

## Natural Gas Vehicles Are An Essential Bridge to Hydrogen

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Natural gas vehicles (NGVs) are garnering unprecedented attention today due to low U.S. natural gas prices brought about by the shale gas “revolution.” According to the recent [Future Transportation Fuels](#) report by the National Petroleum Council, low natural gas prices and the absence of technical barriers give NGVs the potential for “larger, earlier, and faster” impacts on domestic oil consumption compared to other alternatives. (<http://npc.org/FTF-80112.html>)

In addition to these immediate benefits, it has long been recognized that NGVs can play a critical role in facilitating the commercialization of gaseous hydrogen fuel cell vehicles (FCVs). FCVs are a crucial technology for meeting long-term environmental goals, combining the zero-emission performance of EVs with the gasoline-like range and refueling characteristics of NGVs.

Because natural gas is the primary feedstock for hydrogen production, it is increasingly acknowledged that low natural gas prices will also help FCVs become more competitive by lowering hydrogen fuel costs. However, synergies between natural gas and hydrogen don’t end there – indeed, important synergies between these fuels continue throughout the supply chain, from distribution infrastructure to refueling stations to vehicle technologies.

Like other natural gas fueling providers, VNG has a strong interest in the future development of the market for hydrogen fuels, and we are working to increase policymaker awareness of the ability of NGVs to serve as a “bridge” to FCVs. The past year has seen notable progress in this area, as summarized below:

- **Advocacy by VNG and NGVA:** VNG as well as Natural Gas Vehicles for America (NGVA) discussed the importance of the NGV-FCV connection in comments submitted to EPA, and VNG commissioned a white paper on the subject titled “Natural Gas Vehicles: An Essential Bridge to Hydrogen.”
- **Recognition by EPA in New Vehicle Rules:** EPA acknowledged this NGV-FCV connection in its new light-duty vehicle regulations for 2017-2025 with new “advanced technology” incentives for NGVs.
- **Growing Interest at Department of Energy:** The US Department of Energy is showing renewed interest in FCVs as a transportation technology due to low natural gas prices as well as the development of “trigeneration” technology, an important step towards producing hydrogen from natural gas with low or zero emissions.

## “Natural Gas Vehicles: An Essential Bridge to Hydrogen” Report

- The white paper “Natural Gas Vehicles: An Essential Bridge to Hydrogen,” commissioned by VNG and written by the consultancy Energy Futures, examines the linkages between these fuels and finds that “the synergies start with natural gas as the primary and cheapest feedstock for nearly all hydrogen production today and continue through every step in the fuel supply chain.” (<http://vng.co/public-policy/>)
- Key synergies identified in the report include:
  - **Hydrogen Production:** Steam methane reforming (SMR) technology is used to produce 95% of the hydrogen in the US today, due to lower costs compared to electrolysis or other technologies. SMR is thus considered the “most promising” near-term pathway for a transition to hydrogen.
  - **Distribution and Storage:** Pipelines, tube trailers, and storage tanks used to transport and store hydrogen are analogous to those for natural gas. Thus, improvements and technological innovations for distribution and storage due to growing NGV adoption will also benefit hydrogen.
  - **Fueling Stations:** CNG fueling facilities are “ideal” platforms for the development of a decentralized hydrogen production and fueling infrastructure. They share much of the same equipment requirements, allowing CNG stations to be straightforwardly adapted to dispense hydrogen (or CNG-hydrogen blends), and distributed SMR can be used to produce hydrogen from natural gas on site.
  - **HCNG Fuel Mixtures:** Blends of CNG with up to 20% hydrogen (HCNG) can be burned in conventional NGVs without significant engine modifications. Offering HCNG blends at existing CNG/hydrogen fueling stations can lower emissions of NGVs while helping to build infrastructure coverage and market demand for hydrogen fuel.
  - **Vehicle Fuel Storage and Management Technologies:** Finally, the onboard fuel management and storage equipment for both NGVs and FCVs are analogous. In addition to facilitating automaker experience designing vehicles optimized for gaseous fuels, this synergy will help drive the development of advanced gaseous storage materials that could offer game-changing improvements in fuel storage density and cost.
- These findings helped to support public comments made by VNG and NGVA arguing for regulatory incentives for NGVs in recognition of this “bridge.” The full report and VNG’s comments can be found at <http://vng.co/public-policy/>.

## “Bridge” Recognized by EPA with New NGV Incentives:

- In newly finalized light-duty vehicle greenhouse gas regulations for the years 2017-2025, EPA awarded NGVs new “multiplier” incentives based on their ability to serve as a “bridge to hydrogen,” a rationale that was presented extensively in “persuasive” public comments by VNG and Natural Gas Vehicles for America (NGVA). (<http://www.epa.gov/otaq/climate/regs-light-duty.htm>)
- EPA wrote that “CNG investments have the potential to facilitate the introduction of hydrogen FCVs in several respects,” including:
  - *Innovations in advanced storage materials*
  - *Innovations in tube trailer designs*
  - *Improved designs for compressors and fuel dispensers*
  - *On-site production of hydrogen from natural gas feedstock*

## Interest in Natural Gas-Hydrogen Link at Department of Energy

- **US Department of Energy:** The Department of Energy is also considering increasing support for hydrogen FCVs, thanks to falling natural gas prices (<http://wheels.blogs.nytimes.com/2012/05/29/cheap-natural-gas-prompts-energy-department-to-soften-its-line-on-fuel-cells/>)
  - In May, a spokesperson for DOE stated that the department believes that low natural gas prices have potential to cut hydrogen costs in half
- **Secretary of Energy Steven Chu:** In contrast to his stated preference for electric vehicles (EVs) during his early days as Secretary of Energy in 2009, Dr. Steven Chu recently announced his newly positive outlook on FCVs due to two developments tied to natural gas: (<http://www.autoline.tv/daily/?p=22180>)
  - **Low Priced Natural Gas:** "The most important thing that changed my mind was the fact that we have now natural gas in abundance. Hydrogen is reformed from natural gas. That's point number one."
  - **Trigeneration Technology:** New “trigeneration” technology under development at the University of South Carolina can utilize natural gas to produce combined heat and power, pure hydrogen, and a pure stream of carbon dioxide as waste. This highly efficient method of utilizing natural gas to produce hydrogen – and an easily-captured stream of carbon dioxide– could be key to realizing the emission-reducing potential of FCVs, according to Secretary Chu.

- **National Petroleum Council:** The National Petroleum Council, an advisory committee to DOE, published a topic paper on HCNG blends as part of its comprehensive Future Transportation Fuels study in August 2012. The paper examines the potential of HCNG blends and details the results of a number of vehicle trials in the US and around the world:  
([http://www.npc.org/FTF\\_Topic\\_papers/18HCNG.pdf](http://www.npc.org/FTF_Topic_papers/18HCNG.pdf))
  - **Reduced CNG Emissions:** There is “clear potential” for HCNG to further reduce emissions from CNG vehicles, with blends of 20% hydrogen yielding reductions in NOx emissions of up to 50% and CO2 emissions by 7.5% compared to pure CNG.
  - **Reduced Equipment Costs for Hydrogen:** The report notes that economies of scale from HCNG market development “are likely to have a significant effect on both hydrogen production equipment and vehicle manufacture.”
  - **Ongoing Global Research:** Trials for HCNG blends are currently underway in Italy, India, and South Korea, and the NPC report includes an appendix of previous trials conducted in the US, Canada, and Europe.

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