizable investments in personnel costs leading to relatively experienced, knowledgeable staff. Legacy issues continue to challenge the Canadian alternative fuels industry today, despite significant strides made by vehicle, station, and fuel providers in the last few years that continue to drive expansion of alternative fuel projects in other industrialized countries.

CAPTURING THE FUTURE---Canada's Transportation Options

Alternative fuel research and development by engine and vehicle Original Equipment Manufacturers (OEMs) continues to expand available vehicle options for reliable, durable, low-emission transportation. Canadian fleet owners and managers, both public and private, may now access services that will custom design, build, operate and maintain fleet specific refueling infrastructure without the burden of heavy upfront capital investment and staffing resources---costs are amortized into fuel costs over the years of project life, while still allowing for lower fuel costs than traditional diesel. And additional cost control benefits are made possible with long-term fixed-price fuel contracts that fully shift traditionally unavoidable risks to the fuel contract provider. Significant environmental benefits are achieved by the lower-emitting natural gas vehicle engines, and provide direct and indirect benefits to public and private fleets, their agencies or corporations, nearby communities, and local and provincial governments alike. Environmental stewardship is a valued and increasingly marketable asset in today's economy due to the emerging trend towards "green procurement" practices by municipalities, corporations, and consumers. When all aspects of the equation are considered – energy security, economic prosperity and environmental protection – alternative fuel partnerships now offer options to Canadian transportation as never before.

Next Steps to a Secure Canadian Transportation Future

We've all heard the refrain over the last few years – the future is tied to the "Hydrogen Highway". Regardless of the actual timeline to achieve this much touted objective, the reality today is that natural gas *is* the feedstock for hydrogen. Inherent similarities between natural gas and hydrogen will help ensure a smooth transition as we travel along the path to our hydrogen future – vehicle design, station development, societal investment and experience. Natural gas possesses the same "lighter than air" properties as hydrogen, enabling the creation of infrastructure and operational practices that will

transition forward seamlessly, bridging the gap between today and the future. Projects utilizing blends of hydrogen and compressed natural gas are already underway and promise emission levels for future vehicles that are almost undetectable and related engine and technology research and development growth can be expected over the next several years.

For years to come, however, alternative fuel vehicles and engines will allow lower emissions and decreasing dependency on foreign oil. Notwithstanding the economic and environmental benefits of natural gas vehicles, not all are a suitable fit for every application or operation. A thorough understanding of operational requirements - such as duty cycles, driving distances, hours of service, fleet locations, maintenance practices, etc. - must be analyzed to ensure achievement of transportation fleet objectives when choosing CNG or LNG. For centralized fleets operating with regular schedules or routing, and with nominal daily or weekly miles-traveled, a natural gas fleet strategy is an ideal approach. To accurately project economic benefits, a thorough Life Cycle Cost (LCC) analysis is undertaken. Industry representatives can assist with evaluating each fleet's particular needs, in order to assist fleet managers with estimating the likelihood of specific and overall success with meeting their financial and operational objectives.

LIFE CYCLE COST (LCC) METHODOLOGY

LCC analysis typically used for fleets considering alternative fuels involves a computer model that projects annual costs to own and operate natural gas vehicles and related fueling infrastructure over a specified number of years. These models also allow fleets to input their actual engine related maintenance costs and compare them with OEM maintenance costs for more user-specific economic analysis. While industry representatives offer variegated versions of this model, the general methodology employed is basically the same.

The LCC model typically considers:

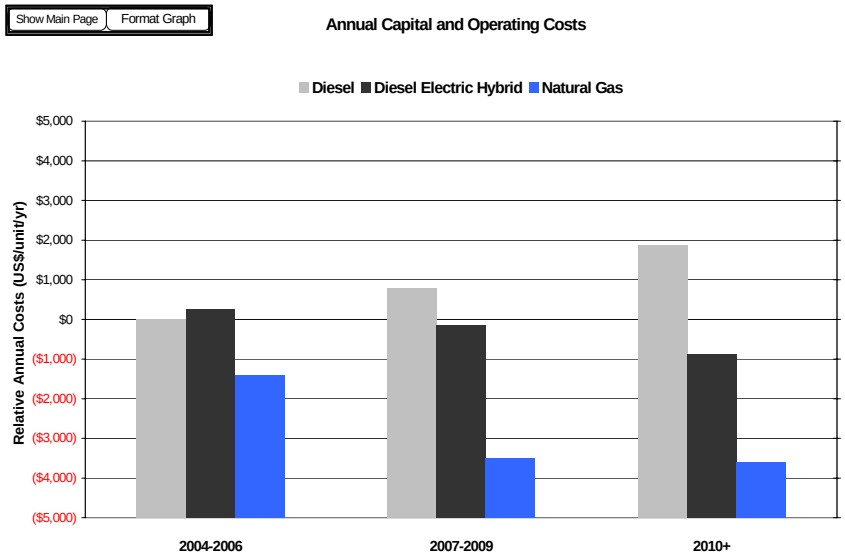
- Fleet acquisition cost for the vehicle

- Fuel costs and usage
- Construction cost for natural gas refueling station and maintenance facility upgrades
- Related maintenance costs to operate the natural gas refueling station
- Engine related maintenance costs, including all-in, bottom-up analysis of scheduled maintenance costs using the OEM maintenance schedule and parts pricing through the OEM distribution channel
- Includes estimated cost of unscheduled engine repair, based on the OEM warranty database of failure and repair data
- Includes cost allocation for non-engine natural gas fuel system maintenance and repair, such as testing and replacement of methane detection sensors, inspection of fuel cylinders, and periodic replacement of regulators, valves, hoses, etc.

The LCC model typically does NOT consider:

- Repair costs for non-engine and non-fuel system components that are not impacted by the engine and fuel type selection, such as brakes, tires, suspension, etc.
- Other fleet related costs, such as road calls, training, etc.

Real Sample of Relative LCC Output (graphic):



NOTE: Graphic analysis summary output utilizing 2004MY Diesel engine as baseline and illustrating the LCC annual savings of $1,500 for each natural gas vehicle. With the introduction of additional technology for 2007 regulatory compliance, the projected LCC savings of natural gas vehicles increase.

REGULATORY DRIVERS AFFECTING FUTURE VEHICLE OPTIONS

Changes to diesel engines are required for compliance with the substantially more stringent 2007 CARB and EPA onroad emissions standards. These changes are widely expected to increase the cost of initial procurement and vehicle maintenance. Documentation from the major engine OEMs indicate that these changes will include:

- Ultra Low Sulphur Diesel (ULSD)
- Active Diesel Particulate Filters (DPF)
- Cooled Exhaust Gas Recirculation (CEGR)

- Crank Case Ventilation (CCV) - sensor impact
- Specialty lube oil – low ash
- Improved oil filters

These additional new engine and exhaust after-treatment technologies will impact the maintenance requirements of diesels, and will likely require additional training of manpower resources. As published in the article "It's What You Don't See" in the December 2005 issue of Waste Age magazine: *"Dee Kapur, president of International's truck group, says that base prices on the company's Class 8 tractors and vocational chassis are increasing $7,000 to $10,000 per unit with medium-duty trucks and school buses increasing between $5,000 to $6,000 for '07."* With the anticipated additional costs associated with the acquisition and maintenance of these new diesel engine platforms, the potential economic benefits of certified natural gas vehicle use becomes even more attractive.

Notwithstanding anticipated cost increases associated with diesel vehicles that will comply with stringent new emission standards, it is important to note that expected OEM performance impacts will accompany emissions compliance:

- 3% diesel engine efficiency penalty for CEGR and exhaust after-treatment (2007)
- Additional 2% diesel engine efficiency penalty for NOx treatment in 2010

FUNCTIONAL COMPONENTS OF THE ALTERNATIVE FUELS PARTNERSHIP MODEL

Provision of partnership opportunities in Canada is through Clean Energy, an established North American supplier of natural gas and refueling infrastructure, and services associated with supply, construction, repairs and maintenance of refueling infrastructure. In providing the partnership option to public and private centralized fleet owners and managers, Clean Energy joins with the fleet entity to provide design, delivery, installation, maintenance, and operational assistance to site and then utilize new refueling infrastructure. Clean

Energy also assists the fleet entity with applications for federal and provincial grant funding that will offset their capital costs for new vehicles and infrastructure - - in the past nine years we have secured $48 Million dollars in grant funds for our partners, and that number keeps growing. This "partnership model" allows fleets to focus on their core business while leaving the refueling to an expert, all at a predetermined, contained cost that makes an easy task of annual budgeting.

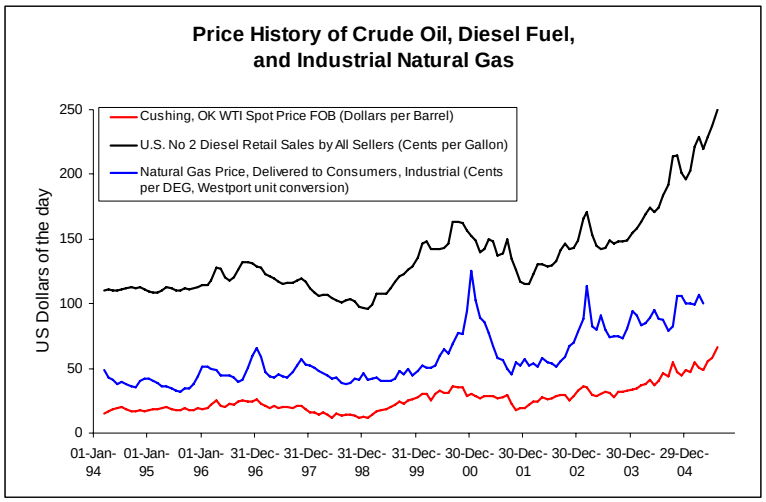
The capital cost of needed natural gas infrastructure can be paid wholly or in part by the fleet entity, or through use of Clean Energy's ability to amortize related capital costs in the dispensed "per litre" fuel pricing. In all instances, Clean Energy works with the local gas distribution company for delivery of the fuel to the refueling station.

Where long-term fixed-price fuel contracts are included, an annual fuel consumption (demand) amount is guaranteed by the fleet and becomes the basis for the guaranteed fuel contract between the partner and Clean Energy. Clean Energy leverages new and existing commodity strip contracts to stabilize fuel price fluctuations to the partner, with Clean Energy assuming the traditional risks of energy cost increases over the life of the project. The fleet may also elect to purchase fuel at the posted rate instead of locking into a long-term fuel supply contract.

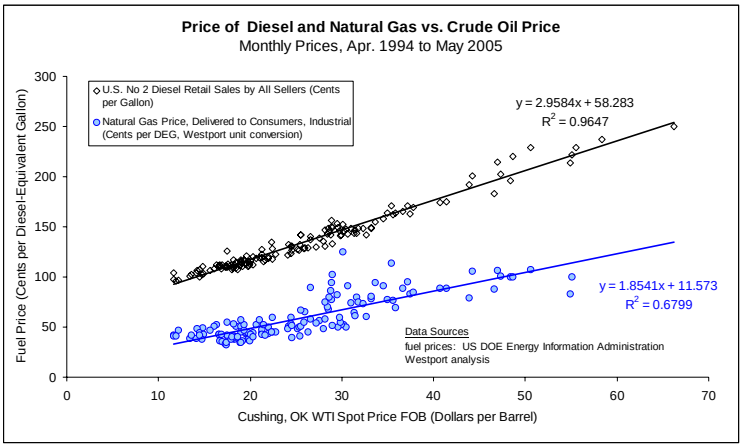
The cost of daily refueling station operations & maintenance is assumable by Clean Energy under an O&M contract, with the cost of this service similarly amortized into "per litre" dispensed fuel price. Remote monitoring of the station equipment by Clean Energy assures that potential "middle of the night" phone calls for unscheduled service are not the fleet's responsibility. Similarly, costs of routine spare parts, materials and major overhauls can also be covered by Clean Energy.

PARTNERSHIP BENEFITS TO SECURE, STABLE FUEL COSTS

Natural gas commodity costs traditionally float about 30% below diesel on a Diesel Litre Equivalent (DLE) basis, notwithstanding recent "force majeure" events such as Hurricane Katrina. Based on commodity market futures values as reflected in the graph below, however, it is very likely that natural gas will remain attractively priced.



NOTE: Natural gas has been 25-42% cheaper than crude oil over the last 14 years.



NOTES: 1.) Based on 10 years of data, the prices of both diesel and NG are well correlated with crude oil prices
2.) NG costs less than diesel on an energy-equivalent basis
3.) As oil prices rise, the NG-diesel price gap gets wider

Without consideration of the additional fuel costs associated with upcoming mandates for the use of Ultra Low Sulphur Diesel (ULSD), and taking into consideration a turnkey station approach, a recent public tender for one major Canadian transit operation calculated the comparative cost as approximately $0.57/DLE for CNG versus $0.94/L for diesel. Based on the estimated fuel consumption use for the fleet, and allowing for incremental growth in fleet size over time and a long-term fixed price fuel contract, the calculated savings for the useful fleet life was estimated at over $16 million dollars.

ANTICIPATED EMISSION REDUCTION BENEFITS

The comparative emission reductions in g/bhp-hr of the 2007 available engines are:

2007 CNG*		2007 Diesel		% Reduction	
NOx	PM	NOx	PM	NOx	PM
0.2	0.01	1.2	0.01	83%	0%

*Cummins ISL G engine having 2010 certified emissions values in MY2007

To better appreciate the significant cumulative emissions reduction benefit across a large fleet of vehicles, consider this example from an actual Canadian transit operation:

Total Tons NOx Emissions - 2007 EPA Certified Diesel Vs. CNG Engines

Formula

(Grams of NOx) X (Horsepower) x (Hours of use a day) X (Number of Days used per Year) X (Number of Years on Road) divided by (Grams in a ton) = Tons of NOx

Assumptions:

2007 EPA Emission Standards NOx	1.2
2010 EPA Emission Standards NOx	0.2
Average Horsepower	250
Hours of Use per Day	8
Number of Days use per Year	313
Number of Years on Road	17
Grams in a ton- NOx	907,000
Number Trucks Replace Each Year	40
2007 EPA Certified CNG Engine Meets 2010 EPA NOx Emission Standard	0.2

Calculations (per vehicle)	**17 Years**	**1 Year**
Total NOx Emissions (TONS)-2007 EPA Certified Diesel Engine	14.07982	
Total NOx Emissions (TONS)-2007 EPA Certified Diesel Engine		0.828225
Total NOx Emissions (TONS)-2007 EPA Certified CNG Engine	2.346637	
Total NOx Emissions (TONS)-2007 EPA Certified CNG Engine		0.138037
Total **Incremental** Tons NOx Emission Reductions: 2007 EPA Certified Diesel Engine vs. 2007 EPA Certified CNG Engine	11.73319	
Total **Incremental** Tons NOx Emission Reductions: 2007 EPA Certified Diesel Engine vs. 2007 EPA Certified CNG Engine		0.690187

The significant NOx and greenhouse gas emission reductions afforded by natural gas fleet vehicles result in improved air quality, with those improvements associated with reduced health care costs. Improved quality of life and increased tourism revenues are other potential benefits that result from a successful alternative fuel strategy.

FLEET "CHANGES" FOR SUCCESSFUL ALTERNATIVE FUELS PROGRAM

Minimal but necessary changes will be required for successful transition from diesel fleet use to natural gas. Driver, technician and mechanic training will be necessary, and are provided with the Partnership model by Clean Energy. Modifications to maintenance

garage facilities may also be required to ensure safety compliance, with technical support from Clean Energy.

CONCLUSION

Winning the 21st Century fuel challenge will provide a competitive advantage to fleets in the business of goods and people movement. Energy security, economic prosperity, and environmental protection attributes can all be achieved simultaneously through the implementation of a natural gas alternative fuel "partnership" approach. This approach will reduce unsustainable dependence on petroleum for transportation prior to severe petroleum shortages or fuel price escalation, while promoting diversity of sustainable, available alternative fuels in the marketplace using creative, competitive marketplace partnerships.

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