New Jersey Global Warming Response Act
Improving Air Quality through Energy Efficiency and Conservation

New Jersey Department of Environmental Protection, Trenton, NJ

Comments by
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I appreciate the chance to submit comments on the New Jersey Global Warming Response Act—an ambitious piece of legislation aimed at ensuring that the State does its share in helping our country reduce the generation of greenhouse gases and the severe impacts already being caused by the atmospheric buildup of these gases.

New Jersey's goals are far reaching: to reduce greenhouse gases (GHG) to 1990 levels by 2020 (about 25% lower than the levels that would be generated doing "business as usual"), and to reduce them further—to 80% of 2006 levels—by 2050. While we commend the State for the many strategies incorporated in this Act, we want to focus on the crucial importance of one of the most concentrated source of greenhouse gases and pollution in the transportation sector—heavy duty diesel trucks and buses —which the Act barely mentions.

The GWRA recognizes the importance of change in the transportation sector which is the largest contributor of GHGs in the State (36%). And the plan includes many strategies aimed at reducing GHGs in the on-road gasoline (car) sector by 3.7 Million Metric Tons (MMTs) of CO2 equivalent by 2020. But with few strategies focused on the heavy duty diesel sector, GWRA projects an increase in its GHG emissions by 2020 of 3.3 MMTs of CO2 equivalent. The plan therefore anticipates virtually no overall progress in curbing GHGs in transportation in the next 11 years. Further, while the reductions in the car sector require a very rapid spread of not-yet-perfected energy generation and vehicle technologies, significant reductions in the diesel sector could be realized using available, commercial options, beginning today.

Our comments focus on the compelling rationale for the State to promote and support a shift away from trucks and buses in both public and private sector fleets powered by diesel fuel and a move to those powered by natural gas (achieving a 20 to 30% GHG reduction in every vehicle converted). We focus also on the kind of incentives the State could use to drive this shift, which would place New Jersey in the forefront of a growing international movement to replace fossil fuels with carbon and pollution free alternative fuels made from renewable resources: "biomethane", the green twin of natural gas, made from organic wastes and other biomass materials, and eventually hydrogen.

Both biomethane and hydrogen fuels, because they utilize gases that are processed, stored, and delivered under pressure, depend on vehicle technologies and fueling infrastructure that resemble those required for natural gas. Therefore, investing in natural gas vehicles and infrastructure today sets the stage for the subsequent move to truly renewable and sustainable fuels in the future.

The Rutgers EcoComplex and the Burlington County Resource Recovery Complex are already positioned to be major players in such an evolution. In 2005, they were partners in demonstrating the Acrion "CO_2 Wash" technology for cleaning up landfill gas to produce liquid biomethane to power refuse trucks, in a project sponsored by Mack Truck/AB Volvo. The EcoComplex is now a partner in research to develop biomethane fuel cells for use in heat and power systems that, as a spin off, provide hydrogen for mixing with biomethane in a vehicle fuel (hythane). The State has a unique opportunity to expand on the renewable energy innovations within its own borders.

What follows is a summary of the reasons why a shift to natural gas by the many thousands of diesel powered trucks, buses, shuttles and vans operating in the State deserves to be a high priority strategy for GHG reduction in New Jersey. Next is a list of examples of the types of modifications that could be made in the GWRA to advance this strategy. Thereafter, we include a section providing a more detailed discussion of the benefits of this strategy.

Summary of Reasons for Shifting On-road Diesel Vehicles to Natural Gas—GHG Reductions and Crucial Other Benefits

Natural gas is the only alternative transportation fuel option that is available today on a broad scale which can achieve significant GHG reductions in New Jersey. Every vehicle powered by natural gas instead of diesel (or gasoline) achieves a 20% to 30% reduction of GHG emissions.

- Natural gas is the ONLY fully commercial choice for the diesel sector— the trucks, buses, and other diesel-powered vehicles that generated 7.5 MMTs of CO2 equivalent in New Jersey in 2004 – more than 15% of the State's transportation-related GHG emissions.

- Natural gas is the cleanest alternative fuel available because it contains only one carbon atom per molecule—and four hydrogen atoms. So the emissions from natural gas vehicles contain virtually none of the particulate and smog-forming nitrogen oxide emissions poured out by diesel powered vehicles, which threaten the health of millions of New Jersey's citizens. Natural gas vehicles are cleaner than even the cleanest new diesel models.

- A greater use of natural gas in New Jersey would reduce the state's dangerous (60%) dependence on oil imports from OPEC and other nations that are not reliably friendly to the US, while taking advantage of a domestically plentiful—and secure—fuel.

- Infrastructure needs can be met by expanding, as needed, the gas pipeline system in NJ and by building new fueling infrastructure. These investments would offer the State the highest pay-off if they were targeted at the most heavily polluted urban areas and along the main transportation corridors of the State (the NJ Turnpike and other roadways cited in the GWRA), where diesel emissions endanger the greatest numbers of residents and commuters.
  With a federal focus on building infrastructure for the fuels and energy sources of the future, what better time could there be for an initiative to expand this infrastructure in New Jersey?

- A shift to natural gas fuel offers New Jersey the unique long-term benefit of paving the way technologically and commercially to the increasing displacement of natural gas by truly sustainable and renewable gaseous fuels, beginning with biomethane and, in the future, hydrogen, breaking once and for all the diesel transportation sector's addiction to oil.

Examples of Changes in the GRWA That Could Reduce GHG Emissions from the Diesel Sector

Once the powerful climate-protection rationale for promoting and supporting the shift from diesel to natural gas, and then to biomethane, many steps could advance this fuel shift in order to reduce GHG emissions, including the following:

- Recalculate the major contribution that diesel reductions could make in achieving New Jersey's 2020 and 2050 goals and give the goal of reducing GHG emissions in the diesel sector visibility and importance in the GWRA.

- Include in the Global Warming Solutions Fund or elsewhere a section that would allow emissions trading to apply to the transportation sector

- Add natural gas refuse and recycling trucks or other vans and shuttles used in municipal fleets to the state purchasing contract, which would encourage and facilitate the purchase by municipal governments of natural gas vehicles, in line with Executive Order 11, which focuses on "green purchasing" by state agencies. (The Office of General Services in New York State was the first state in the country to add natural gas refuse trucks to the state contract, and other states can buy off this contract as well.)

- Include in the program to green the state-owned fleet a preference for vehicles and fuels that 1) reduce GHG emissions; 2) reduce health-damaging air pollutants; and 3) lessen the State's dependence on petroleum-derived fuels. Measured against all three criteria, natural gas is today the clear winner. The only alternative fuel mentioned in the GWRA is "sustainably-derived biodiesel"—which is at best a marginally useful strategy for achieving the State's 2020 GHG reduction goals in the transportation sector.

- Establish state economic incentives or grants such as those in California and Texas that, in conjunction with the incentives provided under the 2005 Energy Policy and Transportation Acts, create a totally level playing field for public and private diesel fleet operators who want to purchase and operate new natural gas vehicles, e.g., by covering all of the incremental costs of buying these more expensive vehicles and possibly even the costs of modifying fleet garages and training workers.

- Develop an overall plan for funding and developing a natural gas fueling infrastructure, focusing in urban centers and along interstates.[1]

- Ensure that educational programs are in place to advise fleet operators and municipal officials about fuel and vehicle options and about the federal economic incentives and any state grants available for purchasing new natural gas vehicles or doing diesel retrofits.

- Create incentives for towns in New Jersey to pool their municipal organic wastes and, instead of throwing away this valuable energy resource at high cost, collaborate to extract biomethane from their landfills (or produce it in anaerobic digesters) to fuel local heavy duty truck and bus fleets.

- Involve the State University's agricultural expertise in developing biomethane production projects in the State's agricultural and park lands.

Detailed Discussion of Reasons—GHG Reductions and Others—for Placing a High Priority on Converting Diesel Fuel Vehicles to Natural Gas

Measurable Greenhouse Gas Reductions Can Be Achieved Immediately

Because transportation is the greatest source of GHG emissions in New Jersey (generating 49 MMTs of CO2 equivalent in 2004—equal to 36% of the State total of 136.6 MMTs of CO2 equivalent), the New Jersey GWRA focuses significant attention on this sector. Within this sector, the GWRA targets on-road gasoline vehicles (mainly consumer cars), which generate 78% of transportation's GHG emissions.

The GWRA sets forth two broad strategies for reducing these emissions; first, promote mass transportation and land-use planning in order to reduce the use of cars and commuter traffic; and

[1] Among the strategies developed in Europe for natural gas infrastructure, an especially interesting one was Germany's requirement that international oil companies doing business in that country had to install 1000 natural gas fueling stations by 2010, knowing that these stations could also be used for biomethane in the very near future.

second, substitute hybrid plug-in and electric vehicles (that use renewable electricity) in place of today's gasoline engines. The first of these strategies is sensible and doable over time, but would produce far lower reductions than the second of these strategies, which is visionary and improbable within the 2020 time frame, given the complex and carefully coordinated changes in the power generation and automotive sectors that would be required for success.

Perplexingly, the GWRA estimates that by 2020, the strategies for reducing GHG emissions from on-road gasoline vehicles will reduce gasoline vehicle GHGs by 3.7 MMTs of CO2 equivalent—while also estimating that, during the same period, diesel truck emissions, which are given so little air time in this plan, will actually increase by a similar amount, 3.3 MMTs of CO2 equivalent. In other words, the transportation sector, which is the largest source of GHGs in the State, is projected to make virtually no progress by 2020, even if the goals in the plan were fully realized.

A strong focus in the GWRA on driving a shift by on-road diesel vehicles from diesel to natural gas fuel could eliminate the 3.3 MMTs of CO2 equivalent forecast in the plan, if not actually reduce these GHG emissions much further. It would open the door also to the use of biomethane fuel (discussed elsewhere) with further significant GHG emission reductions achieved through the capture and reuse of the potent GHG, methane.

Natural Gas Is a Fully Commercial Alternative Fuel for All Classes of Diesel Vehicles

Natural gas vehicles, as substitutes for diesels, are a fully commercial option. After 15 years of development, there is a heavy-duty natural gas engine that is a reliable high performer. Versions of this engine can be used in almost every type of heavy duty vehicle application such as a refuse or recycling truck, a transit or school bus, or a produce delivery truck—not to mention the lighter duty engines appropriate for use in shuttles or vans that run local routes or move between towns and airports. In addition, as discussed below, an industry has grown up to build and service natural gas vehicles, and to install and operate natural gas fueling stations.

The GWRA refers to natural gas vehicles as in need of "demonstration" Yet, these vehicles are in full-scale deployment in towns located close to New Jersey. Smithtown, Long Island, with a population of 117,000, recently became the first town in the North East to mandate that 100% of the refuse and recycling trucks serving its community be natural gas-powered. The success of that initiative led Smithtown to specify in 2008 that every government owned vehicle—car, bus or truck—be powered, where possible, by California-certified natural gas models.

Brookhaven, the largest town on Long Island, just traded in all 75 refuse trucks in its fleet for natural gas trucks. The New York City Department of Sanitation, which operates the largest municipal refuse truck fleet in the US, and two private haulers in the City are also moving in this direction. Owners of these fleets have used federal tax incentives and grants that lower fuel prices and cover most of the incremental cost of the new natural gas vehicles to make these shifts financially attractive. So New Jersey officials have ample on-the-ground experience to consult.

There Are Well-researched Health Imperatives for Supplanting Diesel with Natural Gas

A crucial side-benefit of natural gas as a transportation strategy—in addition to its lower GHG emissions—is that the fuel's emissions are nearly free of airborne particulate matter (PM), which research shows to be strongly linked to serious respiratory and cardiovascular health problems.[2]

[2] A key pollution information source, the American Lung Associate, comparing the environmental performance of US states and counties, ranked New Jersey in 2006 as the 2nd worst state for cancer risk due to vehicle emissions and the 3rd worst state in the country for non-cancerous health hazards from vehicle emissions. Hudson (2nd), Bergen (12th), Essex (13th) Monmouth (16th) and Union (18th) Counties ranked in the top 20 with four more counties in the top 50 for added cancer risk due to vehicle emissions, most significantly those contributed by diesel fuels. \As a main corridor connecting two of America's largest metropolitan areas, New York City and Philadelphia, as well as a trucking crossroads between

Today's new heavy duty natural gas engines, if used by fleets in congested urban areas, can protect the health of millions of New Jersey citizens.

Eleven percent of all adults in New Jersey (710,000) were afflicted by asthma in 2003 (compared to a national average of 6%), and the rate among children was 12%, with even higher incidences of asthma among both adults and children in urban areas where concentrations of smog (ground level ozone) and fine soot (particulate matter, PM10) are higher. The main cause has been the emissions of diesel buses and trucks. But new natural gas heavy duty vehicles are the world's cleanest. They can meet today the stringent standard for nitrogen oxide emissions that goes into effect in 2010.

Prime targets for improving air quality are the approximately 9,000 refuse and recycling trucks in the State that travel down virtually every residential street in cities and communities, leaving their polluting emissions on every doorstep; the almost 3,000 buses operated by New Jersey Transit and local inner city bus fleets; buses serving college campuses and the shuttles; and vans taking people to airports. A primary goal would be to get all old diesel vehicles (1998 or older) off the roads of the State as quickly as possible.

Because of the many health, GHG reduction, and energy security benefits of natural gas fuel, in the last three years the numbers of natural gas vehicles have increased by 90% worldwide to 8.4 million. Unfortunately, North America, which was a leader in developing new natural gas vehicle technology, has not been a leader in its use. This country has at most 150,000 NGVs in operation. However, the last two years have seen the "arrival" of heavy duty natural gas technology on the East Coast setting an example for New Jersey, as noted in the previous section.

A Fueling Station Infrastructure Can Be Built Along the Existing Pipeline Networks

Since natural gas is available through a pipeline system that runs throughout New Jersey, the primary step needed to put many thousands of clean natural gas vehicles on the state's roadways is the building of fueling infrastructure.[3] In the last decade, an industry has grown up that can take this task off of the hands of municipal and state government bodies. One major player has been willing to cover the up-front costs of building fueling stations as part of an agreement that they will then operate and maintain these stations.

With a major federal priority on funding initiatives that will support a shift to the renewable energy and transportation fuels of the future, when could be a better time to take action? Once a natural gas fueling-station infrastructure is in place, heavy duty fleets will not be the only vehicles that can take advantage of it. Light duty fleets, whether they are government fleets, private taxi or car service fleets, or even individuals will also be able to purchase natural gas models (California has already certified a number of these) and fuel them at the same stations. Light duty vehicles that run on natural gas emit 30% less GHG than do their gasoline-burning counterparts.

The Domestic Supply of Natural Gas Is Plentiful and Secure

While natural gas, however clean, is ultimately a depleteable fossil fuel like petroleum, the question of the size of this resource becomes a central one. While it has long been clear that

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the Northeast and the mid-Atlantic and beyond, New Jersey contains one of America's most densely traveled road systems. In 2005, the distance vehicles traveled statewide on its public road system was **203,076,000 miles daily.**

[3] Three types of locations for natural gas fueling facilities may constitute the most efficient investments. Construction of fueling stations in the most urbanized areas may in most cases be the best investment since they permit rapid near term use of this clean fuel to power the school bus, delivery trucks, and especially the refuse and recycling truck fleets that circulate continuously there -- fleets that, today, are virtually all powered by diesel fuel and are the most significant concentrated sources of health threatening pollution impacting millions of New Jersey residents. Construction of fueling stations near waste transfer sites can also be efficient, enabling many refuse truck fleets to take advantage of their use. Finally, construction of fueling stations along the Interstate highways could be part of an East Coast clean fuel corridor for long haul trucks.

natural gas supplies are more plentiful than supplies of oil in the US, the estimates of US natural gas resources have recently been significantly revised. In 2004, the US Department of Energy estimated a 72 year supply (at 2004 consumption levels). This was revised in mid-2006 to an 88 year supply (at 2006 consumption levels.) Then, in 2008 the estimate jumped to 118 years, due primarily to the discovery of natural gas-containing shale formations in Texas, the Northeast, and elsewhere.[4] A thorough understanding remains to be gathered regarding the environmental impacts of obtaining shale gas, especially where drinking water supplies might be affected, but the range of environmental impacts involved in producing and using natural gas remain less extensive and severe than those of producing and using petroleum-derived fuels.[5]

The growing global competition for the world's remaining oil—especially the competition from China, India and other parts of industrializing Asia—means that the wildly fluctuating prices of petroleum-derived fuels will be a continuing threat to New Jersey and the rest of the US. In addition, supply disruptions may well be on the horizon that will wreak havoc on economies reliant on petroleum-based transportation fuels. The faster New Jersey makes a transition to petroleum-free transportation fuels, the more secure its future will be.

The much publicized Pickens Plan, by T. Boone Pickens, one of the foremost experts in the fuels industry, has discussed at length the benefits of using this country's natural gas to power the US transportation sector, while it argues that many other technology options exist – solar, hydro, bio-fuels, wind, etc. – to generate electricity and provide heating.

NJ Can Build a Path Toward Fully Sustainable Fuels—Biomethane, Hythane, and Hydrogen

Taking a long-term perspective as we seek to propel a transition to fully sustainable fuel, the greatest benefits of investing in natural gas vehicles today and of building a fueling infrastructure for gaseous fuel, is that these actions not only produce cleaner air and lower GHG emissions in the State, but also pave the way to the phasing in of truly sustainable fuels—biomethane, hythane (a blend of biomethane and hydrogen), and hydrogen.

Biomethane, hardly mentioned in the GWRA, is of the most immediate importance. The production of biomethane is a great way to turn New Jersey's wastes into a valuable energy resource, to create a whole new industry of green jobs, and to produce a transportation fuel that is secure, pollution-and carbon-free and cheap.

Biomethane is not a revolutionary or experimental fuel. It is simply a form of natural gas that comes from biomass. It is often made by cleaning up the biogases produced naturally as organic wastes are broken down in landfills, sewage treatment plants, and manure lagoons; it can also be produced in anaerobic digesters that process organic wastes, energy grasses, and agricultural wastes. It should also be noted that a new generation of low-cost, small-scale gasification plants for biomethane production is about to come on line in Sweden and elsewhere in Europe, which will significantly expand the commercially viable feedstocks for biomethane and make it possible for many localities to run their own plants economically.

[4] Navigant Consulting, Inc. 2008. *North American Natural Gas Supply Assessment* (prepared for the America Clean Skies Foundation),

[5] More broadly, while natural gas extraction, transport by pipeline and storage are not processes free of environmental impacts, these are nowhere as significant and damaging as those related to the production, transport and storage of petroleum-derived fuels which include: pollution generated by refining operations, which are amongst the most polluting industrial facilities in the nation, spills from tankers or tanker trucks, and leaks from under or above ground tanks at fueling stations, which have been major sources of groundwater contamination in New Jersey and elsewhere. Further, used in a vehicle, natural gas, in the case of an accident, does not pool on the ground posing the risk of vehicle fires; instead, being lighter than air, it rises and dissipates.

Biomethane is increasingly used in Europe today to displace petroleum-derived transportation fuels.[6] One of Europe's leading experts on biomethane has estimated, based on the European experience, that the organic wastes generated directly or indirectly by about one million people can produce about 27 million diesel gallon equivalents of biomethane gas plus CO2 useful for refrigeration, and large volumes of excellent fertilizer.[7] Using this rough calculation, the wastes of just 3 million of New Jersey's 8.3 million residents could generate sufficient clean biomethane fuel to power every one of the 9,000 or more refuse and recycling trucks in the State.

It should be emphasized that New Jersey is already a US leader in demonstrating how biomethane vehicle fuel can be produced from landfill gases for transportation use. As noted above, the Rutgers EcoComplex and the Burlington County Resource and Recovery Complex demonstrated in 2005 how to use landfill biogas to produce liquid biomethane fuel for heavy duty trucks—the first demonstration of its kind in the US. Moreover, exciting new research at the EcoComplex is exploring how to build biomethane fuel cells that can provide—as part of the same energy cycle—both electricity and a hydrogen-biomethane blend vehicle fuel. This research could help reshape the State's, and the nation's, renewable energy options.

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At a critical juncture in the history of New Jersey and of this country, it is our hope that the State's recognition of the need to slash GHG emissions as well as to transition away from excessive reliance on oil-derived fuels in transportation (where two-thirds of all US oil is used) and move toward the cleaner, renewable, and ultimately carbon- and pollution-free fuel options that are on the horizon, will inspire the commitment and momentum that will make concrete and rapid progress toward a sustainable energy future a reality in New Jersey.

We would be glad to provide further information if it would be useful.

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[6] Within two decades, according to Peter Boisen, who heads the NGV Europe association, the organic-waste based form of biomethane alone, could meet 10 to 18 percent of road vehicle fuel demand in fourteen countries including Germany, France, Spain, United Kingdom and Sweden. Biomethane already powers hundreds of city buses in a dozen Swedish cities, as well as buses in Lille, Bern, and Basel. In Madrid, 500 natural gas garbage trucks will soon be converted to run on biomethane.

[7] Boisen, Peter. 2008. *The Rapidly Expanding Use of Biomethane in Europe, and Beyond*, a PowerPoint presentation at the Rutgers University-Energy Vision conference, January 25, 2008.