



Methanol As An Alternative To Diesel: Cleaner and More Efficient Trucks

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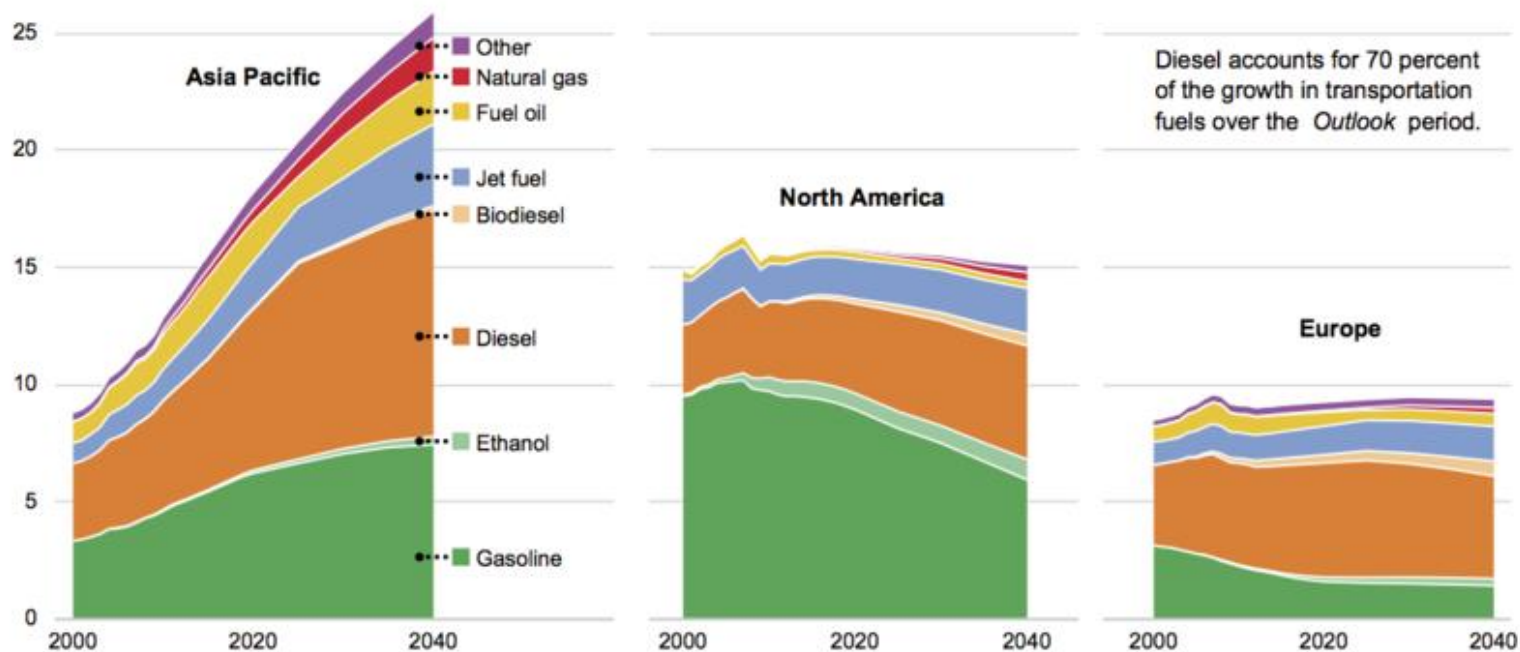
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Diesel Replaces Gasoline as Number One Global Transportation Fuel In 2020

Transportation fuel mix
Millions of oil-equivalent barrels per day





Need For Alternative To Diesel

- NOx, and particulate emissions from high pollution diesel trucks
 - Trucks which do not use expensive exhaust treatment and low-sulfur fuel
 - Major problem in China and growing issue in other countries
- Potential tightness in diesel availability ; increased price
 - Due to refinery limitations and increased demand
- Dependence on oil
- Greenhouse gas emissions



Methanol Truck Engines (Bromberg and Cohn)

1. Use of present spark ignition engine technology
 - Same efficiency, torque and cost as high pollution diesel engine
 - Greater than 90% reduction in particulates and NOx relative to high pollution trucks (China, other countries)
 - Option for gasoline operation

2. Future use of advanced exhaust heat recovery technology
 - 20 -25 % higher fuel efficiency than diesel for \$ 5-10 K extra cost
 - Optimized use of special properties of methanol
 - Now being developed at MIT (support from Arthur Samberg Energy Innovation Fund)



Illustrative Comparison of Methanol Engine to High Pollution Diesel Engine

	Methanol	
	Existing spark ignition engine technology	With advanced exhaust heat recovery
Efficiency & torque	same as diesel	20 -25% higher efficiency
NOx and particulates	reduced by > 90%	reduced by > 90%
Vehicle cost	same as diesel	\$5-10 K higher than diesel
Retail fuel cost in \$/ dge (\$/ diesel gallon equiv)	same as diesel \$4.00/ dge*	same as diesel \$4.00 / dge*
Efficiency-corrected fuel cost (\$/ dge)	same as diesel	\$0.70 – \$0.80/ dge lower than diesel
Power	30% more than diesel	30% more than diesel

*assuming \$ 1.30/gallon methanol



Methanol vs. LNG Trucks

- In countries are using high pollution diesel trucks (e.g., China), LNG & methanol could offer similar large air pollution reduction.
- Methanol advantages:
 - Lower additional vehicle cost (0- \$ 10K vs. \$ 50 -70K)
 - Lower fueling station cost (\$ 75 K vs. > \$ 1 M)
 - Does not have operational complexity and limitations of LNG
 - Potentially 30% more efficient than LNG
- LNG advantage : lower fuel cost than methanol
 - But this advantage could be relatively small or possibly eliminated by high LNG price in some regions (e.g., Asia) and higher efficiency of methanol