

### Introduction

Alternative fuel vehicles offer an unprecedented opportunity to transform and transition our nation's transportation fuel source from petroleum to alternative fuels. The vehicle sector is currently virtually 100% dependent on liquid fuels, more than two-thirds of which is imported. Expanding the diversity of fuel sources used in the transportation sector will increase flexibility in responding to any disruptions in the supply of petroleum-based fuels, enhancing our nation's energy security and protecting our economy from the adverse impact of sudden changes in the availability and/or price of petroleum products. The U.S. Environmental Protection Agency (EPA) estimates that vehicles on the road account for 60% of carbon monoxide (CO) pollution and about one-third of hydrocarbons and nitrogen oxides emissions in the United States. The potential exists to drastically reduce our nation's emissions of carbon dioxide (CO<sub>2</sub>) and other pollutants by making prudent transportation fuel diversity investments.<sup>1,2</sup>

As a result of climate change concerns and historic high costs for oil during summer 2008, there is increased interest to reduce our nation's dependency on petroleum to fuel our vehicles. This white paper focuses on ideas to advance the adoption of Plug-in Hybrid Electric Vehicles (PHEVs), Electric Vehicles (EVs) and Natural Gas Vehicles (NGVs). We will explore the technology, the benefits and the barriers to implementation that would need resolution, as well as recommending policy changes and other actions required to turn this vision into a reality.

### Discussion

#### *Plug-in Hybrid Electrical Vehicles and Electric Vehicles*

The development of PHEVs and EVs has gained momentum over the last few years, coinciding with the concerns over recent high prices of gasoline, climate change, and national energy security. Automakers recognize a consumer market not only anxious to reduce transportation costs but also to respond aggressively to the concerns of climate change and energy security.

EVs are vehicles that run on battery-stored electricity alone. PHEVs have large batteries but also engines which can power the vehicle when the battery charge is depleted. Both types of vehicles will become more attractive as battery technology advances and economies of scale lower costs. The electric-only target driving range of a PHEV is 20 to 40 miles, depending primarily on battery storage capability and the drive cycle. Batteries can be recharged from a conventional 120 volt AC source.

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<sup>1</sup> Reduced emissions from natural gas vehicles: [http://www.ngvc.org/about\\_ngv/index.html](http://www.ngvc.org/about_ngv/index.html)

<sup>2</sup> Reduced emissions from electric vehicles:

[http://www.afdc.energy.gov/afdc/vehicles/emissions\\_electricity.html](http://www.afdc.energy.gov/afdc/vehicles/emissions_electricity.html)

Several benefits result from the use of grid electricity as a transportation fuel. A joint study by EPRI and NRDC, which employed detailed models of the electric system and the transportation sector with sophisticated atmospheric air quality models, showed that the widespread adoption of PHEVs can reduce GHG emissions from vehicles by more than 450 million metric tons by 2050. PHEVs also reduce direct emissions of pollutants when recharged using a portfolio of efficient, low-emitting or renewable generation. Studies have also shown that PHEVs primarily fueled by electricity from the grid can reduce the cost of vehicle fuel for consumers, provide a strong economic incentive for consumers to purchase PHEVs. Since our electricity is primarily fueled with domestically-sourced fuels, PHEV use also enhances our nation's energy security.

Off-Peak charging for PHEVs could coincide with the peak for wind generation in New York (since the wind tends to blow more during non-system-peak hours and less during peaks) and could help to drive a zero-emission transportation sector. Offsetting these benefits is the potential system impact should transmission and distribution system wires no longer benefit from an overnight cool-down period.

A roadblock to widespread use of electric vehicles has been their limited driving range, which is a function of battery technology. Solving the driving range problem within the tradeoffs of battery development is a major challenge. Battery development and research is so critical that fourteen U.S. technology companies are joining forces to form a consortium that would build the first advanced PHEV battery manufacturing plant in the United States. Other barriers include the design of local utility tariffs to accommodate not just local PHEVs and EVs to use the electric system, but also allow PHEVs and EVs from other areas the ability to recharge in other electric systems. This universality of fueling capability throughout the nation must be resolved; no one will buy a car that can't be "tanked up" outside one's own region. Smart chargers enabled by the Smart Grid will help manage the distribution infrastructure and allow for accurate billing.

### ***Natural Gas Vehicles***

According to NGV America, there are approximately 150,000 NGVs in the United States, with approximately 7 million NGVs in service worldwide. Natural gas can be used in all types of vehicles including cars, motorcycles, vans, trucks, buses, and even trains. The MTA's Clean Fuel Bus Program has added 481 natural gas buses to its fleet in New York City. NGVs reduce United States dependence on foreign oil, enhancing our energy security, since approximately 80% of the natural gas used in the United States is domestically produced; by comparison, only one-third of the oil we use is domestic.

NGV engines operate on the same principles as gasoline fueled vehicles, and the engine technology is identical to gasoline engines in conventional vehicles. Natural gas is stored in the vehicle at high pressure in specially designed tanks. Advanced electronic engine-control systems have improved the power output and reduced the emissions of NGVs as compared to earlier models.

According to the EPA, compared to a conventional vehicle, NGVs: reduce CO emissions by 90% - 97%; reduce CO<sub>2</sub> emissions by 25%; reduce nitrogen oxides emissions by 35%

- 60%; reduce non-methane hydrocarbon emissions by 50% -75%; and emit little or no particulate matter

Despite these advantages, less than 1% of natural gas is currently used for transportation, and significant barriers must be overcome and significant capital investments made to adopt wider use of NGVs. The lack of a mature, widely-available compressed natural gas (CNG) fueling infrastructure system to support a large fleet of NGVs makes consumers unwilling to commit to purchasing NGVs, while infrastructure developers are hesitant to build more fueling stations until vehicle sales grow. This “chicken and egg” stalemate will be impossible to resolve without either significant economic incentives to encourage investment by both individuals (to buy vehicles) or investors (to build infrastructure), or public policy initiatives that will resolve the stalemate.

Utility rates to serve CNG fueling stations are designed to be competitive with other forms of firm gas transportation on LDC systems. Since NGVs are true year-round base load, they are typically more economical for an LDC to serve because the upstream pipeline capacity and local distribution infrastructure needed to serve the NGV load can be utilized all year long (and not just during the winter heating season as is true of heating load), suggesting possible rate incentives allowing for lower gas transportation rates to CNG fueling stations can be justified on an economic basis.

## **Proposal**

New York State is recognized as leader in NGV deployment along with California, and has an opportunity to repeat this with aggressive support of PHEV and EV infrastructure. We should continue our leadership by adopting the following measures:

1. Discounted electric and gas rates should be approved for owners of alternative fuel vehicles that subscribe to time-of-use guidelines. Time-of-day electric rates should be sanctioned that sell electric power at low cost for night-time fueling. Special discounted natural gas rates for residential customers should be provided for small home-based CNG fueling stations that operate during off-peak hours for the gas system. Care must be taken, however, to study the impact of incremental energy infrastructure use that will result from the electrification of the transportation system, including impact of greater electric usage on gas transmission capacity (since a high amount of electric generation is gas fired).
2. A New York State Electric Fueling Collaborative should be created to centralize the analysis of the impact of electric fuel vehicles on the power grid. This collaborative will work with all stakeholders to analyze, through implementation of pilot programs, the impacts of PHEVs and EVs on the bulk system and local distribution grid, and should also assess the impact of emissions on air quality and the economic impact of New York State. The collaborative can also promote efforts to harmonize payment and billing systems throughout New York State so that electric vehicles from anywhere in New York (and preferably from a larger geographic area, or even nationwide) can seamlessly plug-in and recharge in any

- part of the state. Such pilot programs should be implemented quickly in order to study system impacts, benefits, billing and tariff systems and consumer behavior.
3. Promote the benefits of PHEVs and EVs among the educational system and partner with them to fulfill the promise of widespread deployment and enhancements of PHEVs and EVs.
  4. Support the implementation of Smart Grid technologies and advanced metering, which will help integrate PHEVs and EVs into the electric system. Implementation of Smart Grid technologies that can identify electric vehicles using the electric system can be the solution to universal access to the electric grid for electric vehicles, and remove the barrier of requiring each electric vehicle to have its own account with every electric utility before recharging. The industry needs to develop proper analytical and billing systems to capture these new dynamics.

***Questions or comments?***

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