

Natural Gas as a Transportation Fuel: Availability, Benefits, and Barriers to Adoption

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Natural Gas Vehicles & Fueling Infrastructure 101

- **NGV (Natural Gas Vehicle)** .. A motorized vehicle that uses natural gas in an internal combustion engine
 - *Dedicated* NGVs use natural gas only, all the time
 - *Bi-fuel* or *hybrid* NGVs use natural gas primarily, but another energy source (gasoline or electricity) as back-up. Bi-fuel NGVs provide the benefits of natural gas operation, while extending the range of travel

- **CNG (Compressed Natural Gas)** To store sufficient natural gas for any appreciable range, the gas must be compressed to 3000 - 3600 psi (pounds per square inch) from typical delivery pressure of 2 to 20 psi. Gas to the engine is regulated back down before combustion

- **LNG (Liquefied Natural Gas)** Natural gas is cooled to -260 F, it becomes a liquid. Because LNG takes up less space than CNG, it has been used in some heavy-duty vehicles such as refuse haulers and long-haul trucks as a replacement for diesel

- **Biogas (or biomethane)** = Renewable gas produced from a wide variety of available organic materials and wastes (such as sewage sludge, animal manure, municipal or industrial organic waste, and landfills). Must be processed to remove impurities before used in vehicles.

- **GGE = Gasoline Gallon Equivalent** ... The amount of CNG that has the same energy content as one gallon of gasoline, roughly 125,000 Btu or 125 cubic feet of natural gas

Options for “Filling Up” with CNG

- **Timed Fill** .. Connect the NGV to a hose that connects to a natural gas compressor
 - Fuelmaker unit at right fills 1-2 light duty cars in 8 hours

- **Fast Fill** ... Run the compressor to fill up a 3-tube storage assembly then connect the NGV to a fast fill dispenser
 - Fast fill can fill a car in less than 5 minutes, a bus in 15 minutes



What Kinds of NGVs are Available Now ?

- Light-Duty Cars and Trucks



Honda Civic GX (8 GGE capacity)

Ford F150 Utility Truck
(aftermarket upfit)



Ford Van for use by AT&T (commitment to 8000 natural gas vehicles over 10 years to replace gasoline)

What Kinds of NGVs are Available Now ?

- Transit and School Buses



Thomas-Built Bus (more than 1000 produced in High Point, NC plant)

MARTA and many transit agencies own and operate CNG buses



What Kinds of NGVs are Available Now ?

- Heavy-Duty Trucks



Freightliner M2 now being produced in Mt. Holly, NC

Piedmont Natural Gas' new dump truck uses a Cummins Westport natural gas engine made in Whitakers, NC



What Kinds of NGVs are Available Now ?

- Industrial Lift Trucks



Toyota (new OEM product)

After-market conversion



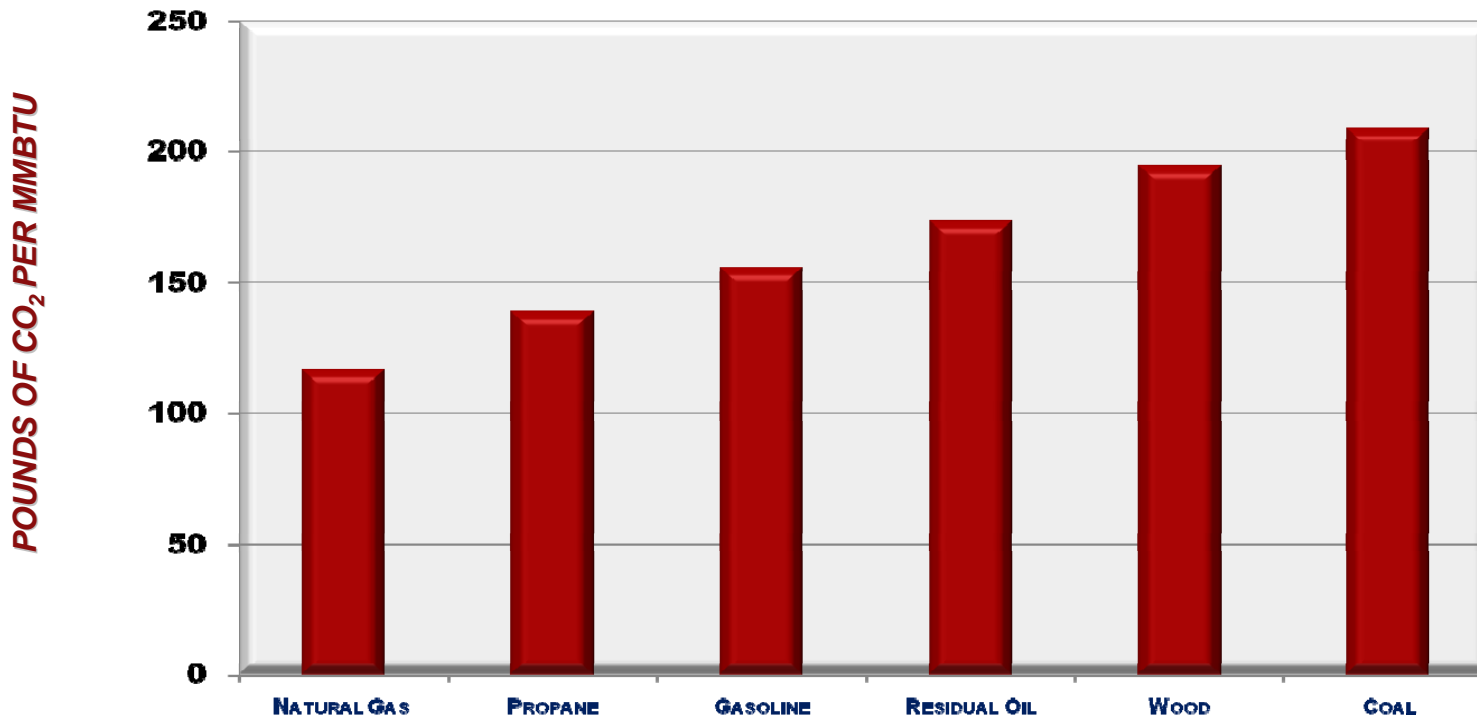
What Kinds of NGVs are Coming ?

- From USA Today - 01/12/2010
 - Look for full-size General Motors pickups -- Chevrolet Silverado and GMC Sierra -- to be powered by compressed natural gas (CNG) as soon as 2012, says Jeffrey Luke, chief engineer for GM's full-size trucks worldwide, in a conversation at the Detroit auto show.
- From the Environmental Leader - 12/01/2009
 - Trash Trucks Make the Switch to Clean-Burning CNG Fuel
 - Waste management operators in Florida, New Jersey, Idaho and California have opened compressed natural gas (CNG) fuel stations to support the deployment of their CNG trash collection truck fleets.



How Can North Carolina Benefit From Using Natural Gas as a Transportation Fuel ?

- Lowest carbon footprint of all carbon-based fuels



Source: U.S. Energy Information Administration.

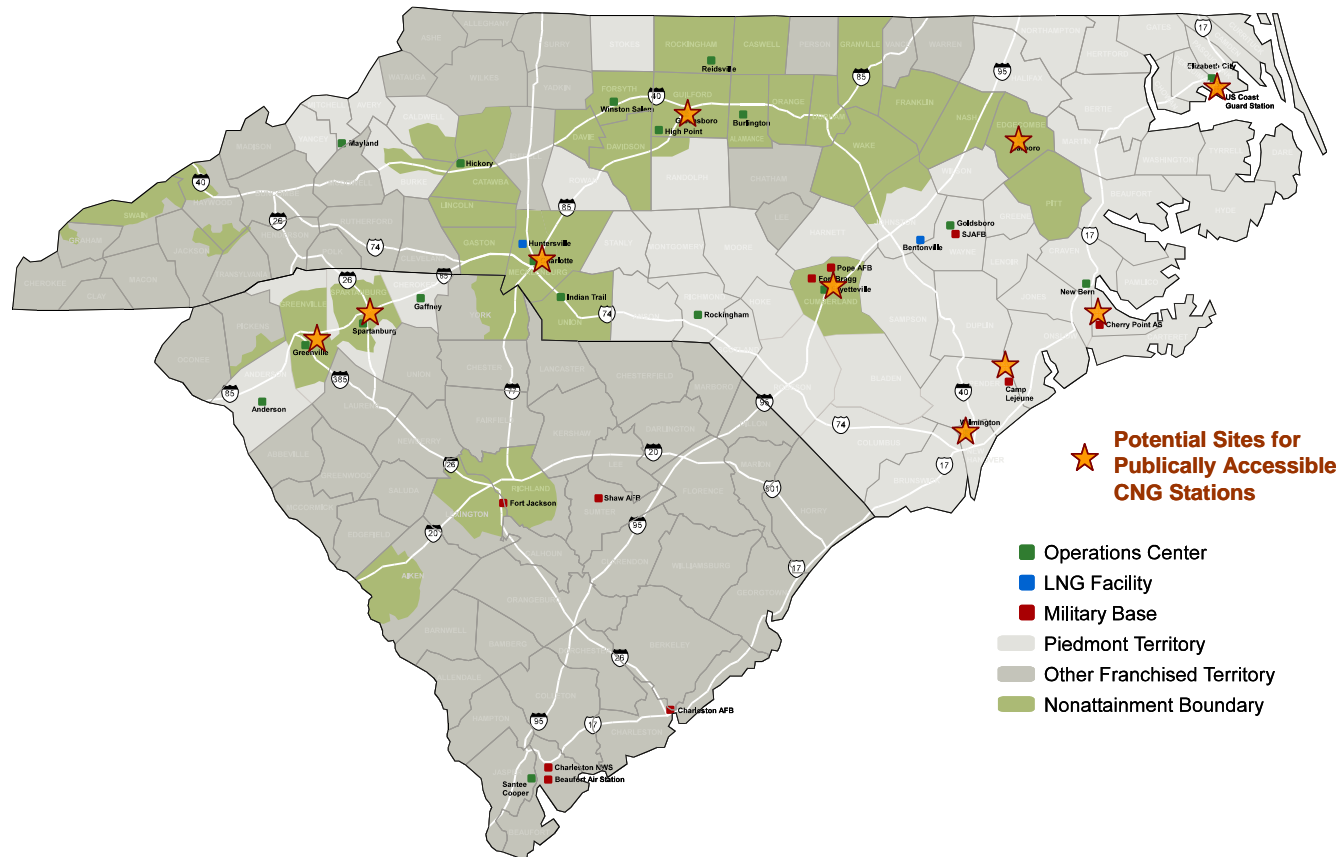
How Can North Carolina Benefit From Using Natural Gas as a Transportation Fuel ?

- Creates new “green” jobs in vehicle and engine manufacturing
 - Cummins Westport builds natural gas engines in Whitakers, NC
 - Freightliner CNG and LNG “M2” truck in Mt. Holly, NC
 - Thomas-Built Buses in High Point, NC
 - Trans-Eco Natural Gas Vehicle conversion facility in Asheville, NC
- Creates job growth for natural gas fueling station installation and conversion



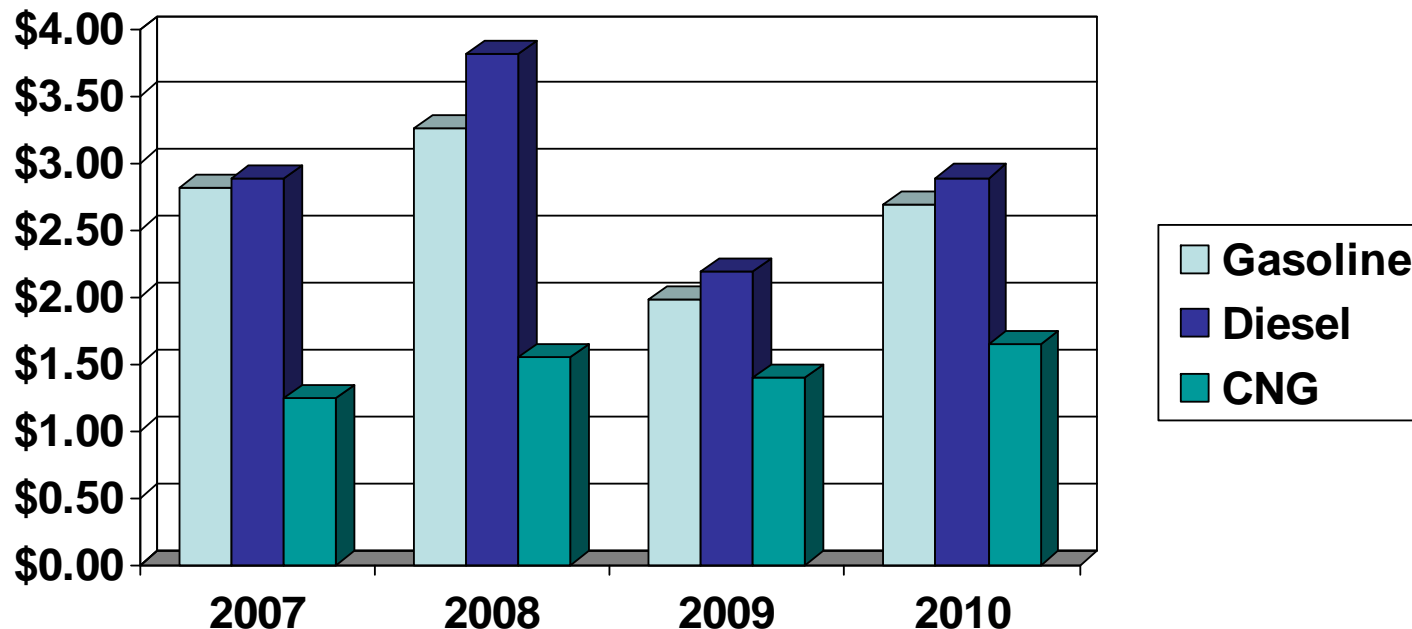
How Can North Carolina Benefit From Using Natural Gas as a Transportation Fuel ?

- Help to Meet EPA Ambient Air Quality Standards for Ozone
 - Many areas of NC are in non-attainment for ground level ozone
 - Major cause - high use of gasoline and diesel
 - Natural gas meets 2010 Heavy-Duty Engine standards



How Can North Carolina Benefit From Using Natural Gas as a Transportation Fuel ?

- Reduce transportation costs in economy
 - Lower long-term fuel costs compared to petroleum (gasoline and diesel) can offset higher first cost
 - Lower maintenance costs compared to diesel



Lowering Barriers to Increased Adoption

- Reduce entry costs for private fleets through tax credits
 - *Credit for % of incremental cost of the original vehicle*
 - *Credit for % of fueling station infrastructure development*
- Reduce entry costs for public fleet adoption
 - *Grants or low-interest loans to fund incremental cost of vehicles*
 - Standardized contract/pricing on state vehicle bids
 - Incentives for providing public access to fueling stations
 - *Pass-through of tax credits to taxable entities*
- Create incentive by reducing taxes relative to gasoline or diesel
 - *Eliminate state road use tax on alternate fuels like CNG, propane and electric plug-in*
 - Or replace with annual fee for AFV sticker
- Increase awareness with consumers and policymakers
 - *HOV lanes for AFV use*
 - Preferred parking spots at state and local gov't buildings
 - Highway signs directing to nearest alternate fuel station

What's Been Most Effective in Other States

- State tax credits for vehicle purchase - Oklahoma
Example - For tax years beginning before January 1, 2015, Oklahoma provides a one-time income tax credit for 50% of the cost of converting a vehicle to operate on an alternative fuel, or for 50% of the incremental cost of purchasing a new Original Equipment Manufacturer AFV. The state also provides a tax credit for 10% of the total vehicle cost, up to \$1,500.
- HOV Lane Exemption – Arizona & Utah
Qualified low-emission and energy-efficient vehicles are permitted to use HOV lanes, regardless of the number of passengers. Qualified vehicles must meet specified fuel economy requirements and are required to display the low-emission and energy-efficient vehicle license plate.
- Alternative Fuel Decal in lieu of state fuel tax – Missouri
The \$0.17 per gallon motor fuel tax does not apply to passenger vehicles, certain buses, or commercial vehicles that are powered by an alternative fuel. The owners or operators of such vehicles are required to pay an annual alternative fuel decal fee of \$75.

For more info on all the state and federal incentives and regulations, go to http://www.afdc.energy.gov/afdc/incentives_laws.html

Recently introduced NC legislation

Alternate Fuel Incentives

| ALTERNATIVE FUEL INCENTIVE BILLS INTRODUCED IN THE 2009 SESSION OF THE NORTH CAROLINA GENERAL ASSEMBLY | | | |
|---|--------------------------|--|---|
| Bill | Primary Sponsors | Provisions | Status |
| House Bill 905 (as filed) | Bryant, Harrison, Tolson | <ul style="list-style-type: none"> • Tax credit equal to 50% of Federal credit for alt. fuel facilities • Tax credit equal to 50% of Federal Credit for incremental cost of AFVs and advanced plug-in vehicles <p>[Federal credits are 50% of incremental vehicle costs, plus 30% if low-emissions, and 30% of fueling facility costs, with caps.]</p> | See 2 nd Edition below |
| House Bill 905 (2 nd Edition) | Bryant, Harrison, Tolson | Completely rewritten as renewable energy/energy conservation tax credit study bill; includes alternative fuel vehicles and fueling facilities in items to be studied. | House Bill 945 (omnibus Studies Bill) authorized the Revenue Laws Study Committee to study House Bill 905 and make recommendations upon the convening of the 2010 Short Session |

Recently introduced NC legislation Alternate Fuel Incentives (continued)

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|------------------|--------------------------|---|--------------------------------------|
| House Bill 906 | Bryant, Harrison, Tolson | <ul style="list-style-type: none"> • Tax credit for 30% of cost of residential or commercial fueling facilities • Credit of \$2,000 for AFV and plug-in vehicles • Provision for pass-through of credits from nonprofit and governmental | Referred to House Finance Committee. |
| Senate Bill 842 | Albertson | Same as filed version of House Bill 905 | Referred to Senate Finance Committee |
| Senate Bill 657 | Goss | Appoint a joint study commission to study expanding use of alternative fuels by State government | Referred to Senate Rules Committee |
| Senate Bill 1066 | Albertson | Similar to House Bill 906 | Referred to Senate Finance Committee |

Additional Information

- NGVs by Country
 - Argentina 1,690,000
 - Pakistan 1,650,000
 - Brazil 1,510,000
 - Europe 812,000
 - Iran 611,500
 - India 354,000
 - Colombia 251,700
 - China 200,900
 - Bangladesh 150,000
 - **USA 150,000**
 - Ukraine 120,000
 - Russia 95,000
 - Bolivia 84,100
 - Egypt 81,400
 - Venezuela 44,100
 - Canada 12,100