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USAGE OF NATURAL GAS

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

TO

ASSESS THE OPPORTUNITIES FOR, CURRENT LEVEL OF INVESTMENT IN, AND BARRIERS TO THE EXPANDED USAGE OF NATURAL GAS AS A FUEL FOR TRANSPORTATION

JULY 24, 2012

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USAGE OF NATURAL GAS

TUESDAY, JULY 24, 2012

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 10 a.m. in room SD–366, Dirksen Senate Office Building, Hon. Jeff Bingaman, chairman, presiding.

OPENING STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO

The CHAIRMAN. Alright, why don't we get started? Thank you all for being here. Today we have a hearing to assess the opportunities for expanded use of natural gas as a fuel for transportation.

I want to welcome the witnesses. I will introduce them after I make a few comments and Senator Murkowski makes a few comments.

The abundant natural gas resource that has become available and here in the United States with the advent of horizontal drilling and hydraulic fracturing has reshaped the energy landscape and led many to consider new ways to use this important resource. As I said before the hearing is to examine the role that expanded natural gas resource might play in meeting our transportation needs to assess its potential in that regard. This is not a hearing to support any specific piece of legislation, but as always we're interested in hearing from experts about possible policy actions the Federal Government could take or should take to further our domestic energy goals.

The transportation sector is vast and complex with a range of different vehicle types and transportation categories including heavy duty trucks for long haul transport, fleet vehicles, consumer cars and trucks, non road vehicles for marine and rail transport. Each of these vehicle types has different technological and infrastructure requirements to be able to use natural gas for fuel. Those differences strongly affect the relative viability of natural gas in each category.

The need for both natural gas vehicle development and infrastructure build out presents a chicken and egg problem. Vehicle manufacturers have historically been reluctant to develop and sell natural gas vehicles if the fueling infrastructure is not in place. Infrastructure developers have been wary of building fueling stations without demonstrated demand from consumers with natural gas vehicles.

In some sectors of transportation like long haul trucking and fleet vehicles there's already been—there are already some excellent examples of co-development of vehicles and infrastructure. In the light duty and consumer vehicle sector, the technology infrastructure chicken and egg problem seems to be more difficult to overcome. Natural gas consumer vehicles have not yet penetrated the domestic market to any significant degree. I know we're going to have some testimony from Chrysler today about their efforts in this regard.

There are also Federal and State government programs designed to address both sides of the technology infrastructure problem. The Department of Energy is funding projects through ARPA–E to facilitate more use of compressed natural gas. We may hear something of those as well.

Finally, I'd like to mention that there are State driven initiatives. Oklahoma Governor, Mary Fallin and Colorado Governor, John Hickenlooper, specifically, have promoted the use of natural gas in the transportation sector in their States.

Some of the obvious questions we're going to try to get answers to today are:

The role that natural gas is already playing in the transportation sector.

What opportunities exist for further use of natural gas in transportation?

What market forces are driving change in this sector?

How natural gas compares to other alternative fuels in terms of its potential to promote energy security and its environmental benefits.

Finally, if there are policies that the Federal Government should be pursuing to promote expanded use of natural gas we need to understand those better.

Let me defer to Senator Murkowski for any opening comments she'd like to make.

STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR FROM ALASKA

Senator MURKOWSKI. Thank you, Mr. Chairman.

Welcome to the witnesses this morning.

I think it's good to see that we've got some consensus developing around the very impressive expansion of America's natural gas resource. I don't think that we'd be able to even have this conversation here this morning about the potential for gas in our vehicles if the resource wasn't so abundant and affordable. You note that in your comments, Mr. Chairman.

The growth in our natural gas resource offers, I think, incredible potential for new and increased uses as an economic energy source for our country. For that reason, I think that the government needs to exercise caution, a great deal of caution regarding how and if it intervenes going forward. In particular I'm concerned that certain forms of government intervention might actually cause more harm than good.

As we speak there are Federal Government studies and rules that are developing on topics ranging from air emissions, the definition of diesel to so called environmental justice, the practice of

hydraulic fracturing. All of which, if improperly implemented could undermine the ability to access the natural gas that we've identified in such amazing quantities. So I want to be clear that whatever opportunities currently exist and whatever potential applications that we might identify. It depends fundamentally on the continued investment in the upstream side of our natural gas resource.

That could be jeopardized by Federal intrusion into what has been, at least by the testimony that we've received here in this committee, a sound and improving State based, regulatory system. That's how I'd like to see this energy revolution translate into better options for consumers. Continue the expansion of our domestic natural gas production, giving Americans a level of certainty that we won't deal with the same supply disruptions or threats of embargoes from foreign cartels that we see with foreign oil. That security results in both cheaper and more stable prices for natural gas. Those are very real, very compelling incentives for natural gas vehicles to develop.

Our interest today is in hearing about both the existing Federal barriers, but also in what Federal policies threaten the ability of entrepreneurs and innovators to compete in the marketplace for vehicles. Importantly, I'm interested in learning more about the potential tradeoffs that are associated with more cars and trucks running on natural gas instead of gasoline or diesel. I think we need to at least understand these dynamics, if not seek to address them in a responsible way.

So look forward to the comments and the opportunity for questions with our witnesses.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much.

We have 5 distinguished witnesses today. Let me introduce them briefly. Then we'll just hear from each.

The Honorable Dave McCurdy, who is our former colleague here in the Congress and now President and CEO of the American Gas Association. We welcome Dave here.

Dr. Michael Gallagher is Senior Adviser of Westport Innovations, Inc. in Vancouver, British Columbia. Thank you for being here.

Mr. Reg Modlin, who is Director of Regulatory Affairs with Chrysler Group out of Auburn Hills, Michigan.

Dr. David Greene, who has testified to us before on various issues. He's a Corporate Fellow at Oak Ridge National Laboratory in Tennessee.

Mr. Paul Cicio is President of the Industrial Energy Consumers of America here in Washington.

Thank you all for being here. If you'd each take 5 or 6 minutes and tell us the main things you think we need to know. We will include your full statement in the record.

Mr. McCurdy, go right ahead.

STATEMENT OF DAVE MCCURDY, PRESIDENT AND CEO, AMERICAN GAS ASSOCIATION

Mr. MCCURDY. Thank you, Mr. Chairman. Thank you for the invitation and opportunity to appear. Thank you, Ranking Member Murkowski, for the invitation as well. It's a pleasure to be here

with friends and former colleagues and Senator Manchin and Franken.

I always have to say that the only distressing thing about coming back, which I do on a fairly regular basis, is that when I have to admit that I served with the father of the members in both the House and Senate. There are more of them than you can imagine. But it's good to be here.

I was asked by the committee to cover a couple areas. Then finally outline some policies.

The first was to explain why using natural gas to offset a measure of our petroleum dependence is a smart path forward for our Nation.

Then second, to describe the momentum we're seeing today in building a national fueling infrastructure to support natural gas vehicles.

Finally, outline some policies we need to keep that momentum going.

As the chairman said and Senator Murkowski, the new abundance of natural gas reserves in our country has fundamentally shifted our energy landscape. A decade ago it seemed inevitable that the United States would become a major importer of natural gas. Instead today we're the world's leading producer of natural gas. In fact, the President of the United States in the State of the Union mentioned that and said that we'd have 100 years of supply. Many believe that may be a conservative estimate.

We've made great strides in turning down the curve of petroleum imports through increased domestic petroleum production and the landmark fuel economy standards for light duty vehicles. But we can do more. We have virtually eliminated petroleum use in other sectors such as electrical generation in home heating. Yet our transportation sector depends on petroleum for 94 percent of its primary energy.

Our singular dependence on oil for transportation fuel makes us vulnerable to economic and national security risks.

Every American recession over the past 4 decades has been preceded by or occurred concurrently with an oil price spike including the most recent. Our armed forces, and as the Chairman knows and Senator Murkowski, as a former Chairman on the Intelligence Committee and a member of the Armed Services Committee, very much concerned about our national security aspects. We all know that we expend enormous financial and human resources ensuring that oil transit routes remained open and critical infrastructure is protected. Our relations with foreign governments are too often influenced by our need to minimize disruptions of the flow of oil.

In 2011 the U.S. trade deficit in oil, the trade deficit just in oil, was $327 billion and accounted for 58 percent of our total trade deficit. The size of the U.S. trade deficit means we are, as a Nation, incurring an international debt burden that dampens the prospects for our long term economic health. The path that we are currently on is not sustainable and it's not smart.

A smart path forward includes diversifying our transportation energy mix and seeking to displace high cost imports with lower cost, domestic alternatives. Greater use of natural gas, such as a transportation fuel, delivers on both of these objectives. While nat-

ural gas represents 24 percent of the primary energy used to drive our economy as a whole. It is only 1 percent of the transportation sector.

The United States lags much of the world in natural gas vehicles. In fact, there are 13 million natural gas vehicles in use worldwide today, up from just 4 million just 7 years ago. Yet only, there's about 120,000 vehicles in the United States, again, less than 1 percent of the global total.

But there is good news. Here is the good news. The market is recognizing that switching from gasoline or diesel can mean significant cost savings. There are major fleet operators today, such as Waste Management, Verizon, Ryder and others who are switching to natural gas vehicles because of the business case that it offers.

Thirteen Governors, as the Chairman mentioned, are working together to coordinate a multistate purchase program for natural gas vehicles for their fleets. The gas utilities, in our membership, the American Gas Association, maintain over 2 million miles of natural gas distribution lines worldwide, pipelines. This distribution network means that we can place CNG, compressed natural gas, fueling stations around the country without the need to truck in fuel.

There are about 1,000 compressed natural gas stations in the United States. Now that's, admittedly, out of about 130,000 gas stations. Many of these are owned and operated by gas utilities.

Working with their regulators, a number of our companies are exploring innovative approaches to utility participation in this market. Natural gas utilities are pioneering new business models, forming creative partnerships and investing in cutting edge technologies. There was an announcement even just today of one that uses renewable gas in the dairy industry where they're converting their big milk trucks to CNG from renewable gas or biogas.

We expect home refueling for natural gas vehicles will become increasingly available and attractive to residential customers in the near, not too distant future. Again, there's a mention later of that.

The attractive price of natural gas, about half the cost of gasoline or diesel is creating some momentum in the market that is translating into growth in our fueling infrastructure for these vehicles. Since 2008, the number of CNG stations has grown by over 10 percent each year. This sustained growth has occurred even as we've weathered the worst economic recession our Nation has seen in decades. But again, it's a question of pace and scale. I think we can do more.

Finally let me mention some policies, as requested by the committee.

The most important component in our view of maintaining this momentum is also ensuring that we have a level playing field that allows natural gas vehicles to compete fairly in the marketplace.

Unfortunately some current policies and some recent policy decisions have failed to give adequate wait to the new opportunities presented by the new abundance of domestic natural gas. For example, the heavy duty fuel economy and greenhouse gas standards, finalized just a year ago, are an unfortunate example of the significant missed opportunity. The resulting program fails to create manufacturing incentives to accelerate adoption of natural gas ve-

hicles in the heavy duty segment. Dr. Gallagher, I'm sure, will talk about that more.

Currently the second round of the Obama Administration's Fuel Economy and Greenhouse Gas Standards for Light Duty Vehicles, which will apply from 2017 to 2025, is ongoing. I must say, working with Reg Modlin and others that the historic first round from 2012 to 2016 saw savings of 1.8, expected savings of 1.8 billion barrels. So there are significant savings to be achieved here.

But with regard to the second standard, the Natural Gas Industry has asked the Administration to include the same manufacturing incentives for natural gas vehicles that their proposed rule included for electric drive vehicles. Equal incentives makes some sense because both alternative technologies provide the same energy security and environmental benefits. It is vital for the success of the natural gas and alternative fuel sector that this rule expands consumer choice in the marketplace for alternative fuel vehicles rather than being weighted to favor only one technology.

Mr. Chairman, there's a couple issues in the tax code. I'm not going to spend much time on that, I know, are outside the jurisdiction. But it's important to note that the current excise tax rate or about 41 cents per diesel gallon equivalent verses the 24 cent for diesel fuel is a disadvantage.

This is because LNG has a lower energy density per gallon than diesel, but the tax is applied on a volume or gallon basis rather than the energy equivalent basis. That's something that could be changed. It was changed in the light duty sector. This could be affected here and would spur a lot of the movement in heavy duty.

Excise tax rate of 12 percent is also a disincentive that could be addressed.

The last thing, Mr. Chairman, the recent announcement by ARPA-E from DOE of a $30 million program aimed at engineering light weight affordable natural gas tanks for vehicles and to develop natural gas compressors that can efficiently fuel a natural gas vehicle at home is a welcome step. We certainly support that. We would just ask that the same effort, enhanced effort, be applied within the vehicle technologies program across the board on natural gas vehicles.

In conclusion, Mr. Chairman, developing the market for natural gas vehicles enhances our national security and energy security, our economic competitiveness and encourages the expansion of transportation fueling infrastructure and technologic advances. We urge the Congress and the Administration to ensure that our policies set us on the path to capture these benefits for our entire Nation.

Thank you.

[The prepared statement of Mr. McCurdy follows:]

STATEMENT OF DAVE MCCURDY, PRESIDENT AND CEO, AMERICAN GAS ASSOCIATION

Good morning, Chairman Bingaman, Ranking Member Murkowski, and members of the Committee. I am Dave McCurdy, President and CEO of the American Gas Association (AGA), and I am pleased to appear before you today.

The American Gas Association, founded in 1918, represents more than 200 local energy companies that deliver clean natural gas throughout the United States. More than 65 million residential, commercial and industrial natural gas customers or

more than 175 million Americans receive their gas from AGA members. Today, natural gas meets almost one-fourth of the United States' energy needs.

I've been asked by the Committee to use my remarks to do 2 things: First, to explain why using natural gas to offset a measure of our petroleum dependence is a smart path forward for our nation. Second, to describe the momentum we are seeing today in building a national fueling infrastructure to support natural gas vehicles, and to outline the policies we need to keep that momentum going.

We are pleased that the Committee has decided to hold today's hearing, because it is critical that the Congress remains current on the dynamic discussion regarding natural gas brought about by the shale gas revolution. The new abundance of natural gas reserves in our country has fundamentally shifted our energy landscape. A decade ago, it seemed inevitable that the United States would become a major importer of natural gas. Instead, today, we are the world's leading producer of natural gas. As the President noted in his state of the union address earlier this year, we have at least a hundred years supply of domestic natural gas right here at home.

We have made great strides in "turning down the curve" of petroleum imports, through increased domestic petroleum production and landmark fuel economy standards for light duty vehicles. But energy security means more than reducing our petroleum imports below the fifty percent mark. In past decades, we have successfully reduced—or virtually eliminated—petroleum use in other sectors, such as electrical generation, and home heating. Yet our transportation sector depends on petroleum for 94 percent of its primary energy.

Our singular dependence on oil for transportation fuel makes us vulnerable to economic and national security risks. Every American recession over the past four decades has been preceded by-or occurred concurrently with-an oil price spike, including the most recent. Our armed forces expend enormous financial and human resources ensuring that oil transit routes remain open and critical infrastructure is protected. Our relations with foreign governments are too often influenced by our need to minimize disruptions to the flow of oil.

In 2011, the U.S. trade deficit in oil was $327 billion—and accounted for 58 percent of our total trade deficit. The size of the U.S. trade deficit means we are incurring an international debt burden that dampens the prospects for our long-term economic health.

The path that we are on is not sustainable, and it is not smart. A smart path forward includes diversifying our transportation energy mix, and seeking to displace high cost imports with lower cost domestic alternatives. Greater use of natural gas as a transportation fuel delivers on both of these objectives.

And while natural gas provides 24 percent of the primary energy used to drive our economy, only 0.1 percent of transportation energy is supplied by natural gas. Natural gas has tremendous potential as for the transportation sector, and many nations are ahead of the United States in grasping this opportunity. There are over thirteen million natural gas vehicles (NGVs) in use worldwide today, up from just four million seven years ago. Yet only about 120,000 vehicles—less than one percent of the global total—are on U.S. roadways.

Here is the good news—the market is recognizing that switching from gasoline or diesel to natural gas can mean significant cost savings. Major fleet operators like Waste Management, Verizon, Ryder, and others are switching to natural gas vehicles because the business case is there. Thirteen governors are working together to coordinate a multi-state purchase program for natural gas vehicles for their state fleets.

Natural gas utilities are also in the lead in providing early markets for NGVs. Many of our companies have ambitious vehicle purchase programs aimed at transitioning their own fleets to run on clean burning natural gas.

As this market continues to grow, AGA member companies will play a key role in supplying the fueling infrastructure needed to support these vehicles. The gas utilities in our membership maintain over 2 million miles of natural gas distribution pipelines nationwide. This distribution network means that we can place compressed natural gas fueling stations around the country without the need to truck in fuel. Currently, there are over 1,000 compressed natural gas (CNG) stations in the United States, and many of these are owned and operated by gas utilities.

AGA member companies can play a vital role in the next phase of building our national fueling infrastructure for natural gas vehicles. Working with their regulators, a number of our companies are exploring innovative approaches to utility participation in this market. Natural gas utilities are pioneering new business models, forming creative partnerships and investing in cutting edge technologies.

We believe that in the next few years, home refueling for natural gas vehicles will become increasingly available and attractive to residential consumers, and our com-

panies will be involved in ensuring the safe and reliable operation of these refueling appliances.

The attractive price of natural gas—about half the cost of gasoline or diesel—is creating momentum in the market that is translating into growth in our fueling infrastructure for natural gas vehicles. Since 2008, the number of CNG stations has grown by over 10 percent each year. This sustained growth has occurred even as we have weathered the worst economic recession our nation has seen in decades.

In addition to utilities, natural gas producers have committed to building refueling stations along our nation's highways. Two companies recently announced hundreds of millions of dollars in investments in 250 LNG fueling stations by the end of 2013.

To stay on the smart path forward, we need policies that help us sustain the momentum we are seeing in the adoption of natural gas vehicles and fueling infrastructure. The most important component of this is maintaining a level playing field that allows natural gas vehicles to compete fairly in the market. Unfortunately, some current policies—and some recent policy decisions—have failed to give adequate weight to the new opportunities presented by the new abundance of domestic natural gas. The heavy duty fuel economy and greenhouse gas standards finalized a year ago are an unfortunate example of a significant missed opportunity. The resulting program fails to create manufacturing incentives to accelerate adoption of natural gas vehicles in the heavy duty segment.

The Administration is working now to finalize the second round of the Obama Administration's fuel economy and greenhouse gas standards for light duty vehicles, which will apply from 2017 to 2025. This is a critical, once-in-a-decade opportunity to get the policy right. The natural gas industry has asked the Administration to include the same manufacturing incentives for natural gas vehicles that their proposed rule included for electric drive vehicles. Equal incentives make sense, because both alternative technologies provide the same energy security and environmental benefits. It is vital for the success of the natural gas and alternative fuel sector that this rule expands consumer choice in the marketplace for alternative fuel vehicles, rather than being weighted to favor one technology.

There are 2 areas where changes in the tax code could remove barriers to growth in the natural gas vehicle market. Currently, each gallon of LNG sold incurs an effective excise tax rate or $0.41 per diesel gallon equivalent versus $0.243 for diesel fuel. This is because LNG has a lower energy density per gallon than diesel, but the tax is applied on a volume (gallon) basis rather than an energy equivalent basis. This discrepancy has been corrected for the sale of CNG, but not for LNG, and provides an unfair disincentive to the sale of LNG.

Also, heavy duty natural gas trucks cost $30,000 to $60,000 more than diesel trucks. The federal excise tax rate of 12 percent is imposed on the full cost of a truck. The effect is an additional cost premium of $3600 to $7200 towards a new natural gas truck.

On a positive note, AGA strongly supports a new $30 million ARPA-E program aimed at engineering light-weight, affordable natural gas tanks for vehicles and develop natural gas compressors that can efficiently fuel a natural gas vehicle at home. We applaud the MOVE program and encourage the Department to develop a similarly focused, enhanced effort within the Vehicle Technologies Program on NGVs.

Developing the market for natural gas vehicles enhances our energy security, our competitiveness, and encourages the expansion of transportation fueling infrastructure and technologic advances. We urge the Congress, and the Administration, to ensure that we set policies that set us on the path to capture these benefits to our nation.

The CHAIRMAN. Thank you very much.

Dr. Gallagher, go right ahead.

STATEMENT OF MICHAEL GALLAGHER, SENIOR ADVISER, FORMER PRESIDENT & CHIEF OPERATING OFFICER WESTPORT INNOVATIONS INC., VANCOUVER, BC CANADA

Mr. GALLAGHER. Thank you and good morning, Chairman Bingaman, Ranking Member Murkowski and members of the committee.

You know the last time I testified in Washington was 32 years ago when I was a young engineer at the Bechtel Group on loan to MIT, where I'd written a couple of books on energy, oil and coal.

But today I'm a Senior Adviser to and the former President and Chief Operating Officer of Westport Innovations, a leading natural gas engine technology company.

I'm also Chairman of the Board of Agility Fuel Systems, an onboard storage company.

I'm just finishing a 2-year project as chairman as the Natural Gas Group of the National Petroleum Council's study on future transportation fuels. That study will be released, by the way, next week here in Washington.

In this study, which I believe is the most comprehensive analysis ever performed of America's transportation technology and options. We have assessed every technology involved in natural gas transportation, identified every conceivable barrier to expansion and identified their resolution. We can put all this information in the committee record next week.

Today more than 95 percent of all vehicles run on oil either conventional petroleum or biofuel blends. But I'm here to tell you that there's good news coming on energy and transportation. A lot of that good news is being driven by what's going on today in the world of natural gas vehicles.

Technology innovation is literally exploding with hardly a week passing without another new announcement from a major industry participant. Companies like Shell, Cummins, Caterpillar, PACCAR, Ford, Chrysler. My company, Westport Innovations is best known for developing the technology and commercializing the engines and vehicles for heavy duty natural gas buses and trucks. I've been asked why we chose to do that.

My colleagues and I were inspired to develop this technology because we were able to demonstrate that natural gas works in diesel engines and burns cleaner. We also believe that the world needed an alternative to oil for transportation. There weren't many.

We believe that the infrastructure challenges could be managed more easily for heavy duty. So we focused on that. We've developed partnerships with some of the world's preeminent heavy duty engine manufacturers starting with Cummins in Indiana, where I grew up by the way, and Volvo in Europe, Weichai in China. I want to acknowledge today the tremendous leadership we are seeing from these and other OEMs, the engine, automotive and trucking manufacturers.

Ten years ago Cummins took the bold step of partnering with Westport in a 50/50 joint venture which has since sold thousands of bus and truck natural gas engines. It may surprise you to hear that today we are actually exporting natural gas engines from a factory in North Carolina to China to bus manufacturers in China for installation in buses that are manufactured there.

Kenworth and Peterbilt also jumped in 4 years ago with us to put the first big natural gas trucks on the road. Now there are nearly a thousand clean natural gas trucks at the ports of LA and Long Beach where we started.

Just a couple of weeks ago we opened a new factory in Kentucky dedicated to making Ford F–250 light duty natural gas pickup trucks.

We no longer have to choose which markets to serve with natural gas. Last fall the NPC issued an earlier parallel study on oil and

gas resources. That study concluded that the supply of North American natural gas is enormous with the potential to meet even the highest levels of demand considered in various market sectors at reasonable cost. In fact today the price spread between natural gas and diesel is so large that you can drive a truck through it. That's exactly what we're doing.

Will this transformation of America's transportation system be easy? Of course not. But what important achievement in our Nation's history has ever been easy?

We do have a strong platform of building blocks to provide confidence that natural gas can play an increasing role in vehicles. We have the low cost domestic natural gas. There's relatively few technology barriers.

All the great work that is going on in the labs and automotive R and D centers to improve the efficiency and fuel economy of internal combustion engines. Natural gas engines use the same spark in diesel combustion engine technologies as diesel and gasoline. Build out of infrastructure, retail CNG and LNG stations is critical to support this expansion.

You mentioned the chicken and egg problem. This build out is already occurring for heavy duty vehicles with Shell, Chesapeake and clean energy fuels making large infrastructure investments. Just this spring, the first ever coast to coast, cross country trips were achieved on natural gas vehicles both for a Ford pickup truck, natural gas pickup truck and a freight liner, natural gas 18 wheeler crossed coast to coast using existing public infrastructure. So there is some infrastructure in place.

In summary, I believe that we are looking at a vision of our energy and transportation future which is good news for America. Technology and innovation are happening everyday throughout the entire natural gas transportation value chain. Each of us can and should encourage this game changing transformation.

Let's all capitalize on our technology leadership and low cost natural gas resources of today to build America's natural gas transportation systems for tomorrow.

Thank you very much for this opportunity to speak with you today.

[The prepared statement of Mr. Gallagher follows:]

STATEMENT OF MICHAEL GALLAGHER, SENIOR ADVISER, FORMER PRESIDENT & CHIEF OPERATING OFFICER, WESTPORT INNOVATIONS INC., VANCOUVER BC

Good Morning, Chairman Bingaman, Ranking Member Murkowski, and Members of the Committee. I am Mike Gallagher, Senior Adviser to and Former President and Chief Operating Officer of Westport Innovations, a leading natural gas engine company. I am also Chairman of the Board of Agility Fuel Systems, and am just finishing a 2 year project as Chairman of the Natural Gas Group of the National Petroleum Council's Study on Future Transportation Fuels, which will be released next week here in Washington.

In this study, which I believe is the most comprehensive analysis ever performed of America's transportation technology and options, we have assessed every technology involved in natural gas transportation—from engine combustion science to on board storage to cryogenics to infrastructure to the vehicles themselves. We identified every conceivable barrier to the commercialization and expansion of natural gas transportation, assessed the significance of those barriers, and identified their resolution. We looked at the expansion potential, in heavy and light duty markets, the costs and economic attractiveness, the investment requirements, and the environ-

mental emissions. We can put all this information in the Committee Record on August 2.

Today, more than 95% of all vehicles—cars, pickup trucks, buses, big rigs, trains, planes and ships—run on oil, either conventional petroleum or biofuel blends.

But I am here to tell you that there is GOOD NEWS COMING on ENERGY and TRANSPORTATION. And a lot of that good news is being driven by what's going on today in the world of Natural Gas Vehicles. Technology and innovation is exploding in natural gas transportation, with hardly a week passing without another new announcement from a major industry participant.

My company Westport Innovations is best known as being successful at developing the technology and commercializing the engines and vehicles for heavy duty buses and trucks. We made these large strategic investments in heavy duty engine technology and market development because we felt the trucking industry was motivated almost entirely by economics and the cost of moving freight, where the lower cost of natural gas would drive market decisions. And we believed that the infrastructure challenges could be managed more easily, by evolving from central fueling stations, return to base fleets, and transportation corridor refueling. So we developed partnerships with some of the world's preeminent heavy duty engine manufacturers, including Cummins in Indiana, and Volvo in Europe and Weichai in China.

I want to acknowledge the tremendous leadership we are seeing from the OEMs-the engine, automotive and truck manufacturers. Ten years ago Cummins took the bold step of partnering with Westport in a 50:50 Joint Venture, which has since sold thousands of bus and truck natural gas engines. It may surprise you to hear that we are now exporting natural gas engines from a factory in North Carolina to bus manufacturers in China.

Kenworth and Peterbilt also jumped in four years ago to put the first big natural gas trucks on the road, at the Ports of LA and Long Beach. And just a couple of weeks ago we opened a new factory in Kentucky dedicated to making Ford F-250 natural gas pickup trucks. All these industrial enterprises-and many others-are working to create an exciting new clean energy industry, a natural gas transportation industry.

All this entrepreneurial activity is also setting the stage for use of new low carbon sources of natural gas, so-called renewable natural gas from landfills, agricultural waste, and forestry resources.

We no longer have to choose which markets to serve with natural gas. Last Fall's earlier NPC study on oil and gas resources concluded that the economically recoverable supply of North American natural gas is enormous, with the potential to meet even the highest levels of demand considered.

Will this transformation of America's transportation system and the creation of a robust natural gas transportation industry be easy? Of course not—but what important achievement in our Nation's history has ever been easy. We do have a strong platform of building blocks to provide confidence that natural gas can play an increasing role in vehicles:

1. We know that we have a long-term and low-cost domestic supply of natural gas, driven by economically recoverable shale gas resources.
2. We also now know there is a big opportunity both for light duty and heavy duty natural gas vehicles, based on this lower cost of natural gas relative to diesel and gasoline fuels.
3. We have also concluded that there are relatively few technological barriers to market entry and expansion for either LD or HD natural gas vehicles.
4. All the great work that is going on in the labs and automotive R&D centers to improve the efficiency and fuel economy of oil-based internal combustion engines is directly applicable to natural gas engines-which use the same spark and diesel combustion engine technologies.
5. Build-out of infrastructure-retail CNG and LNG stations-is critical to support this increased use of natural gas in transportation. This build-out is already occurring for heavy duty fleets, with central stations, return to base and corridor fueling systems leading the way. Just this Spring, the first ever Coast-to-Coast cross country drives were achieved for both a pickup truck and a freight truck using available natural gas public infrastructure.

In summary, I believe we are looking at a vision of our energy and transportation future which is good news for America. Technology and innovation are happening every day throughout the entire natural gas transportation value chain-much of it led by American technology leadership. Each of us can and should encourage this game-changing transformation of our transportation future. Let's all capitalize on today's technology leadership and low cost natural gas resources to build America's natural gas transportation systems for tomorrow.

Thank you very much for this opportunity to speak with you today.

The CHAIRMAN. Thank you very much.

Mr. Modlin.

STATEMENT OF REG MODLIN, DIRECTOR, REGULATORY AFFAIRS, CHRYSLER GROUP LLC, AUBURN HILLS, MI

Mr. MODLIN. Good morning, Chairman Bingaman, Ranking Member Murkowski and members of the committee. I am Reg Modlin, Director of Regulatory Affairs at Chrysler Group LLC. Thank you for the opportunity to discuss natural gas in the transportation sector with you today.

Chairman Bingaman, it was a pleasure talking with you about natural gas and natural gas vehicles during Chrysler's Ride and Drive held here in Washington in June where we featured our bi-fuel, compressed natural gas RAM 2500 pickup truck. Chrysler appreciates your committee holding this hearing because transportation fuels play an important role in Chrysler's strategy for regulatory compliance and reduction in greenhouse gases.

We create customer value by providing a diverse portfolio of vehicle technologies that enable customers to choose the best package to fit their needs. Vehicle range between refueling, fuel cost and convenient refueling infrastructure are fundamental to creating customer value. The abundant supply of natural gas in the United States could be a significant development for the transportation sector.

Due to its supply natural gas is expected to maintain a strong price advantage compared to gasoline and diesel fuel. Further, natural gas can reduce dependence on oil, enhance energy security and reduce greenhouse gases and smog forming emissions. We are excited about the potential for natural gas powered vehicles in the marketplace.

Our strategic partner, Fiat, brings valuable background to this discussion. Fiat has produced more than 500,000 passenger and commercial CNG powered vehicles spanning all vehicle segments. The United States can learn a lot from the Italian experience. Italy's CNG market proved to be a success for several reasons including product incentives, CNG costs that were half the cost of gasoline, refueling stations are widely available and vehicles that provide a robust driving range.

The availability of fuel stations is fundamental to the success of the market experienced in Italy. Italy has nearly 900 CNG stations. The situation in the United States is much different. Of the approximately 1,000 stations in the United States, 135 can be found in California.

This is of interest because California is comparable to Italy in terms of population and land area. With bi-fuel vehicles the refueling infrastructure in Italy is adequate. Likewise the limited availability of CNG stations in California and throughout the United States will require that bi-fuel products be offered to make customers comfortable with purchasing a CNG vehicle.

We are proud that the RAM is the only brand in North America to offer a complete factory built, tested and warranted CNG truck. We designed our CNG RAM 2500 to satisfy customer needs by providing a work site vehicle capable of carrying a work crew and in

recognition of the limited availability of CNG stations, made the vehicle bi-fuel with a back up gasoline system. We chose the heavy duty truck segment because our large and small fleet owners provide willing customer base.

The product offers them the operative range and total cost of ownership necessary to operate their businesses efficiently and profitably. Production has begun. Vehicles will be arriving at dealerships in August.

The Federal Government can be a partner in expanding the role of natural gas as a transportation fuel. We support technology neutral policies and natural gas powered vehicles should be given access to the same incentives as other alternative fuel vehicles. Government incentives do not have to be financial.

For example, if Congress modified the definition of dedicated CNG to include range extended CNG vehicle customers would be able to take advantage of non financial opportunities offered in some regions like access to HOV lanes.

There is also a role for the States. In an effort initiated by Governor Fallin of Oklahoma and Governor Hickenlooper of Colorado, 13 States are supporting coordination of State fleet CNG vehicle purchases. We expect a request for proposal would be published this week with awards based on responses to the RFP announced in October.

In summary, Chrysler believes that natural gas powered vehicles have strong potential to compete in the retail transportation market. The abundant and now more accessible supply of natural gas in the United States could be a game changer. Natural gas powered vehicles offer customers a good value proposition because natural gas is expected to hold a strong price advantage compared to gasoline and diesel fuels and will be increasingly available. Added advantages include enhancing energy security, reducing dependence on oil, creation of jobs and reduction of greenhouse gas and smog forming emissions.

There are challenges ahead in terms of the expansion of infrastructure and increasing product offerings. As those challenges are overcome customer acceptance should grow.

Thank you again. I'd be happy to address any questions.

[The prepared statement of Mr. Modlin follows:]

STATEMENT OF REG MODLIN, DIRECTOR, REGULATORY AFFAIRS, CHRYSLER GROUP LLC, AUBURN HILLS, MI

Good morning Chairman Bingaman, Ranking Member Murkowski, and Members of the Committee. Thank you for the opportunity to discuss natural gas and increasing its use as a fuel in the transportation sector. I am Reg Modlin, Director of Regulatory Affairs at Chrysler Group LLC. I am responsible for overseeing the product environmental and safety regulatory planning activities for the company.

Chairman Bingaman, it was a pleasure talking with you about natural gas and natural gas vehicles during Chrysler's ride and drive held here in Washington in June. During the ride and drive, we featured our bi-fuel compressed natural gas (CNG) Ram 2500 pick-up truck. Chrysler appreciates your Committee holding this hearing because transportation fuels, particularly alternative fuels such as natural gas, play an important role in Chrysler's strategy for regulatory compliance and reduction of greenhouse gas (GHG) emissions.

Chrysler supports a goal to reduce transportation greenhouse gas emissions by 80 percent by 2050. The use of alternative fuels, such as natural gas, plays a significant role in achieving that goal. The plentiful supply of natural gas in the United States can reduce the country's dependence on petroleum-based transportation fuels,

enhance the nation's energy security, and reduce greenhouse gas and smog-forming emissions. These are all important reasons for looking to natural gas as an alternative fuel in the transportation sector.

As an automobile manufacturer, Chrysler's goal is to fulfill our customers' needs with regard to vehicle performance, utility, safety, styling, comfort, and affordability. We create customer value by providing a diverse portfolio of vehicle technologies that enable customers to choose the best package to fit their needs. Fuel choice between gasoline, diesel, ethanol, electricity, and natural gas is one important option considered by a customer. Vehicle range between refueling, fuel cost, and convenient refueling infrastructure are related to a customer's fuel choice.

In the more recent past, customers have not embraced natural gas powered vehicles for a variety of reasons including higher initial vehicle cost, inability to conveniently refuel, and fuel price volatility. Without seeing interested customers, automobile manufacturers have been reluctant to offer natural gas powered products in the show room. However, the abundant supply of natural gas in the United States, which is now more accessible due to advances in production technology, could be a significant development for the transportation sector. Natural gas powered vehicles offer consumers a good value proposition because natural gas prices are expected to remain stable for the foreseeable future, natural gas will likely continue to hold a strong price advantage compared to gasoline and diesel fuels, and natural gas is increasingly available via an expanding retail infrastructure. As a result, we are excited about the potential for natural gas powered vehicles becoming successful in the marketplace.

We believe that the market for natural gas vehicles could reach approximately 10 percent of new vehicle sales over time. Currently, natural gas vehicles comprise less than 1 percent of new vehicle sales. Growing the on-road natural gas vehicle fleet from current levels to 10 percent is projected to take about 20 years. Even with this anticipated growth, the amount of natural gas needed for transportation will remain relatively small, which is not expected to significantly impact the price of natural gas.

Chrysler has a long history of producing natural gas powered vehicles. In the 1990s and early 2000s, Chrysler produced dedicated CNG powered full-size vans, minivans, and pick-up trucks. Although these products were discontinued because of market conditions and lack of consumer demand, Chrysler continued to be watchful for the potential re-emergence of a natural gas powered vehicle market.

Our strategic partner, Fiat, is a world leader in producing CNG vehicles, having manufactured more than 500,000 passenger and commercial vehicle applications of CNG technology since 1997. Fiat commands more than 80 percent of the European market for CNG vehicles and its CNG powered products span all vehicle segments, from small passenger cars to buses and large trucks.

The United States can learn a lot from the Italian experience. The CNG vehicle market in Italy from 2001-2009 proved to be a success for several reasons including product incentives that fully offset bi-fuel CNG hardware costs, CNG costs that were half the cost of gasoline, refueling stations that were widely available, and vehicles that provided a robust driving range. The take-away is: Incentives + Range + Infrastructure + Fuel Cost = Customer Acceptance.

The wide availability of refueling stations is fundamental to the success of the market experience in Italy. Italy has nearly 900 public CNG stations, which translates into approximately 28 stations per 3,861 square miles for a country of about 116,000 square miles and a population of about 60 million people. With those numbers, the refueling infrastructure in Italy is adequate to support the application of bi-fueled vehicle designs; however, more stations are needed to support dedicated CNG products.

The refueling infrastructure situation in the United Sates is much different. Of the approximately 1,000 public and private stations in the United States, 135 are located in California. This is of interest because California is comparable to Italy with a population of about 38 million and a land area of approximately 164,000 square miles. California's CNG station density is about 3 stations for every 3,861 square miles—still far less than Italy's 28 stations for similar geographical coverage. Similar to the situation in Italy, the station density in California will require that bi-fueled vehicles be offered to make customers comfortable with a CNG vehicle purchase. For the rest of the country, where the CNG station density is far less per square mile than in California, the need for a bi-fuel vehicle option is even greater.

With that history and experience, Chrysler's decision to re-enter the CNG vehicle market was a conscious one. We designed our CNG Ram 2500 to satisfy customer needs by providing a "worksite" vehicle capable of carrying a work crew, and, in recognition of the limited CNG station infrastructure, made the vehicle bi-fuel with a back-up gasoline system. We chose the heavy-duty pick-up truck segment because

our large and small fleet owners provide a willing customer base. The bi-fuel CNG Ram 2500 offers these customers the operating range and total cost of ownership necessary to operate their businesses efficiently and profitably. Production has begun, and vehicles will begin arriving at dealerships for fleet customers in August.

We are proud that Ram is the only brand in North America to offer a complete factory-built pick-up truck that comes off our production line fully assembled, factory tested, factory warranted, and shipped directly to our 2400 authorized dealers who are trained to provide a full range of services on the vehicles. The CNG Ram 2500 is built as a bi-fuel vehicle with CNG tanks holding up to an equivalent of 18.2 gallons of gasoline and an 8-gallon reserve gasoline tank. The vehicle's range on CNG is 255 miles and the total range of the vehicle, including use of the 8-gallon gasoline reserve, is 367 miles. An optional 35-gallon reserve gasoline tank will extend the vehicle's range to about 745 miles. The vehicle is designed to deplete the CNG fuel before seamlessly switching to using gasoline.

The federal government can be a key partner in expanding the role of natural gas as a transportation fuel. As I have discussed, creating a value proposition for the customer is critical for the successful penetration of natural gas powered vehicles in the marketplace. The ultimate goal is to have customers choose to buy a product without a government incentive. Currently, though, other alternative fuel vehicles, such as battery electric vehicles, are eligible for incentives that create an un-level playing field for potential retail CNG vehicles. We support technology neutral policies, and providing equivalent incentives for natural gas powered vehicles would create parity between natural gas powered vehicles and other alternative fuel vehicles. Incentives do not have to be financial. For example, if Congress modified the definition of "dedicated CNG vehicle" to include "range-extended CNG vehicle" (a "range-extended CNG vehicle" is a product with a small gasoline fuel tank to ease customers' "range anxiety" of running out of fuel), customers would be able to take advantage of non-financial opportunities offered in some regions, such as access to High Occupancy Vehicle (HOV) lanes.

There is also a role for the states in responding to the challenges in promoting the widespread use of natural gas as a transportation fuel in the United States. In an effort led by Governor Mary Fallin of Oklahoma and Governor John Hickenlooper of Colorado, 13 States are supporting a multi-state Memorandum of Understanding (MOU) that outlines a coordinated effort among states to promote natural gas market development, CNG vehicle production, and state fleet purchases of CNG vehicles. The goal of pooling multiple state fleet needs is to create a market for natural gas powered fleet vehicles and enable manufacturers to plan for expanding their CNG product offerings. We understand that a Request for Proposal (RFP) will be published this week, and awards based on responses to the RFP are expected to be issued in October.

Summary

Chrysler Group LLC believes that natural gas powered vehicles have strong potential to compete in the retail transportation market. The abundant—and now more accessible—supply of natural gas in the United States, could be a significant development for the transportation sector. Natural gas powered vehicles offer consumers a good value proposition because natural gas prices are expected to remain stable for the foreseeable future, the fuel holds a strong price advantage compared to gasoline and diesel fuels, and it is becoming more readily available via an expanding retail infrastructure. Other advantages include enhancing the nation's energy security, diversifying transportation energy choices by reducing our dependence on oil, creation of jobs, and reduction of greenhouse gas and smog-forming emissions.

Challenges lay ahead in expanding the retail fueling infrastructure and increasing product offerings of natural gas vehicles. As those challenges are overcome, though, the value proposition for the customer will become increasingly clear and customer acceptance will occur. Thank you for allowing me the opportunity to testify on this important issue. I will be happy to address any questions.

The CHAIRMAN. Thank you very much.

Dr. Greene, go ahead.

STATEMENT OF DAVID L. GREENE, CORPORATE FELLOW, OAK RIDGE NATIONAL LABORATORY, SENIOR FELLOW, HOWARD H. BAKER, JR. CENTER FOR PUBLIC POLICY, UNIVERSITY OF TENNESSEE, OAK RIDGE, TN

Mr. GREENE. Good morning, Chairman Bingaman, Ranking Member Murkowski and Senator Franken, staff and guests. Thank you for the opportunity to comment on the potential for natural gas in transportation. Let me also say I'm as well as a Corporate Fellow at Oak Ridge National Lab, a Senior Fellow at the Howard H. Baker Jr. Center for Policy at the University of Tennessee.

My first 2 observations may seem obvious but I think they're important.

First, yes, advanced recovery methods have greatly increased our economical natural gas resources. There's now much more gas available, but not enough to satisfy all our energy needs.

Second, today's low natural gas prices are not likely to last. Although today the prices are up. More likely prices will rise over time to levels consistent with the world price for LNG.

Historically, our transportation sector has used very little natural gas. Of the 0.6 quads used in transport in 2010, all but 0.04 went to power the pumps that move natural gas around the country in pipelines. Given—that's out of a total of 27 quads used in transportation. So it's a very small fraction.

Given present policies, the EIA projects that by 2035 natural gas used by transportation vehicles will quadruple from 0.04 to 0.16 quads. I think we can use more than that. But that's an indication of what the expectations are.

But natural gas use by electric utilities is expected to increase by 2.1 quads, used in buildings by 0.4 quads, industrial use by 0.9 quads and we should switch according to their projection from importing 2.7 quads to become a net exporter of 1.4. All those changes are 60 times the size of the change they expect in transportation.

There are good reasons why the transportation sector prefers liquid over gaseous fuels.

The first is energy density. The energy density of compressed natural gas is 30 to 35 percent of that of gasoline depending on the storage pressure. Liquefied natural gas contains about 65 percent of the energy of a gallon of gasoline.

The second is the cost of storage onboard the vehicle which the costs are about an order of magnitude greater than the cost of storing diesel fuel or gasoline.

Now we can convert natural gas to liquid fuels including drop in fuels, diesel, gasoline or methanol. Depending on the process, 35 to 45 percent of the energy content is used in the conversion, much more than the energy used in refining petroleum.

The use of methanol since it's not a drop in fuel would require that vehicles either be adapted to flexibly accept methanol which can be done at a cost of about $100 or so per vehicle or designed specifically for dedicated methanol use. Methanol compatible flexibly fueled vehicles would have only about half their range as when running on methanol as opposed to gasoline and would require deployment of a new refueling infrastructure as well as dealing with new safety issues due to the different toxicity of methanol.

In my opinion it probably would not be worthwhile to deploy a full scale natural gas refueling infrastructure. Although natural gas produces fewer greenhouse gas emissions than petroleum those emissions are not low enough to meet the reductions that will be required in the future to protect the global climate. If a large scale natural gas infrastructure were deployed by say, 2030, it would need to be substantially dismantled by 2050 to achieve greenhouse gas reductions on the order of 60 to 80 percent.

On a well to wheel basis future compressed natural gas vehicles are expected to generate about 80 percent of the emissions of an advanced gasoline powered vehicles. But these kinds of estimates are also highly dependent on assumptions about upstream emissions such as methane. According to one study recently published in the proceedings of the National Academy of Sciences, upstream emissions must be 1 percent or less for heavy duty vehicles and 1.6 percent or less for light duty vehicles if there are to be any greenhouse gas benefits from a switch to natural gas vehicles.

In my opinion, we should act cautiously to encourage greater use of natural gas in those applications where its cost effective solution by facilitating the deployment of refueling infrastructure, codes and standards. For example for liquefied natural gas, and by pursuing fuel neutral polices which have already been mentioned that provide markets with clear signals to improve energy efficiency, choose environmentally sustainable fuels and enhance energy security. These policies could include Feebates which I've discussed before this committee before as well as energy based highway user fees indexed to the average efficiency of the vehicle's stock on the road so that the energy user fee would increase as fuel economy increased. This is consistent with David McCurdy's recommendation that the taxes be energy based rather than based on volume and also low carbon fuel standards.

So in closing increased use of natural gas in transportation can make measured by important contributions to economic growth, environmental protection and energy security. However, attempting a large scale transition from petroleum to natural gas would likely be a mistake in my opinion. Expanding use of natural gas in specialized markets where the economics are favorable and adequate fuel availability can be deployed cost effectively can be an important part of a comprehensive energy policy.

Thank you for the opportunity to comment. I look forward to questions.

[The prepared statement of Mr. Greene follows:]

STATEMENT OF DAVID L. GREENE, CORPORATE FELLOW, OAK RIDGE NATIONAL LABORATORY, SENIOR FELLOW, HOWARD H. BAKER, JR. CENTER FOR PUBLIC POLICY, UNIVERSITY OF TENNESSEE, OAK RIDGE, TN

Good morning Chairman Bingaman, distinguished senators, staff and guests. Thank you for the opportunity to comment on the potential for natural gas to contribute to solving America's energy problems through greater use in our transportation sector.

My first 2 observations may seem obvious but I think they are important. First, advanced recovery methods have greatly increased our economical natural gas resources, yet not enough to transform our energy system to one based on natural gas. There is now much more gas available but not nearly enough to satisfy all our energy needs.

Second, today's low natural gas prices are not likely to last. More likely, they will rise over time to levels consistent with the world price for LNG adjusted for the costs of liquefaction and transport. Energy markets respond slowly due to the time required for energy using capital stocks and capital-intensive resource development to adjust. But the domestic gas market is competitive and prices will adjust to reflect the long-run market value of natural gas (Figure 1*).

I believe that increased natural gas use in transportation can and should make a relatively moderate but important contribution to reducing our dependence on petroleum for the following reasons:

1. The recent increase in natural gas resources is indeed "game changing" but market forces are likely to allocate the increased domestic production to the traditional natural gas using sectors. The new gas resources are game changing in the sense that, as the Energy Information Administration (EIA) projects, they will transform the US from a net importer to a net exporter of natural gas and keep natural gas reasonably priced for decades.
2. Electric utilities' natural gas consumption is likely to increase even more than projected if responsible efforts are undertaken to reduce greenhouse gas (GHG) emissions from electricity production.
3. Natural gas prices are almost certain to rise from their currently depressed levels to levels similar to those seen in the recent past when natural gas use in transportation was limited to niche markets.
4. Although increased use of natural gas in transportation would reduce US oil dependence and probably GHG emissions in the near term, methane is not a suitable fuel for achieving the kinds of reductions in GHG emissions likely to be necessary by 2050.
5. While substituting natural gas for gasoline or diesel fuel in motor vehicles will help reduce our dependence on petroleum, so will substituting natural gas for distillate fuel for heating buildings. This is another important opportunity to improve our energy security.

Outlook

Expansion of America's natural gas and oil resources thanks to the technologies of hydro-fracturing and directional drilling is already producing benefits to our economy and energy security and will do even more in the future. The Energy Information Administration (EIA, 2012) estimates that production of natural gas will increase from 20.6 TCF in 2010 to 27.9 TCF in 2035, with the contribution from shale gas increasing from 23% to 49% of U.S. production (Figure 2). Yet our shale gas resources are not unlimited. The EIA's 2012 Reference Case puts U.S. proved and unproved shale gas resources at 542 trillion cubic feet (TCF) out of total natural gas resources of 2,203 TCF.

Production of shale oil and natural gas liquids (NGL) (typically considered to be petroleum) is now projected to increase domestic petroleum supply from 7.3 million barrels per day (mmbd) in 2010 to 10.4 in 2020 and 9.5 by 2035, in contrast to previous expectations of continued decline and increasing imports.

Energy Security

Increased natural gas use in transportation and buildings could make an important contribution to achieving oil independence over the next 10 to 20 years. By energy independence I do not mean using no oil nor do I mean importing no oil. We can achieve energy independence by shrinking our oil dependence problem down to a size at which it will not pose an important threat to our economy (Greene, 2009). In 2008 dependence on petroleum cost our economy $500 billion in wealth transferred to oil exporting countries and reduced gross domestic product (Figure 3). From 2005 to 2010 oil dependence cost our economy approximately $2 trillion (Greene, Lee and Hopson, 2012). Increased domestic supply of crude oil and natural gas liquids due to exploitation of shale gas and oil resources, together with improvements in the energy efficiencies of light and heavy duty will benefit our economy thorough lower energy prices and improved energy security.

The U.S. Energy Information Administration estimates that development of the 24 billion barrels of U.S. shale oil resources (EIA, 2011) will add 1.3 million barrels per day to U.S. crude oil supply by 2025-2030 while increased NGL production from shale gas development will add another 0.9 mmbd, making up the greatest part of a 2.5 mmbd increase in domestic petroleum supply (Figure 4; EIA, 2012).

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*All figures have been retained in committee files.

Use of Natural Gas in Transportation

Historically, our transportation sector has used very little natural gas. Most of the 0.61 quads consumed in transport in 2010 went to power the pumps that move natural gas around the country in pipelines; transportation uses other than natural gas pipelines amounted to only 0.04 quads out of a total of 27.04 quads. Given present policies, the EIA projects that by 2035 natural gas use by transportation vehicles will quadruple to 0.16 quads. Natural gas use by electric utilities is expected to increase by 2.12 quads, use in buildings by 0.35 quads, and industrial use by 0.86 quads. From importing 2.68 quads of natural gas in 2010 the US is projected to become a net exporter of 1.36 quads by 2035.

There are good reasons for the transportation sector's preference for liquid over gaseous fuels. The first is energy density: a gallon of liquefied natural gas contains about 65% of the energy of a gallon of gasoline and the energy density of compressed natural gas (CNG) is only 30% to 35% of that of gasoline, depending on the storage pressure (AFDC, 2012a). The second is the cost of storage on-board a vehicle. The EIA has estimated that storing the energy equivalent of a gallon of diesel fuel on board a heavy-duty vehicle costs $350 for CNG and $475 for LNG. These costs are an order of magnitude greater than the costs of storing diesel fuel or gasoline.

Natural gas can be converted to liquid fuels including diesel, gasoline and methanol. Depending on the process, 35% to 45% of the energy content is spent in the conversion process, much more than in traditional petroleum refining. Widespread use of methanol would require that vehicles either be adapted to flexibly accept methanol (at a cost on the order of $100 per vehicle) or designed specifically for dedicated methanol use. Methanol compatible flexibly fueled vehicles (FFV) would have only about half the range when running on methanol in comparison to gasoline, would require deployment of new refueling infrastructure, and would introduce new safety issues due to the different toxicity of methanol. Natural gas to drop-in fuels does not face these barriers. However, the EIA's 2012 Annual Energy Outlook Reference Case projection foresees no production of liquid fuels from natural gas through 2035 under current policies.

There are reasons to proceed with caution, however, and to rely as much as possible on market-based decision-making. The technology of natural gas fueled internal combustion engines is relatively mature. Vehicles running on compressed or liquefied natural gas have been in the U.S. and other countries for decades and their pros and cons are relatively well understood. For both heavy and light duty vehicles, the benefits of switching to natural gas are lower energy costs in comparison to petroleum, approximately a 20% reduction in tailpipe greenhouse gas emissions and the substitution of a domestic, competitively priced energy resource for petroleum. The downsides are 1) increased vehicle cost mainly due to the greater cost of compressed gas storage tanks, 2) reduced range and therefore increased frequency of refueling and 3) diminished cargo space due to the lower energy density of compressed natural gas. CNG, LNG and methanol additionally face the "chicken or egg" problem of developing an adequate refueling infrastructure and producing a range of vehicle makes and models that can satisfy the needs and preferences of most motorists.

Since 2002, the number of natural gas vehicles in operation has remained stable at just under 120,000, according to the latest data available from the EIA (Figure 5; Davis et al., 2011, table 6.1). CNG vehicles far outnumber LNG vehicles, largely due to the lack of LNG refueling infrastructure and the greater cost of on-board storage.

Existing studies indicate that a minimally acceptable refueling infrastructure for passenger cars and light trucks would require the equivalent of 10% to 20% of the over 150,000 gasoline stations in existence today. The EIA and DOE's alternative fuel data center report that there are about 1,000 natural gas refueling stations in the U.S. today of which only about half are open to the public (table 1*). Although much remains to be learned about the value of fuel availability to consumers, there is little doubt that it is important, particularly for vehicles with limited range, and that the existing low level of fuel availability is an enormous barrier to market acceptance of natural gas vehicles.

It would probably not be worthwhile to deploy a full-scale natural gas refueling infrastructure. While shale gas provides an enormously important new resource for the U.S., it is not large enough to supply even a large fraction of transportation's energy use in addition to expanding traditional uses in other sectors. And although natural gas produces lower tailpipe GHG emissions than petroleum, those emissions are not low enough to meet the reductions that will be required in the future to protect the global climate. If a large-scale national natural gas infrastructure were

*Table 1 retained in committee files.

deployed by, say, 2030 it would need to be substantially dismantled by 2050 to achieve overall reductions in GHG emissions on the order of 60% to 80%. On a well-to-wheel basis, future compressed natural gas vehicles are expected to generate 80% of the emissions of an advanced gasoline powered vehicle (Davis et al., 2012, figure 11.3). But such estimates are highly dependent on assumptions about upstream methane emissions. Alvarez et al. (2012) note the very large uncertainty about emissions from methane infrastructure, citing estimates ranging from 1% to 9% of gross production. According to their estimates, upstream emissions must be 1% or less for heavy-duty vehicles and 1.6% or less for light-duty vehicles if there are to be any GHG benefits from a switch to natural gas.

Summary Observations

Natural gas can play a constructive role in reducing the petroleum use and greenhouse gas emissions of transportation vehicles but it is by no means a panacea. In my opinion, we should act cautiously to encourage greater use of natural gas in those applications where it is a cost-effective solution by facilitating the deployment of refueling infrastructure and by pursuing fuel neutral policies that provide markets with clear signals to improve energy efficiency, choose environmentally sustainable fuels, and enhance our energy security.

Our current fuel economy and emissions standards are currently the most important such policies. Other policies worth considering include feebates for new vehicle purchases and restructuring of highway user fees on motor vehicles. Feebates can be structured analogously to the fuel economy and emissions standards (e.g., footprint based and reflecting similar values for reducing petroleum use and GHG emissions) to encourage market demand for more efficient vehicles and technologies. They can also be designed to be revenue neutral. As the University of California's analysis of feebates for the California Air Resources Board showed, feebates can reduce petroleum use and GHG emissions at negative cost (Bunch and Greene, 2011).

As work is defined in the physical sciences, transportation is work: force applied over a distance to overcome inertia and friction. The laws of physics require that energy must be used to do work and, energy efficiency held constant, the amount of energy used is directly proportional to the amount of work done. Holding energy efficiency constant, the amount of energy used by a vehicle is an accurate measure of the amount of transportation work done. But current and proposed increases in light-and heavy-duty vehicle fuel economy will decouple energy use from vehicle travel, just as they did following the first round of fuel economy standards in 1975. By converting motor fuel taxes to energy user fees indexed to the average energy efficiency of all vehicles on the road we could maintain the financial integrity of surface transportation while creating a continuously increasing incentive for energy efficient vehicles and fuels.

Increased use of natural gas in transportation can make measured but important contributions to economic growth, environmental protection and energy security. However, attempting a large-scale transition from petroleum to natural gas would be a mistake. Expanding use of natural gas in specialized markets where the economics are favorable and adequate fuel availability can be deployed cost-effectively can be an important part of a comprehensive energy policy.

The CHAIRMAN. Thank you very much.

Mr. Cicio, go right ahead.

STATEMENT OF PAUL N. CICIO, PRESIDENT, INDUSTRIAL ENERGY CONSUMERS OF AMERICA (IECA)

Mr. CICIO. Thank you, Chairman Bingaman, Ranking Member Murkowski and committee members for this opportunity to testify before you today. Thank you.

IECA is a—membership is exclusively manufacturing companies. We employ some 650,000 people. IECA member companies represent a diverse set of energy intensive industries that include chemicals, plastics, chemicals, paper, food processing, fertilizer, steel, glass, pharmaceutical and aluminum.

The manufacturing sector uses one third of the U.S. natural gas and one third of the electricity. One third of the electricity is produced from natural gas. Natural gas is used as a fuel for the entire manufacturing sector supporting 12 million jobs and as a feed stock

for producing products such as nitrogen fertilizer, chemicals and plastics that are used in everyday life.

For energy intensive industries relatively small changes in the price of natural gas and electricity can often determine our ability to compete with foreign competitors.

From 2000 to 2011 the manufacturing sector lost 5.5 million jobs or 32 percent. High prices of natural gas significantly contributed to job losses. Over the last 2 years we have recovered only 418,000 jobs. This is a good start, but a long way from where we need to be to restore output and jobs to past levels.

We have 4 points today.

Point No. 1 is that IECA does not oppose the use of natural gas in the transportation sector. We do oppose legislation or regulation that picks winners and losers, that provides direct or indirect incentives that result in higher demand for natural gas. Higher demand places upward pricing pressure on natural gas and raises manufacturing costs, not just for natural gas, but also for electricity directly affecting competitiveness.

Point No. 2. The favorable economics and environmental advantages between natural gas and transportation fuels such as diesel and gasoline is driving the market toward greater use of natural gas. Our written testimony provides a stunning list of examples that show that the market is working and government legislation is not needed.

Point No. 3. IECA is becoming alarmed at the ever increasing potential demand and over reliance on natural gas. While we have an abundant supply, it appears that we also have explosive potential demand due to a suite of EPA regulations on electric generators, EPA regulations on industrial boilers, one approved and 14 applications to export natural gas and increased use of natural gas by the industrial sector. Total potential demand could increase 45 percent over the EIA base case for 2012 to 2020.

Point No. 4. While it appears that we indeed do have an abundant supply of natural gas, manufacturing is concerned about the growing threats of continued robust and economic production of natural gas. There are at least 3 potential major barriers.

Public opinion concerns regarding drilling and hydraulic fracturing.

No. 2, government regulation.

Three, actions by the environmental organizations.

New regulations are a concern because we can recall the time period of 2002 to 2006 when natural gas prices were doubling and tripling. Producers wanted to drill. They filed applications to drill to the Bureau of Land Management.

Unfortunately there were thousands of these APDs backlogged at the Bureau of Land Management. The natural gas was in the ground. Drillers wanted to drill. Consumers needed the gas. But the government stood in the way. Now new regulations may have the same effect but on both private and public lands.

In closing we urge you to not artificially create demand for natural gas that may jeopardize the manufacturing sector. Natural gas prices are already rising quickly. Today's NYMEX natural gas prices rised 84 percent between now and 2020. That is a 9.5 percent annual increase.

Let markets work. Let end users compete for the natural gas without government picking winners.

Thank you.

[The prepared statement of Mr. Cicio follows:]

STATEMENT OF PAUL N. CICIO, PRESIDENT, INDUSTRIAL ENERGY CONSUMERS OF AMERICA

Thank you Chairman Bingaman and Ranking Member Murkowski and committee members for this opportunity to testify before you. My name is Paul Cicio and I am the President of the Industrial Energy Consumers of America (IECA).

The Industrial Energy Consumers of America is a nonpartisan association of leading manufacturing companies with $700 billion in annual sales and with more than 650,000 employees nationwide. It is an organization created to promote the interests of manufacturing companies through advocacy, and collaboration for which the availability, use and cost of energy, power or feedstock play a significant role in their ability to compete in domestic and world markets. IECA membership represents a diverse set of industries including: chemicals, plastics, cement, paper, food processing, fertilizer, steel, glass, industrial gases, pharmaceutical, aluminum and brewing.

KEY POINTS

1. IECA does not oppose the use of natural gas in the transportation market. We do oppose legislation or regulation that picks winners and losers—that provides direct or indirect incentives that result in higher demand for natural gas. Higher demand places upward pricing pressure on natural gas and raises manufacturing costs of natural gas and electricity directly impacting competitiveness. In this case, the transportation sector, including corporate fleets, is a winner and manufacturing and other natural gas and electricity end-users lose.

2. The favorable economics and environmental advantages between natural gas and transportation fuels such as diesel and gasoline is driving the market toward greater use of natural gas in the transportation sector (see Exhibit A*). The market is working and government legislation and/or incentives are not needed (see Exhibit K).

3. IECA is becoming very alarmed at the ever increasing potential demand and overreliance on natural gas. While we have an abundant supply, it appears that we also have explosive potential demand due to the suite of EPA regulations on the electric utility generators that could shut down up to 81,000 MW of coal-fired power generation according to one Federal Energy Regulatory Commission report (see Exhibits B and C), EPA regulations on industrial boilers; one approved and fourteen applications to export natural gas (see Exhibit D), and increased use of natural gas by the industrial sector. Total potential demand could increase 45 percent over the Energy Information Administration base case for the period of 2012 to 2020 (see Exhibit E).

4. While it appears that we have an abundant supply of natural gas, manufacturing is concerned about the growing threats to continued robust and economic production of natural gas. There are at least three potential major barriers: 1) Public opinion concerns regarding drilling and hydraulic fracturing; 2) government regulation and 3) actions by environmental organizations. Regarding government regulation, we note that the Bureau of Land Management (BLM) has proposed to regulate hydraulic fracturing on federal lands and that the EPA has regulated drilling emissions. The EPA gives every indication that it intends to regulate drilling and hydraulic fracturing on public lands where most of the natural gas supply is being currently produced. This must be done carefully so that environmental objectives are achieved while allowing economical production without drilling delays.

New regulations are concerning because we can recall that during the time frame of 2002 to 2006 when natural gas prices were doubling and tripling, natural gas producers wanted to drill and filed applications to drill (APD). There were thousands of APDs backlogged because of the BLM. The natural gas was in ground, drillers wanted to drill and consumers needed the gas, but the government stood in the way. Now, new regulations may have the same effect but on both private and public lands.

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*All Exhibits have been retained in committee files.

5. If Congress "is" going to get in the business of picking winners and losers—we urge you to "pick" manufacturing. Remove barriers that may prevent the manufacturing sector from using our nations' abundant supply of natural gas to build or expand factories and use more natural gas to fuel cogeneration facilities that would increase competitiveness, capital investment, economic growth and jobs.

THE MANUFACTURING SECTOR

The manufacturing sector uses one-third of the natural gas and one-third of the electricity, of which about one-third is produced from natural gas. Natural gas is used as a fuel for the entire manufacturing sector and a feedstock for products such as nitrogen fertilizer and chemicals and plastics that are used in everyday life.

For energy intensive industries, relatively small changes in the price of natural gas and electricity can often determine whether they are competitive with global competitors (see Exhibit F).

From 2000 to 2011, the manufacturing sector lost 5.5 million direct manufacturing jobs or 32 percent due to a loss of competitiveness (see Exhibit G). While much has been said recently about a surge in manufacturing and companies bringing jobs back to the United States, it is important that we keep reality in perspective. The fact is, over the last 2 years, we have increased only 466,000 jobs. This is a good start, but a long way from where we need to be to restore output and jobs to past levels.

The manufacturing sector employs 12 million people directly and indirectly an additional 5 million. In 2011, we accounted for 86.1 percent of exports totaling $1.27 trillion. In 2011, $1.71 trillion of manufactured products where imported into the U.S. (see Exhibit H). We view displacing these imports as a fabulous growth opportunity for U.S. manufacturers, high paying jobs and economic growth (see Exhibit I).

We also believe that the newfound natural gas from shale and the hydraulic fracturing process has created a significant opportunity for us and the country. We encourage policy makers to work closely and in partnership with the oil and natural gas industry to ensure that this competitive advantage is not shackled by overregulation and costs.

We urge you to not artificially create new demand for natural gas that may jeopardize the manufacturing sector. Natural gas prices are already rising quickly. Today's NYMEX natural gas prices rise 84 percent by 2020, or a 9.5 percent annual increase. Let the markets work, and let end users compete for the natural gas without the government picking winners.

Thank you.

The CHAIRMAN. Thank you all very much for your testimony. Let me start with a few questions.

You know one of the intriguing ideas out there that to deal with this so called infrastructure issue with regard to the use of natural gas in transportation is this idea of home refueling for natural gas vehicles. Most American homes today have natural gas or many of them do at any rate. If in fact there were a relatively inexpensive and effective way to use your natural gas that comes to your home to refuel your vehicle the same way that electric car manufacturers are arguing people can do in recharging their batteries. That would seem to solve a lot of the infrastructure problem with regard to the use of natural gas for cars and trucks.

Mr. Modlin, you folks are in the business of providing these kinds of vehicles that use natural gas. Is this something you think is a real prospect or is this just pie in the sky? There are all kinds of reasons why it's never going to work?

Mr. MODLIN. I think you're on to an important observation.

The refueling at home does have an advantage of the customer not having to go to a gas station. I think one of the important observations that we make as an industry is that people don't love going to their corner gas station. It's something they have to do. So if we can make their life more efficient that would be an advantage, we think, to the product.

A disadvantage right now to home refueling is the pretty high cost. It's generally in the neighborhood of $5,000 to put a unit in your home. So added onto the cost of the vehicle, which is a premium, that's a bit of a barrier.

But what we are pleased to see is the research going on to reduce cost of home refueling apparatus. The industry on its own is pursuing that. They're attempting to bring down the cost from like about 5,000 to about a third of that.

The recent announcement from DOE to pursue $500 cost point or price point for home re-fueler we think is fantastic.

So we think the opportunities could be very real. I really think customers would appreciate it.

The CHAIRMAN. Dr. Gallagher.

Mr. GALLAGHER. I might just add a word if I might because we looked at that in this NPC study that I just chaired.

I don't think you have to have home refueling to make natural gas go and to have infrastructure. But I do think to the degree we can make it happen, it would be a tremendous benefit for everybody. We've got natural gas going into 60 million homes in the United States. So the gas is there. We just need the system.

The technology is there in a sense in that systems have been offered in the past. But there hasn't been a big take up primarily for the reason Reg mentions. They've been expensive. But they work.

This new R and D program, that was just announced a week ago in Houston, by Deputy Secretary Poneman, Energy. $30 million for natural gas transportation storage R and D, of which, I think, 2 of the 13 projects are going to focus on home refueling technology. One of them is led by General Electric, by the way. So with some serious players getting involved, I think it could have a very nice future.

The CHAIRMAN. Dr. Greene, did you have any thoughts? Have you looked at this issue about whether this is a possible solution to the need to build infrastructure?

You advised that you don't think we should build out an infrastructure because of the cost and the fact that ultimately we're going to have to replace it all, as I understood your testimony.

Mr. GREENE. I think what I'm speaking/referring to there is a large scale national infrastructure rather than infrastructures along specific routes or in specific places where natural gas use makes good sense.

Honda tried to sell such a system along with their natural gas powered Civic with not very much success. I think the cost was a serious barrier, the cost of the compressor. If that cost can be brought down a lot I think this makes more sense for the consumer in terms of avoiding trips to the CNG refueling station.

If you think it takes about 6 minutes if your time refueling is worth $20 an hour you're talking about something like $100 a year saved in time or something like that. So I think that it can be helpful. But the costs will have to come down considerably.

The CHAIRMAN. Dave, did you have a comment?

Mr. MCCURDY. Just quickly, Mr. Chairman. In mentioned in my testimony we see this opportunity for the consumer market. This—the long haul is the low hanging fruit where you're going to see

rapid development to in where the market is moving rather dramatically.

David Greene is right that Honda did offer that. But it was prohibitive cost. It was $5 to $7 thousand. The company just couldn't sustain that with the small market they have.

If in fact you get the scale and the price does come in that, even in the thousand dollar range, 500 to 1,000, then there are other innovative business models. Utilities could in fact own those and either lease it or manufacturers could include that in a part of the price of the vehicle. It's equivalent if you have a gas dryer in your home, a line is there.

You know, we are in a kind of a plug in culture now. We go home at night. I plug my iPad in, my iPhone. My wife does the same. You know you could come in and plug.

The difference with the home refueling it doesn't have to have the quick refilling. So you can actually plug it in at night and it would be a slow refill.

The other point here and I've heard these claims that concern that this market is going to be, the demand is going to explode. Then all of a sudden because of vehicles there's not going to be availability for industrial use. I don't really believe that's the fact.

When I was in the auto industry, when you're looking at the percentage of the market for alternative fuel vehicles, out of the 12 plus million vehicles sold a year, it's a relatively small number. It's not going to—in a worst case scenario if all 12 million converted, sure, there might be a demand issue. But that's not going to be the case. You're going to see this slower ramp up on the consumer side.

The CHAIRMAN. Senator Murkowski.

Senator MURKOWSKI. Thank you, Mr. Chairman.

I want to talk to some of you guys afterwards because I have your perfect pilot project. I've got a community up North that is isolated from the rest of the world. They're paying seven/eight bucks a gallon for gas. Their natural gas is dirt cheap. They don't need to worry about fueling up anywhere else along the transportation grid because we don't have one. So we'll be talking afterwards.

I want to ask because the Chairman mentions the issue of the chicken and the egg in this whole infrastructure and how we build this out. So many have said that, you know, it's not, this is not doable because we just can't get the infrastructure moving to the point that the consumer feels comfortable enough to purchase these vehicles. Yet we know that when we're talking about the long haul vehicles, we're seeing those changes. I think each and every one of you has mentioned instances where the private sector is figuring this out.

The question to each of you is whether or not you see a need outside of the desire to get what some might consider to be free money. But a need for taxpayer money being used to subsidize the development of whether it's vehicles, whether it's infrastructure, other expenses that might be associated with switching to natural gas or really for any other fuel for that matter. Several of you have mentioned the need that we need to be technology neutral, fuel neutral.

So among the 5 of you here today, do you see a need for direct Federal dollars? Those kinds of incentives that will take taxpayer money at this point in time whether it's for infrastructure, vehicles or other?

We'll start with you, Mr. McCurdy and just go on down.

Mr. MCCURDY. Thank you, Senator. We can talk about Alaska.

But the Senate recently voted on the Nat Gas Act and there were 51 votes for it, but it failed to reach the requisite 60. That was a funding neutral provision. There were pay fors for that. But the Senate has acted recently so I'm going to leave it at that.

What we've asked for are technology neutral approaches in the regulatory front and to correcting some of the tax, current taxes, that discriminate against LNG such as the excise tax.

We believe that the fuel economy rule, the CAF rules, are a wonderful opportunity because here is a mandate from government for the manufacturing world on a sales average based approach to meet certain standards. Here's an opportunity for alternative fuel vehicles both electric and natural gas to meet that standard by having an equal incentive. So that's meeting the standard and a government obligation. It's not direct taxpayer expense. Those kind of approaches, we think, can move this in a more rapid basis.

So we all understand that the tough balance that our government and our country has to face as far as the rising deficits. But we also have a sluggish economy and as we see this infrastructure being market driven in fact there's opportunity to accelerate that pace with some wise policy choices.

Senator MURKOWSKI. Dr. Gallagher.

Mr. GALLAGHER. Thank you.

The economics, as we said, are starting to move markets which is great. I do agree with Dave's comment that we should at least not penalize natural gas as a transportation fuel. So we really need to equalize this tax on LNG verses diesel at the energy equivalent level. It's currently a 17 cent per diesel equivalent gallon penalty for using a cleaner, domestic fuel, natural gas which I don't think makes a lot of sense.

There used to be a—so in terms of—so this thing is going to go. But we have to realize we're at, really, at the infancy of this industry here in the United States particularly for long haul where we put the very first long haul truck on the road 4 years ago at the Port of Los Angeles, the very first. Today there are, you know, a modest number. But it's at the infancy. The same is really true for light duty in the United States.

So we're looking for ways that we can encourage and accelerate this wonderful transition toward a cleaner, cheaper domestic fuel. So I think we look at ways to do that. I'm not sure using taxpayer money has to be the way to do that. But we look for ways to do it.

There was a proposal to reinstate the Vehicle Tax Credit for heavy duty trucks, floating, recently. Because the current price premiums are higher given that there's no scale yet in the industry that produces those trucks. That proposal was going to pay back all the credits with the fuel cost savings over the life of the vehicle. So it was tax neutral, I think.

So things like that I think could work.

Last there's other, sort of, non fiduciary budgetary ways like going after the $150 billion that the Federal Government spends on procuring third party transportation services. We could put in alt fuel standards for those procurements. Require some percentage of new transportation services provided by third parties, the United States Postal Service and others be natural gas vehicles, electric vehicles, biofuel vehicles, etcetera.

Thanks.

Senator MURKOWSKI. My time is expired. But I want to give the others a quick opportunity.

Mr. MODLIN. So quickly that I like the ideas that have been presented so far.

The main thing we look at is that the market has to want this first. Without a market then none of these efforts are going to be of much value.

Right now we think the value proposition is there for the customer to consider with the price difference between natural gas and gasoline and diesel. So from a manufacturer's standpoint we say the customer should be interested in this.

Also then with that potential the distributors have seen that there's potential here. So what's been interesting for us is of companies approaching us and saying can we form partnerships in developing or in presenting these products as a mutual product to the market. We're working on it. We think that has some excitement.

So what you asked was would dollars from the government help?

I think at this point dollars always help in exciting interest in a product. I just witnessed, especially the difference between electric vehicles and natural gas where electric vehicles are being offered significant incentives to move those along. So we're just asking for parity between electric vehicle or any other alternative fuel and this so we can compete fairly in the marketplace.

Senator MURKOWSKI. Thank you.

Mr. GREENE. So my general answer is no. I don't see a need for the Federal Government to use funds to subsidize natural gas infrastructure.

On the other hand I'm very much in sympathy with the other comments about fuel neutral policies. There are definite, real benefits in terms of reducing oil dependence, somewhat reducing greenhouse gas emissions, somewhat reducing/improving air quality. So I think if we can structure policies that in a fuel neutral way reflect those values that would be the right way to go.

Senator MURKOWSKI. Mr. Cicio.

Mr. CICIO. Yes, no funding is necessary. I'll give you a real life example.

Clean Energy Fuels Corporation is offering long term contracts. It doesn't matter whether it's to a trucking fleet or to a municipal or to a State government or a Federal Government. They will sell natural gas at an equivalent price of a $1.50 below diesel fuel prices. For diesel users that's about a 25 percent savings.

This company will put in the infrastructure for that long term contract and sell the natural gas. The fleet, the user, has a 25 percent lower cost. The infrastructure goes in.

So the market is working.

The CHAIRMAN. I believe Senator Manchin is next.

Senator MANCHIN. Thank you very much, Mr. Chairman. Thank all of you, panelists.

I want to just take off on what Mr. Cicio said. To me the low hanging fruit is basically the commercial vehicles, State by State. It doesn't cost a penny. A long term contract if they converted their school buses, their mass transportation, their State road vehicles and basically their sanitation which none of them ever show up at a filing station right now.

That would be the cheapest thing we could do. Take a tremendous load off of the oil based products that we're dependent on right now and not cost a penny. I don't know why we, as a body, haven't taken that approach.

Do you agree with that?

Mr. CICIO. This is—the spread between the cost of diesel and the price of natural gas is so compelling that the economics are very clear that you can do these contracts long term where there's a winner for the buyer and the seller. It doesn't get any better than that.

Senator MANCHIN. There's 15 States now that have a coalition. 15 States are working together to try to get mass purchasing for these—changing their school buses, changing their mass transportation, changing their State road vehicles. That could have a tremendous impact on the market, I think.

Mr. CICIO. If just this one company as of December 31st, 2011 has served 530 fleets and this is just one company. Any company in the United States could do this.

Senator MANCHIN. I'm saying that I know we have talked about, I think it was Mr. Pickens, his long term trucking and all this and it's a tremendous cost to the infrastructure. This is no cost. It doesn't take any government incentive. It doesn't take a penny from any of us right now to make this happen.

Correct? Just the support?

Mr. CICIO. That's correct.

Senator MANCHIN. Let me just go on to, sir. You said also in your statement you had used because of EPA you thought 14 gigawatts of coal fired power plants would be retired. This was in your written statement.

Mr. CICIO. Actually there's under a FERC study.

Senator MANCHIN. FERC is 70 to 81.

Mr. CICIO. I thought it was 81,000 megawatts.

Senator MANCHIN. Gigawatts, yes.

Mr. CICIO. It's in that neighborhood, yes.

Senator MANCHIN. OK. With that being said and the demand on natural gas, do you think and I don't mean we've had those 11 or 12 projects, one to export because of the higher prices. We've got to be a little bit careful what we're doing cause this is the last fuel that, I believe, we have as a Nation that could be a renaissance of manufacturing.

It could be a transformation of transportation fuels. It could really get America back in a competitive stage. But also there's a balance to be had. Anybody could chime in here. But we're watching this very carefully, very much concerned.

I see my good friend, Senator Wyden, came in. We've had some good discussions about this. But I didn't know if any of you all would.

Mr. Gallagher.

Mr. GALLAGHER. Yes, I'd love to chime in. Thank you.

On the business of using our precious natural gas, absolutely. But as I mentioned, the guys that look at these things in terms of supply of resources. Just last September the National Petroleum Council with its 200 member companies, after exhaustive analysis of those resources concluded that the resources are not only plentiful, they're enormous. They're sufficient to not only meet current demands but also new demands from power gen, new demands from transportation and new demands from export all at reasonable cost.

Even in our own government agencies the Energy Information Agency and the DOE looking out to the year 2035 shows maintaining and widening that price gap that we see today with oil.

My second comment, briefly, on the other point about——

Senator MANCHIN. I'd like to also know about coal, also where you all come down on the side of coal.

Mr. GALLAGHER. Sorry?

Senator MANCHIN. On coal, coal fired plants, too.

Do you think we can do a complete fuel switch or there has to be a balance?

Mr. GALLAGHER. I think there's always—balance always makes sense. I testified in Congress 32 years ago about world prospects for coal. So there's a role for coal.

But natural gas is cleaner. It's a lot lower carbon. So we're going to see some substitution in natural gas for coal.

On the truck issues and——

Senator MANCHIN. Gas can't carry it all, can it?

Mr. GALLAGHER. We don't want to carry everything and the economics won't drive natural gas to carry everything. So but we'd like to see natural gas—

Senator MANCHIN. But your pricing is much more different, isn't it?

The pricing is so unstable with gas verses coal, long term contracts coal is much more dependable than gas has been.

Mr. GALLAGHER. Used to be, but not so much today.

Senator MANCHIN. OK.

Mr. GALLAGHER. On the truck I applaud what we're doing at the States on the buses that you mentioned, school buses, the transit systems, the garbage trucks, the municipal trucks. Pretty much every one of those trucks has one of our engines in it, by the way, Cummings Westport or Westport engines.

Senator MANCHIN. OK.

Mr. GALLAGHER. So that's fabulous. We're meeting 20, 30 percent of some of those markets. But the big consumers of energy are the long haul trucks, not the transit district buses and the school buses.

So if we really want to start making substitution for oil and saving some carbon we're going to have to move into the long haul. That's what we're trying to do.

Senator MANCHIN. Yes, sir. Dave?

Mr. MCCURDY. Senator, if I could?

We hear a lot about price. Since our members, the gas utilities that provide gas to—natural gas for 175 plus million Americans really appreciate and support low natural gas prices. But $2.80 or $2.50, quite frankly, is not sustainable.

We don't have a supply challenge. We have a demand challenge. When the supply, which is there, 100 plus years and with advanced technologies, many of us believe that it can actually be greater than that.

But if the differential—and the game changer here, the amazing game change, is that natural gas prices are no longer pegged to petroleum prices. So that's given the strategic advantage to the United States in a second chance here. But those prices in most estimates, EIA and the Petroleum Council, are looking at it somewhere between $4 and $5 MMBTU in the future. You know, that's a fourth of what it was a decade ago.

What we see is not the absolute price. Quite frankly, consumers will get a benefit at $4 natural gas. It's the reduced volatility. Until you make sure that the producing community at the supply chain, the upper, is in the field than you're going to have more price volatility.

So we think that increasing demand actually will help levelize the price and keep it at an affordable level and still use this abundant resource which is domestic and very clean.

The CHAIRMAN. Senator Barrasso.

Senator BARRASSO. Thank you, Mr. Chairman.

Mr. McCurdy, I'd like to ask you about Federal excise tax issues on liquefied natural gas. I understand the excise taxes are about 70 percent higher for LNG than the diesel fuel on a diesel gallon equivalent basis. I mean, you've been in the Congress. Just kind of look at the excise taxes and given that they go to the Highway Trust Fund.

I mean, how should Congress end this disparity without harming the trust fund?

Mr. MCCURDY. Thank you, Senator. As in my statement I mentioned it very briefly. It was recently corrected in the CNG arena. But on the tax code for diesel and Mr. Gallagher, Dr. Gallagher, mentioned that as well.

It's 41 cents or about 17 cents difference over the 24 cents tax, excise tax, for diesel fuel. The reason it was at the current level according to government reports is that they price it on a volumetric basis as opposed to an energy content.

Senator BARRASSO. Energy, sure.

Mr. MCCURDY. So because of that there is a disadvantage. So this could be corrected. You know, the Highway Trust Fund is going to be challenged as we know. From the auto world we know with the reducing amounts of gas tax collections.

But there are some who would argue that LNG because it's not or CNG is not taxed if it came from the utility. But there's ways to look at some equivalency in the transportation arena that would help offset as well. So that maybe another incentive to get natural gas vehicles on the road and to have some reasonable tax approach there.

But this can be corrected. There's an extender provision that and we know how challenging it's going to be between now and the end of the year for major tax policy or tax reform. But there could be some action taken in the extenders to correct this disparity.

Senator BARRASSO. Dr. Gallagher, do you have any additional thoughts on how we can do this without harming the trust fund?

Mr. GALLAGHER. I think it's an important thing to do. I think I don't have anything additional to what Dave has said on it.

Senator BARRASSO. Mr. Modlin, any additional thoughts on this?

Mr. MODLIN. I have no additional thoughts.

Senator BARRASSO. OK. Thanks.

Mr. McCurdy, I'd like to ask about the maximum fuel economy increased standards and manufacturers of the dual fuel natural gas vehicles are subject to less favorable maximum fuel economy increase standards than manufacturers of say, plug in hybrids.

Senator Inhofe has introduced a bill from your home State of Oklahoma which would allow manufacturers of dual fuel natural gas vehicles to take advantage of the same standards set for manufacturers of plug in hybrids. To what extent to these less favorable standards maybe discourage production of dual fuel natural gas vehicles?

Mr. MCCURDY. That's a great question, Senator.

The—first of all having been involved in the auto world with the setting of the previous standard from 2012 to ?16, we saw that there was tremendous fuel savings for the country, 1.8 billion barrels of oil. So it's good for consumers. I think manufacturers have benefited as well. It's not an easy consensus, but we did get there.

For 2017 to 2025 on the light duty vehicles we've asked the Administration to include in that rule which is now at OMB, I understand, an equalization there with the plug ins. That would create an equal incentive for alternative fuel, bi-fuel vehicles. Again, I don't think you'd see any impact on the price of natural gas. At the same time it would encourage manufacturers and support them to make these major capital investments.

That really can be done now, as we speak. We would encourage Congress to speak out on that.

With regard to the previous rule on the heavy duty trucks that did not include a provision like this. There are some credits there that potentially the Administration could open up and revisit.

So, these both would be very helpful to encourage advanced technologies.

Senator BARRASSO. I think I only have time for one last question.

Mr. Cicio, if I could ask you. Your organization opposed the Nat Gas Act. In a press release your organization said that subsidies are not needed. Natural gas prices, the release said, are substantially below that of gasoline and diesel and provide consumers significant financial incentives.

Does your organization oppose all financial incentives for natural gas vehicles?

Mr. CICIO. I believe we do.

Senator BARRASSO. OK. So——

Mr. CICIO. We haven't, but we haven't considered some of the things that's being discussed at this moment.

Senator BARRASSO. OK. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Senator Franken.

Senator FRANKEN. Thank you, Mr. Chairman.

This is really to the whole panel, I guess.

According to a 2010 MIT study there are significant advantages to using natural gas to generate electricity for electric vehicles rather than using it as a direct fuel in natural gas vehicles.

For example, 100 cubic feet of natural gas converted to electricity can power an electric car 45.7 miles. Whereas the same 100 cubic feet used directly in a natural gas vehicle can only power it for 22.4 miles which is just under half.

This study suggests that there is an argument to be made for prioritizing electric vehicle infrastructure over natural gas vehicle infrastructure. Can you talk about the pros and cons of such an approach?

Mr. GALLAGHER. If I?

Senator FRANKEN. Dr. Gallagher.

Mr. GALLAGHER. Yes, OK, Dave.

Senator FRANKEN. I'll go to Dr. Greene after that.

Mr. GREENE. We'll both take a shot at it. Go ahead.

Mr. GALLAGHER. I'll start first thanks to Dave's kind pass there.

Yes, I was a reviewer on that MIT study actually. So I'm familiar with it. I'll say a couple of things.

First of all, there's some new MIT work out just in the last 90 days from Professor Chris Knittle, who chairs the MIT Center for Energy and Environmental Policy Research, CPER, as they call it which comes up with quite a different finding around natural gas for transportation. Very positive and in fact with some specific policy suggestions both for the Federal Government and State governments to encourage—

Senator FRANKEN. Can you speak to this study that you were a reviewer on?

It basically says that if you use natural gas to create electricity and then that you can drive a car twice the miles that if you use it just as compressed natural gas or liquid natural gas. Can you speak to the study I mentioned?

Mr. GALLAGHER. Yes. I will say that the work I've done for the past 2 years as chair of the Natural Gas Group of the NPC's Future Transportation Fuel Study which is going to be released next Wednesday here in Washington looked at electric vehicles verses natural gas vehicles verse biofuels and hybrids in vehicles and gasoline and diesel. Is coming up with some very strong findings for the positive benefits of natural gas both compared to conventional gasoline and diesel and other alternative fuels like electric vehicles.

It's true that the range. You might be able to go further based on the range per unit of natural gas to that question.

Senator FRANKEN. OK.

Dr. Greene.

Mr. GREENE. Yes, I think that is probably right. There's a lot of assumptions behind it, I'm sure.

But conversion of natural gas to electricity is relatively efficient among ways of converting energy to electricity. The electric vehicle is probably 3 times more energy efficient than the natural gas vehicle. So that sounds about right.

Senator FRANKEN. OK. Thank you.

I'd actually like to move on because, you know, there's one area where I do like natural gas a lot. That is for commercial and public vehicle fleets rather than for passenger cars. So I'd like to get this question out and have it discussed.

Of the 120,000 natural gas vehicles on the road in the U.S. today, most of them are transit buses like those made by New Flyer which is a company with manufacturing facilities in St. Cloud, Minnesota and Crookston, Minnesota. I think that's—and that's because the refueling infrastructure can more easily accommodate these fleets and because larger vehicles are capable of carrying the heavy tanks required to contain the compressed natural gas. I know they're working on the weight of those tanks.

Could you discuss the pros and cons of government policies that focus on fleet vehicles as opposed to personal passenger vehicles? You can take that answer anywhere you want. I just wanted to get the question out.

Mr. MCCURDY. Thanks, Senator.

I understand the need to get the question in. It's a good one because fleet vehicles and long haul is where you're going to see the most dramatic early increase. I think something like 30 percent of all buses being built today are natural gas. We'll see that number rise.

The benefits of fleet vehicles is that they return to base either in the evening or sometime.

Senator FRANKEN. So the infrastructure is there.

Mr. MCCURDY. That's right. The infrastructure is there. The value of that infrastructure is that it's hooked up to the natural gas pipeline.

The inefficiency that's not conveyed in the MIT study is that when you convert to electricity it's about—it loses 92 percent of its energy in the transmission as opposed to natural gas which only loses about 7 percent. So in fact you'll find whether you—if you could refuel at home you would take the electric transmission out of the equation and you'd have less lost efficiency there. There you could actually see some benefit.

But the fleet——

Senator FRANKEN. You lose 92 percent?

Mr. MCCURDY. Yup. In transmission. That's right.

Senator FRANKEN. Is that part of the MIT study?

Mr. MCCURDY. No.

Senator FRANKEN. I mean, it does seem very—I mean how does that factor, I mean.

Mr. MCCURDY. It depends on the transmission line. It depends on transmission. But if you're doing wells to wheels, if you do wells to wheels and there is a loss of transmission.

Senator FRANKEN. Dr. Greene, do you have a response to that. I saw him react.

Mr. MCCURDY. I can actually provide. We'll provide it to you. The——

Senator FRANKEN. When someone reacts like that I have to ask them.

Dr. Greene.

Mr. GREENE. No, it can't be 92 percent. It's way too high.

Mr. MCCURDY. Actually, we'll provide the study.

Mr. GREENE. So the conversion efficiency from primary energy to electricity is going to be somewhere between 33 percent and even 60 percent depending on how exactly you do it. Then the transmission is going to lose single digit percents.

Senator FRANKEN. OK.

Mr. MCCURDY. Production to through—I'll provide the study for you.

Senator FRANKEN. OK.

Mr. MCCURDY. But——

Senator FRANKEN. You're from the Natural Gas Association, right?

Mr. MCCURDY. Yes, but I support electric vehicles.

[Laughter.]

Senator FRANKEN. OK. Yes.

Mr. MCCURDY. Senator, I support—I think that the country needs both. I think there's opportunities for both.

But the important question you asked about the fleets is that this is they're 13, I guess now. Senator Manchin mentioned 15 States. This is where government can actually, through directives, have State fleets convert to natural gas. Also military facilities and others could do that.

Senator FRANKEN. Right.

Mr. MCCURDY. There you could see tremendous development deployment which helps you get up to scale.

Senator FRANKEN. I know my time has run out. But Dr. Gallagher seemed to want—be itching to go.

The CHAIRMAN. Why don't you give us a quick response, Dr. Gallagher? Then we'll go to the next questioner here.

Mr. GALLAGHER. Thank you. I'll try to be brief.

Quickly, factoring in all those efficiency considerations that we're talking about the new economics of natural gas whether you're looking light duty or bigger vehicles makes natural gas vehicles look quite attractive even compared to electric vehicles and all of those efficiency considerations. But of course we support and like electric vehicles as well.

Totally applaud and support your comments on moving into long haul trucking. We think we can build out the infrastructure there. We can use the return to base fleets. We can use corridors. That's all fabulous. We can get that established.

Then I think the light duty infrastructure can begin to evolve from that pattern.

Senator FRANKEN. OK.

Thank you, Mr. Chairman, for indulging me.

The CHAIRMAN. No problem.

Senator Wyden.

Senator WYDEN. Thank you, Mr. Chairman.

This has been a very helpful panel. I want to turn to a different area. My sense is that the new technologies, the new natural gas vehicle technologies, for example, like the better fuel tanks, can help make natural gas vehicles more practical.

But it is not the technology that is hampering the U.S. market for natural gas vehicles. It is the economics of the market. That is what I'd like to get into with you gentlemen.

I mean, particularly, the volatility of the U.S. natural gas market, in my view, has scared away some of the long term investment. The big question now is whether the breakthrough in shale gas development is going to alter this equation. Whether, in effect, the price advantage of natural gas as a fuel is going to continue, especially when other economic sectors go out and compete for that fuel to produce electricity or to provide feed stock for the chemical industry.

The natural gas prices today are lower than they have been for years, but no less volatile. So, in effect, the volatility that we've seen in the past, you know, continues. You see that because prices have risen and have fell over the past year from less to $2 to more than $5 per thousand cubic feet. That's just over the past 12 months.

I have a considerable concern that tying North American gas prices to the international markets. This, of course, would happen if you had these LNG construction terminals, export terminals, constructed. Certainly has the potential to worsen the problem because if you think guessing on the future of natural gas prices was a challenge before add the international competition from companies that are already paying 4 or 5 times as much. See if the road to stability, to stability and predictable natural gas prices, that's really the key to getting these investments smoothed out.

So I think what I'd like to ask you, Dr. Greene and you Mr. Cicio, in your view what's it's going to take in order to get the major players here, businesses and people are purchasing for fleets and others, to have the confidence that there's going to be a real price advantage which would justify their making the switch and in effect, putting their eggs in these vehicles?

Dr. Greene, what's your take on it? Then you as well, Mr. Cicio.

Mr. GREENE. There clearly is a price advantage now. I think with the increased supplies of natural gas the consensus is there will be a price advantage in the future. I think that will be true whether or not we allow exports of LNG.

So I think there will be a price advantage. I think people have confidence that there will be a price advantage. I think the issues are how convenient, how useful natural gas is in any given particular application. Does that offset the price advantage or not?

I do think that Professor Knittle's study, for example, makes some very good points about the societal benefits of natural gas that are not included in the price, the benefit of reducing oil dependence, the benefits of reducing emissions to a certain degree. So I guess I think the market does see the price advantage of natural gas and does expect that that will continue into the future and we'll respond to that accordingly.

There are additional advantages that are not reflected in the price of natural gas. In my view, that should be the focus of policy to try and make those clearer.

Senator WYDEN. Mr. Cicio.

Mr. CICIO. Confidence is an important word. From a manufacturer's perspective they would answer, you've got to look at 2 parts, both parts of the equation.

You've got to look at supply.

You've got to look at demand.

As you have seen in our testimony, we have, manufacturers have concerns on both sides of the equation. On one hand we, today, have an abundant supply of natural gas. But we see potential headwinds there, including government regulations that could impair this robust, economic supply of natural gas.

On the demand side, we see some extraordinary demand, unlike the United States has ever seen before. You mentioned exports. We, for the record, we're not against exports. But the fact is, and probably in every board room manufacturers are talking about their concern about what impact 14 export facilities may have.

Those—if all of them got approved and probably they won't, that's a 27 percent increase in demand. Now let's put that in perspective. We've increased demand from 2000 to 2011 by 4.4 percent.

Manufacturers today are considering investing $65 billion in new facilities in the United States, that's mostly petrochemical and steel, that would consume some 3.7 trillion cubic feet of natural gas a day. Huge into capital investments, they want to be sure that the supply is there at an affordable price relative to international markets.

Senator WYDEN. We're going to have to do some more work following this up with you. I was just struck reading your testimony on page one, Mr. Greene. I quote here.

"Today's low natural gas prices are not likely to last. More likely they will rise over time to levels consistent with the world price for LNG adjusted for the cost of liquefaction and transport."

So I think the point really is, we have got to find that sweet spot where companies really do have a sense of stability in order to get them to make these long term changes.

I know my time is up, Mr. Chairman. I thank you for the questions.

The CHAIRMAN. Senator Shaheen.

Senator SHAHEEN. Thank you, Mr. Chairman.

Thank you all very much for being here this morning.

I want to follow up, Mr. Cicio, on the line of questioning that Senator Wyden was pursuing.

But first, I want to thank you and the Industrial Energy Consumers of America for endorsing S. 1000.

Mr. CICIO. You're welcome.

Senator SHAHEEN. My energy efficiency legislation with Senator Portman because I think regardless of what kind of fuel we use, it's important for us to do the very best job we can at being energy efficient with whatever we're doing. That's what that legislation is designed to address.

But your testimony mentions that relatively small changes in the price of natural gas can often determine whether energy intensive businesses can remain competitive. Can you talk a little bit more about the role that those prices play with the companies that are members of your coalition?

Mr. CICIO. Most certainly.

For example, glass production, 20 to 25 percent of the cost is energy. If you're using recycled steel, you know, about 50 percent of the cost is the cost of electricity. If you're making chemicals and

plastics and fertilizer, 80 percent of the cost of the product, its feedstock, is the price of natural gas.

So when we say that relatively small changes in price can have a direct impact, you can appreciate why.

Senator SHAHEEN. Thank you.

Mr.—Dr. Gallagher, you talked about the importance of addressing long haul trucks because that's where so much of the usage is. Can you talk about what the challenges to doing that are? Obviously the installations that can refuel those trucks is an issue. Are the type of engines also a big issue?

I mean, how we—let me start a little differently. It sounded to me like there was general agreement from all of the panelists that one of the best ways to start making the transition was through municipal or State vehicle fleets, that that's one of the best ways. We've started to do that in New Hampshire. We've seen that in some of our cities.

But as you talk about transitioning to long haul trucks what are the big challenges there?

Mr. GALLAGHER. OK.

Yes, we're kind of moving up on engine and vehicle size, so buses, transit and school. Refuse, waste management just announced that they're going to convert every single diesel truck in their fleet to natural gas in the coming years, 18,000 waste management, garbage trucks.

So next is the long haul trucks that we're talking about. The importance to America is the huge consumption of oil that the long haul trucks consume, much larger demands and quantities of oil than these other markets that we've already busted into.

The engines are coming along. I say that with some modesty in that my companies are creating them and developing them and selling them. So, but hundreds of millions of dollars of R and D invested in the engines by my company alone in the last decade to get us to this point.

We're still—so what are the barriers? We need more engine platforms. So until, currently there's really only one heavy duty engine platform, a Westport 15 liter on a Cummins base engine. In January there will be a second, a Cummins Westport joint venture, 12 liter engine that runs on CNG or LNG. But we need more platforms obviously. So that's going to take some time.

We need more OEM vehicle platforms. So we're getting there. Kenworth, Peterbilt, Freight Liner are introducing these into long haul. But there's still a relatively modest number of platforms. So we need more of that.

The big barriers are—and we talked about the chicken and egg. The build out of infrastructure to support these vehicles as the demand grows. It's a brand new technology. The first truck hit the road 4 years ago in California.

It's going to take a while to build scale. Because of that it's going to take a while to build up the infrastructure to support that scale.

It's going to take a while for the economics to get improved. They're good now because we've got this buck fifty a gallon fuel cost savings. But the trucks cost more than a diesel truck partly because we've only made a couple thousand of them in the history of mankind.

So we need some time to bring the cost down on the vehicle price premiums. So that will happen with scale and with engineering ingenuity. But anything we can do to help jump start, accelerate, these barriers would be helpful.

Senator SHAHEEN. Mr. McCurdy, the—in New Hampshire, as I said, we've begun moving in some of our communities to compressed natural gas. They've seen some significant savings in addition to the environmental benefits, cost savings.

But one of the challenges we have in New Hampshire and in the Northeast is that we don't have pipeline capacity to get that gas into our communities. So what can you tell us about the potential to get additional pipeline capacity into the Northeast?

Mr. MCCURDY. Thank you, Senator.

It's a big concern. We've been approached by Governors. We're trying to work with the State regulators since we're a regulated industry in the distribution side it really takes the State to work with us to expand those lines. There has to be a rate base equivalent to that.

So we've been working with the cinders from Maine and some Governors to look at different approaches there. So I think there's opportunity. Crtainly those are based with fuel oil. They see tremendous opportunities.

Senator SHAHEEN. Right. I understand those regulations. We permitted 2 gas pipelines through New Hampshire when I was Governor.

Mr. MCCURDY. Right.

Senator SHAHEEN. So I appreciate that.

Mr. MCCURDY. Yes.

Senator SHAHEEN. We need to see the industry though being interested in coming up.

Mr. MCCURDY. The industry is interested. Again, we have to work with the regulators at State level to make sure the right base is there and the economics work.

If I could, because Senator, I know I need to correct the record if I could, Mr. Chairman because I did misspeak on the one point that Senator Franken. My staff was able to get the facts here. When I said 92 percent, actually when you look at source energy to deliver to customer on natural gas if you take 100 MMBTU, even through the extraction processing, through distribution, you still retain 92 percent of that energy.

In the electricity side if you take 100, you end up with 32 percent. So there is a 68 percent loss in that process. So in transmission is about 6 percent. So David was right on the transmission side.

So I wanted to clarify. Unlike some I, you know, I will admit to making a mistake and I did there. But I think it is important to note that the efficiency of the process.

Senator SHAHEEN. Thank you. My time is up, Mr. Chairman.

The CHAIRMAN. We appreciate the testimony. I think it's been very useful, very useful hearing. We will try to take some of your suggestions and see if we can follow up with them.

But thank you very much. That will conclude our hearing.

[Whereupon, at 11:35 a.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

RESPONSES OF DAVE MCCURDY TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. What are the primary obstacles to building out the compressed natural gas infrastructure for light-duty vehicles? Is it a potential conflict that many oil and gas companies would be hesitant to invest capital to build out infrastructure for selling a product that competes with gasoline and diesel?

Answer. AGA and America's Natural Gas Alliance have formed a collaborative effort, the Drive Natural Gas Initiative, to advocate for greater use of natural gas as a transportation fuel. One of the Initiative's main objectives is to foster the development of refueling infrastructure for natural gas vehicles.

The primary challenge to building a national refueling infrastructure is the scale of the overall investment needed. While there are over 130,000 gasoline stations nationwide, only 500 compressed natural gas (CNG) stations are available to the public. Building the number of stations needed to make natural gas a mainstream transportation fuel will require investments by a great number of companies under a variety of business models.

AGA member companies can play a vital role in the next phase of building our national fueling infrastructure for natural gas vehicles. Working with their state regulators, a number of our companies are exploring innovative approaches to utility participation in this market. Natural gas utilities are pioneering new business models, forming creative partnerships and investing in cutting-edge technologies.

Greater availability of home refueling appliances for natural gas vehicles could transform the market for these vehicles. The ability to fuel at home would lessen the need for an extensive network of public refueling stations. We believe that in the next few years, home refueling for natural gas vehicles will become increasingly available and attractive to residential consumers, and our companies will be involved in ensuring the safe and reliable operation of these refueling appliances.

Question 2. ARPA-E is funding research on at-home CNG refueling to bring down system costs and time required to refuel. Could you please provide cost and fill time estimates for current at-home refueling systems and comment on the likelihood and possible time-line for such systems to become viable and desirable to consumers?

Answer. A home refueling appliance currently on the market is the Phill, manufactured by FuelMaker. This appliance can cost upwards of $4,000 with a refueling time ranging between five to eight hours, based on the unit's pressure. General Electric and Eaton Corporation both recently announced efforts to develop home refueling appliances for natural gas vehicles, with goals of reducing the unit cost to around $500, and reducing refueling time to under one hour. Both companies project that they will produce prototypes by the end of 2015. We believe that at this price point, home refueling will be transformative for the natural gas vehicle market.

AGA commends the Department of Energy Advanced Research Projects Agency (ARPA-E) on the announcement of a $30 million program to develop new ways of harnessing U.S. energy resources to reduce America's dependence on foreign oil. Funded through this ARPA-E program, the Methane Opportunities for Vehicular Energy (MOVE) program focuses on overcoming barriers associated with the adoption of natural gas vehicles. One of the program goals is the development of an affordable home refuelling appliance for natural gas vehicles.

Question 3. Are there sensible policy actions, technology-neutral or otherwise, that the Congress should be considering to incentivize natural gas infrastructure development?

Answer. Natural gas gives the nation the opportunity to take advantage of an abundant domestic resource that will decrease our dependence on foreign oil, utilize existing distribution infrastructure, and stimulate the economy. Congress should pursue technology neutral policies that create a level playing field for all alternatives fuels, including natural gas.

As I described in my testimony before the committee, AGA supports the following actions to correct current policies that unfairly disadvantage natural gas vehicles:

Providing equitable tax treatment for liquefied natural gas (LNG).—Currently, each gallon of LNG sold incurs an effective excise tax rate of $0.41 per diesel gallon equivalent versus $0.243 for diesel fuel. This is because LNG has a lower energy density per gallon than diesel, but the tax is applied on a volume (gallon) basis rather than an energy equivalent basis. This discrepancy has been corrected for the sale of CNG, but not for LNG, and provides an unfair disincentive to the sale of LNG.

Waiving a portion of federal excise taxes on natural gas trucks.—Heavy-duty natural gas trucks cost $30,000 to $60,000 more than diesel trucks. The federal excise tax rate of 12 percent is imposed on the full cost of a truck. The effect is an additional cost premium of $3600 to $7200 towards a new natural gas truck.

Establishing parity in federal tax incentives.—Previous federal tax incentives for NGVs have expired. Consumers who purchase electric drive vehicles are eligible for a federal tax credit of up to $7500. Similar consumer incentives toward the purchase of NGVs could encourage greater adoption.

Question 4. With the recent natural gas boom in the U.S. natural gas is enjoying a low price relative to gasoline and diesel. How much can this price go up before it is no longer economically viable to convert to LNG or CNG vehicles in the various transportation categories?

Answer. The natural gas commodity price accounts for a small fraction of the price of compressed natural gas (CNG) the consumer sees at the fueling station. The majority of the pump price at a station operated by a regulated utility reflects fixed costs related to transportation, distribution, and compression of the natural gas; maintenance fees; a regulated rate of return; and state and federal taxes. This pricing structure means that even if the commodity price of natural gas were to increase significantly, the price of fueling a natural gas vehicle would not change considerably.

At current commodity prices, the natural gas commodity contributes about $0.32 for each gasoline gallon equivalent (gge) of CNG sold. The current national average cost of CNG is about $2.00 per gge, meaning that the natural gas commodity price accounts for only 16 percent of the price at the CNG pump. In contrast, the commodity price of oil contributes 60 to 80 percent of the pump price of gasoline and diesel.

To put this in context, if the commodity price of natural gas were to double overnight from $2.00 to $4.00 per mmBtu, leaving all fixed costs the same, the new CNG pump price would only increase from $2.00 to $2.32.

The Energy Information Agency (EIA) projects natural gas commodity prices (Henry Hub price per mmBtu) to increase to $7.37 in 2035. EIA meanwhile projects petroleum prices to be $145 per barrel by the same year. At these levels, CNG will retain a significant cost advantage over petroleum-derived fuels.

Question 5. What role does the possibility of LNG exports (and possible related price increases) have on the economic viability of natural gas vehicles in the long-term?

Answer. The natural gas market in North America today is characterized by abundance in supply. AGA believes that this expanding resource base is capable of satisfying existing and emerging markets, including the LNG export market. The possibility of LNG exports will improve the overall health of the market by incentivizing the continued production of natural gas and contributing to the balance of trade. Any fluctuations in the price of natural gas, resulting from LNG exports, will be marginal and natural gas will remain an affordable and attractive option for consumers.

RESPONSES OF DAVE MCCURDY TO QUESTIONS FROM SENATOR CANTWELL

In a study published in 2010, researchers at the Massachusetts Institute of Technology concluded that methanol was the 'liquid fuel most efficiently and inexpensively produced from natural gas,' and they recommended methanol as the most effective way to integrate natural gas into our transportation economy.

I would appreciate hearing the views of the American Gas Association as to the potential of using methanol to power our transportation system since methanol today is made primarily from the steam reformation of natural gas, a mature and inexpensive technology. As I understand it, today the U.S. has produces roughly 280 million gallons of methanol, and by 2015 that number will increase to one billion gallons. On the ground that means three methanol plants will be reactivated in Texas and a fourth will be moved from Chile to Louisiana to take advantage of today's lower natural gas costs. 1.

Question 1. Is the AGA supportive of expanding methanol production from domestic natural gas sources?

Answer. AGA supports technology-neutral policies that allow all alternative fuels to compete in the market, including the direct use of natural gas (in the form of liquefied natural gas or compressed natural gas), electricity derived from batteries or fuel cells, biofuels, and other liquid fuels such as methanol.

Given a level playing field, AGA believes that the direct use of natural gas will compete more successfully in the market than methanol for a number of reasons. First, using natural gas as a transportation fuel utilizes the country's existing gas distribution infrastructure and does not require the significant additional investment in industrial scale conversion of natural gas to methanol. Industrial-scale methanol production is highly capital-intensive: a facility can cost more than $700 million.

Moreover, using methanol as a transportation fuel would require the establishment of a transportation and distribution system since none exists today. In contrast, AGA members own and operate over two million miles of natural gas distribution pipeline, making its direct use a more efficient and affordable choice.

Question 2. How large a market is methanol producers for AGA members, and would that grow if methanol were used in America's transportation system?

Answer. Methanol does not provide a market for local distribution companies (LDCs), which comprise AGA's membership. Large industrial users of natural gas typically bypass LDCs and enter into direct contracts with either natural gas producers or interstate pipelines.

I understand that at today's natural gas prices methanol costs about 35 cents a gallon to produce, and for the past five years, the wholesale price for natural gas-derived methanol has ranged between $1.05 and $1.15 a gallon.

Question 3. How do you think the price of methanol will change over the next decade as the price of natural gas changes?

Answer. Since AGA members are not involved in the methanol market, AGA has no comment.

RESPONSES OF MICHAEL GALLAGHER TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. Although you did not specifically address the non-road transportation sector including marine, rail, and mining/oil/gas fleets in your testimony, can you please provide an analysis of the potential market and driving factors for or against conversion to natural gas in the non-road sector.

Answer. Please see the attached PDF* document for details titled 'Natural Gas as a Transportation Fuel'. The potential market for natural gas in these sectors is tremendous because these off-road and high horse power segments represent highly concentrated areas of high fuel consumption.

Firstly, the driving forces for the conversion of these sectors to natural gas are the abundant domestic supply of low cost natural gas that is less vulnerable to supply disruptions, geopolitical factors and volatility in price fluctuations. Secondly, natural gas emits lower greenhouse gasses and because it is a cleaner burning fuel, it can help reduce criteria emissions in off-road segments, in areas that have emissions reductions mandates or are suffering from poor air quality. Finally, companies such as Westport have developed robust high performance technologies for the conversion to natural gas, allowing diesel-like performance in horsepower and torque so there is no compromise in operability or performance of the engine. These technological advancements in engine development have not existed in the past. Companies like Westport and others are examining ways to deliver natural gas alternatives to diesel fueled engines in locomotives, mining, marine and in the oil and gas industries.

Some of the barriers to adoption are the cost and speed to which these technologies can be commercialized. Westport is currently working with industry partners such as Electro Motive Diesel and Caterpillar to adapt the success we have

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*Attached PDF has been retained in committee file.

seen with the on-road engines to higher horsepower applications. As with any new technology, the costs per unit of these products are higher than the closest diesel alternative. Not until higher volumes are manufactured do the costs generally decline per unit. While monetary incentives are not always possible, incentives for companies to adopt natural gas engines in off-road segments requires government support through policies to give confidence to purchasers to make the investment in natural gas technologies and infrastructure. There are also regulatory hurdles around the use, transportation and taxation of LNG as a transportation fuel as well as the classification of vehicles and engines under existing regulations by governing regulatory agencies. In an oil-centric environment, new rules, regulations, and standards must be developed, changed or adapted to consider the specialized characteristics and considerations of using LNG. Barriers such the small incremental weight of tanks and taxation of LNG fuel compared to diesel can and have hampered the speed to which new technologies can be adopted and deployed.

Question 2. What factors played a role in Westport's decision to build the LNG engines you spoke about in your testimony? What does the market space for these engines look like and are others entering into it and building engines for long haul as well or are they waiting to see how Westport's experience plays out?

Answer. Westport's decision to build LNG engines centered on the research of Dr. Phillip Hill, the inventor of the High Pressure Direct Injection Technology (HPDI). The goal was to find a way to reduce emissions for on-road vehicles, namely class 8 trucks that were and continue to be responsible for criteria pollutants in air-challenged areas around the country. As an example, regions such as Southern California continue to suffer from air quality issues, resulting from air borne pollutants such as nitrous oxides, carbon monoxide, sulfur dioxides and particulate matter that can contribute to negative respiratory events within the population.

The general principal was developed around the logic that a cleaner fuel used in an engine would result in cleaner emissions at the tail pipe. After experimenting on various fuels and fuel blends, Dr. Hill discovered that natural gas would provide the cleanest emissions, and provide the power required by truck operators.

Natural gas, primarily composed of methane, burns more cleanly than diesel or gasoline. As a transportation fuel, natural gas produces significantly less NO_X, PM and GHG emissions than petroleum based fuels. Natural gas is a safe, stable fuel and in the form of LNG has an energy density of 60% of diesel fuel.

Natural gas, in addition to its emissions benefits, is an abundant and domestically available fuel which in some cases can be obtained from renewable sources as biomethane.[1]

Westport's HPDI technology allows for the use of natural gas in a manner that preserves the diesel performance characteristics of the engine. Westport's injector technology is unique within the industry and currently, we are the only company offering a 15L compression ignition dedicated natural gas engine for on-road use in the market today. Through Westport's joint venture with Cummins and Cummins-Westport, there are two spark ignited engine offerings available: the 8.9L and the 11.9L engine, to be released soon. Both are based on a gasoline base engine technology and have slightly different performance characteristics. In the Westport case, the LNG is pumped from the storage tanks warmed, and pressurized through the fuel system and then injected at high pressure as compressed natural gas into the engine. The decision to use an integrated LNG fuel system is based on the fact that the type of truck for which this technology was developed has limited space on board to store fuel. The weight and size of the tanks was a consideration in the design. Liquefied natural gas contains approximately 40% less energy per diesel gallon equivalent (DGE) than a diesel fuel and as a result, more fuel in volume must be stored on board to allow for the equivalent mileage range of the truck.

Trucks are constrained by the 80,000 lbs GCW requirement of interstate highway travel and the weight of tanks can constrain the amount of freight allowed on board.

Compressed natural gas would require a higher volume of fuel and fuel tanks than LNG for the same fuel equivalent. Heavy duty trucks operating with CNG on board storage capabilities would require a larger number of storage tanks on board the truck resulting in a higher weight vehicle, and reduced payload capacity. Even vehicles that use onboard LNG storage[2] tanks are sensitive to the additional weight of the tanks which due to their construction of double walled stainless steel, are heavier by weight than a traditional diesel tank. The following diagram illustrates the differences in volume and range of natural gas and diesel. The extra weight and reduced payload capacity due to the 80,000lb interstate highway rule has been a deterrent for some fleets to adopt this technology. A Federal weight exemption be-

[1] Diagram-Westport.com website
[2] Westport HD presentation

tween 1000-2000lbs could significantly impact adoption for fleets that are sensitive to weight and payload considerations.

The market for heavy duty class 8 trucks that are capable of transporting heavy loads is growing rapidly, however, there are only a few companies that offer factory installed engines in new trucks. Westport and Cummins-Westport are the industry leaders in both the compression ignition (HPDI) and spark ignited engine technologies. Engine manufacturers such as Cummins, Volvo, Navistar, and others offer or are planning to develop and offer heavy duty natural gas trucks and engines. Most of the other players in this arena are developers of aftermarket dual-fuel systems which use different combinations and proportions of natural gas fuel or bi-fuel systems that can run on natural gas or other fuels

The market potential for dedicated heavy duty natural gas vehicles is promising as the cost of diesel continues to rise and the cost of fuel becomes more of a factor in the ability of American companies to remain competitive. In the refuse industry alone, companies such as Waste Management have converted a large percentage of their fleet to natural gas vehicles and are planning to move to all natural gas in the future. In the class 8 sector, the market is now focused on high mileage fleets that log greater than 60,000 miles per year per vehicle. This has been the market focus because the fuel cost savings are high enough to offset the higher incremental cost of natural gas vehicles on the market today. Although great strides have been made in combustion technology and engine and fuel systems development, the relatively low volumes of vehicles, compared to diesel, on the road means there is still a significantly higher incremental cost for the purchase of a natural gas class 8 truck.

In consort with vehicle availability, the build-out of natural gas infrastructure is critical to the long term success of these vehicles. Fleets whose operations include return-to-base or corridor routes have seen the greatest success with transitioning their fleets to natural gas because of the ability to locate fuelling stations within their area of operations. In areas where some public infrastructure is available, such as Southern California and the Los Angeles to Las Vegas to Salt Lake City corridor, the market has benefited from early adopters who have established fuelling stations and fleets are able to convert a smaller number of trucks. However in regions where natural gas is not yet established, fleets must convert a larger number of vehicles to create enough demand to support fuelling stations. As well, the number of vehicles must be significant enough for truck dealerships and maintenance facilities to invest in accommodating natural gas vehicles.

Thank you for allowing us the opportunity to present further details.

RESPONSES OF REG MODLIN TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. As you mentioned, Chrysler has recently introduced the bi-fuel natural gas/gasoline truck to the U.S. market and through its industry partner, Fiat, sells dedicated natural gas vehicles in Italy. Can you detail some of the policies that have been implemented in Italy that have been successful in driving consumer demand for natural gas vehicles there and comment on whether similar policies might be implemented in the U.S.?

Answer. The following are examples of policies that were enacted in Italy in an attempt to increase consumer demand for vehicles operating on compressed natural gas (CNG).

1. Favorable fuel taxation of CNG for transportation.
2. Customer purchase incentives to offset the incremental cost of the CNG system compared to an equivalent gasoline-powered vehicle. The incentive ranged from 1,500 ? to 3,500 ? per vehicle based upon a vehicle's CO_2 emissions.
3. Subsidies for new refueling stations with a financial contribution up to 40 percent of the total cost.
4. Streamlined regulatory and permitting procedures for locating and operating new CNG refueling stations.

Similar policies could also be implemented in the U.S. in an attempt to increase consumer demand for natural gas vehicles. Current U.S. polices relating to other alternative fuels and alternative fuel vehicles, such as incentives to purchase battery electric vehicles, should be technology and fuel-neutral and applied to all alternative fuels and alternative fuel vehicles to create a level playing field.

Question 2. If lack of infrastructure is the problem for consumer natural gas vehicles, why not build fueling stations at dealerships or fund research to provide better and less expensive at-home fueling systems?

Answer. Generally, retail refueling stations are not located at franchised dealerships. Dealerships that sell natural gas vehicles may have to install limited CNG fueling capacity to support repair operations similar to what they have today for gasoline and diesel-powered vehicles.

Chrysler is closely following research and development efforts by third-parties regarding home refueling appliances, including research programs funded by the U.S. Department of Energy. Recent progress to develop a more efficient, affordable, fast-fueling and maintenance-free appliance for transferring CNG to light-duty vehicles is encouraging.

Question 3. How do the infrastructure challenges for CNG vehicles compare to other alternative fuel technologies like electric vehicles?

Answer. The challenges to developing a robust refueling infrastructure for CNG vehicles are similar to the challenges facing other alternative fueled vehicles, such as vehicles operating on electricity, ethanol, methanol and hydrogen. Any alternative fuel must be widely available and priced competitively with gasoline in order to drive consumer demand. Burdensome permitting procedures and limited investment dollars are also obstacles to the greater availability and accessibility of alternative fuels.

RESPONSES OF REG MODLIN TO QUESTIONS FROM SENATOR CANTWELL

I understand that Chrysler has long been an industry leader in exploring alternatives ways to fuel America's cars. Chrysler invented the smart sensor for alcohol and was the first to commit to the production of methanol-gasoline flex fuel vehicle (FFVs). According to an article in the Chicago Tribune on May 3, 1991, "Chrysler has come up with an engine that can detect what kind of fuel is being used and adjust itselfwithout any intervention by the owner-to run on gas, methanol or a mixture of the two that could range up to an 85 percent concentration of methanol." The article also stated that Chrysler would produce cars for the 1993 model year that can run either on gasoline or methanol-or on a combination of the two fuels . . . In an effort to reduce the nation's dependence on foreign fuel and to clean up the atmosphere."

Question 1. Is the article correct in stating that Chrysler has had the capacity to make methanol FFVs since the early 1990s?

Answer. After years of research and development, Chrysler introduced two models of flex fuel vehicles (FFVs) in 1993 and 1994 that were capable of operating on methanol. Both models, the Dodge Spirit (1993) and Dodge Intrepid (1994), were discontinued due to low consumer demand and lack of methanol fuel in the marketplace.

Question 2. If yes, what was the cost of making such FFV cars in the early 1990s, and would that cost be less today because modern engines have additional sensors and emission control upgrades?

Answer. In the early 1990s, the cost of adding a new fuel sensor and upgrading the engine and fuel systems to accommodate methanol fuel was several hundred dollars per vehicle. The cost to provide M85 capability for today's vehicles that are not capable of running on E85 would likely be similar.

Question 3. According to the 1991 Chicago Tribune article, Chrysler didn't intend to pass any additional costs along to consumers, is that what happened?

Answer. In an effort to encourage customers to purchase methanol-capable FFVs, Chrysler did not pass any of the additional costs associated with the FFV upgrades along to consumers.

The seminal Massachusetts Institute of Technology Institute report entitled "The Future of Natural Gas 2011" found that "methanol could be used in tri-flexible-fuel, light-duty (and heavy-duty) vehicles in a manner similar to present ethanol-gasoline flex fuel vehicles, with modest incremental vehicle cost. These tri-flex-fuel vehicles could be operated on a wide range of mixtures of methanol, ethanol and gasoline. For long distance driving, gasoline could be used in the flex-fuel engine to maximize range. Present ethanol-gasoline flex-fuel vehicles in the U.S. are sold at the same price as their gasoline counterparts. Adding methanol capability to a factory 85% ethanol blend (E85) vehicle, to create tri-flex fuel capability, would require an air/fuel mixture control to accommodate an expanded fuel/air range with addition of an alcohol sensor and would result in an extra cost of $100 to $200, most likely at the lower end of that range with sufficient production."

Question 4. Do you generally agree with MIT's conclusions?

Answer. A tri-fuel vehicle could potentially be developed once a durable and reliable tri-fuel sensor is invented. The tri-fuel sensor would have to accurately identify and measure the correct amount of each fuel type in the vehicle, be it methanol, ethanol, gasoline, or any combination of the three. In addition to the costs associ-

ated with the new sensor, there would also be costs incurred for fuel system material upgrades to accommodate multiple types of alcohols. Furthermore, additional emission controls may be required to comply with today's more stringent tailpipe emission and onboard diagnostic requirements. Once developed, the cost of such a fuel sensor system to accommodate tri-fuel capability may be approximately $200 per vehicle.

Question 5. Please speak specifically to the marginal costs estimated by MIT of producing tri-flex fuel capability at scale.

Answer. The MIT cost projections for a tri-fuel system as identified in the question above appear reasonably accurate. This cost is in addition to the incremental cost for engine and fuel system upgrades that are already built into vehicles that are E85 capable. It should be noted that using methanol as a transportation fuel will require the construction and deployment of a methanol distribution network that currently does not exist. In contrast, an extensive natural gas pipeline distribution network already exists in the U.S.

Question 6. What are the specific upgrades necessary to make a vehicle have tri-flex fuel capability?

Answer. Ethanol, methanol and gasoline each have unique physical and chemical properties. As a result, engine and fuel system upgrades, in addition to a new fuel sensor, would be required to accommodate all possible combinations of ethanol, methanol and gasoline. The vehicle's powertrain would also need to complete full useful life durability testing and be calibrated for satisfactory emissions, driveability, and performance on all possible combinations of ethanol, methanol and gasoline.

Vehicles that are capable of operating on multiple fuels cannot be optimized for any one particular fuel, which results in decreased fuel efficiency compared to an optimized dedicated fuel vehicle. The inability to fully optimize a vehicle's fuel efficiency could potentially hamper a manufacturer's ability to comply with current and future greenhouse gas and fuel economy standards, as well as meet consumer demand for more fuel efficient vehicles.

Question 7. What are the specific differences in parts or technology between a non-FFV Chrysler model and an E85 FFV models? (for example, what is the difference between a 2012 Chrysler 300 3.6 L E85 and a 2012 Chrysler 300 3.6 L; or a 2012 Dodge Durango 3.6 FFV and a 2012 Dodge Durango 3.6L; or a Jeep Grand Cherokee 3.6 L FFV and a Jeep Grand Cherokee 3.6L)

Answer. FFV models have engine upgrades to the valve seats and piston rings because ethanol acts as a cleansing agent and inhibits lubricity. The entire fuel system (tank, fuel pump, lines, injectors and elastomers) is upgraded to protect against corrosion, decomposition and swelling of the elastomers, and chemical attack and stress cracking of plastics. The FFV engine must also be calibrated to operate and meet exhaust and evaporative emission requirements on all possible blends of gasoline and ethanol.

Today, all 3.6L engines and fuel systems in the Chrysler 300, Dodge Durango and Jeep Grand Cherokee are E85 flexible-fuel capable. Though capable, not all 3.6L equipped vehicles are offered for sale in California as FFVs due to the State's more stringent exhaust emission requirements.

Question 8. I understand that today's E85 FFVs may be tested with methanol, please describe the testing and certification procedures for flex fuel vehicles Chrysler produces today.

Answer. Chrysler's E85 FFVs are neither designed nor tested to operate on methanol, and therefore methanol usage is not permitted in any of Chrysler's vehicles, including E85 FFVs. Extensive development and certification testing is performed only with E85 and gasoline at multiple temperatures and against multiple driving cycles. The addition of methanol, once capability is established, would expand the testing and certification accordingly.

In your testimony, you discussed Chrysler's decision to re-enter the CNG vehicle market with the CNG Ram truck.

Question 9. Can you please provide a comparison of the marginal cost to consumers of making Chrysler's new CNG Ram 2500 pick-up truck be capable of running on compressed natural gas and gasoline versus the cost of making the same Ram 2500 pick-up truck being capable of running on methanol and gasoline?

Answer. The marginal cost of a bi-fuel CNG vehicle compared to a conventional gasolinepowered vehicle is driven primarily by the high pressure fuel tanks. This marginal cost is likely greater than the marginal cost associated with a methanol FFV, which is discussed in the response to Question 2 above.

Question 10. Would a methanol FFV Ram 2500 be less likely to need federal subsidies to be competitive than a CNG Ram 2500?

Answer. Government incentives for alternative fuels should be technology and fuel neutral so that one alternative fuel is not unfairly advantaged over others. To compete fairly with conventional gasoline-powered vehicles, any alternative fuel vehicle, including a methanol FFV, would likely need some form of government incentive. However, government incentives for methanol would likely be ineffectual if methanol fuel is not readily available in the marketplace.

I understand that between 2005 and 2011 China increased its methanol production capacity from 1.5 billion gallons a year to 15.5 billion gallons and they are already blending around 15% methanol in its automotive fuel. 26 of China's mainland 30 provinces have carried out testing and demonstrations of methanol fuel and methanol fuel vehicles. Chinese automakers like Cherry, Geely, Shanghai Automotive, andMaple have rolled out cars that can run on M100 or M85.

Question 11. Do you believe U.S. automakers will soon have to offer methanol FFVs cars in order to stay competitive in the Chinese market?

Answer. Chrysler is not aware of any immediate plans by China's domestic auto industry to transition to methanol fuel other than as a potential gasoline extender in low level blends.

Question 12. If the Chinese government requires new light duty vehicles to be capable of running on methanol, how would Chrysler respond?

Answer. Chrysler has not evaluated the potential impact if the Chinese government were to require new light-duty vehicles to be capable of running on methanol. If that were to occur, Chrysler would have to evaluate whether building vehicles to comply with such methanol requirements was commercially practicable.

RESPONSES OF DAVID L. GREENE TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. In your testimony you mentioned the concept of a technology-neutral "feebates" policy that would naturally incentivize alternative fuels and greater efficiency in the use of existing fuels. Please describe how such a policy would operate and what you would expect the effects of a feebates policy would be on natural gas and other types of vehicles.

Answer. Feebates are a technology-neutral fiscal policy that can be used to internalize external costs as well as address other market shortcomings. A feebate system consists of a performance benchmark(s) and a feebate rate. Benchmarks can be a single value, vary by type of vehicle or be a function of vehicle attributes, such as a vehicle's footprint, just as the current fuel economy and emission standards are. For example, one benchmark might be petroleum consumption per vehicle mile (for example, 0.03 gallons/mile) and the rate might be chosen to reflect the marginal social costs of oil dependence (for example, $500 per 0.01 gallons per mile). In this example, a new vehicle rated at 25 miles per gallon (0.04 gallons per mile) would pay a fee at time of sale of ($500/0.01gal/mi)X(0.03-0.04) = -$500, while a vehicle rated at 50 miles per gallon would receive a rebate of ($500/0.01gal/mi)X(0.03-0.02) = $500 (fees are represented as negative numbers, rebates as positive). A feebate system could be based on more than one factor. For example, the feebate might be calculated as a sum of a petroleum component and a carbon dioxide emissions component. Suppose the benchmark were set at 266 g/mi and the feebate rate for carbon dioxide at $10/g/mi. A vehicle getting 50 miles per gallon (0.02 gal/mi) and emitting 177 gm/mi of carbon dioxide would receive a total rebate of ($500/0.01gal/mi)X(0.03-0.02) + ($10/g/mi)X(266-177) = $500 + $890 = $1390.

Natural gas vehicles would likely benefit significantly from the feebate system described above because they do not consume petroleum. Assume for simplicity that the feebate system were based on tank-to-wheels petroleum use and tailpipe carbon dioxide emissions. The natural gas vehicle (with an energy efficiency of 0.03 gallons of gasoline equivalent energy per mile) would have no petroleum consumption and about 20% lower carbon dioxide emissions. Its feebate would be: ($500/0.01gal/mi)X(0.03-0.00) + ($10/g/mi)X(266-142) = $1,500 + $1,240 = $2,740, almost twice that of an equally energy efficient gasoline vehicle.

Question 2. There are numerous ways that natural gas could be used in transportation, both directly and indirectly. All of them would seem to offer different levels of economic and environmental benefit. You testified that an electric vehicle charged off energy generated at a natural gas power plant could go about twice the distance of a natural gas vehicle powered off the same amount of natural gas. Could you please evaluate the environmental benefits in terms of greenhouse gas emissions and non-greenhouse gas emissions as well as the gasoline displacement for this same scenario?

Answer. Argonne National Laboratory's GREET model (ANL, 2012) can provide answers to questions 2 and 3 based on comparable vehicles. The GREET model esti-

mates used to produce figures 1-3 are based on current technology. Future technologies could change the results for both vehicles and upstream activities. In addition, natural gas powered internal combustion engine vehicles and battery electric vehicles are not entirely comparable due to the shorter range and longer recharging time of the battery electric vehicle. Setting that difference aside, the following calculations are based on a typical, new U.S. passenger car. Figure 1* shows estimated well-to-wheel energy use by vehicle propulsion technology. The well-to-wheel energy use for a dedicated CNG vehicle is 6,079 Btu/mile, 73% more than an electric vehicle (EV) using electricity produced from the average US grid sources. The energy use of a Bi-fuel, CNG and gasoline vehicle is 6,346, 80% higher than the EV using grid-average electricity. Despite the fact that, in the U.S. electricity is produced from natural gas with an average efficiency of 42% while the overall grid average energy efficiency is only 35%, the GREET model estimates that well-to-wheels energy use per mile would be somewhat higher for an EV using electricity produced entirely from natural gas. A dedicated CNG vehicle is estimated to use 62% more energy per mile than a comparable EV using electricity produced from natural gas.

The greenhouse gas emissions of the two propulsion systems are strongly correlated with their energy use if the U.S. average grid is assumed to be the source of electricity (Figure 2). Electricity generation from natural gas produces about 25% fewer carbon dioxide emissions per kWh than the average U.S. grid. Even considering that methane leakage per kWh would likely be somewhat higher for electricity produced from natural gas, an electric vehicle using electricity produced with natural gas would likely produce about 60% of the well-to-wheel GHG emissions of a CNG vehicle.

Neither the CNG nor the electric vehicle use gasoline directly, but the GREET well-to-wheels analysis shows that both pathways consume negligible quantities (<1% of total energy) of petroleum for such activities as transporting feedstocks and vehicle lubrication. The GREET model estimates are per vehicle mile. It is not certain that the two vehicle types would displace the same number of gasoline vehicle miles. The empirical evidence at present is of limited usefulness because neither vehicle type is widely used by the public.

Other pollutant emissions are generally higher for the EV using U.S. grid electricity (Figure 3). Exceptions are volatile organic compounds (VOC) and carbon monoxide (CO), where the CNG vehicle's emissions are substantially higher. The EV using electricity generated from natural gas has the lowest pollutant emissions of large particulates (PM10), fine particulates (PM2.5) and oxides of nitrogen (NOx) and sulfur (SOx). Well-to-wheels, the FCV using hydrogen from natural gas produces more PM10, PM2.5 and SOx than the CNG vehicle but fewer emissions of VOCs, CO and NOx.

Question 3. Along similar lines as question 2, natural gas can be reformed into hydrogen and used in a fuel cell or processed to make methanol or ethanol which can be used directly as alternative fuels. Can you please compare the distance a consumer car could travel on each of these fuels as well as compressed natural gas given an equivalent amount of natural gas for each? How would the emissions for each technology compare to the others? And how much gasoline would be displaced in each case?

Answer. Again using the GREET model results shown in figure 1, a fuel cell vehicle using hydrogen made by distributed reforming of natural gas could travel 40% to 50% farther on a given amount of natural gas than a vehicle powered by natural gas in an internal combustion engine, and 67% to 75% farther than a vehicle powered by methanol produced from natural gas. Since methanol can be produced from natural gas more energy efficiently than ethanol, the results for a vehicle powered by ethanol from natural gas would be less favorable. The well-to-wheel greenhouse gas emissions of vehicles burning natural gas in internal combustion engines are 40% to 50% higher than those of a hydrogen fuel cell vehicle using hydrogen produced from natural gas (figure 2). The natural gas powered ICE vehicles and the hydrogen fuel cell vehicles both use negligible amounts of petroleum on a well-to-wheels basis, would be likely to be driven an equal number of miles, and would displace 99% of the petroleum used by a conventional gasoline vehicle.

Question 4. In your written testimony you noted that, over time, you expected natural gas prices to rise to the level of the world price for LNG adjusted for costs of liquefaction and transport. Is this because, in your view, the United States will inevitably export significant amounts of LNG, or are there other reasons that such a price adjustment will occur?

Answer. I do believe that if our shale gas resources are produced as projected by the Energy Information Administration's 2012 Annual Energy Outlook, the U.S. will

*All figures have been retained in committee files.

export significant amounts of natural gas. The 2012 AEO Reference Case, for example, projects that the U.S. will become a net exporter of natural gas by 2025 and will have net exports of 1.4 TCF by 2035. This will create the option, in at least some regions, to sell gas domestically or to export it. Given this option, the price of domestic gas should rise to approximately the world FOB price of LNG, minus the cost of transport and liquefaction. However, natural gas and other energy sources can be substituted in other areas, as well, including electricity generation, industrial uses, home heating and even transport. Because of these opportunities for substitution, it is highly unlikely that the current price advantage of natural gas will continue for decades into the future. Contrary to the EIA's projections, I do not believe that markets will tolerate a $15/mmBtu price differential between gas and oil for more than a few years at the most (figure 4). At these prices market forces will encourage oil production, discourage gas production and encourage alternative uses for natural gas until the price gap is substantially narrowed. Oil prices are likely to be lower, at times, than the EIA projection shown in figure 1 and natural gas prices are likely to be higher.

RESPONSES OF DAVID L. GREENE TO QUESTIONS FROM SENATOR CANTWELL

The seminal Massachusetts Institute of Technology Institute report entitled "The Future of Natural Gas 2011" found that "methanol could be used in tri-flexible-fuel, light-duty (and heavy-duty) vehicles in a manner similar to present ethanol-gasoline flex fuel vehicles, with modest incremental vehicle cost. These tri-flex-fuel vehicles could be operated on a wide range of mixtures of methanol, ethanol and gasoline. For long distance driving, gasoline could be used in the flex-fuel engine to maximize range. Present ethanol-gasoline flex-fuel vehicles in the U.S. are sold at the same price as their gasoline counterparts. Adding methanol capability to a factory 85% ethanol blend (E85) vehicle, to create tri-flex fuel capability, would require an air/fuel mixture control to accommodate an expanded fuel/air range with addition of an alcohol sensor and would result in an extra cost of $100 to $200, most likely at the lower end of that range with sufficient production."

Question 1. Do you generally agree with MIT's conclusions?

Answer. Yes, I agree with the MIT study's conclusions about tri-flex-fuel technology and its costs. Although FFVs are sold at the same price as their gasoline counterparts, it is my opinion that they cost $50 to $100 more to manufacture. Still, the extra cost of tri-flex-fuel vehicles is likely to be in the range of $100 to $200.

Through the Renewable Fuel Standard, Congress has called for the steady increase of biofuels in the transportation sector through 2022. But today, with virtually every gallon of gasoline in America containing ten percent ethanol, coupled with very little growth in gasoline consumption, there is effectively no way to consume the additional gallons of biofuels required to be produced by the RFS.

To introduce more biofuels into the transportation sector, it seems like more vehicles capable of running higher alcohol blends and the infrastructure to deliver higher blend fuels will be needed. I note from your testimony that you do not believe that the infrastructure for introducing natural gas into the transportation sector makes sense.

Question 2. Would you support building out the infrastructure for fueling flex fuel vehicles so that they could be fueled with natural gas derived methanol?

Answer. First, I would like to clarify my comments about natural gas infrastructure. I do not believe it would be wise to deploy a large scale (by which I mean nationwide or nearly nationwide) natural gas refueling infrastructure because of the very modest or possibly negligible fuel cycle greenhouse gas benefits of natural gas as a transportation fuel. It is my opinion that it would take two decades or more to build up such an infrastructure and to sell the numbers of natural gas vehicles necessary to make it economically viable. By that time, we would need to begin dismantling it in order to reduce greenhouse gas emissions from transportation as part of an overall strategy to reduce the impacts of climate change. On a smaller scale, specialized natural gas infrastructure for transportation vehicles could be economical and contribute to national energy security without producing an unacceptable quantity of greenhouse gas emissions. For example, the MIT study's suggestion to replace 5% of US oil consumption (approximately 1 mmbd) with 2 TCF of natural gas use in transportation is ambitious and a reasonable compromise between energy security and mitigation of climate change. Likewise, the Energy Information Administration's analysis of the potential for high levels of future LNG use by heavy duty vehicles also proposes an ambitious but limited transition to natural gas use by these vehicles (1.87 quads, or somewhat less than 1 mmbd of petroleum displacement). As the MIT study also notes, the GHG emissions from using natural gas derived methanol, including full fuel cycle emissions of methane, could be somewhat

higher than those of gasoline. Increased natural gas use in transportation will have unambiguous energy security benefits but will do little, if anything, to help achieve GHG mitigation unless it is used indirectly by electric or hydrogen fuel cell vehicles. In my opinion, deployment of a CNG, LNG, methanol or flex-fueling infrastructure in special applications where it could be economical, would be beneficial to national energy security at an acceptable cost in increased GHG emissions. A full-scale, nationwide deployment of vehicles and refueling infrastructure, in my opinion, would not.

I would also like to modify my response to a question about the desirability of using federal funds to subsidize natural gas refueling infrastructure. Given that the value of reducing petroleum dependence is not fully reflected in the price of petroleum or petroleum-powered vehicles, subsidization of natural gas vehicles and natural gas refueling infrastructure to reflect the value of reducing the nation's dependence on petroleum is justified. Existing incentives for vehicles that do not use petroleum should be taken into account in considering how much should be spent on infrastructure.

Question 3. Does the ability to substitute various fuels and fuel sources in Flex-Fuel Vehicles (FFVs) make methanol from natural gas a less risky investment proposition?

Answer. There would likely be no risk for FFV owners but substantial risk for fuel providers. Consumers' choices among fuels for fuel flexible vehicles are likely to be highly sensitive to the prices of the fuels and motorists could easily switch from one fuel to another as prices changed. The range the fuels will provide is likely to be their principal difference. However, the prices of the fuel options are likely to be both correlated and volatile, as the prices of gasoline and fuel ethanol have been. High oil prices will benefit investments in methanol infrastructure but low oil prices could make the investments unprofitable. If oil prices decrease significantly in the future, investments in methanol production and refueling infrastructure could become uneconomical.

APPENDIX II

Additional Material Submitted for the Record

PREPARED STATEMENT OF GREGORY A. DOLAN, ACTING CEO, METHANOL INSTITUTE

Mr. Chairman, thank you for providing an opportunity to submit testimony on behalf of the Methanol Institute. My name is Gregory Dolan, and I am the Acting CEO for the global trade association that represents methanol producers, distributors and related technology companies around the world. The United States is currently reliving an all-too-familiar experience with sustained high gasoline prices causing us to seek alternatives to satisfy our growing energy needs. Energy drives commerce, and can fuel our economic recovery, but the current price situation is putting an unbearable burden on American families and businesses.

My testimony here focuses on the global experience with methanol fuels, and offer some insight into how the U.S. can once again regain its position as a leader in transportation innovation.

In the late 1970's, when high gasoline prices driven by instability in the Middle East led to long lines at gas stations, our country began to explore new alternatives in earnest. At that time in California, the state government looked at the range of alternative fuels that could reduce the economic burden of oil and also provide environmental benefits for consumers. California determined that methanol offered the best range of benefits. They launched the nation's first large-scale alternative fuel demonstration program placing nearly 18,000 methanol fueled vehicles onto their roads and establishing a network of one hundred methanol fueling stations. America was leading the way in transportation innovation with the methanol experiment.

Methanol is the most basic form of alcohol, is naturally occurring, and is everpresent in our environment. Commercially, methanol can be made from anything that is, or ever was, a plant—meaning it is made from natural gas and coal, but it is also made from forest thinnings, biomass, industrial and municipal solid waste, and even CO_2 itself. We have members around the globe that are actively producing these second generation biofuels, at commercial scale. Worldwide most methanol is made from the steam reformation of natural gas, a mature production process that is much more efficient and economical than other "gas-to-liquid" transportation fuels such as Fischer-Tropsch diesel. Global methanol demand exceeds 15 billion gallons per year, while generating $35 billion in economic activity and 100,000 jobs.

California did not only choose methanol for the wide availability of different feedstocks to produce it, they also selected methanol for its low-cost and excellent performance. With its high octane rating and efficient burning performance, methanol is most often associated with motor racing in the United States. The low cost of methanol is truly the impressive feature though. For the past five years, the wholesale cost of methanol has ranged from $1.05 to $1.15 per gallon. If you were to sell methanol fuel as M-85 at the pump today, including all distribution, taxes and retail mark up, the 15% gasoline—and accounting for the difference in energy density—consumers would pay $3.00 a gallon without any incentives; more than $0.40 cheaper than the national average of $3.44 for a gallon of regular gasoline (and more than $1.00 a gallon less than the AAA quoted price of $4.13 for E-85 ethanol fuel blends). That is over $750 in savings for the average household every year—almost 8% of a minimum wage earners annual income, a group that is hit hardest by fluctuations in energy prices.

California's experiment continued for a number of years, but ultimately more powerful interests asserted themselves in the transportation market and prices for gasoline were brought back down towards historic norms, and consumers and governments quickly forgot about the stinging pains of high prices and continued business as usual. The question that is on everyone's mind today is ultimately, how do we implement meaningful long-term change that will have a substantive impact on our dependence on foreign oil, help reduce costs at the pump, and be a bridge to the next generation of energy innovation?

Other countries are answering that question by taking on the methanol experiment and implementing it on a much larger scale. In China for example, a country that does not have extensive liquid fuel holdings, methanol makes up about 8% of their transportation fuel pool—and they use domestic feedstocks to meet that demand. The Chinese have buses, taxis, fleets, and passenger vehicles on the road that are running on M-15, M-85 and even M-100 fuel. China's powerful National Development and Reform Commission considers coal-based methanol to be a strategic transportation fuel. Between 2005 and 2011, China increased its methanol production capacity from 1.5 billion gallons a year to 15.5 billion gallons.

Israel is also building from America's innovation, and is currently launching a pilot program for methanol fueled vehicles to take advantage of new natural gas finds in the region. Brazil has often employed methanol to help extend the pool of ethanol produced from sugar cane. The European Union has in place fuel specifications that allow for low-level methanol blending. And we are seeing methanol fuel programs developing in Trinidad & Tobago, Denmark, Iceland, Australia, Malaysia, even in Pakistan and Iran.

There are no technical hurdles to the use of methanol as an alternative fuel. Methanol—like ethanol—is slightly more corrosive than gasoline, which means we need to use alcohol compatible materials in fuel-wetted car parts. Additionally, today's modern cars employ computer technology that recognizes the oxygen content of the fuel and adjusts the engine timing accordingly, and can be modified to recognize varying levels of mixed alcohol fuels.

Flexible fuel vehicles or "FFV's" are often interpreted as some wholly new technology, or an entirely different vehicle. That is not the case. To create a truly flexible fuel vehicle that can operate on methanol, ethanol, gasoline, and most other liquid fuels, costs about $150. That's about 0.005% of the $30,000 sticker price for the average new car, and consumers could recoup that cost difference in about three months from methanol fuel savings. Everything about the vehicle is the same, and the transition would be practically invisible to the consumer—except when they pull up to the pump to fill their tank, where they would truly have fuel choice.

By comparison, the cost for a compressed natural gas-capable Honda Civic is about $6,000 more than its gasoline counter-part, meaning the payback period for the consumer in fuel savings would be measured in years. In 13 years of production, Honda has only sold 13,000 CNG-Civics, while the number of flexible fuel vehicles on U.S. highways is approaching 12 million. Vehicle conversion costs are even higher, with a price tag of $13,500 to provide a 13-gasoline gallon equivalent natural gas fuel capacity to a Ford Crown Victoria, and $18,500 for a Ford F150 pick-up truck. Compressed and liquefied natural gas works well in bus and long-haul truck fleets; it is not a solution for the passenger car fleet.

The current fleet of FFV's that are on the road today are warranted to run on ethanol only, and they are facing the classic chicken-and-egg conundrum. With a limited number of vehicles on the road today, gas stations are hesitant to put in pumps. Likewise, automakers are also hesitant to produce FFV's claiming a low availability of refueling stations.

Congress has a chance to act, to break the chicken-and-the-egg cycle and take a critical step that costs the taxpayers nothing, but can serve as a bridge forward in energy innovation. That step would be to raise the standards for new cars on the road to ensure that they are compatible with multiple types of fuel.

When consumers can truly choose between fuel options in their vehicle, then the monopoly that oil currently maintains in transportation can be effectively broken. This will not only enable emerging technologies and fuel options to permeate the market, but will also force gasoline to compete at the pump, dollar for dollar, and drastically reduce the cost of gasoline itself as well. Today only about 3.5% of vehicles on the road are ethanol-only FFV's. With a much larger portion of vehicles capable of using alternative fuels, then fueling station owners will have the economic incentive to install or upgrade pumps. The first stations to install these pumps will be able to command considerable margins for the fuel, while still saving consumers money. And stations dispensing liquid alcohol fuels cost a small fraction of the fueling equipment needed to compress natural gas to 3600 psi and pump it into a fuel cylinder.

The United States is currently experiencing a boom in natural gas production that is creating sustainably low prices for this powerful energy source. In Beaumont, Texas, a methanol plant that had been mothballed for years due to high natural gas prices is now coming back to life. LyondellBassell has announced that it will reopen a methanol plant next year in Channelview, Texas, Celanese has also announced plans to restart a methanol plant in Clear Lake, Texas, and Methanex is moving an idled methanol plant in Chile to Louisiana. Low natural gas prices are leading a resurgence of the domestic methanol industry.

In a study published in 2010, researchers at the Massachusetts Institute of Technology concluded that methanol was the 'liquid fuel most efficiently and inexpensively produced from natural gas,' and they recommended methanol as the most effective way to integrate natural gas into our transportation economy.

Your colleagues, Senators Maria Cantwell and Richard Lugar, have introduced legislation that would take the first step in our path away from oil dependency. They have introduced the Open Fuels Standard Act of 2011 (S. 1603), which has been referred to the Commerce, Science and Transportation Committee for consideration. A companion bill has been introduced by Congressmen John Shimkus and Eliot Engel in the House (H.R. 1687). The OFS would require that an increasing percentage of vehicles sold in the U.S. be capable of running on alternative fuels in addition to, or replacement of, gasoline. This means that electric vehicles, natural gas vehicles, fuel cells, hydrogen, biodiesel, and of course alcohol FFV's would all qualify under this standard.

This bill is about competition and economics; it is not about dictating what alternatives should be moved forward. Our addiction to oil produces numerous negative consequences to our health, our economy, and our national security. The Open Fuels Standard Act would ensure that new vehicles on the road are not dependent on oil-derived gasoline and are not aiding the continued monopoly and hold oil has on our economy. As former Pennsylvania Governor and Homeland Security Secretary Tom Ridge and former Secretary of Transportation Mary Peters wrote in the New York Times: "If Congress were to enact an open fuel standard that required new cars to be warranted to run on all-alcohol fuels, including methanol, natural gas could compete with oil in the liquid fuels market."

The OFS has another potentially significant benefit. Researchers at Ford recently published a paper noting that the octane rating of the U.S. fuel pool has not increased since the 1970s, and suggesting that the addition of a mid-range alcohol fuel blend (20-30% alcohol, up from today's 10% ethanol) would facilitate a four to seven point increase in the octane rating of U.S. fuels. With this octane boost, automakers could increase engine compression ratios and turbocharging to significantly increase vehicle efficiency, and facilitate compliance with not only the upcoming increased corporate average fuel economy ratings but also the renewable fuel standard targets.

Innovation is within our reach, and the role of government has always been to foster innovation and technology, not direct it. By embracing choice as offered by the Open Fuels Standard Act, Congress has the chance to take action that will help serve as a bridge to new technologies and new solutions. At no cost to the federal government, adoption of the OFS would provide a clear signal that the U.S. is serious about kicking the oil habit.

America—like other countries—is currently experiencing a renewed interest in methanol as a sustainable energy source, and we encourage you to continue to foster the innovation that America began more than three decades ago so that we can reclaim our role as the leading innovators in alternative transportation fuels.

Thank you for providing an opportunity for the Methanol Institute to contribute our thoughts on this critical issue.

PREPARED STATEMENT OF AMERICAN HONDA MOTOR COMPANY, INC.

Introduction

Honda appreciates the opportunity to submit written testimony on the subject of the July 24, 2012 Senate Energy Committee hearing entitled, "Exploring Natural Gas as a Transportation Fuel." Honda has extensive experience with light duty natural gas passenger vehicles and looks forward to sharing some of our experience with the Committee.

First produced in Ohio beginning in 1998, the Civic Natural Gas is the only mass-produced, dedicated compressed natural gas (CNG) passenger vehicle built and sold for the consumer market in the U.S. It was the world's first CNG vehicle to be built entirely on the same assembly line as its gasoline counterparts, ensuring build quality without compromise. The production of the vehicle recently shifted to Honda's newest manufacturing facility in Greensburg, Indiana. Honda has sold more than 13,000 Civic Natural Gas vehicles. While our sales in the first decade of the vehicle were targeted primarily to fleets, over 80 percent of our sales today are to individual retail consumers.

This year, Honda has significantly increased production and is expanding its fleet and retail dealership network from 71 dealers in four states to approximately 200 dealers in 37 states (see Appendix A for a full list of states). The increased availability of the Civic Natural Gas helps bring lower cost and inherently clean-burning

natural gas vehicles to an even broader audience while also supporting diversity in transportation energy resources.

History

Honda first started to research the possibility of a CNG passenger vehicle in the mid-1990s in response to two concerns: reducing emissions and energy security. California aggressively reduced smog emissions with their Low Emission Vehicle (LEV) regulations. At the time, no gasoline-powered cars were clean enough to meet the new, lower standards, and the general industry consensus was that only electric vehicles could achieve zero or near-zero emission levels. Honda pursued other options, such as alternative fuels, mainly to see how close an internal combustion engine could get to zero emissions. Additionally, the Energy Policy Act of 1992, developed in response to the first Gulf War, encouraged private and public fleets to adopt alternative fuel vehicles for their home-based, centrally refueled fleets. Today's Civic Natural Gas is the product of both of those efforts.

We chose the Civic as the optimal platform because many private and public fleets were focused on compact cars with low operating costs, and among the vehicles made by Honda, the Civic was the obvious choice to fit that need. Additionally, the highly efficient Civic platform would enable us to deliver a vehicle with exceptional range—an important value for any alterative fuel vehicle with limited refueling infrastructure. We were able to achieve over 200 miles range and the cleanest Internal Combustion Engine (ICE) ever tested by the US EPA.

Dedicated vs. Bi-Fuel Vehicle

Honda offers a dedicated natural gas vehicle because it allows for manufacturing and production efficiencies, and guarantees 100 percent petroleum displacement. Only a dedicated vehicle can ensure the use of the alternative fuel, thus achieving environmental and energy policy goals, including reduced emissions, reduced CO_2, energy diversity, and energy security. Additionally, the dedicated vehicle design allows Honda to optimize the engine design for natural gas, assuring maximum range, an essential attribute.

Environmental Benefits

The Civic Natural Gas is the only vehicle certified by the Environmental Protection Agency (EPA) to meet both Federal Tier 2 Bin 2 and Inherently Low Emission Vehicle (ILEV) zero evaporative emission certification standards. EPA has said that it is the cleanest internal combustion vehicle it ever tested. In 2011, it was named "America's Greenest Vehicle" for the eighth time by the American Council for an Energy-Efficient Economy (ACEEE), and Green Car Journal bestowed its Green Car of the Yearr award on the Civic Natural Gas in 2012. The Civic Natural Gas has greenhouse gas emissions that are approximately 20 percent lower than a similar gasoline powered Civic, due to the reduced carbon content of methane compared to gasoline.

Safety

Despite the differences in fuel properties and fuel storage, safety concerns have been fully addressed in the Civic Natural Gas. The Civic Natural Gas is Federal Motor Vehicle Safety Standard-tested as a natural gas vehicle, and has achieved a 5-Star overall safety rating by the National Highway Transportation Safety Administration (NHTSA). It also has a designation as an Insurance Institute for Highway Safety (IIHS) Top Safety Pick.

Consumer Benefits

From a consumer point of view, the driving experience of a dedicated NGV is superior to a bi-fuel NGV. The engine of the Civic Natural Gas is designed specifically for the combustion properties of natural gas, and incorporates unique features to operate exclusively on compressed natural gas. There are approximately 210 parts on the Civic NGV that are unique to this model. Some of those key differences in vehicle components and design include:

- A compressed natural gas tank that is made from aluminum and military grade reinforced carbon fiber, and stores eight gasoline gallons equivalent (GGE) of CNG at 3600 psi.
- The compression ratio is increased to 12.7:1, compared to 10.6:1 in the Civic sedan's gasoline-powered engine.
- Exclusive fuel injectors, intake and exhaust valves, and valve seats are designed to accommodate the unique properties of natural gas.
- Stronger connecting rods and crankshaft, as well as special pistons that are used to accommodate both the higher compression ratio of the engine and higher octane rating of the fuel.

As a result, dedicated NGVs, when compared to bi-fuel vehicles, deliver superior driving performance, higher fuel economy, lower emissions, and better durability.

One of the major selling points of the Civic Natural Gas in particular is that the driving dynamics are virtually identical to the gasoline Civic. The Civic Natural Gas has a fuel economy of 27 MPGge city/38 MPGge highway/31 MPGge combined, while the gasoline-powered Civic has a very comparable fuel economy of 28 MPG city/39 MPG highway/32 MPG combined. The horsepower on the Civic Natural Gas is 110, while the gasoline-powered Civic is 140. And like the gasoline version, refueling takes less than five minutes. These attributes make the likelihood of consumer acceptance high.

Another benefit that excites our customers is the possibility of home refueling appliances that tap into the existing natural gas line at home. Home refueling is extremely convenient and economical. Honda has supported the development, sales and distribution of such an appliance (FuelMaker's PHILLT™[1]) and believes a new, lower cost yet more durable home-refueling option would accelerate consumer sales of NGVs. We are pleased to see the renewed interest and development of home refueling devices by GE and other companies.

From the fueling perspective, natural gas appeals directly to consumers' pocketbooks. A typical new Civic will consume 500 gallons of gasoline: 15,000 miles/year at an average of 30 mpg. If a consumer switches from gasoline to CNG, and achieves approximately 30 MPGge, then the savings will be $500/year for each $1/gallon savings. Compressed natural gas often costs as much as $3 less per GGE than gasoline, and on average in the largest markets about $2 less per GGE, for savings ranging from $1,000 to $1,500 per year.

Honda's Approach to Alternative Technology Vehicles

In addition to the Civic Natural Gas, Honda is a leader in the development of leading-edge technologies to improve fuel efficiency and displace petroleum, including vehicles powered by advanced gasoline engines, gasoline-electric hybrid, plug-in hybrid electric, battery-electric and hydrogen fuel cell-electric vehicles. Honda believes this comprehensive portfolio approach is the right way to address our nation's near-and long-term transportation needs.

Natural Gas and Fuel Cell Electric Vehicles

Honda fully supports the use of natural gas as a transportation fuel in internal combustion engines. But the newly developed abundance of domestic natural gas offers another significant opportunity for advancing its use in transportation—the fuel cell electric vehicle (FCEV). Natural gas is the most widely used fuel stock today to produce hydrogen, which offers zero emission transportation while cutting CO_2 emissions 60-plus percent on a well-to-wheel basis. As such, Honda supports revising the fuel tax credit to include natural gas use as a feedstock for hydrogen.

While Honda firmly believes that CNG vehicles should play a strong role in today's consumer vehicle mix, fuel cell electric vehicles hold the most promise in the long-run to displace petroleum across the transportation sector, from light-duty passenger vehicles of all sizes to buses and heavy-duty trucks. Our investment in the Civic Natural Gas has helped in the design of our fuel cell-electric vehicle, the FCX Clarity, in many ways, including the compressed gas fuel tank.

Challenges

The greatest challenge to natural gas vehicles for both fleet and retail consumers is the lack of a consumer-friendly CNG fueling infrastructure network. As with any alternative fuel vehicle, consumers must have the confidence that they will be able to refuel wherever necessary. Although there are over 1000 natural gas stations online in the U.S. today, only half of those are available to the public, mainly in California, New York, Utah, and Oklahoma, and many are designed primarily to serve fleet operations rather than retail consumers. We also see promising public infrastructure growth in major metropolitan areas like Denver, Atlanta, Detroit, and Chicago. Building the CNG refueling infrastructure contributes directly to the future success of expanding hydrogen refueling infrastructure, by expanding the supplier base for compressors, dispensers, and gas storage tubes, as well as the knowledge base of constructors who can build and operate those stations.

Another challenge is the incremental cost of the Civic Natural Gas as compared to its gasoline-powered counterpart. The CNG tank is the single most expensive

[1] In May 2009, Fuel Systems Solutions, Inc. completed the purchase of selected assets and technology for compressed natural gas refueling products manufactured by FuelMaker Corporation, including the home refueling appliance marketed under the Phil™ brand. Fuel Systems Solutions currently markets the home refueling appliance through their subsidiary company, BRC Fuelmaker.

component that differs from the gasoline-powered Civic. Currently, the Civic NGV incremental cost is $6,935.[2]

Incentives

Honda supports technology-neutral, performance-based incentives at the federal, state, and local levels, and as a general philosophy, Honda believes that incentives should be proportionate to their social values. Alternative fuel vehicle incentives should correspond to the amount of petroleum displaced. Therefore, dedicated alternative fuel vehicles should receive the highest incentives. Historically, natural gas vehicles have benefited from incentives in four key areas: a vehicle tax credit for consumers; an infrastructure tax credit for fuel producers; a fuel credit for the alternative fuel; and a production tax credit for manufacturing in the U.S. Honda supports such a comprehensive type of approach for a limited but certain period of time that addresses the various market challenges. Additionally, non-financial incentives such as single-occupant access to High Occupancy Vehicle (HOV) lanes, free access to toll lanes, and free parking have proven effective at attracting customers.

Honda also supports the inclusion of natural gas vehicles on EPA's list of alternative fuel vehicles receiving incentives in the 2017—2025 Corporate Average Fuel Economy (CAFE) and Greenhouse Gas standards. These incentives are designed to support powertrain/fuel combinations that have the potential to lower GHG emissions but have near-term market barriers to overcome, such as infrastructure and market acceptance.

In its proposed GHG rulemaking for 2017—2025, EPA created two categories of incentives for alternative fuel vehicles: dedicated (e.g., electric vehicles and fuel cell electric vehicles) and bi-fuel (e.g., plug-in hybrid electric vehicles). Honda believes that dedicated natural gas vehicles should receive the higher dedicated vehicle multiplier (2.0), and bi-fuel natural gas vehicles should receive the lower bi-fuel multiplier (1.6). The application of GHG multipliers is a low or no cost policy tool that can encourage automakers to more aggressively bring these vehicles to market, thus bringing the cost of the technology down and maximizing the societal benefits of using natural gas.

In May 2012, 13 states, led by the governors from Oklahoma and Colorado, joined together to undertake an initiative to expand the CNG vehicle footprint in their state fleets. A formal request for proposals (RFP) from the states and solicitation offers from auto dealers are expected in the coming months. This is an excellent example of government acting to send a clear signal to both automakers and fuel producers that there will be a market for their products. (See Appendix B for a full list of states.)

Conclusion

Honda strongly supports light duty passenger NGVs as one of several promising technologies to displace petroleum, reduce smog, and cut CO_2. Dedicated NGVs are 100% effective in achieving that goal. Honda has shown a long term commitment to the technology and to finding ways to expand its application; first in fleets and now with a focus on individual customers. We also believe that natural gas vehicle development is a major contributor to the growth of the FCEV market worldwide.

Infrastructure development is a challenge but with greater efforts being undertaken, such as those led by the governors of Colorado and Oklahoma, Honda is hopeful infrastructure development can proceed on a parallel track with vehicle deployment. The deployment of other infrastructure options, such as home refueling, could accelerate this effort.

Appendix—A, States to sell the Civic Natural Gas to retail customers

Alaska, Alabama, Arkansas, Arizona, California, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Louisiana, Massachusetts, Maryland, Michigan, Minnesota, Missouri, North Carolina, Nebraska, New Hampshire, New Jersey, New Mexico, Nevada, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, Wisconsin.

Appendix—B, States looking to expand their CNG fleet footprint

Colorado, Kentucky, Louisiana, Maine, Mississippi, New Mexico, Ohio, Oklahoma, Pennsylvania, Texas, Utah, West Virginia, and Wyoming.

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[2] For comparison purposes, the Civic Natural Gas is a model that is between—both feature-wise and pricing—the gasoline-powered Civic LX and the gasoline-powered Civic EX.

STATEMENT OF THE UNITED STATES ENERGY SECURITY COUNCIL

Mr. Chairman, members of the Committee, the United States Energy Security Council is America's highest level extra-governmental group dedicated to introducing competition into the transportation fuel sector. Members of the Council include former Secretaries of Defense, State, Interior, Transportation, Homeland Security, Agriculture, Navy and Air Force, Former Chairman of the Fed, three former National Security Advisors, Directors of Central Intelligence and National Reconnaissance Office, U.S. Senators, flag officers, prominent business leaders and a Nobel Laureate. The Council holds that the current changes in energy markets present great challenges to the U.S. but at the same time open unique opportunities that, if correctly exploited, could significantly strengthen America's strategic posture and bring about a fundamental and favorable shift in the world's economic balance of power. The strategic importance of oil to our society is derived not from the amount of oil we import or consume but from oil's virtual monopoly over transportation fuel. This monopoly is enabled by the fact that for the most part our automobiles are blocked to fuels not made from oil. Since 2005 roughly 100 million new petroleum-only vehicles rolled onto U.S. roads, each with an average lifespan of 15 years. This means we are effectively locking ourselves to petroleum for the next two decades, with all the implications. The shale gas revolution provides a unique opportunity to transition America's transportation system from a single commodity sector to one in which consumers can arbitrage between petroleum-based fuels and natural gas-derived fuels, among others.

Immediate goal: opening the fuel market to natural gas

Less than a decade ago, natural gas prices hovered around $8 mmbtu. In May 2003, one of our members, then Federal Reserve Chairman Alan Greenspan warned in a testimony before the Congressional Joint Economic Committee that tight natural gas supplies presented "an extremely serious problem." Two years later, in a June 2005 white paper, Senator James Inhofe, then Chairman of the Senate Committee on Environment and Public Works, noted "the days of low gas prices are over, and the nation is in the midst of a very real natural gas crisis." Much has happened since, and today our natural gas predicament is not a result of lack of supply but lack of demand. Indeed we are awash with cheap natural gas. The price of U.S. natural gas has declined by about 80% between 2008 and 2012. As Rex W. Tillerson, Chairman and CEO, Exxon Mobil Corporation, a major gas producer, recently put it: "We are all losing our shirts today. [.] We're making no money. It's all in the red."

The recent shale gas revolution has disconnected prices of the oil and natural gas, two commodities whose prices traditionally tracked each other. While natural gas prices hit rock bottom, oil prices have rebounded more or less to their pre-2009 level. Shale gas is currently 34% of U.S. natural gas production and will reach 43% in 2015 and double by 2035 to 60%. But if prices remain low, the natural gas industry will have little incentive to invest in further growth and natural gas projects will be mothballed, the shale gas revolution will die in its infancy and the promise of new jobs and economic activity will fade out. However, sending a market signal that our vehicles are open to fuels made from natural gas would give the industry the certainty it needs to continue and grow this sector to the benefit of its investors and our economy writ large.

A number of automotive technologies allow us to take advantage of natural gas' low cost. One way to use natural gas in automobiles is to use it to generate electricity to charge battery operated vehicles. Plug-in-hybrid and pure electric vehicles are entering the market slowly. They are clean, cheap to operate and quiet, and in many respects their performance is superior to that of gasoline cars. Furthermore, vehicle electrification offers great flexibility. If natural gas prices were to spike, there is always coal, nuclear or renewable power to rely upon for power generation. But due to the high cost of the automotive batteries, mass market penetration of plug-in-hybrid-electric vehicles and pure electric vehicles will take a very long time. For this reason, parallel to advancing the electrification of transportation, the U.S. would best be served from a transportation fuel market open to competition from a variety of fuels that are commercial and economic today.

Projections for battery powered vehicles market penetration

Study	Projection
U.S. National Academy of Sciences (2010)	3% of sales by 2015 and 15% by 2035
Credit Suisse (2009)	7.9% of sales by 2030
U.S. Energy Information Administration (2011)	1.8% of sales in 2020 and 3.8% by 2035
IHS Global Insight (2010)	20% of sales in 2030
Roland Berger Strategy Consultants (2011)	8-10% of sales by 2020
The Boston Consulting Group, (2010)	5% of sales by 2020
Deloitte, (2010)	3.1% of sales by 2020

Another way to run cars on natural gas is to convert them to run on compressed natural gas (CNG). CNG vehicles have a dedicated fuel line and a large gas canister in the trunk. Few ready-made CNG cars are manufactured by the OEMs. The cost of converting a light-duty vehicle to CNG is expensive-roughly $10,000. At such a high incremental cost, the payback period for most Americans, even with current low natural gas prices, would be longer than the expected ownership time of the car. Payback period would only be reasonable in high mileage users (over 35,000 miles per year) such as taxis, buses, garbage trucks, etc.

The methanol option

This leaves one realistic way of opening cars to natural gas without adding thousands of dollars to the cost of the vehicle. A Massachusetts Institute of Technology (MIT) study entitled The Future of Natural Gas determined the most economical way to utilize natural gas in transportation is to convert it to the liquid fuel methanol (wood alcohol) due to low cost, mature production and vehicle technology. Our transportation system is based on liquid fuels. A flex fuel vehicle that can run on methanol (and ethanol) in addition to gasoline costs automakers about $150 more to make than a gasoline-only car. Today about 90% of the worldwide production of methanol is derived from natural gas. At today's natural gas prices methanol costs about 35 cents a gallon to produce. For the past five years the wholesale price for natural gas-derived methanol has ranged between $1.05 and $1.15 a gallon—without any subsidies. As methanol packs less energy per gallon than gasoline, to travel the same distance on M85 (a blend of 85% methanol and 15% gasoline) a consumer would pay about $3 including taxes, distribution, and retail markup to travel the same distance on methanol as on a gallon of gasoline, well below the current national average for gasoline. The MIT report points out that the production cost of natural gas conversion to methanol is 30 percent cheaper on an energy equivalent basis than conversion to diesel fuel (commonly referred to as GTL).

China is already blending 15% methanol in its automotive fuel—in China primarily made from coal—and 26 of its mainland 30 provinces have carried out testing and demonstrations of methanol fuel and methanol fuel vehicles. In Shanxi Province (Population 36 million) light duty vehicles fuel regularly with M15 without any impact on the engine, roughly 70,000 taxis were converted to run on M100 and M85, and more than 1,200 service stations offer methanol blends. The number of refueling stations offering alcohol fuel will double by 2015. Chinese automakers like Cherry, Geely, Shanghai Automotive, and Maple have rolled out cars that can run on M100 or M85 and U.S. automakers like GM and Ford will soon have to offer methanol cars in order to stay competitive in the Chinese market. Methanol is so economically attractive that illegal blending is rampant in China. Israel, which has newly discovered reserves of natural gas, has identified methanol as the most economic way to utilize its bonanza and it is now following China's footsteps, conducting a national pilot on methanol blending.

The Open Fuel Standard

Congress can break oil's virtual monopoly over transportation fuel and open the transportation sector to natural gas by enacting an Open Fuel Standard, ensuring that every new car put on the road is open to some sort of fuel competition. The cheapest way to enable fuel competition is the flex fuel car, which looks and operates exactly like a gasoline car but has a $150 set of features which enables it to run on any combination of gasoline and a variety of alcohol fuels made from natural gas, coal and biomass.

The bipartisan Open Fuel Standard Act of 2011 (S.1603) introduced in the Senate by Senators Cantwell and Lugar would ensure that cars sold in the U.S. are open

to fuel competition so drivers can compare prices per mile and make on-the-fly choices between gasoline or diesel and non-petroleum fuels. The technology neutral Open Fuel Standard would ensure no less than 50% of new automobiles in model years 2015, 2016, and 2017 and no less than 80% of new vehicles in model year 2018 and beyond would be warranted to operate on at least some non-petroleum fuels in addition to or instead of petroleum based fuels. The Open Fuel Standard would provide certainty to investors to expand nonpetroleum fuel production capacity and fueling stations to install pumps supplying economically competitive non-petroleum fuels. A companion Open Fuel Standard Act (HR 1687) was introduced in the House.

Comparison of natural gas uses in transportation: CNG vs. methanol FFV

	CNG	Methanol FFV
Vehicle platform	Extra $10,000-$15,000 to retrofit a regular gasoline car. --Honda Civic CNG $26,000 vs. $16,000 for standard version	Roughly $150 extra to the cost of an equivalent gasoline-powered car. After market conversion: $400-$1,000
Refueling infrastructure	Single pump installation: $750,000 Home refueling system: around $4,500	Single pump retrofit: $15,000-$20,000 New pump with storage tank: $60,000
Fuel cost	$2.13 for a gasoline gallon equivalent (gge) of fuel.	$3.00 per gge
Refueling time and convenience	Few minutes at the station Home refueling units: 4 hours after 50 miles of driving or 16 hours if the tank is completely empty.	Few minutes
Greenhouse gas emissions: % change vs. petroleum fuel displaced	-28%	-8% However, an FFV platform enables use of: •Cellulosic ethanol -91% •Sugar ethanol -56% •Methanol from biomass -50%
Convenience	Reduced trunk space	No change
Energy security	-No fuel flexibility -Problems in domestic supply would entail import from unfriendly sources -Reliance on domestic resource	-Full fuel flexibility: Methanol can also be made from other sources (coal, biomass) -Methanol FFV can also run on other alcohols as well as on gasoline -Many countries have potential for alcohol production.

The combination of high oil prices and low natural gas prices creates a historical opportunity for the U.S. to arbitrage between natural gas and oil in the transportation fuel market, but this cannot happen as long as cars sold in the U.S. are blocked to fuel competition. In time of fiscal tightness expensive policies involving mass subsidization are not likely to enjoy broad political support. What is needed are solutions that enable natural gas to compete against oil without burdening taxpayers with the cost and without embarking on major infrastructure changes. The Open Fuel Standard is a no subsidy approach to opening the market to natural gas fuels. We hope that this distinguished committee will give this approach serious consideration.

STATEMENT OF THE AMERICAN CHEMISTRY COUNCIL

INTRODUCTION

The American Chemistry Council (ACC[1]) commends the Senate Energy and Natural Resources Committee for holding a hearing on Natural Gas and Transportation. The natural gas market is going through many changes as new sources of supply come onto the market, and as new and growing demand markets emerge, including the use of natural gas as a transportation fuel. It is abundantly clear that these new market dynamics are creating a significant competitive advantage for American manufacturers generally, and for the U.S. chemical industry in particular. We encourage policy makers to use caution before supporting policies that may distort and disrupt this fast-changing market. Policies that may be intended to support one sector of the natural gas market may have the unintended effect of causing serious damage to other sectors of the market.

Natural gas from shale rock formations is a critical component of a comprehensive domestic energy plan that encourages the development of the entire portfolio of U.S. energy sources, including fossil fuels, renewables and energy efficiency. Access to vast new supplies of domestic shale gas, rich in the ethane needed for chemical production, is revitalizing the chemical industry and America's manufacturing base.

Natural Gas Market Fundamentals

According to the Energy Information Administration's (EIA) July 2012 Short-Term Energy Outlook, U.S. natural gas production increased by nearly 8 percent in 2011 and is expected to increase again in 2012. The U.S. is producing record amounts of natural gas and is now the largest natural gas producer in the world. EIA notes that the strong growth in production was "driven in large part" by increases in shale gas production.

Concurrent with the increase in natural gas supply, demand is increasing. U.S. natural gas consumption has increased in 2012 to nearly 70 billion cubic feet (BCF) per day, a record high. Consumption is fueled by a 21 percent increase in the use of natural gas to fuel electrical power generation. In some markets, natural gas prices have dipped below coal prices and for the first time ever, natural gas and coal-fired generation are at approximately the same level. A year ago, coal surpassed natural gas by a nearly 2:1 ratio.

Natural gas inventories remain at high levels and EIA is now projecting that inventory levels going into the winter heating season will set a new record high slightly above 4,000 BCF. As a result of strong production and bulging inventories, U.S. natural gas prices remain at "historically low levels," according to EIA. The June, 2012 Henry Hub spot price averaged 46 percent less than the June, 2011 price. Looking ahead EIA projects that U.S. natural gas prices will remain low throughout 2013.

The historically low prices for natural gas confer a significant competitive advantage for U.S. manufacturers compared to their counterparts around the world.

Importance of Natural Gas to Manufacturing

Natural gas from shale is possibly the most important domestic energy development in the last 50 years. It has huge potential for the United States. Many are

[1] ACC represents the leading companies engaged in the business of chemistry. ACC members apply the science of chemistry to make innovative products and sservices that make people's lives better, healthier and safer. ACC is committed to improved environmental, health and safety performance through Responsible Care®, common sense advicacy designed to address major public policy issues, and health and environmental research and product testing. The business of chemistry is a $720 billion enterprise and a key element of the nation's economy. It is one of the nation's largest exporters, accounting for ten cents out of every dollar in U.S. exports. Chemistry companies are among the largest investors in research and development. Safety and security have always been primary concerns of ACC members, and they have intensified their efforts, working closely with government agencies to improve security and to defend against any threat to the nation's critical infrastructure.

aware of the bright outlook for production-related jobs, but shale gas is helping to revive American manufacturing and create hundreds of thousands of jobs, leading our economic recovery and strengthening the Nation's energy security.

The business of U.S. chemistry is among America's most energy intensive manufacturing sectors. A few short years ago, in the face of high and volatile domestic natural gas prices, U.S. chemical manufacturers were at the top of the global price curve. Those high prices were forcing production and jobs to leave the country.

Today, U.S. chemical manufacturers are again leading the global industry. New investments and the jobs associated with them are increasing significantly. For example, ACC has identified more than 30 new capital investment projects announced by U.S. chemical companies. Those projects represent more than $30 billion in new investments, and will increase U.S. petrochemical manufacturing capacity by approximately one-third. Much of that new capacity is being developed to serve global markets and will give a substantial boost to U.S. exports.

The business of chemistry uses natural gas not only for heat and power at our manufacturing plants, but as the key raw material, or "feedstock" for chemistry products. Chemical products are key ingredients in 96% of all manufactured goods, including cosmetics, electronic products, pharmaceuticals and plastics. A healthy, competitive U.S. chemical industry helps make other U.S. manufacturers—those that use the products of chemistry to make other goods—more competitive as well.

ACC recently completed a report that shows the positive impacts of shale gas on eight natural gas-intensive industries (paper, chemicals, plastic & rubber products, glass, iron & steel, aluminum, foundries, and fabricated metal products). Our analysis demonstrated that the United States can expect some $121 billion in increased manufacturing output, which will generate 200,000 new, high-paying jobs. Further, we expect an additional 979,000 jobs will be created in the supply chain and elsewhere in the economy through the indirect and induced economic effects of expanded production from these eight core manufacturing industries. Thus, we should expect some 1.2 million American jobs to be generated from the effects of expanded production of natural gas in the United States.

Other Growing Markets for Natural Gas

While power generation and manufacturing are the two biggest markets for natural gas, the clear economic advantage enjoyed by natural gas is naturally attracting other sectors. A good deal of attention is focused on deploying natural gas as a transportation fuel, particularly for fleet vehicles and long-haul freight trucks (natural gas vehicles, or NGVs).

Natural gas-based transportation fuels have lower operating costs and a smaller environmental footprint than conventional transportation. On the other hand, NGVs are more expensive to buy, and the refueling infrastructure is not yet deployed to adequately serve the needs of long-haul freight trucks.

There has been considerable debate about government's role in promoting the development of the NGV market. The administration supports policies to spur deployment of NGV, primarily as a way to reduce dependence on imported oil. But does the NGV market need government incentives in order to succeed in the market? Based on dozens of buying decisions being made by vehicle operators, the anecdotal evidence suggests the NGV market is doing quite well without the help of costly new government subsidies. Consider:

- "Garbage companies will recoup the higher costs of a natural gas truck within two years through fuels savings. That's why almost 40 percent of new trash truck sold last year were natural gas trucks." Richard Kolodziej, President, Natural Gas Vehicles of America, The Morning Call, May 13, 2012.
- "According to Waste Management, 80 percent of the trucks it purchases during the next five years will be fueled by natural gas." Wall Street Journal, May 23, 2012.
- "Ford, Chrysler and GM will all have natural gas powered pickup trucks on the road this year. Those manufacturers wouldn't invest in CNG vehicles if they didn't believe that demand will continue to rise in the future." Bob Strickland, Manager of Natural Gas Transportation at Alagasco, The Birmingham News, April 26, 2012.
- "The United States could have tens of thousands of natural gas filling stations for vehicles in five years." Aubrey McClendon, Chairman of Chesapeake Energy Corporation. "He noted that the company plans to invest $1 billion over 10 years on infrastructure to support natural gas as a fuel for vehicles." Pittsburgh Tribune Review, September 8, 2011.

Policy Considerations

The U.S. natural gas market is as dynamic as it has ever been. Demand from the power sector is growing rapidly. U.S. manufacturers are taking advantage of affordable natural gas and natural gas liquids to invest billions in new capacity here in the U.S. reversing decades of decline among energy-intensive industries. Natural gas is making rapid inroads in the transportation market. On the supply side, new sources of natural gas supply are being found in shale rock formations all over the country.

In short, the natural gas market is finding its new equilibrium. It is vitally important that policymakers refrain from taking actions that would distort the rapidly changing market for natural gas.

The government should not act to artificially inflate demand for natural gas by subsidizing the purchase of natural gas vehicles, for instance. Nor should the government artificially restrict access to promising new sources of natural gas supply as it is proposing to do in its new 5 year plan to develop oil and gas reserves in the Outer Continental Shelf. If policymakers take steps to encourage demand growth in natural gas markets, it should also act to ensure that access to supply sources can also grow to keep pace with demand and prevent price volatility.

Abundant and affordable supplies of natural gas are creating an economic renaissance in the U.S. manufacturing sector and are challenging the status quo in power and transportation markets as well. Last year, the National Petroleum Council, the Congressionally-mandated advisory council to the Secretary of Energy, completed a three-year study of North American oil and gas markets and concluded there are enough natural gas resources available to meet "any demand scenario." That conclusion depends on letting the market is work without undue interference or policy-induced volatility.

STATEMENT OF AMERICA'S NATURAL GAS ALLIANCE

Good morning Chairman Bingaman, Ranking Member Murkowski, and Members of the Committee. America's Natural Gas Alliance appreciates the opportunity to express our member's views on natural gas use in transportation. ANGA is an educational and advocacy organization dedicated to increasing appreciation for the environmental, economic, and national security benefits of North American natural gas. ANGA's 30 members include many leading, North American independent natural gas exploration and production companies. Their collective natural gas output comprises approximately 40 percent of total annual U.S. natural gas production.

ANGA works to promote a policy environment that increases market-driven use of natural gas as a transportation fuel. We especially support efforts to encourage a substantial transition of fleet vehicles to natural gas through policies that encourage natural gas vehicle (NGV) conversions and original equipment manufacturer (OEM) production. ANGA also supports significant expansion of natural gas fueling infrastructure along key transportation corridors throughout North America. These targeted efforts represent the most prudent and efficient means to encourage the development of economies of scale within this market while decreasing emissions, dramatically reducing exportation of domestic capital, and advancing U.S. energy security. Similarly, ANGA is aware of the current challenges in this economic climate and the responsibility at all levels of government to be conservative in its expenditure of public funds. ANGA's efforts emphasize the importance to maintain parity among alternative transportation fuel policies.

ANGA also collaborates with the American Gas Association in the Drive Natural Gas Initiative to advance a common vision of enhancing our national energy security by promoting the development of natural gas vehicles and infrastructure throughout North America. Our joint activities focus on infrastructure development, vehicle production, marketing and education for clean transportation solutions, and targeted advocacy. Our aim is to work in a cooperative and complementary fashion with other stakeholders who share our commitment to promoting natural gas vehicles and clean, American transportation solutions.

Supply and Demand

Natural gas vehicles represent a tremendous energy security and environmental opportunity for the United States. With the advent of new technologies and the advancement of shale gas production, the United States has now surpassed Russia as

the world's top producer of natural gas, according to the EIA.[1] Indeed, in the last decade alone, the Potential Gas Committee estimates of natural gas resources have increased by more than 70 percent, almost all from shale gas. EIA estimates of natural gas resources increased by 86 percent over a three-year period. The size of the resource could increase further as exploration and technology advances continue to provide more information, something which has already been observed in Alaska, in the Gulf of Mexico, and in other newly accessed resource basins.

In addition, crude oil and natural gas prices in the U.S. have diverged since about 2009. The EIA projects this trend to continue and the gap to widen through 2035. A key reason for this is that oil is a far more fungible commodity in the global market than natural gas. Domestic natural gas prices are down primarily due to dramatically increased supply from the shale plays. At the same time, rising global demand for oil (primarily from Asia) along with an unstable Middle-east has caused oil prices to rise.

Although the United States has a rich abundance of natural gas energy, less than 0.1% of domestic natural gas in 2010 fueled our nation's vehicles, according to EIA. This remains true despite the fact that there are over twelve million NGVs worldwide today and the number is growing. Only about one percent of those twelve million vehicles are in use here in the United States, despite our vast resources. Interest in NGV transportation has increased throughout the country, which has presented an opportunity in the United States for many of the leading auto manufacturers that already produce NGVs elsewhere, including Ford, GM, Chrysler, Fiat, Toyota, Honda, Nissan, Hyundai, Volkswagen and Mercedes, among others. Many truck manufacturers are already ramping up NGV volumes in the United States, including Daimler Trucks, Volvo, Kenworth, Peterbilt, and Navistar. Therefore, combined with continued safe and responsible development of our domestic natural gas resource, stable market growth among domestic end users, and consistent policy signals from Washington, natural gas as a transportation fuel can help to provide a low cost way to achieve emission reductions and energy security goals in the transportation sector.

CNG/LNG

Both liquefied natural gas (LNG) and compressed natural gas (CNG) offer fleets the opportunity to improve their environmental footprint, increase use of a domestic resource, and lower overall operating costs, therefore providing a multitude of benefits for both companies and the general public. CNG/LNG also provides new opportunities in emerging nonroad and marine engine applications. Natural gas is the alternative fuel of choice for most heavy-duty vehicle operators and many light-and medium-duty fleets and consumers. NGVs provide similar power, torque and fuel range as conventionally-fueled vehicles, while providing fuel cost savings and lower emissions. Additionally, NGV options are ready in a variety of factory-direct applications that can meet most fleets' light-duty, medium-duty and heavy-duty operational needs.

Natural gas is an extremely versatile transportation fuel that can be sold in the compressed or liquefied state, or as a feedstock to produce other liquid fuels. CNG is made by compressing natural gas to about 3600 pounds per square inch (psi). LNG is made by cryogenically cooling natural gas to -260° F. Natural gas stations can provide CNG, LNG, or a combination of the two.

CNG is ideal for light and medium duty vehicles and any heavy-duty fleets whose operations remain more local, such as municipal operations, refuse collection, and some delivery applications. There are two types of CNG stations: fast-fill and time-fill. A fast-fill station is more expensive than time-fill, but is excellent for retail sales and supporting fleets that require speedy fueling similar to conventional fuels. A time-fill station is less expensive, but works best for fleets that return to central locations and are parked for extended periods—generally overnight—such as a refuse hauling fleet. Time-fill fueling is also available for passenger vehicles, with home fueling appliances that connect to the home's gas line and fuel CNG-powered vehicles over a multi-hour timeframe.

LNG vehicles provide the best commercially available technology for heavy-duty fleets with high fuel use and long-distance travel demands. This is because cooling gaseous natural gas to make liquid takes up about 1/600th the original volume, meaning trucks can carry more energy in their tanks as LNG versus CNG. LNG is dispensed in fast-fill stations via mobile or permanent stations. Mobile stations, which consist of an insulated LNG tank and dispensing equipment built on a trailer that can be parked, provide an ideal option for off-road fueling and remote locations

[1] The U.S. surpassed Russia as world's leading producer of dry natural gas in 2009 and 2010, March 13, 2012, EIA Today in Energy

without pipeline access to natural gas. Mobile stations can also provide important fuel support until permanent LNG stations can be built.

Infrastructure

As of June, 2012, there are currently 53 LNG fueling stations[2] in the U.S. serving over 3,300 LNG vehicles[3]. Of the 53 LNG fueling stations, 36 are located in California. California is typically an early adopter for new vehicle technologies, due to local air quality challenges and associated government programs that support environmental protection. Although the existing network of LNG stations is highly concentrated in California and other southwestern early adopter states, these early alternative fuel leaders laid the groundwork for a growing national network of natural gas refueling stations.

Approximately 100 additional LNG stations are in the planning stages nationwide. 90% of these stations will be located outside of California, significantly improving the geographic distribution of stations and opportunities for an alternative fuel future.

A large nationwide network of CNG fueling stations already exists. Currently, there are over 1,000 CNG stations in the U.S, with 36 states that have at least five CNG stations[4]. About half of the CNG stations are for public use and others are for fleet-specific vehicle use only, although the prevalence of both is increasing. As of June 2012, there were 94 CNG stations currently planned or under development[5]. Recent CNG announcements by retailers such as Love's, Kwik Trip, Flying J, and Clean Energy demonstrate growing mainstream demand for CNG fueling.

ANGA works to increase this momentum by supporting major expansions of natural gas fueling stations along key highways, in order to support the transition to a lower cost, domestically produced transportation future. One region where ANGA has had recent success is the Texas Clean Transportation Triangle, or CTT. The goal of the CTT is to develop sufficient natural gas stations and initial fleet users to transform heavy-duty trucking in Texas. On July 15, 2011, Texas Governor Rick Perry signed into law Senate Bill 385, a first-of-its-kind legislation designed to help create a sustainable network of natural gas-refueling stations along the interstate highways connecting Houston, San Antonio, Austin, and Dallas/Fort Worth. The CTT legislation allocates funding from the Texas Emissions Reduction Plan (TERP) to support the development of new stations and the deployment of NGVs. For the biennium 2012-2013, over $4.2 million was committed to funding natural gas stations, and $18.3 million to the Natural Gas Vehicle Rebate/Grant Program.

The first round of CTT grant funding was very successful. In April 2012, the Texas Commission on Environmental Quality (TCEQ) received 21 applications for the development of natural gas fueling stations along the CTT. These proposed projects include 3 LNG stations, 4 LCNG stations, and 14 CNG stations. All proposed stations will offer public access and be located within 3 miles of one of the major interstate freeways along the triangle. Natural gas truck sales are expected to expand further as program truck rebates are released in early July 2012.

This great program developed thanks to the leadership and support of the State Legislature of Texas, the TCEQ, and the Governor's office. An unprecedented consortium of more than 200 stakeholders was engaged in the strategic plan, including fleet operators such as United Parcel Service and business groups such as the Houston NGV Alliance and the Metroplex NGV Consortium. They were joined by utilities, fuel suppliers such as Clean Energy Fuels Corp., natural gas producers, and universities. Similar broad stakeholder efforts are now underway in other parts of the country, especially in areas of shale gas production, like the Marcellus or Rocky Mountain regions.

LNG—An ideal alternative fuel for long-haul trucking

Interest in fueling options from long-haul truck operators drives much of this infrastructure growth. Energy security and transportation air quality are complex problems that require the right fuel for the right application. Natural gas is a practical, cost-effective alternative fuel that can support the operational needs of our nation's heaviest vehicles. The transition to a natural-gas powered transportation fu-

[2] "Alternative Fuels Station Locator" US Department of Energy Alternative Fuels Data Center, June 2012

[3] "Alternatives to Transportation Fuels" US Energy Information Administration, 2010

[4] "Alternative Fuels Station Locator" US Department of Energy Alternative Fuels Data Center, June 2012

[5] "Alternative Fuels Station Locator" US Department of Energy Alternative Fuels Data Center, June 2012

ture will increase energy security, grow the American workforce, and improve air quality.

Heavy-duty vehicles account for just over two percent of the U.S. vehicle population, but they consume more than 21 percent of the nation's transportation fuel[6]. Currently, diesel costs $3.36 per gallon[7], versus $2.31 per diesel gallon equivalent of CNG[8]. Our heavy-duty transportation economy could save $54 billion in fuel costs each year with a conversion to natural gas, freeing up these billions of dollars to reinvest in local businesses and economies.

Diesel fuel use is rising. Our consumer economy relies on heavy-duty trucks and fueling networks to transport our nation's goods and drive our economy. Due to growing demand over the last several decades, the number of trucks—and associated diesel consumption—is increasing. Of the 4.8 million heavy-duty trucks (Class 7 & 8)[9] on our roads, 4.2 million run on diesel. These heavy-duty trucks consume over 70% of all diesel in the United States[10]. By 2035, the number of heavy-duty trucks will increase by almost 70% and will consume 34% more oil to meet our transportation demand[11].

Average annual mileage per heavy-duty tractor in the United States is 69,000 miles, which equates to approximately 11,700 gallons of diesel per vehicle each year (assuming 5.9 mpg[12]). Using the national average fuel consumption for a heavy duty tractor, the current annual diesel consumption for heavy-duty tractors is approximately 30 billion gallons of diesel per year, or 82 million diesel gallons per day.

Natural gas offers a clear, cost-effective path to energy security and economic growth. As the public network for CNG and LNG stations expands, more Americans will have access to a domestic, low-cost alternative to high gasoline prices and foreign oil.

GOVERNORS' NGV MEMORANDUM OF UNDERSTANDING AND LIGHT DUTY MOMENTUM

Momentum for increased NGV use is growing throughout the nation. Last fall, Oklahoma Governor Mary Fallin and Colorado Governor John Hickenlooper announced a high-level, bipartisan initiative to use NGVs in state fleets by aggregating vehicle purchase numbers. Since then the Governors of 11 additional states have signed the NGV MOU and have worked closely with the natural gas community to support the growth of infrastructure and fueling station initiatives to serve the increasing number of public and private NGVs on the road.

The governors recently took their efforts to a whole new level. In a letter to 19 auto manufacturers with plants in the U.S., the team of governors pushed for the increased production of more affordable compressed natural gas (CNG) vehicles. As an incentive, the governors re-affirmed their commitment to buy CNG vehicles for their respective state fleets.

This bipartisan team of governors recognizes that their combined purchasing power is one way to encourage auto manufacturers to harness the abundant and affordable natural gas resources right here in America. They are asking automakers to consider seriously the value in producing new NGV models not only for state fleets but also for the everyday consumer. This "power in numbers" can—and will—help jumpstart cleaner transportation choices, and with their powerful collective voice, this gubernatorial team certainly is on the road to a better future with cleaner, more affordable natural gas vehicles.

Automakers are responding as well, with Chrysler recently bringing online the U.S.'s only OEM factory-built, CNG/gasoline bi-fuel (capable or running on gasoline and CNG) pickup truck, built on the production line by Chrysler itself. Other manufacturers such as Ford and GM are similarly increasing their bi-fuel options. Honda is also ramping up long-term efforts to market its Civic Natural Gas, with new dealerships across the country signing up to sell the CNG car, which is made in America at Honda's Greensburg, Indiana plant.

Federal Policy Choices

ANGA supports constructive policies to promote natural gas vehicles and all of the benefits they bring for local air quality, community health and U.S. energy security.

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[6] "Transportation Energy Data Book", U.S. Department of Energy, 2010 Table 5.4

[7] http://www.eia.gov/petroleum/gasdiesel/ as of 7/2/2012

[8] "Clean Cities Alternative Fuels Price Report", U.S. Department of Energy, April 2012

[9] "Highway Statistic 2010", Federal Highway Administration, Table VM-1 and "Transportation Energy Data Book", U.S. Department of Energy, 2010 Table 5.4

[10] "Transportation Energy Data Book", U.S. Department of Energy, 2010 Table 5.4

[11] "Annual Energy Outlook 2011", U.S. Energy Information Administration, 2011, Supplemental Tables 45-72

[12] "Highway Statistic 2010", Federal Highway Administration, Table VM-1

From government purchasing decisions, to support for transportation corridors that expand fueling infrastructure, policymakers at all levels of government can play a significant role in encouraging this clean form of transportation.

At the federal level, ANGA supports efforts to create a level playing field among alternative fuels policies. We agree that it takes "all of the above" alternative fuels to enhance our energy security. However, current levels of federal support for NGVs are not on par with other alternatives. We encourage the Committee to take a comprehensive technology-and feedstock-neutral approach when evaluating current levels of federal support for alternative fuels among all areas of the federal government, including Executive branch federal fleet performance, federal agency regulatory programs such as CAFE and EPA GHG standards, existing mandates such as the Renewable Fuel Standard, and Research and Development programs.

We look forward to continuing to work with the Committee on constructive policies that help to level the playing field for all alternative fuels and contribute to greater energy security though the increased use of natural gas.

AMERICAN FUEL & PETROCHEMICAL MANUFACTURERS,
Washington, DC, July 24, 2012.

Hon. JEFF BINGAMAN,
Chairman, U.S. Senate Committee on Energy and Natural Resources, 304 Dirksen Senate Office Building, Washington, DC.

Hon. LISA MURKOWSKI,
Ranking Member, U.S. Senate Committee on Energy and Natural Resources, 304 Dirksen Senate Office Building, Washington, DC.

RE: Committee Hearing on Natural Gas and Transportation

DEAR CHAIRMAN BINGAMAN AND RANKING MEMBER MURKOWSKI:

AFPM, the American Fuel & Petrochemical Manufacturers, respectfully submits this letter for the record regarding the Senate Energy and Natural Resources Committee's July 24th hearing, "Natural Gas and Transportation." AFPM is a trade association representing high-tech American manufacturers of virtually the entire U.S. supply of gasoline, diesel, jet fuel, other fuels and home heating oil, as well as the petrochemicals used as building blocks for thousands of products vital to everyday life. AFPM's members have a significant interest in the natural gas markets-as both producers and consumers.

The U.S. is experiencing a renaissance in natural gas production. In four short years, the "shale revolution" in the U.S. has changed the conversation from one of energy scarcity to one of abundance. In 2005, the U.S. was producing 48 billion cubic feet (BCF) of natural gas per day. Today, the U.S. is producing nearly 65 BCF per day, a 35 percent increase. During the same time, the price of natural gas fell from more than $13 per million BTU (MMBTU) to less than $3 per MMBTU, and U.S. proved reserves grew from an estimated 10-15 years to 40-100 years.

The resultant effects on U.S. manufacturing, the economy, and the environment have been overwhelmingly positive and did not require subsidies, mandates, or blue-ribbon panels to come about. Rather, the marketplace induced investment, and technology and innovation propelled exploration. These investments and innovations have brought prices down to today's levels. In other words, the market works.

Abundant and affordable natural gas benefits many industries and the consumers they serve. AFPM's fuel production members are able to power refineries at a lower cost, just as residential consumers enjoy lower heating and air-conditioning bills. AFPM's petrochemical members now have access to an important low-cost feedstock for the petrochemicals that go into everything from iPhones to Kevlar to medical devices to solar panels. New investment and infrastructure to produce these products is being planned or built in areas of the country that are still suffering from the decline of U.S. manufacturing. In turn, construction of new drilling equipment and plant construction drive demand for steel, concrete, labor and many other products and services. Just last week, North Dakota—which is the epicenter of the Baakan shale boom—reported that its unemployment rate is less than 3 percent. The growth in shale production is so rapid that other businesses are having trouble keeping up with demand. A recent report prepared for the US Conference of Mayors identified the chemical industry as a key driver of economic growth across a number of metro areas:

> The industry surge this decade in investment, jobs, and incomes has been largely spurred by low natural gas prices, a result of the rapid incorporation of new drilling techniques to extract shale and other unconventional gas supplies in the US. Investment in the US is now competitive with over-

> seas locations. And the new gas fields have spurred investment not only in the Gulf of Mexico region, but across the US. For instance, a petrochemical processing, "Cracker," plant is to be constructed in the Pittsburgh metro owing to its proximity to shale gas supplies.
>
> Twenty eight metros have employment in excess of 10,000 in this sector, and 206 metros employ more than 1,000 in the chemicals and plastics industries. Notably fast growth occurred in 2011 in Minneapolis, Dallas, San Diego, and Milwaukee among large metros, and in Muskegon [MI], Greeley [CO], Spokane [WA], Gadsden [AL], and Warren [MI].[1] (state abbreviations added)

In addition to keeping electricity prices stable and driving new investment in petrochemical production, the natural gas revolution is driving investment in natural gas vehicles (NGVs) and infrastructure. There are currently more than 110,000 NGV's on the road and a recent report released from Pike Research estimates that the market for NGVs will grow steadily in the coming years, particularly in commercial trucking and in fleets. In fact, fleet sales of NGV's are currently growing at a rate of 10.8 percent annually.[2] This growth has been fueled by market forces rather than government subsidies and mandates. Where the savings from natural gas have been great enough to offset the cost of NGVs and refueling infrastructure, fleet owners have behaved rationally and invested in these alternatives.

AFPM welcomes market developments attributable to increased natural gas production, but urges Congress to refrain from layering new subsidies and mandates onto a market that is already working. In particular, new mandates and subsides, in the form of legislation such as the NAT GAS Act, will distort markets that are currently allocating natural gas to the most efficient use.

Creating artificial demand for natural gas could lead to unnatural, large-scale fuel switching that could abruptly drive up natural gas costs to the detriment of industrial consumers that use natural gas to power facilities or as a feedstock for chemical production. Just as the low prices we have seen to date are attracting new investment and bringing back manufacturing jobs, government induced higher costs will dissuade investment and threaten jobs. In other words, government simply does not have the ability to foresee the unintended consequences of picking winners and losers in the marketplace.

For examples of unintended consequences, one needs to look no further than the Renewable Fuels Standard, which has layered an unworkable mandate to blend increasing volume of biofuels into the fuel supply on America's refineries. Countless economists have identified the RFS—which is primarily being met by corn ethanol -as a driver of higher corn prices and resultant economic difficulties and job loss in meat and poultry production. In the refining industry, the volume of biofuels the RFS envisions cannot be integrated into the national fuel supply without a prohibitively expensive and unrealistic overhaul of the nation's fueling infrastructure and vehicle fleets. Moreover, investment in ethanol facilities is capital that may have otherwise gone to NGV infrastructure if not for government mandates. Similarly, subsidies for NGVs may divert investment from some other, more efficient, investment. In all cases, consumers ultimately bear the costs of these policies, either in higher prices or in less innovative products.

To be clear, AFPM is not anti-NGV, not anti-biofuel, and not seeking to drive out competition. Rather, AFPM's members are pro-competition on a level playing field, free of government-selected winners and losers. If there is an efficient use of a resource to compete with petroleum fuels, market forces will ensure such a fuel is made available to consumers, just as they have with other technologies. Allowing the marketplace to dictate fuel choice ensures U.S. taxpayers are not put at risk, and indeed, will benefit from the highest quality, lowest cost fuels that the marketplace can produce.

AFPM appreciates the opportunity to share its views. Please contact Geoff Moody, AFPM's director of government relations, with any questions.

Sincerely,

CHARLES T. DREVNA,
President.

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[1] http://usmayors.org/metroeconomies/0712/FullReport.pdf

[2] http://www.pikeresearch.com/wordpress/wp-content/uploads/2012/07/LDNGV-12-Executive-Summary.pdf

STATEMENT OF ALEX SCHROEDER, COLORADO ENERGY OFFICE, DENVER COLORADO

Chairman Bingaman, Ranking Member Murkowski, and Members of the Committee:

Thank you for the opportunity to participate in today's hearing on Natural Gas and Transportation. This topic is both very relevant and timely in the context of a broad, bi-partisan effort among states. While all of us are approaching opportunities for the nation's increased supply of natural gas on a variety of fronts, we are delighted today to announce that the release of a multi-state request for proposals (RFP) to procure natural gas vehicles for state fleets.

Over the past year, Colorado Governor John Hickenlooper has worked with Oklahoma Governor Mary Fallin to spearhead a multi-state, bi-partisan memorandum of understanding (MOU)* to increase the use of natural gas vehicles in state fleets. They have been joined by the Governors of Kentucky, Louisiana, Maine, Mississippi, New Mexico, Ohio, Pennsylvania, Texas, Utah, West Virginia and Wyoming in making fleet commitments to encourage the production of natural gas vehicles (NGV) that are comparable in price and performance to their gasoline counterparts. The RFP seeks to issue an award by early October 2012 and will have an interim informational meeting in Oklahoma City on August 8th, 2012.

In the most basic terms, the MOU seeks to aggregate and leverage the state's fleet purchasing power to deliver a volume to manufacturers that will be sufficient enough to lower the incremental cost of NGVs and to drive technical innovation on both vehicle and component design. To be clear, this effort seeks to form a partnership with auto manufacturers in developing the market for natural gas vehicles as we certainly appreciate the complexities involved in vehicle manufacturing and marketing.

The MOU seeks to extend this effort to local governments in each of the participating states. In Colorado, local governments makeup a significant portion of vehicle purchases made through the state bid system creating a substantial opportunity to further leverage our efforts. Recognizing the dilemma of requiring both vehicles and infrastructure in order to achieve market penetration, the MOU also seeks to address the availability of natural gas fueling stations. States have an opportunity to strategically place these vehicles in locations where their fuel demand can provide market certainty to retailers that are considering natural gas fueling stations.

While significant momentum has been established over the past year, it is our intention that this be a continuing effort so that automakers can have confidence in our commitment to this market. We would encourage the federal government to consider its role in participating in the market for natural gas vehicles as part of the stated commitment to purchase alternative fueled vehicles exclusively by 2015. Additionally, it is our hope that the forthcoming corporate average fuel economy (CAFE) standards reflect a truly fuel neutral standard that will guide us swiftly towards the twin goals of reducing petroleum imports and vehicle emissions.

Beyond the MOU, Colorado has had a number of recent high-profile successes in increasing the use of natural gas in transportation. This spring, the Roaring Forks Transportation Authority (RFTA) announced that it would be operating the nation's first rural bus rapid transit system exclusively on natural gas, which will save RFTA $375,000 a year in fuel costs and decrease the likelihood of requiring fare increases from spiking fuel prices. We are also encouraged by and appreciative of efforts by our natural gas producers and other private sector fleets in operating their vehicles on natural gas. UPS currently operates its largest fleet of compressed natural gas package trucks in the Denver Metro area and last fall Republic Services, a refuse hauler, began the conversion of their entire fleet to CNG. The fact that many of these companies are making the switch on an economic basis is very encouraging to the future market for natural gas in transportation.

As a state that imports 2/3 of the oil it consumes, and exports 3/4 of the natural gas that it produces, Colorado can vastly improve its energy security through the increased adoption of natural gas vehicles. Our efforts on NGVs are the tip of the spear in the larger objective of diversifying our state's fuel mix to use more of what we produce right here in Colorado. From advanced engine design, to battery technology, to cellulosic biofuels, Colorado has a multitude of opportunities to continue its leadership role in clean energy by expanding our efforts in advanced vehicles and transportation fuels. Everyone plays a part in ensuring the success of these efforts and we look forward to opportunities to partnering with this Committee, Congress, and the federal government to do so. We again thank you for the opportunity to provide testimony in today's hearing.

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*The Memorandum of Understanding has been retained in committee files.

STATEMENT OF NATURAL GAS VEHICLES FOR AMERICA

Introduction

NGVAmerica is pleased to offer the following written statement with regard to this hearing. NGVAmerica is a national organization dedicated to the development of a growing and sustainable market for vehicles powered by natural gas and biomethane. NGVAmerica represents more than 150 companies, including: vehicle manufacturers; natural gas vehicle component manufacturers; natural gas distribution, transmission, and production companies; natural gas development organizations; environmental and non-profit advocacy organizations; state and local government agencies; and fleet operators.

The purpose of the Committee's hearing on July 24, 2012 is to receive testimony concerning opportunities for, current level of investment in, and barriers to the expanded usage of natural gas as a fuel for transportation.

Natural Gas Vehicles Should be a Part of Future Energy Legislation

Today, natural gas vehicles (NGVs) are uniquely positioned to help the United States achieve a number of critical policy objectives. The increased use of natural NGVs can reduce our dependence on foreign oil while reducing greenhouse gas emissions and urban pollution. And, equally important, increased use of NGVs will benefit the economy by stimulating demand for domestic natural gas and by lowering fuel cost to businesses, fleets and consumers that operate NGVs. Future energy legislation that is intended to reduce reliance on oil consumption should explicitly promote the use of NGVs. Both the House and Senate have introduced a number of energy bills that promote the increased use of alternative fuel vehicles. Some of these bills, like the New Alternative Transportation to Give Americans Solutions (NAT GAS) Act of 2011 (S. 1863, HR 1380), are targeted specifically to NGVs. We urge the committee members to work to ensure passage of the NAT GAS Act before the 112th Congress comes to an end, and ensure that any future legislative actions by this Congress include policies that promote NGVs. We also urge Congress to remove federal barriers that are slowing the use of NGVs.

Reducing Reliance on Foreign Oil

Reliance on foreign oil exacts a high toll on the U.S. in terms of direct economic costs and indirect energy security costs. In the past three years (2009—2011), the US spent nearly $760 billion on imported petroleum. More recently, the tab for imported oil has been much higher as oil prices hover between $85 and $100 per barrel. In the coming decade, the EIA forecasts total expenditures for petroleum imports to top $3.4 trillion dollars.[1] The High Oil Case estimates that expenditures for oil will exceed $4.5 trillion dollars. This wealth transfer, as Boone Pickens likes to say, is quite possibly the largest wealth transfer in history. Our reliance on oil not only affects our trade balance but makes the U.S. vulnerable to price spikes and supply disruptions. And high oil prices result in a windfall for regimes that may not be friendly to the U.S.

Fortunately, the U.S. has an unprecedented opportunity to displace petroleum with domestic natural gas. As President Obama recently declared, the U.S. is "the Saudi Arabia of natural gas." The EIA, the Potential Gas Committee and other expert bodies now estimate that the U.S. has up to a 100 year supply of natural gas. The Potential Gas Committee's 2011 bi-annual report indicates that the U.S. now has a total future supply of 2,170 trillion cubic feet of natural gas. The 2011 report includes the highest resource estimate in the Committee's history. The availability of this significant domestic resource provides an unprecedented opportunity to solve a number of pressing national objectives like transforming the transportation sector.

Increasing the use for natural gas in transportation will keep our economy growing by supporting new jobs and economic development. In 2008, U.S. production of 20 Tcf of natural gas supported nearly 3 million jobs.[2] In his State of the Union remarks before Congress, the President indicated that new development of natural gas could result in 600,000 new jobs in this decade alone. Thus, increasing demand for natural gas as a transportation fuel will help put more people to work and ensure that we put this natural gas to good use, here where it can have the most benefit for U.S. energy users.

Natural gas benefits our economy because it is a low cost energy that helps businesses grow while at the same time controlling costs. Natural gas is priced much lower than petroleum. The two fuels no longer track one another—and haven't for

[1] See EIA, 2012 Annual Energy Outlook, Table 11 (Reference Case).

[2] "The Contributions of the Natural Gas Industry to the U.S. National and State Economies," IHS Global Insight 2009, p.1.

many years. The current future contract price for natural gas (NYMEX August) is approximately $3 per million Btu, which equates to a per-barrel of oil price of only $17.40 while oil is trading at close to $90 a barrel. The low price of natural gas translates into significant savings for fleets and consumers who use natural gas to fuel their vehicles. In most areas of the country, natural gas sells at about a $1.50 discount compared to gasoline and diesel fuel. EIA's long-term forecast projects that differential between natural gas and petroleum fuels will remain as high as $2 per energy-equivalent unit.

The Opportunity for NGVs

NGVAmerica believes that there could be a substantial market for NGVs in all applications. However, the most immediate opportunity for displacing petroleum and increasing the use of natural gas as transportation fuel lies with light-, medium-and heavy-duty fleets—especially trucks, buses and other heavier vehicles.

Today, the U.S. only has about 120,000 NGVs. Vehicle demand has been growing, but slowly. However, because of the large fuel use per-vehicle, the amount of natural gas used (and petroleum displaced) has been increasingly at a robust pace. NGVAmerica estimates that, in 2010, NGVs used about 43 billion cubic feet of natural gas. That is the equivalent of about 320 million gallons of gasoline that was not imported, and a savings in overseas expenditures of about a billion dollars.

The U.S. currently leads the world in offerings of new medium-and heavy-duty NGVs. In the past several years, virtually all the major truck and bus manufacturers in the U.S. have begun offering factory-built NGVs. The impressive list of manufacturers includes: Kenworth, International/ESI, Peterbilt, Mack, American LaFrance/Condor, Crane Carrier, AutoCAD Truck, Capacity, Thomas Built Bus, Blue Bird Bus, Optima, NABI, El Dorado, New Flyer, Daimler/Orion, Freightliner, Gillis, Workhorse Chassis, Elgin, Allianz/Johnston, Schwarz, and Tyco. Major successes in terms of market penetration: NGVs made up 40 percent of all refuse trucks ordered in 2011, and 30 percent of transit bus orders. While these markets are still relatively small in terms of overall sales, it does point to the inroads natural gas vehicles are making. The future of natural gas as a transportation fuel is likely tied to its ability to gain traction in the heavy-duty short-haul and over-the-road trucking market. Some of the most exciting developments underway for NGVs are in this market. Trucks are the economic lifeblood of America. Everything we buy moves by truck. Reducing the cost of trucking by using less-expensive natural gas reduces the cost of everything, benefiting businesses and consumers alike.

The current picture regarding light duty vehicle development is somewhat different. NGVs are not yet economic for most owners of light-duty vehicles. The primary reason is that these vehicles have higher initial purchase costs than conventionally fueled vehicles, but are not driven enough miles or consume enough lower-cost fuel for the fuel cost savings that they offer to offset this higher purchase cost in a reasonable number of years. That being said there are some high-fuel use applications, like taxicabs and delivery vehicles, where light duty NGVs already make economic sense. Reductions in cost spurred on by increased production and technology improvements are likely to improve the future prospects of NGVs in the light duty market.

Outside the U.S., demand for NGVs is growing at a rapid pace, and much of this growth is in the light-duty vehicle market. In the last seven years, the global market for NGVs has more than tripled with a compound growth rate of over 17 percent per year. In fact, NGVs are the fastest growing alternative to petroleum vehicles in the world. In 2003, there were only about 2.8 million NGVs globally. Today, there are over 15 million NGVs in operation worldwide. This rapid growth points to the fact that rapid scaling up of NGVs is possible. The NGV Global (the international NGV association) forecasts that, by 2020, there will be 65 million NGVs on the world's roads. Unfortunately, the U.S. currently ranks 17th in the world in total number of NGVs—despite having more vehicles on the road than all the other fourteen countries combined.

As noted above, most of the new NGVs sold outside the U.S. are light-duty vehicles. In many countries, tax and other government policies help make NGVs even more economically attractive to consumers. As a result, in overseas markets, NGVs are now available from almost all major OEMs, including: Ford, GM, Toyota, Honda, Nissan, Hyundai, Fiat, Volkswagen and Mercedes. In 2009, Fiat offered 14 separate NGV models, and more than 100,000 NGVs were sold in that year in Italy alone, comprising some 7 percent of the new vehicle market. Most U.S. manufacturers currently offer NGVs in Europe, South America and Asia, but only Honda currently offers a light-duty OEM NGV product in the U.S.—the Honda Civic Natural Gas. General Motor currently offers the GMC medium-duty Savana and Chevrolet Express vans as fully-backed, factory produced NGVs rated above 8,500 lbs. GVWR.

This summer, General Motors and Chrysler will begin offering factory built natural gas powered pickup trucks. As these offerings show, U.S. automakers certainly have the capability to produce NGVs—IF the proper incentives are in place.

Recent events are clearly pointing to a viable domestic market for light-duty NGVs. We are particularly encouraged by the unprecedented Memorandum of Understanding (MOU) concerning NGVs that has now been signed by 13 state governors. The MOU urges U.S. automakers to expand their offerings of NGVs and attempts to stimulate the market for such vehicles by signaling the intent of these states to purchase NGVs. As noted above, in just the past two years, GM and Chrysler have announced plans to produce NGVs for the U.S. market. Honda also has expanded its production capacity for the Honda NGV offering, and is now marketing the car to consumers as well as fleets. Another telling factor is the significant growth in the aftermarket offerings here in the U.S., where nearly a dozen manufacturers offer systems to retrofit light-duty vehicles to operate on natural gas. These offerings include systems for the Fusion, Focus, Impala, Malibu, Milan, Transit Connect, in addition to a variety of popular pickup truck offerings. Ford, while not offering a factory NGV, has been working closely with the aftermarket industry to ensure that aftermarket systems offered for its vehicles meet its demanding standards for quality. These activities clearly show that there is very strong interest in bringing more NGV products to the U.S. passenger car and light-duty segment.

Investments in Fueling Infrastructure

Natural gas fueling infrastructure development is once again on the rise, recently exceeding 1,000 stations. More importantly, major industry players such as Apache Corporation, Clean Energy Fuels, Chesapeake Energy, and Shell Oil have recently committed hundreds of millions in new capital toward the development of natural gas fueling infrastructure. The largest of these announcements include deals to develop liquefied natural gas (LNG) fueling at Flying J and Travel Centers of America (TA) truck stops across the country. These efforts will soon make it possible for LNG trucks to serve most major areas of the country. President Obama's Blueprint for Energy, announced on January 26th, also calls for development of natural gas corridors.

Barriers to Increased Use of NGVs

As just noted, the most significant barriers to increase use of NGVs are starting to come down. Those barriers have historically been a lack of vehicle offerings and limited fueling infrastructure. Automakers and investors are starting to address these issues. Economics also has been a barrier in times when oil prices have plummeted. The current outlook, however, appears to favor the long-term economic viability of natural gas as a transportation fuel.

Barriers do continue to exist, however. Building out a national fueling infrastructure to support a new fuel is a daunting task. It requires enormous capital and a belief that the demand for the new fuel will materialize. Other policies and incentives are necessary to support the investments being made by businesses and fleets.

Here is a list of the some of the federal barriers that continue to exist:

- Inequitable tax treatment of LNG. Today, LNG pays an effective excise tax rate or $0.41 per diesel gallon equivalent versus $0.243 for diesel fuel. LNG has less energy per gallon than diesel and it takes 1.7 gallons of LNG to equal the energy content in one diesel gallon. This discrepancy increases the taxes paid by fleets and reduces the economic benefit of switching to natural gas. From a budgetary standpoint fixing this issue should not be a problem because the impact is neutral since energy diesel gallon equivalent of LNG that is used would pay $0.243—just like every diesel gallon.
- Higher FET taxes on natural gas trucks. Natural gas trucks currently cost more than diesel trucks, in some cases $30,000—$60,000 more. And since the federal excise tax on trucks (12% tax) is imposed on the full cost of a truck, natural gas trucks pay a much higher tax than comparable diesel trucks. The effect of this provision is to increase the cost of a new natural gas truck by several more thousand dollars.
- EPA & NHTSA Regulations. The U.S. EPA and NHTSA recently have proposed or finalized new fuel efficiency and greenhouse gas emission standards for motor vehicles. In most cases, these rules provide added incentives for manufacturers who produce electric vehicles or other advanced technology vehicles, but they do not currently provide incentives for NGVs. To EPA's and NHTSA's credit, the proposed light duty 2017-2025 regulations do include some incentives for NGVs but these incentives still fall short of providing equitable treatment. The natural gas industry has provided extensive comments to the agencies regarding these rulemakings and is hopeful of a favorable outcome in the 2017-2025

rulemaking. However, the agencies should reopen the now finalized heavy-duty rulemaking in order to provide equitable incentives for NGVs.

- Federal fleet programs. The federal government purchases thousands of vehicles each year. Federal policies currently favor purchase of flexible fueled vehicles and hybrid-electric vehicles. These vehicles are largely fueled by petroleum. Most federal agencies do not operate their flexible fueled vehicles on ethanol. Moreover, hybrid electric vehicles, while recently classified as alternative fuel vehicles, rely 100% on petroleum for their motive fuel. The federal government should join with the state governors and start placing orders for NGVs.
- Research and development programs. The federal government currently has no ongoing research and development efforts to secure advancements in the use of NGVs. ARPA-E's recently announced awards for $30 million in new funding for NGV projects. However, this effort, while important, represents only a very small investment relative to the hundreds of millions that are going to support biofuels and electric vehicles. Moreover, the ARPA-E funding is a one-time only opportunity. The lack of a standing R&D program for NGVs signals to industry and the market that the federal government is not interested in facilitating the use of NGVs.
- Federal tax incentives. There currently are no federal tax incentives for NGVs. Previous incentives have expired and the Congress has not acted on legislation to revise or extend these incentives. Electric vehicles, however, continue to benefit for a $7,500 tax credits. The $7,500 tax credit provides a huge incentive for manufacturers to offer electric vehicles because it only phases out after 200,000 (per manufacturer) of these vehicles are sold. That equates to $1.5 billion in tax credit incentives per manufacturer! Congress needs to provide similar incentives for light-, medium-and heavy-duty NGVs.

Why NGVs need incentives

Currently, NGVs cost more to buy than comparable gasoline or diesel powered vehicles. But they cost less to operate. The more miles a vehicle is driven each year, the faster the payback and the more likely the owners can justify the investment in NGVs. For some of the most fuel intensive fleets and vehicle applications, NGVs already are economic. However, to expand the use of NGVs and maximize NGVs' oil displacement potential, the first-cost or incremental cost of NGVs needs to be brought down rapidly. And this will only happen with large scale production and increased economies of scale. The NAT GAS Act (S. 1863, HR 1380), provides the means to accelerate demand for NGVs and to help manufacturers achieve economies of scale and build-out much needed fueling infrastructure. The cost of these incentives is scored at roughly $5 billion. The Senate version, however, includes a pay-for provision that over-time compensates the federal budget for the cost of the incentives by imposing fees on NGV users. Whether it is paid for via this fee or not, the investment in NGVs makes sense when compared to the trillions that will be spent on imported oil.

NGVs do not need technical breakthroughs to capitalize on the potential of natural gas as a transportation fuel. What is needed most is to grow demand for these vehicles faster. Federal leadership in leading in breaking down barriers and providing incentives will make this happen. Congress can help jumpstart that growth.

Conclusion

The U.S. has an unprecedented opportunity to displace petroleum with domestic natural gas. Now is the time to act to encourage the increased use of natural gas vehicles. We have an abundant supply of readily available, low-cost domestic natural gas. The fact that this fuel is domestic, low-cost, and clean means that America can achieve multiple national goals (energy security, clean air, economic security) all the while helping fleets and businesses to lower their costs, thus improving economic prosperity. Today, nearly every major truck or bus manufacturer in the U.S. is now offering factory-built NGV models. Federal policies and incentives, however, are needed to aid in the successful market penetration of these vehicles and to help accelerate their use so that the benefits of increased natural gas use can be realized.

STATEMENT OF THE VNG.CO BALA, CYNWYD, PA

Introduction

The purpose of the Committee's hearing on July 24, 2012 was to receive testimony concerning opportunities for, current level of investment in, and barriers to the expanded usage of natural gas as a fuel for transportation. VNG.CO ("VNG") is pleased to offer the following written statement with regard to the hearing.

VNG is a Pennsylvania-based company that is developing a nationwide, retail-oriented, gaseous-fueling network to supply the growing number of gaseous fuel vehicles expected to be produced over the next decade and beyond. Founded by seasoned, highly successful, and proven entrepreneurs from the automotive sector (Harvey Lamm, founder and former Chairman and CEO of Subaru of America), and with experience in national multi-billion dollar infrastructure development (Bob Annunziata, founder and former Chairman and CEO of Teleport Communications Group), VNG has the experience and industry relationships to achieve the successful build-out of a national compressed natural gas ("CNG") fueling network.

VNG is initially building a national public-access fueling network that will deliver CNG to light-duty natural gas vehicles ("NGVs") in the fleet and mass-market consumer segments. Later, the CNG network can also evolve to deliver gaseous hydrogen, thus serving as a near-term platform for NGVs as well as a long-term platform for the deployment of hydrogen fuel cell electric vehicles.

Reducing America's Dependence on Foreign Oil

Since the oil crises of the 1970s, reducing America's dependence on foreign oil has been a critical goal for economic, environmental, and national security reasons. However, the U.S. has not made significant progress towards achieving this goal in the more than forty years since 2 it was set, largely due to continued dependence on petroleum-based fuels for transportation, especially for light-duty vehicles, which account for seventy-five percent (75%) of on-road petroleum consumption and greenhouse gas emissions. Unless and until we are able to fuel America's light-duty fleet on a cleaner, domestic source of fuel, the nation will continue to fall far short of achieving its energy independence and environmental goals.

NGVs Offer Opportunity for "Larger, Earlier, Faster" Impacts on Oil Consumption

Today, for the first time, America has access to an abundant, low-cost, domestic alternative fuel supply that is capable of meeting the fuel needs of America's fleet of light-duty vehicles on a mass-market scale. Recent advances in hydraulic fracturing and horizontal drilling techniques have unleashed an abundance of natural gas that experts predict will last over 100 years. This "shale gas revolution" has led to a substantial price advantage for natural gas over gasoline of roughly 40% today, and this advantage is projected by the U.S. Department of Energy to be sustained for decades to come.

With these low, stable natural gas prices, light-duty NGVs have unique potential to be an affordable, mass-market alternative fuel solution. NGVs are a proven commercial technology with no technical barriers, and offer range, refueling, performance, and functionality on par with the full range of gasoline vehicles. By contrast, today's battery-electric vehicles have limited range, long recharging times, and are impractical for the light truck models (such as pickups, minivans, and SUVs) popular with fleets and many consumers due to the weight of the battery packs that would be needed to move these larger vehicles. For these reasons, a comprehensive study of transportation fuels just released by the Department of Energy's National Petroleum Council (NPC) found that "the benefits from natural gas may be larger, earlier, and faster than alternative technologies."[1]. NGVs are also based on the same internal combustion engine ("ICE") technology as gasoline vehicles, which are expected to remain the "dominant" propulsion technology through 2050.[2]

The build-out of a national CNG fueling network on par with our existing gasoline stations and the accompanying conversion of America's light-duty fleet to natural gas would rank amongst the seminal achievements of this nation, on par with the construction of the nation's railroads, the interstate highway system, and the space program—and it would provide benefits on a similar scale. The conversion to natural gas of America's light-duty fleet will spur American innovation, support tens of thousands of jobs in the automotive, gas production, and construction sectors, eliminate as much as $400 billion in annual payments to foreign (and often hostile) countries for oil imports, and reduce emissions of greenhouse gases and other pollutants. Because natural gas is typically forty percent (40%) less expensive than gasoline on a gallon equivalent basis, conversion of the entire light-duty fleet to NGVs would also in effect provide an economic stimulus of $200 billion per year based on current gasoline expenditures of nearly $500 billion per year.

The conversion of America's light-duty fleet to natural gas and the development of a national CNG fueling infrastructure will also lay the foundation for the future adoption of hydrogen FCEVs, a zero-emission gaseous vehicle technology that can overcome the refueling and range issues surrounding EVs but face major obstacles

[1] http://npc.org/FTF-report-080112/Natural__Gas__Analysis-08112.pdf
[2] http://npc.org/FTF-report-080112/Ch2-LDV-08112.pdf

in reducing vehicle and refueling infrastructure costs. The development of on-board gaseous fuel storage and management technologies for NGVs will contribute to their development for FCEVs, and existing CNG fueling infrastructure can serve as a platform for the development of a network for hydrogen fueling since natural gas is a feedstock for producing hydrogen and both natural gas and hydrogen use similar compressing and dispensing equipment. Thus, a transition to CNG will also accelerate the technology development of FCEVs and lower the costs of an eventual hydrogen refueling infrastructure build-out.

Simple, No-Cost (And Cost-Saving) Measures to Spur NGV Production

NGVs offer the greatest potential to reduce America's dependence on foreign oil and emissions from America's light-duty fleet, and they are ready to begin making an impact today. Private entities such as VNG.CO and others are ready, willing, and able to develop the national fueling infrastructure required to support natural gas vehicles. However, while GM and Chrysler have recently made available bi-fuel NGV versions of popular pickup trucks, the mass-market adoption of light-duty NGVs will require higher volume production of a wider variety of vehicle models to ensure that NGVs are a cost-effective option for all fleets and consumers.

Fortunately, achieving this goal does not require massive government investment or subsidy programs. In order to encourage auto manufacturers to produce natural gas vehicles in sufficient volumes so as to achieve economies of scale that will substantially lower the price of NGVs, the federal government should take the following steps, which have no budgetary impact and, in the case of federal fleet purchases of NGVs, could even save taxpayers' money:

1. Ensure that the pending EPA greenhouse gas regulations provide regulatory (non-financial) incentives for the production of NGVs that are similar to those offered for electric vehicles, in recognition of the important short-and long-term benefits of NGVs and subsequent gaseous fuel technologies for meeting emissions goals;
2. Remove the existing statutory cap on the credits NHTSA can provide bi-fuel NGVs under the CAFE regulations; current law requires bi-fuel NGVs to share a limited pool of credits with flex-fuel E85 vehicles;
3. Allow states to permit special access to High Occupancy Vehicle ("HOV") lanes for both dedicated and bi-fuel NGVs; and
4. Encourage federal fleets to convert to NGVs. Low natural gas prices will likely result in overall savings on the cost of operating these government fleets. The federal government has an in-place mandate to solely purchase alternative fuel vehicles by the end of 2015, and meeting these requirements with NGVs helps to provide automakers with a real market incentive to increase production volumes and reduce incremental vehicle costs. State governments are already undertaking such an initiative, aggregating their demand for NGVs in a multi-state effort with 20 participating states—and adding the federal government's support along similar lines would greatly increase the impact of this approach.

The conversion to natural gas of the light duty fleet market is nearing the beginning of a "virtuous cycle" whereby the increasing availability of CNG fueling increases demand for NGVs, and increased demand for NGVs results in higher-volume production, a broader range of vehicle offerings, and lower costs. With the simple measures outlined above, the federal government can kick-start this virtuous cycle so that in a matter of years—not decades—the expanding availability of CNG fueling as well as a growing number of low-cost NGV models will make natural gas the fuel of choice for all light-duty vehicles.

FACT SHEET

Natural Gas Supply

Two respected authorities, the U.S. Energy Information Administration (EIA) and the Potential Gas Committee (PGC), provide reliable estimates of domestic natural gas resources.

The PGC's year-end 2010 assessment exceeds all others in their 46 year history with a reported 1,898 trillion cubic feet (Tcf) of technically recoverable natural gas. Combined with the U.S. Department of Energy's (DOE's) proven dry-gas reserves as of year-end 2009, the PGC estimates the U.S. has 2,170 Tcf of future supply.

In the *Annual Energy Outlook 2012 (Early Release)*, the EIA reports there are 2,214 Tcf of technically recoverable natural gas resources as of January 1, 2010. At the current rate of consumption in the U.S., which is about 24.1 Tcf per year, the EIA estimates domestic natural gas resources will supply over 90 years of use.

NGVs

According NGV Global, the number of NGVs in use worldwide by the end of 2011 had grown to 15.2 million. Global NGV sales—according to Pike Research —are expected to rise at a compound annual growth rate (CAGR) of 7.9% to reach 19.9 million vehicles by 2016. NGVs have been most successful in the Middle East and Latin America, especially so in countries that lack a high capacity to refine oil.

The U.S. currently ranks 17th in the world with approximately 110,000 NGVs or less than 1% of total NGVs. The top ten countries for NGVs as reported by the latest Gas Vehicle Report are summarized in the table below.

Country	Number of Vehicles
Pakistan	3,100,000
Iran	2,893,948
Argentina	2,110,023
Brazil	1,719,197
India	1,500,000
China	1,200,000
Italy	785,000
Ukraine	388,000
Columbia	376,060
Thailand	328,675

Fuel Consumption

According to the Energy Information Administration (EIA, June 2012), the U.S. consumed an estimated 171 billion gallons of fuel in 2011, of which 77% is attributable to light-duty vehicle consumption. Demand is anticipated to grow to approximately 183 billion gallons by 2035 according to the EIA. Gasoline and diesel comprise the majority of vehicle fuel consumed in the U.S., with CNG, LNG, ethanol, methanol, propane, hydrogen, biodiesel, electricity, and other alternative fuels and technologies collectively representing less than 3% of consumption.

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