

# ADVANCED VEHICLE TECHNOLOGIES

---

---

## HEARING BEFORE THE COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

TO

RECEIVE TESTIMONY ON POLICIES TO REDUCE OIL CONSUMPTION  
THROUGH THE PROMOTION OF ADVANCED VEHICLE TECHNOLOGIES  
AND ACCELERATED DEPLOYMENT OF ELECTRIC-DRIVE VEHICLES, AS  
PROPOSED IN S. 734 AND S. 948

---

MAY 19, 2011



Printed for the use of the  
Committee on Energy and Natural Resources

---

U.S. GOVERNMENT PRINTING OFFICE

67-290 PDF

WASHINGTON : 2011

---

For sale by the Superintendent of Documents, U.S. Government Printing Office  
Internet: bookstore.gpo.gov Phone: toll free (866) 512-1800; DC area (202) 512-1800  
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

COMMITTEE ON ENERGY AND NATURAL RESOURCES

JEFF BINGAMAN, New Mexico, *Chairman*

RON WYDEN, Oregon	LISA MURKOWSKI, Alaska
TIM JOHNSON, South Dakota	RICHARD BURR, North Carolina
MARY L. LANDRIEU, Louisiana	JOHN BARRASSO, Wyoming
MARIA CANTWELL, Washington	JAMES E. RISCH, Idaho
BERNARD SANDERS, Vermont	MIKE LEE, Utah
DEBBIE STABENOW, Michigan	RAND PAUL, Kentucky
MARK UDALL, Colorado	DANIEL COATS, Indiana
JEANNE SHAHEEN, New Hampshire	ROB PORTMAN, Ohio
AL FRANKEN, Minnesota	JOHN HOEVEN, North Dakota
JOE MANCHIN, III, West Virginia	BOB CORKER, Tennessee
CHRISTOPHER A. COONS, Delaware	

ROBERT M. SIMON, *Staff Director*

SAM E. FOWLER, *Chief Counsel*

MCKIE CAMPBELL, *Republican Staff Director*

KAREN K. BILLUPS, *Republican Chief Counsel*

# CONTENTS

## STATEMENTS

	Page
Alexander, Hon. Lamar, U.S. Senator From Tennessee .....	5
Bingaman, Hon. Jeff, U.S. Senator From New Mexico .....	1
Crane, David, President and CEO, NRG Energy, Inc., Princeton, NJ .....	36
Cullen, Genevieve, Vice President, Electric Drive Transportation Association .	23
Davis, Patrick, Program Director, Vehicle Technologies Program, Office of Energy Efficiency and Renewable Energy, Department of Energy .....	9
Ghasemi, Seifi, Chairman and CEO, Rockwood Holdings, Inc., Member, Elec- trification Coalition, Princeton, NJ .....	14
Merkley, Hon. Jeff, U.S. Senator From Oregon .....	3
Murkowski, Hon. Lisa, U.S. Senator From Alaska .....	2
Stabenow, Hon. Debbie, U.S. Senator From Michigan .....	7
Van Amburg, Bill, Senior Vice President, CALSTART, Pasadena, CA .....	28

## APPENDIXES

### APPENDIX I

Responses to additional questions .....	53
---	----

### APPENDIX II

Additional material submitted for the record .....	69
--	----



## ADVANCED VEHICLE TECHNOLOGIES

---

THURSDAY, MAY 19, 2011

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

The committee met, pursuant to notice, at 10:01 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. OK. I think we'll go ahead and get started. Senator Murkowski is delayed just a few minutes, but asked us to start without her. She will be here shortly.

Thank you all for coming to testify today. Give us your thoughts on 2 important bills: S. 734 and S. 948. These are both bills aimed at accelerating the development and deployment of advanced vehicle technologies.

The topics that we're discussing today have been a high priority for the committee for some time. These bills are constructive steps forward in dealing with our energy security, economic security and ultimately our competitiveness internationally. So I commend the authors of the legislation.

I'm sure there will be plenty of debate about the causes and short term fixes for high prices of gasoline at the pump. I think the case has been settled for some time that now that the economic and national security costs of our current reliance on oil are unacceptable. I don't think there's any real debate that the only way we're going to substantially affect that cost to our economy and to many of ourselves, our consumers, is to reduce the amount of oil we use in transportation.

This means both increasing the efficiency of traditional combustion engines and increasing alternatives for powering vehicles. They're promising technologies today in alternative fuels, in increasing energy efficiency and in light weight materials. But because they are new and produced on smaller scales they are not yet seen as widely commercially available and viable. Other technologies remain in even earlier stages, need more research and development before they're commercially ready.

These bills that we're discussing today will focus on both of these areas. Senator Stabenow's bill will provide a useful structure to do the research and development programs at the Department of Energy as well as providing tools to effectively partner with industry to quickly bring advances to the commercial marketplace. It also

brings more focus to the important medium and heavy duty vehicle segment. This is an area where substantial fuel savings opportunities exist.

Senators Merkley and Alexander joined together in a bill. They had Senator Dorgan, who is on this committee in the last Congress, also joined with them in the previous Congress with the bill, providing for a targeted approach to overcoming initial barriers to widespread deployment of light duty vehicles powered by electricity. The benefits replacing some portion of oil use with domestically generated and comparatively cheap electricity are obvious. This likely accounts for the strong vote that their legislation received in this committee in the last Congress. I believe the vote here in our committee was 19 to 4 in reporting that legislation.

So once again this is a very timely topic. We look forward to getting people's updated views on the issues.

Senator Murkowski has just arrived. Let me call on her for any opening comments she has. Then we'll call on our 3 colleagues to give us their views.

But, Senator Murkowski.

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

Senator MURKOWSKI. Thank you, Mr. Chairman. Good morning. Good morning to Senator Alexander, Senator Merkley. Senator Stabenow, I also want to thank you for your hard work on this legislation that we have before us today.

Earlier in the week we considered several bills that are designed to increase domestic energy production. Now we're going to be looking at the other side of the equation with a few of the goals, the bills, that we are putting before us that look to reduce demand. In my mind those are both going to be necessary goals for the foreseeable future. Both supply and demand matter and the policies that we can consider here in this committee, I think should reflect that.

As I've said a number of times, this is an exciting time to be working on vehicle legislation. I think that the automobile industry is once again entering a period that will be marked by tremendous strides in innovation. Advanced technologies are already allowing us to use fuel more efficiently. With the prices at the pump hovering or above \$4 a gallon, that's something that we can all appreciate.

For the first time in a long time it also appears that the internal combustion engine is facing some real competition. That's a fine thing. Electric vehicles are perhaps the most promising of several technologies that could, over time, dramatically reduce our Nation's oil consumption. I think every member of our committee would agree that electric vehicles have great potential. We want to see them transform the industry.

Mr. Chairman, as you've noted, both of the bills on today's agenda were considered and reported by our committee last Congress. While I hope we're able to overcome some of the issues and come to a bipartisan consensus on a path forward. I do have some concerns, perhaps some greater than others that will need to be resolved before I can offer my full support.

Of course, the cost is at the top of my concern list. On Monday, the Federal Government hit its debt ceiling of \$14.3 trillion. Given the huge amount of work that it will take to balance the budget we need to be careful as authorizers to make sure that everything that we pass is well justified. One of the best ways to ensure that our work keeps moving through the legislative process will be to make sure that it's fully paid for whether by repealing old authorizations or applying some of the revenues from new energy production.

But beyond cost, we also need to consider the design of each of these policies.

With respect to the Promoting Electric Vehicles Act, I believe that a national plan is quite relevant. I also believe that deployment communities have considerable merit. But I think we need to be careful. Just a handful of communities will be selected and public money could very well crowd out the private investments that are now being made. I've got some questions about the number of communities that should be created, the funding limits for those communities and the technologies that should be eligible for deployment with them.

With respect to the Advanced Vehicle Technology Act, I certainly appreciate the desire to streamline the current tangle of authorities for the Vehicles Technology program. While I agree that one umbrella authority would be an improvement I do have some concerns about the size of the umbrella that this bill envisions. There's a role for the Federal Government to pay in vehicle research. But it is entirely possible to expand that role too far, especially as we're dealing with our debt and deficits.

Mr. Chairman, I look forward to the hearing this morning as we learn more. To work with you to advance responsible policies that reduce our Nation's fuel consumption.

Thank you.

The CHAIRMAN. Thank you very much. Why don't we hear from our colleagues in the order that they appeared here.

Senator Alexander, did you want to go first? Do you want Senator Merkley to go first?

Senator ALEXANDER. Let Senator Merkley go first.

The CHAIRMAN. Senator Merkley, why don't you go ahead? We'll hear from you 2 and then from Senator Stabenow.

**STATEMENT OF HON. JEFF MERKLEY, U.S. SENATOR  
FROM OREGON**

Senator MERKLEY. Thank you, Chairman Bingaman and Ranking Member Murkowski and members of the committee. I appreciate the opportunity to testify before you in partnership with my colleague, Senator Alexander on a topic both of us feel is very important to the future of our Nation. It addresses one of the biggest issues that faces America, namely America's addiction to imported oil.

We're the largest consumer of oil in the world. We depend on foreign countries like Saudi Arabia and Venezuela for more than 50 percent of that oil. Many of these countries share neither our security interests nor our values.

Transportation is the circulatory system of our economy. Without it, we can't survive. Yet, with 95 percent of transportation powered by oil we have a system in which instability in the Middle East or natural disasters far from our shores or even market manipulation can cause a heart attack in the American economy. Heart attacks in the economy are not good.

We need to take charge of our economic health, our economic future which means breaking our addiction to foreign oil. Since cars consume one-third of our oil, powering cars by electricity is a powerful strategy toward that end. A number of reasons why investing in electric vehicles is good.

First, they promote fuel efficiency. It's a surprise to many that burning fuels create electricity and delivering that electricity to cars is more efficient than actually burning the fuel in individual cars. So we get more bang for our energy buck.

Second, electric fuels promote fuel diversity. Since electricity for cars can be generated from a diverse set of fuels including coal, nuclear, natural gas, hydroelectricity, wind, geothermal, solar and so forth.

Third, because of that diversity, the price of electricity has low volatility insulating America from the type of gasoline price spikes that we're currently experiencing.

Fourth, electric vehicles eliminate pollution from the tailpipe. Our fleet today emits pollutants that lead to asthma and contribute to global warming. Electric vehicles are clean, as electricity they use. Fortunately that electricity is getting cleaner.

Fifth, the fuels that provide us with electricity will come right here from America creating jobs at home. 99.99 percent of the fuels we use to create electricity are here in America. We import .01 percent from Canada.

By meeting our transportation energy needs from domestic fuels we reduce economic and security risks. We reduce our trade deficit. Half of our trade deficit comes from importing oil. When we replace imported oil with red, white and blue American made energy, we create jobs here at home.

Sixth, the battery capacity of an electric vehicle fleet is a positive in that it can eventually create the capacity to even out electricity demand. For example, in some parts of the country cars can take advantage of surplus nuclear energy at night, base load energy. In other parts of our Nation, car batteries can help absorb surplus supply of wind energy.

So let me turn to the design of the bill. Three main concepts.

First is to prove the concept of electric vehicle deployment in targeted deployment communities. It accomplishes this by providing competitive grants to communities to accelerate investments in electric vehicle infrastructure including charging stations, code updates, work force training and so forth. In this sense it's really taking on the chicken and the egg problem.

Communities are reluctant to build the necessary infrastructure until there are enough individuals with cars. Individuals are reluctant to buy until the infrastructure exists. The goal of these deployment communities is to learn from the challenges in diverse areas in order to develop the best strategies to promote effective, cost efficient deployment.



A second main goal is to expand the use of vehicles in fleets. Our bill provides competitive grants to companies that have fleets such as rental car or taxi cab companies and also to change the law so the Federal Government could purchase electric vehicles.

Third, investing in breakthrough battery research to bring down the cost and improve the battery life. This type of research will enable us to have batteries that are more affordable, last longer on each charge and extend battery life as well as reduce electric vehicle component costs and reuse spent batteries. It also creates competition to reach the standard of a 500 mile battery and awards a prize in that competition.

Now there is a significant cost as our Ranking Member pointed out, pegged at \$3 billion over 5 years. To place that into context during that 5 year period we will spend approximately \$1.5 trillion on imported oil. So this bill calls for us to spend \$1 for every \$2,000 we spend overseas out of our economy so that we can stop sending those dollars out of our economy.

Keep them here. Keep them creating jobs here. Have those dollars circulating through our grocery stores, our small businesses, our Main Street businesses. So by spending a fraction of what we're popping out overseas we can greatly strengthen our economy. I think both of us are deeply committed to finding that offset that's necessary when we come to the point of passing this legislation.

So in closing, for the American economy to thrive we need to have a smart energy policy that breaks our addiction to imported oil. Accelerating the deployment of electric vehicles is a key piece of that strategy. It will improve our national security. It will create jobs by spending our energy dollars here at home. It will improve our environment.

Thank you.

The CHAIRMAN. Thank you very much.  
Senator Alexander.

**STATEMENT OF HON. LAMAR ALEXANDER, U.S. SENATOR  
FROM TENNESSEE**

Senator ALEXANDER. Thanks, Mr. Chairman. Mr. Chairman, Senator Murkowski, distinguished colleagues, I appreciate the invitation to try to take 3 to 5 minutes to persuade you to do again what you did last year which is to report the Promoting Electric Vehicles Act to the floor. One difference is the price of gasoline is higher this year than it was last year. The bill costs less this year than it did last year.

Last year's vote was, as the Chairman said, by bipartisan vote of 19 to 4. This is an appropriate role for the Federal Government. 8 to 15 pilot communities, battery research, short term, the billion dollars we saved in authorization, we saved by avoiding duplicating other programs.

Finally if you believe the solution for \$4 gasoline and high energy prices is finding more American energy and using less, this is the best way to use less. Electrifying half our cars and trucks would reduce our use of foreign oil by one-third. Saving money on fuel and stopping the sending of billions of dollars overseas.

So instead of making the speech about—with the rest of my time, let me tell you a story. It's the story of Ross Perot and how he

made his money. Back in the 1960s he noticed that the big banks down in Dallas were locking their doors at 5 o'clock. They had all these big computers that they weren't using at night.

So he made a deal with the banks. Sell me your unused computer time. Then he went to the States and made a deal with the States to use that cheap computer time to do all their data. He made a billion dollars.

In the same way, we've got an enormous amount of unused electricity at night. Conservative estimate is that we have 65 to—we have an amount of electricity that's unused at night. It's equal to the output of 65 to 70 nuclear power plants between 6 a.m. and 6 p.m. I suspect that's probably our greatest unused resource in the United States.

If we were able to use that resource to plug in cars and trucks at night, we could electrify half our—well, 43 percent of our cars and trucks without building one new power plant. We could plug them in at night at electrify 43 percent of our cars and trucks without building one new power plant. Very ambitious goal to electrify half our cars and trucks, take a long time to do it. But it's the best way to reduce our use of oil.

Another reason I think this will work is because it's easy for consumers and I am one. For 2 years I drove a Toyota Prius that had an A123 battery in it. It increased my mileage up to 80 or 90 miles per gallon. I just plugged it in at night at home.

I've now got a Nissan Leaf. I live in an apartment nearby. I plug it in at night. I don't even have a charger. I just plug it into the wall. I can drive a couple of hours every day without buying any gas. Plug it in at night, had no problems.

For that reason almost every car company is now making electric cars. So if extra electricity is available and they're easy to use and car companies are making them, then why do we need the government to be involved? It's a good question.

One is the urgency of the problem. Four dollar a gallon gasoline is killing our economy, throwing a big wet blanket over it. The only solution is to find more and use less and this is the way to use less.

Now to my Republican colleagues.

One, we've been saying for 3 years in our caucus, find more, use less. We criticize Democrats for wanting to find more—for wanting to use less without being serious about finding more. We're subject to the same criticism if all we want to do is find more and don't have a credible way to use less. This is the best way to use less oil.

Second, a criticism is this interferes with the marketplace. It does that, but in a short term, in a limited way. Short term incentives to jump start nuclear energy, to jump start natural gas truck fleets, to jump start electric cars for 4 or 5 years, I think are appropriate given the urgency of the problem. If I'm here in 5 years, I'll be the first to say this should be the end of it. If not, I'll come back and argue for its repeal.

Third, and this is my list of arguments to my Republican colleagues. Conservative groups across the county have said national security demands that we do this. Gary Bauer, President of American Values, Richard Land, President of the Ethics and Religious Liberty Commission, have endorsed our bill saying that national

security concerns overwhelm any opposition to it. It's the best way to displace our use of oil.

Finally can we afford it? It's a billion dollars cheaper. It is an authorization bill. Within the money we spend every year we should be setting priorities. This should be a priority.

There's some suggestion that this committee should also appropriate the money. I would respectfully suggest that we're in a 2-year period where we have no earmarks because authorizers didn't like appropriators authorizing. Let's be consistent and say to authorizers, you shouldn't be appropriating. Let's just do the job of authorizing and then work together. Senator Merkley and I are—have pledged to each other that should you report it and it come to the floor we'll work together to try to pass it without adding to the debt working with the Appropriations Committee.

So in summary, thank you for the time to address \$4 gasoline and high energy prices. We need to find more American energy and use less. The single best way to use less is to jump start electric cars and trucks.

You approved it once before. The problem is worse than it was then you last approved it. The bill costs less than when you last approved it. It's an appropriate role for the Federal Government. We'll work with the appropriators if you report it to find a way to enact it without adding a penny to the debt.

Thank you for your time.

The CHAIRMAN. Thank you both very much for your strong advocacy for the bill that the 2 of you have introduced.

Senator Stabenow has the other bill that we are looking at today. I want to give her a chance to briefly describe that bill before we call our panel of experts.

If you have to go on to other business, we understand that. Thank you again for being here.

Senator Stabenow.

**STATEMENT OF HON. DEBBIE STABENOW, U.S. SENATOR  
FROM MICHIGAN**

Senator STABENOW. Thank you, Mr. Chairman.

First, before my colleagues leave, I just want to thank Senator Merkley and Senator Alexander for a thoughtful and I think, exciting piece of legislation to really move us forward on all of the issues that you talked about, but certainly energy independence, national security. We already have, with the investment we made in advanced batteries last year in the Recovery Act, an example of what you can do with a relatively small amount of dollars that create an explosion of private investment in battery technology. Senator Alexander, you mentioned A123 batteries. Their first manufacturing facility is in Michigan and so we are proud that you are using that battery technology.

But it's about jobs for us as well. That's the one thing I would add. This is very much about jobs. So, thank you for your efforts.

Mr. Chairman, my bill and I want to thank Senator Wyden for co-sponsoring it, really is a partnership with this vision of moving us forward on electricification which I think is incredibly important. The Advanced Vehicle Technology Act does a couple of things. Both allows us to broaden.

So we're looking at a variety of technologies which I know the Chairman is very interested in as well. That we are looking at a variety of opportunities to look at technologies that get us off of foreign oil but also to look at batteries in a broader sense. Right now we're looking at automobiles. That's important. That's a great first step.

But I have seen trucks, not just service trucks, panel trucks like Fed Ex or UPS or others, but large trucks now that have the capacity to use battery technologies. Then talk about getting us off of foreign oil and using less gas. If we can take those technologies and move them to large vehicles we are doing even more.

So, the bill that I've introduced which is very similar to the one passed last year, last September by the committee, looks to do that, bring all of the advanced technology partnerships together in one place. But broaden the way we're looking at it. This is enjoy—this enjoys the support of the Motor and Equipment Manufacturers Association, Electric Drive Transportation Association, Hybrid Truck User Forum, Alliance of Auto Manufacturers as well as a number of individual manufacturers, suppliers and environmental groups.

This helps support our manufacturers and suppliers to make the most fuel efficient vehicles through a wide variety of technologies, which of course, will save consumers money at the gas station, reduces dependence on foreign oil and creates jobs which is so important for us. We are putting through S. 734. We're putting a framework together for vehicle research and development within the Department of Energy's Vehicle Technologies Program.

We are improving the program to go beyond the traditional partnerships. As I mentioned by including suppliers because component parts whether it's batteries or other component parts that have motors, engineering parts and so on, is important. Including medium and heavy duty trucks and that technology is very important for us in terms of saving energy.

Under the bill Department of Energy would form public/private partnerships with companies of all sizes, with universities, other groups, to work on a broad range of innovative technologies like electric cars, hybrids, natural gas, advanced batteries, would look broadly at what we can do to jump start a number of technologies. I should finally just point out there is no price tag in the bill. It remains the job of the appropriators to decide where the funding will come from. We used the term such sums as are appropriated. We also keep the cost to a minimum by specifically directing the Department to avoid duplication with other agencies.

So again, thank you Mr. Chairman. I think it's very important that we bring our activities together in one place and focus them more on ways to really get us off of foreign oil by great American ingenuity and technology.

The CHAIRMAN. Thank you very much, Senator Stabenow for your leadership on this legislation. We appreciate your early and strong advocacy for what we're trying to consider today.

Why don't we call our panel of witnesses today? Let me ask them to come forward. I'll introduce them at this time.

We have Mr. Patrick Davis, who is the Program Manager with the Office of Vehicle Technologies in the Department of Energy.

We have Mr. Seifi Ghasemi, who is a Board Member with the Electrification Coalition also, Chairman and CEO of Rockwood Holdings in Princeton, New Jersey. Thank you for being here.

Ms. Genevieve Cullen is Vice President of the Electric Drive Transportation Association.

Mr. Bill Van Amburg is the Senior Vice President with CALSTART in Pasadena, California.

Mr. David Crane, who is President and CEO of NRG Energy in Princeton, New Jersey.

So thank you all very much for being here. If each of you could take about 5 minutes and give us the main points you think we need to understand from your testimony. We will include your full testimony in the record as if read. So you don't need to go through all aspects of it. But again, we appreciate your being here.

Mr. Davis, why don't we start with you and tell us the Department of Energy's view on these 2 bills and anything else you think we need to understand.

**STATEMENT OF PATRICK DAVIS, PROGRAM DIRECTOR, VEHICLE TECHNOLOGIES PROGRAM, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY**

Mr. DAVIS. Thank you.

Chairman Bingaman, Ranking Member Murkowski and members of the committee, thank you for the opportunity to discuss the Advanced Vehicles Technology Act and the Promoting Electric Vehicles Act of 2011.

The transportation sector accounts for approximately two-thirds of the U.S. oil consumption and contributes to one-third of our Nation's greenhouse gas emissions. After housing, transportation is the second biggest monthly expense for most American families. As the President said in his recent energy speech, "In an economy that relies so heavily on oil rising prices at the pump affect everybody." In addition the President outlined a portfolio of actions which if taken together could cut U.S. oil imports by a third by 2025.

The Office of Energy Efficiency and Renewable Energy's Vehicle Technologies Program develops and promotes energy efficient, environmentally friendly transportation technologies that will reduce petroleum consumption and lower greenhouse gas emissions while meeting driver's expectations of vehicle performance. Few technologies hold greater promise for reducing our dependency on oil than electric vehicles. In his 2011 State of the Union Address, the President spoke of his goal to have the United States become the first country with a million electric vehicles on the road by 2015. Meeting this goal will help the U.S. become a leader in the clean energy economy while capitalizing on the ingenuity of American industry.

In 2009, the U.S. had only 2 factories manufacturing advanced vehicle batteries and produced less than 2 percent of the world's hybrid vehicle batteries. But over the next few years, thanks to investments from the American Recovery and Reinvestment Act in battery and electric drive manufacturing, the U.S. will be able to produce enough batteries and components to support 500,000 electric drive vehicles per year. High volume manufacturing coupled

with battery technology advances and material cost reductions will lead to a drop in battery costs of approximately 50 percent by 2013 compared to 2009 making electric vehicles accessible to more consumers.

Making our cars and trucks more efficient is one of the easiest and most direct ways to limit our petroleum consumption and save consumers money. To help increase the fuel economy of the vehicle fleet DOE is investing not only in electric vehicles, but also in higher efficiency combustion engines, vehicle light weighting, ethanol and biofuel development, fuel cell electric vehicles, manufacturing and vehicle electrification deployment. The Promoting Electric Vehicles Act of 2011 includes several important provisions to promote near term deployment of electric drive vehicles which complement and supplement the Department's ongoing activities.

The Department recognizes the potential benefits of activities such as those proposed by the National Plug in Electric Vehicle Deployment program including technical assistance, work force training and a targeted communities program to facilitate the rapid deployment of plug in vehicles. We believe that such an effort will help create models and facilitate the local leadership necessary for faster, easy adoption across the country and would be a natural extension of the activities undertaken through our Clean Cities Program. The coalitions that comprise the Clean Cities network bring together State and local governments, early adopter fleets, local utilities, infrastructure developers and other key stakeholders to help advance the deployment of alternative fuel vehicles.

These partnerships are proven and effective resources for sharing information at the local level and are prime to support the roll out of electric drive vehicles and infrastructure. We believe that both the work force training as well as the technical assistance component of the proposed National Deployment Program are vital to the successful roll out of electric drive vehicles. Again, the Department is well positioned to disseminate information and provide training and technical assistance to communities seeking to accelerate EV deployment.

As an example the Clean Cities network is working today to share best practices and lessons learned about permitting and inspection processes as well as opportunities for code official and first responder training. The program authorized by the Advanced Vehicle Technology Act of 2011 would complement several of the Department's current activities focused on increasing vehicle energy efficiency. The Department supports an integrated portfolio of advanced vehicle and fuel research development demonstration and deployment activities. Ultimately Senate 734 would further support the widespread commercialization of advanced vehicle and fuel technologies to reduce U.S. oil consumption, strengthen our economy and reduce air pollution and greenhouse gas emissions.

In summary, the Department's transportation portfolio will save consumers money, reduce our dependence on oil, reduce/lower our environmental impact and keep America on the cutting edge of clean energy technologies enabling us to build a 21st century clean energy economy. Thank you again for the opportunity to discuss these issues. I welcome any questions you may have.

[The prepared statement of Mr. Davis follows:]

PREPARED STATEMENT OF PATRICK DAVIS, PROGRAM DIRECTOR, VEHICLE TECHNOLOGIES PROGRAM, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY

Chairman Bingaman, Ranking Member Murkowski and Members of the Committee, thank you for the opportunity to discuss the Department's advanced vehicles technology programs. The Administration is still reviewing S. 734 the Advanced Vehicles Technology Act and S. 948 Promoting Electric Vehicles Act of 2011 and does not have a position on either bill at this time and so this statement will provide only general DOE comments.

The transportation sector accounts for approximately two-thirds of the United States' oil consumption and contributes to one-third of the Nation's greenhouse gas (GHG) emissions.<sup>1</sup> After housing, transportation is the second biggest monthly expense for most American families.<sup>2</sup> As the President said in his recent energy speech, "In an economy that relies so heavily on oil, rising prices at the pump affect everybody." Emphasizing that "there are no quick fixes," the President outlined a portfolio of actions which, taken together, could cut U.S. oil imports by a third by 2025. These include programs that would put one million electric vehicles on the road by 2015.

The Office of Energy Efficiency and Renewable Energy's (EERE's) Vehicle Technologies Program (VTP) develops and promotes energy-efficient, environmentally-friendly transportation technologies that will reduce petroleum consumption and lower GHG emissions while meeting drivers' expectations of vehicle performance. VTP's activities promote energy security, environmental, and economic benefits in both the near-and long-term.

Few technologies hold greater promise for reducing our dependence on oil than electric vehicles. In his 2011 State of the Union address, the President spoke of his goal to have the United States become the first country with a million electric vehicles on the road by 2015. Meeting this goal will help the United States become a leader in the clean energy economy, while capitalizing on the ingenuity of American industry. Manufacturing products needed for the clean energy economy will generate long term economic strength in the U.S., creating jobs across the country while reducing air pollution and greenhouse gas emissions.

EERE investments past, present, and future are critical to achieving this goal. In 2009, the U.S. had only two, relatively small, factories manufacturing advanced vehicle batteries, and produced less than two percent of the world's hybrid vehicle batteries.<sup>3</sup> But over the next few years, thanks to investments from the American Recovery and Reinvestment Act of 2009 (Recovery Act) in battery and electric drive component manufacturing, and electric drive demonstration and infrastructure, the U.S. will be able to produce enough batteries and components to support 500,000 plug-in and electric vehicles per year. High volume manufacturing, coupled with battery technology advances, design optimization, and material cost reductions, could lead to a drop in battery costs of 50 percent by 2013 compared to 2009, which will lower the cost of electric vehicles, making them accessible to more consumers.

Further policies and research are needed to build on the work under the Recovery Act. That is why the President's FY 2012 Budget proposes a new effort to support electric vehicle manufacturing and adoption in the United States through new consumer rebates, investments in R&D, and competitive programs to encourage communities that invest in electric vehicle infrastructure and regulatory streamlining. Specifically, the Budget proposes to: transform the existing \$7500 tax credit for electric vehicles into a rebate that will be available to all consumers immediately at the point of sale; advance innovative technologies through new R&D investments, building on Recovery Act investments, by investing \$588 million for vehicle technologies at DOE; and reward communities that invest in electric vehicle infrastructure through a \$200 million program which provides an incentive for communities to invest in electric vehicle infrastructure and remove regulatory barriers.

GENERAL COMMENTS ON S. 948, THE PROMOTING ELECTRIC VEHICLES ACT OF 2011

The investments that we have made through the Recovery Act as well as those in the Budget align with many of the priorities that are reflected in the Promoting Electric Vehicles Act of 2011—though we do not take a position on the bill itself. Below, I will discuss some of the priorities included in this bill:

One of the main elements of the Promoting Electric Vehicles Act is a deployment program in which communities would be chosen on a competitive basis to receive

<sup>1</sup> [http://www1.eere.energy.gov/vehiclesandfuels/pdfs/vehicles\\_fs.pdf](http://www1.eere.energy.gov/vehiclesandfuels/pdfs/vehicles_fs.pdf)

<sup>2</sup> <http://www.bls.gov/news.release/cesan.nr0.htm>

<sup>3</sup> [http://www.whitehouse.gov/sites/default/files/blueprint\\_secure\\_energy\\_future.pdf](http://www.whitehouse.gov/sites/default/files/blueprint_secure_energy_future.pdf)

grants that would be used to support integration of electric vehicles through means such as installing charging infrastructure, updating building codes. The Administration is supportive of this concept, which is why the President's Budget includes \$200 million to reward communities for leadership in reducing regulatory barriers and developing comprehensive electric vehiclefriendly infrastructure.

Specifically, this funding will support a competitive program within the Department of Energy to help communities across the country become early adopters of electric vehicles through regulatory streamlining, infrastructure investments, vehicle fleet conversions, deployment of EV incentives (e.g., parking, HOV access) partnerships with major employers/retailers, and workforce training. The FY 2012 Budget includes a proposal that would allow up to 30 communities across the country to receive grants of up to \$10 million each on the basis of their ability to demonstrate concrete reforms and to use the funds to help catalyze electric vehicle deployment. This approach builds on bi-partisan proposals and ideas including some developed by the sponsors of this bill.

The Promoting Electric Vehicles Act of 2011 includes provisions to promote near-term deployment of plug-in electric drive vehicles, many of which may complement and supplement the Department's ongoing activities, funded both through the Recovery Act and annual appropriations. However, as stated previously, the Administration is continuing to review this extensive bill and does not have a position on it at this time.

S.948 includes provisions which would support technical assistance, workforce training, and a targeted communities program to facilitate the rapid deployment of plug-in vehicles. The bill's targeted deployment program would offer communities of different sizes in various parts of the country an opportunity to execute various deployment approaches and develop best practices that can be shared nationwide to address critical questions about planning and managing vehicle and charging infrastructure deployment.

The Department notes that the community selection criteria includes an emphasis on diversity of climate and type of electric utility. Such diversity in pilot programs, particularly across electricity-generation sources, would be crucial for estimating the environmental impacts of expanded adoption of plug-in electric drive vehicles.

DOE is already examining ways to work more closely with communities on vehicle electrification and infrastructure deployment, particularly in connection with our Clean Cities Program. The coalitions that comprise the Clean Cities network bring together state and local governments, early adopter fleets, local utilities, infrastructure developers, and other key stakeholders in a community to advance the deployment of alternative fuel vehicles. These public private partnerships are proven and effective resources for sharing information at the local level and are primed to support the rollout of electric drive vehicles and infrastructure. Our goal is to better understand how the Department can support local community efforts to deploy EVs and infrastructure.

To maximize the effectiveness of the targeted communities program, the Department would seek to coordinate this effort with related ongoing projects to deploy electric drive vehicles and infrastructure. Our Recovery Act projects for transportation electrification are building critical expertise through large-scale vehicle and infrastructure deployment, collecting data on vehicle-grid interaction and producing valuable lessons learned that can support and help to accelerate future deployments in other communities. We note that the deployment community selection criteria as outlined in the legislation, is crafted to help ensure that the selected communities stand up as models for deployment across the country.

We also believe that technical assistance is vital to the successful rollout of any proposed national deployment program for electric drive vehicles. The Department is well positioned to disseminate information and provide training and technical assistance to communities seeking to accelerate EV deployment. As an example, and as noted earlier, the Clean Cities network is primed to share best practices and lessons learned about permitting and inspection processes, as well as other local ordinances and opportunities for code official and first responder training. I would like to note, however, that the Department plays a supporting role in the development of model codes and standards. In regard to this provision, we can bring value to the process because of our extensive experience working with code development organizations (CDOs) and standards development organizations (SDOs) to facilitate consensus around the development and adoption of vehicle-and infrastructure-related codes and standards. We are also working to enable the harmonization of codes and standards at an international level collaborating with the National Institute of Standards and Technology (NIST) and the Department of Transportation, as well as with the private sector. Standards and codes for electric vehicles must be con-



sistent with the broader Smart Grid Interoperability Panel (SGIP) effort led by NIST.

The Promoting Electric Vehicles Act includes several other significant provisions in addition to the National Plug-in Electric Drive Deployment Program; I will briefly comment on several of them here.

- The bill authorizes a R&D program focused on advanced batteries, electric drive components, and other technologies supporting the manufacture and deployment of electric drive vehicles and charging infrastructure. These priorities are aligned closely with ongoing activities in the Vehicle Technologies Program—specifically, our Batteries and Electric Drive Technology subprogram, which includes advanced battery R&D and advanced power electronics and electric machines, as well as our Vehicle and Systems Simulation and Testing subprogram, which includes work to examine vehicle and infrastructure interface issues through testing and evaluation. Notably, the President’s FY 2012 Budget request will significantly broaden R&D investments in technologies like batteries and electric drives including an over 30 per cent increase in support for vehicle technology R&D and a new Energy Innovation Hub devoted to improving batteries and energy storage for vehicles and beyond.
- The bill focuses on Federal electric vehicle upgrades. I note that the Administration shares your commitment to upgrading the federal fleet and is finalizing the procurement of 100 electric vehicles.
- The bill also discusses partnership with the private sector surrounding vehicle upgrades, an area where Administration policies are strong. Specifically, we recently announced the Clean Fleets partnership. This program is focused on working with private sector partnerships to help them become leaders in deploying advanced vehicles—including electric vehicles—and technical assistance is a critical component of the program. In fact, DOE has developed a wide range of technical tools to help partner companies to navigate the world of alternative fuels and advanced vehicles. A diverse collection of cost calculators, interactive maps, customizable database searches, and mobile applications puts vital information and analysis at fleets’ finger tips. This is just one example of our activities in this area—and shows how important we think it is to offer technical assistance.
- We also understand and appreciate the Committee’s interest in a technical advisory committee focused on plug-in hybrid vehicles. We place great value in independent reviews and external input to our program. You may be aware that the National Academy of Sciences National Research Council conducts independent biennial reviews of both our light-duty and heavy-duty vehicle research programs.
- With respect to the new loan guarantee authorities included in the bill, we are continuing to evaluate these proposals. At a minimum, we would want any credit assistance to be the most efficient and effective means of achieving policy goals, and therefore any new authorities should comply with Federal credit policies to mitigate cost and risk to the taxpayer.

#### COMMENTS ON S 734 THE ADVANCED VEHICLE TECHNOLOGY ACT OF 2011

While the Administration is still reviewing S 734 and has no position on the bill at this time, it appears that the program authorized by the bill could complement several of the Department’s current activities focused on increasing vehicle energy efficiency. The Vehicle Technologies Program is meeting the transportation challenge with an integrated portfolio of advanced vehicle and fuel research, development, demonstration, and deployment activities. We are accomplishing this work in collaboration with industry leaders, national laboratories, universities, state and local governments, and other stakeholders. S. 734 could further support the widespread commercialization of advanced vehicle and fuel technologies to reduce U.S. oil consumption, strengthen our economy, and reduce air pollution and greenhouse gas emissions. That being said, we suggest that the Director of the program be appointed by the Secretary within the Office of Vehicle Technologies itself to facilitate better coordination across activities with similar goals and work.

Further, it also appears that Section 102 “Sensing and Communications Technologies,” would unnecessarily duplicate the existing research, development, and demonstration efforts of the Department of Transportation’s National Intelligent Transportation Systems Program. We recommend against such duplicative Federal programs.

In sum, the Department’s transportation portfolio will save consumers money, reduce our dependence on oil, lower our environmental impact, and keep America on the cutting edge of clean energy technologies, enabling us to build a 21st century

clean energy economy. Thank you again for the opportunity to discuss these issues, and I welcome any questions you may have.

The CHAIRMAN. Thank you very much.

Mr. Ghasemi, we're very glad to have you here. Go right ahead.

**STATEMENT OF SEIFI GHASEMI, CHAIRMAN AND CEO, ROCKWOOD HOLDINGS, INC., MEMBER, ELECTRIFICATION COALITION, PRINCETON, NJ**

Mr. GHASEMI. Thank you, sir.

Chairman Bingaman, Ranking Member Murkowski and members of the committee, I would like to thank you for giving me this opportunity to speak to you regarding our Nation's dangerous dependence on imported oil and the enormous opportunity presented by the electrification of transportation. While I'm here largely to discuss the Promoting Electric Vehicle Act of 2011, I would first like to take a moment to thank this committee for its ongoing effort to improve our Nation's security. I would also like to specifically recognize Senator Stabenow's legislation for highlighting the importance of research and development as we adopt new technologies.

The Promoting Electric Vehicle Act of 2011 introduced by Senator Jeff Merkley and Lamar Alexander, in both my view personally and that of the Electrification Coalition represents a critical step in ending the very real economic and national security threats posed by our dependence on imported oil.

I am Chairman and CEO of Rockwood Holdings, a global chemical company that employs 9,600 men and women in 100 facilities around the world. I was born in 1944 in the Town of Mashad in what is now called the Islamic Republic of Iran. I came to the United States in 1966 to complete my education at Stamford University. In 1970 I went back to Iran to teach at the University and work in the manufacturing sector.

All was well until the Iranian Revolution in 1979. At that time I had 3 strikes against me. I had gone to school and worked in the United States. My wife was an American and Jewish. I had been a vocal opponent of the mullahs.

Thankfully my wife and son were visiting the United States when the revolution occurred. I fled and met them months later. I was one of the very lucky ones.

This is a very significant part of why I am here. I feel very passionate about the issue of our dependence on oil from those parts of the world. I know what oil dependence means. It means that the in power, oil producing nations such as Iran to defy U.S. Foreign Policy since they know we need their oil to run our transportation system.

Oil dependence means that the enabled foreign governments to impose unreasonably high gasoline prices on U.S consumers who have no alternative but gasoline to run their cars and get to work. In 2008 alone, the United States sent \$388 billion overseas to pay for imported oil, half of our National Trade Deficit. Department of Energy researchers have estimated that the economic cost of U.S. dependence on imported oil at \$500 billion just in 2008 and have added up to more than \$5 trillion since 1970, a third of our total national debt that we are all so concerned about now.

Between 2001 and 2008 the average price of gasoline increased from \$1.46 to \$3.27 costing typical households \$2,115 a year in fuel expenses. Some Americans today are paying more for gas than they are paying for food. It would be ideal, obviously, if there was a free market solution. But there is not free market for oil, far from it.

Today more than 90 percent of proven conventional oil reserves are controlled by foreign governments whose interests are often at odds with ours. The fundamental reason for America's dependence on imported oil is the energy demand of the transportation sector. Transportation now accounts for approximately 71 percent of American oil consumption. Any shortage of oil will cause a massive destruction of transportation system threatening our national security and economic stability.

But there is a solution. An electrified transportation sector is a viable alternative. We are not saying it's the only alternative. But it is a very viable alternative.

Electricity is a diverse, domestic, stable, fundamentally scalable energy supply whose fuel inputs are almost completely free of oil. The Promoting Electric Vehicle Act of 2011 is a great first step toward energy independence. The act would create a competition for cities and towns would compete to be elected as deployment communities where all of the elements of electrified transportation system are deployed at scale. These communities would move electrification beyond a niche product into a dominant concept. When the plan is implemented it would accelerate the production of electric vehicles, components and infrastructure across the country.

Right now my company, Rockwood, is spending more than \$100 million to expand our operations in the United States in places like North Carolina, Michigan and Nevada. But the fact is that Chinese electric vehicles will need our materials as much as any other countries. As an American I want those electric cars made in the United States.

Let's not go the direction we have gone with personal computers. Designed by Americans but made overseas. A strong manufacturing sector is critical to a strong economy. A strong auto industry is critical to a strong manufacturing sector.

The auto industry in the United States can be the world leader in a game changing technological leap forward by making the electric cars of the future. The opportunity before this committee and indeed before the entire Senate is tremendous. I truly believe that dependence on imported oil is a clear and present danger to the national security and economic stability of the United States.

We can end our dependence on imported oil. We have the technology. The first step is passing the Promoting Electric Vehicle Act of 2011.

Thank you very much, Mr. Chairman.

[The prepared statement of Mr. Ghasemi follows:]

PREPARED STATEMENT OF SEIFI GHASEMI, CHAIRMAN AND CEO, ROCKWOOD HOLDINGS, INC., MEMBER, ELECTRIFICATION COALITION, PRINCETON, NJ

Good morning, Chairman Bingaman, Ranking Member Murkowski, and members of the Committee. I would like to thank you for giving me this opportunity to speak to you regarding our nation's dangerous dependence on petroleum, and the enormous opportunities presented by the electrification of transportation.

While I am here largely to discuss the Promoting Electric Vehicles Act of 2011, I would first like to take a moment to thank this committee for its ongoing efforts to improve our nation's energy security. I would also like to specifically recognize Senator Stabenow's continued dedication to electrification. As her bill today highlights, research and development will continue to play a critical role as we adopt new technologies, and we look forward to working with her moving forward.

I am proud to serve as a member of the Electrification Coalition, an organization made up of a group of business leaders who represent the entire value chain of an electrified transportation sector and who are committed to promoting policies and actions that facilitate the deployment of electric vehicles on a mass scale.

The Promoting Electric Vehicles Act of 2011, introduced by Senators Jeff Merkley and Lamar Alexander, in both my view personally and that of the Electrification Coalition, represents a critical step forward in our nation's effort to reach that goal, helping us toward ending the very real economic and national security threats posed by our dependence on oil.

This is an issue I am very passionate about.

I am Chairman and CEO of Rockwood Holdings, a global specialty chemicals and advanced materials company that employs 9,600 men and women in 100 facilities around the world.

I came to Rockwood through a route that is probably a little unusual.

I was born in 1944 in the town of Mashad in what is now called the Islamic Republic of Iran.

When I was 15, I went to a special school organized and run by the international oil companies that, at the time, had the concession for the exploration, production and refining of the oil from Iran. When I graduated, I was offered a scholarship by the oil companies to go to graduate school with a condition that I would come back and work for them. But by then, I knew where I wanted to be: I came to the United States to complete my education at Stanford University.

After I completed my education, I went to work with William Lear—the man who developed the Lear Jet—on his project to develop and build a steam-powered automobile. Even back then, we were looking for better, safer alternatives to oil. Steam-powered cars and trucks did not turn out to be the route to the future, but working on them helped shape mine.

In 1970, my wife—a third-generation American descendent of Russian Jewish immigrants—and I moved to Tehran, initially to teach at the university. I continued my work there in the manufacturing sector, working with the National Iranian Steel Industries Company to help develop a steel industry in Iran. It was an exciting, challenging time for me, my wife, and my son . . . until the Iranian Revolution in 1979.

At that time, I already had three strikes against me. I had gone to school and worked in the United States. My wife was an American and Jewish. And I had been a vocal opponent of the mullahs.

Thankfully, my wife and son were visiting the United States when the revolution occurred. I fled, and met them there months later. I was one of the lucky ones.

And that is a very significant part of why I am here today.

This is not just dollars and cents to me.

I know what oil dependence means. I know that the mullahs are still in power today at least in part because the West cannot and will not take overt action against a major oil-producing nation. Oil dependence distorts American diplomacy, subverts American goals, and forces us to accommodate hostile, brutal governments.

The vulnerability of global oil supply lines and infrastructure has driven the United States to accept the burden of securing the world's oil supply. Much of the infrastructure that delivers oil to the world market each day is exposed and vulnerable to attack in unstable regions of the world. According to the U.S. Department of Energy, each day more than 40 percent of the world's oil supplies must transit one of six maritime chokepoints, narrow shipping channels like the Strait of Hormuz between Iran and Oman. Even a failed attempt to close one of these strategic passages could cause global oil prices to skyrocket. A successful closure could bring economic catastrophe.

To mitigate this risk, U.S. armed forces expend enormous resources patrolling oil transit routes and protecting chronically vulnerable infrastructure in hostile corners of the globe. This engagement benefits all nations, but comes primarily at the expense of the American military and ultimately the American taxpayer. A 2009 study by the RAND Corporation placed the cost of this defense burden at between \$67.5 billion and \$83 billion annually.

And the threat to our economy is no less real.

In 2008, when oil prices spiked, Americans consumed nearly 20 million barrels of oil a day—one-fourth of the world's total. We imported 58 percent of the oil we

consumed, leading to a U.S. trade deficit in crude oil and petroleum products that reached \$388 billion—56 percent of the total trade deficit. That figure fell back to \$200 billion in 2009, but jumped to \$265 billion in 2010. In the first quarter of 2011, with near-record volatility in oil markets and high prices driven by turbulence in the Middle East, the United States ran an \$84 billion deficit in petroleum trade over a three month period. In March, crude oil and petroleum products accounted for 65 percent of the monthly U.S. trade deficit, a figure which eclipsed otherwise strong growth in U.S. export strength.

And the steps we usually would take to help strengthen the economy and create jobs in times of weakness are just as easily overcome by oil price volatility. The total effect of changes to the federal tax code from 2001 to 2008 code was a decrease in annual federal income and estate taxes by about \$1,900 for the median household. But a typical household's energy costs rose more than that. In other words, every penny that the most Americans saved due to federal income and estate tax cuts over those eight years was spent on higher gasoline bills.

At the beginning of 2001, oil prices were steady at \$30 per barrel. Over the subsequent five years, prices steadily rose, reaching \$75 per barrel in June of 2006. After retreating slightly, benchmark crude prices jumped 50 percent in 2007, from \$60 per barrel in January to more than \$90 in December. In 2008, oil prices soared rapidly, eventually reaching their all-time high of more than \$147 per barrel on July 3.

Prices only came down when demand plunged along with the global economy. And now, with prices at the pump once again on the rise, we must ask ourselves how many times we must repeat this damaging cycle? Many of the underlying fundamentals that pushed oil prices to record levels are pushing them up once again today. Oil demand continues to recover, both in the United States and abroad. Unrest in the Middle East is only driving prices up faster. Historically, crude oil costs of more than 4 percent of gross domestic product have occurred concurrently with recessions. At between 4 and 5 percent of GDP, oil spending is reaching dangerous levels once again. Our nascent economic recovery is at risk.

It would be ideal if there was a free market solution to these threats. But there is no free market for oil. Far from it: today, more than 90 percent of proved conventional global oil reserves are held by national oil companies that are either fully or partially controlled by foreign governments whose interests are often at odds with our own. As long as we remain dependent on those nations, we remain vulnerable.

At the crux of America's oil dependence is the energy demand of the transportation sector. Transportation accounts for approximately 71 percent of American oil consumption. Cars and trucks are 94 percent reliant on oil-based fuel for their energy, with no substitutes immediately available in anything approaching sufficient quantities. Any shortage of oil will cause a massive disruption of the transportation system, creating significant difficulties in day-to-day life which will inevitably lead to chaos. Put another way, when prices go up, we have only two choices: drive less or pay more. This is unacceptable.

A new path forward begins with a statement of fundamental fact: As long as our cars and trucks are powered by internal combustion engines, we will continue to be dependent on oil. The solution can be found in something that nearly every single one of you has either on your belt or on the table in front of you. The lithium ion batteries that power our cell phones and laptop computers can one day form the nucleus of an electrified transportation sector that is powered by a wide variety of domestic sources: natural gas, nuclear, coal, hydroelectric, wind, solar, and geothermal. No one fuel source—or producer—would be able to hold our transportation system and our economy hostage the way a single nation can disrupt the flow of petroleum today.

Electricity represents a diverse, domestic, stable, fundamentally scalable energy supply whose fuel inputs are almost completely free of oil. It would have clear and widespread advantages over the current petroleum-based system:

- 1) Electricity is Diverse and Domestic: Electricity is generated from a diverse set of largely domestic fuels. Among those fuels, the role of petroleum is negligible. In fact, just 1 percent of power generated in the United States in 2009 was derived from petroleum. An electricity-powered transportation system, therefore, is one in which an interruption of the supply of one fuel can be made up for by others.

This ability to use different fuels as a source of power would increase the flexibility of an electrified light-duty vehicle fleet. As our national goals and resources change over time, we can shift transportation fuels without having to overhaul our transportation fleet again. In short, an electrified transport system would give us back the reins, offering much greater control over the fuels we use to support the transportation sector of our economy.

Moreover, while oil supplies are subject to a wide range of geopolitical risks, the fuels that we use to generate electricity are generally sourced domestically. All renewable energy is generated using domestic resources. We are a net exporter of coal, which fuels about half of our electricity. Although we currently import a net of approximately 11 percent of the natural gas we consume, more than 80 percent of those net imports were from North American sources (Canada and Mexico) in 2010. And in fact, recent advancements in the recovery of natural gas resources from unconventional reservoirs like shale gas, coal bed methane, and tight gas sands have led to wide consensus that our domestic undiscovered technically recoverable reserves are well in excess of 1,000 trillion cubic feet. We do import a substantial portion of the uranium we use for civilian nuclear power reactors. Forty-two percent of those imports, however, are from Canada and Australia.

2) Electricity Prices are Stable: Electricity prices are significantly less volatile than oil or gasoline prices. Over the past 25 years, electricity prices have risen steadily but slowly. Since 1983, the average retail price of electricity delivered in the United States has risen by an average of less than 2 percent per year in nominal terms, and has actually fallen in real terms. Moreover, prices have risen by more than 5 percent per year only three times in that time period.

This price stability, which is in sharp contrast to the price volatility of oil or gasoline, exists for at least two reasons. First, the retail price of electricity reflects a wide range of costs, only a small portion of which arise from the underlying cost of the fuel. The remaining costs are largely fixed. In most instances, the cost of fuel represents a smaller percentage of the overall cost of delivered electricity than the cost of crude oil represents as a percentage of the cost of retail gasoline. Second, although real-time electricity prices are volatile (sometimes highly volatile on an hour-to-hour or day-to-day basis), they are nevertheless relatively stable over the medium and long term. Therefore, in setting retail rates, utilities or power marketers use formulas that will allow them to recover their costs, including the occasionally high real-time prices for electricity, but which effectively isolate the retail consumer from the hour-to-hour and day-to-day volatility of the real-time power markets.

By isolating the consumer from the price volatility of the underlying fuel costs, electric utilities would be providing to drivers of grid-enabled vehicles (GEVs)—vehicles propelled in whole or in part by electricity drawn from the grid and stored onboard in a battery—the very stability that oil companies cannot provide to consumers of gasoline.

3) The Power Sector has Substantial Spare Capacity: Because large-scale storage of electricity has historically been impractical, the U.S. electric power sector is effectively designed as an ‘on-demand system.’ In practical terms, this has meant that the system is constructed to be able to meet peak demand from existing generation sources at any time. However, throughout most of a 24-hour day—particularly at night—consumers require significantly less electricity than the system is capable of delivering. Therefore, the U.S. electric power sector has substantial spare capacity that could be used to power electric vehicles without constructing additional power generation facilities, assuming charging patterns were appropriately managed.

4) The Network of Infrastructure Already Exists: Unlike many proposed alternatives to petroleum-based fuels, the nation already has a ubiquitous network of electricity infrastructure. No doubt, electrification will require the deployment of charging infrastructure, additional functionality, and increased investment in grid reliability, but the power sector’s infrastructural backbone—generation, transmission, and distribution—is already in place.

Based on these and other advantages, a wide array of automakers is beginning to introduce grid-enabled vehicles into the marketplace. There are important differences in drivetrain architectures, with some vehicles relying solely on battery power (electric vehicles, or EVs) and others augmented by liquid fuels as well (plug-in hybrid electric vehicles, or PHEVs). All told, automakers worldwide are developing dozens of plug-in hybrid and electric vehicles. By 2013, more than 40 models could be available to consumers.

From just a handful of units introduced in 2010, the industry is beginning to scale up. Announced North American production capacity will exceed 100,000 vehicles in 2012 and 350,000 by 2014. (These figures do not include trucks.) Additional volumes will reach the U.S. market from OEM plants overseas, particularly in the next two years.

High penetration rates of GEVs could radically minimize the importance of oil to the United States, strengthening our economy, improving national security, and pro-

viding much-needed flexibility to our foreign policy while clearing a path toward dramatically reduced economy-wide emissions of greenhouse gases. No other alternative to petroleum can claim these widespread advantages.

The logical next question is how we can successfully devise and deploy an electrified transportation system. Here's what we need to avoid: it has now been more than 10 years since traditional hybrids were first introduced in the United States. And despite government support and record high gas prices for part of that time, there are still only 1.9 million hybrids on the road in the U.S. today—out of approximately 250 million light-duty vehicles in the fleet.

We cannot let electric vehicles turn into another niche product. We cannot allow their use to be limited to the environmentalists and technological enthusiasts who will buy those first waves of them. To make our nation's investment worthwhile—and, more importantly, to truly combat our oil dependence—we must put ourselves on the pathway toward millions, then tens of millions, and then hundreds of millions of electric cars and trucks.

It is not as simple as flipping a switch. Electrification on a mass scale is an enormously complex undertaking. The issue is not simply one of putting electric cars into showrooms. At the most basic level, the first commercially available EVs and PHEVs will be significantly more expensive than their internal combustion engine counterparts. The existing tax credits help offset that cost, but they hardly represent a transformative policy framework that will give consumers the necessary confidence to adopt a fundamentally new technology. For electrification to appeal to consumers, it will truly 'take a village.'

For example, drivers will want to know that installing a charger in their garage will be a seamless and simple process that isn't bogged down by weeks of red tape. For EV drivers, they will want access to some amount of public charging infrastructure so that they can feel confident as they complete a Saturday full of errands and shopping—or take the family on the highway for the great American road trip.

The proactive engagement and support of utilities will be absolutely critical. Smart charging will make EVs and PHEVs an asset for the grid, but dumb charging will make them a liability. One analysis by EPRI found that plugging in just one PHEV to charge at 220 volts overloaded 36 of 53 transformers examined during peak hours and 5 of 53 transformers during off-peak hours. We are all excited about the benefits of using EVs and PHEVs to fill valleys in utility load curves, but this will only work if consumers have the ability to receive information that incentivizes them to charge their cars at night. Yet, most public utility commissions don't encourage or allow time-of-use pricing.

The bottom line is that, for this technology to succeed, the vehicles will need a network of support—both in terms of regulations and infrastructure. Without that, they will be relegated to niche product status. Consumers will have poor experiences, many of the 3,000 utilities in the U.S. will play an absentee role—at best—in the process, and we will have invested billions of dollars in a battery industry that finds stronger roots in Europe (where fuel prices are higher) and in China (where the public imperative is already stronger). We have to recognize that such a network of support does not currently exist in most places in the U.S.

That is where this crucial legislation comes in.

The Promoting Electric Vehicles Act would initiate a competition in which specific geographic areas would vie to be selected as large-scale deployment communities: areas in which all of the elements of an electrified transportation system are deployed simultaneously and at scale, thereby providing a crucial first step toward moving electrification beyond a niche product into a dominant, compelling, and ubiquitous concept. These deployment communities would be selected on a competitive basis. The most attractive regional bids would demonstrate a clear path to successful integration of GEVs, including:

- A supportive regulatory environment that facilitates concepts like utility investment in upgraded physical and IT assets; time-of-use pricing; and a seamless process for permitting and installing level II EVSEs in residential consumer garages.
- Support and participation from a broad swath of stakeholders, including state and local governments, utilities, utility regulators, large local employers, universities and others.
- A diversity of business plans, allowing innovators and entrepreneurs to explore the most effective and efficient models for deployment.

In sum, successful bids should be those in which all of pieces have been brought together—autos, infrastructure, favorable regulatory environment, interested consumers—to ensure that large scale deployment of GEVs has the best chance of success.

Once selected, deployment communities would be eligible for amplified, targeted, and temporary financial incentives for consumers, infrastructure providers and utilities. Upon completion of the program, the Secretary of Energy would be required to produce a final report evaluating its success, challenges and lessons learned as well as recommending whether to promote further deployment of electric vehicles. If the conclusion is that further deployment is warranted, the Secretary would provide recommendations on how many additional cities to select, updates to the selection criteria, changes to incentive structure, and whether other forms of energy storage should be included. If fully implemented, the legislation would aim to deploy a total of 400,000 grid-enabled electric vehicles and their infrastructure in the first deployment communities over a three-year period.

We believe this approach is critical to avoiding the pitfalls of the past. These deployment communities would:

1) **Demonstrate Proof of Concept Beyond Early Adopters:** A deployment community approach would drive significant penetration of GEVs into a limited number of auto markets, as opposed to very shallow penetration in many auto markets. By demonstrating the benefits of grid-enabled vehicles in a real world environment, this deployment plan will make consumers, policymakers and industry aware of the tremendous potential of electrification of transportation.

In general, consumers are probably unaware that GEVs have evolved to the point where they can meet most individuals' daily driving needs. In addition, electric drive vehicles generally have faster acceleration and operate more quietly than internal combustion engine vehicles. They hold out the promise of offering drivers a wide range of features, based on the electronic package in the vehicle, that are beyond our imagination today in the same way that iPhone applications would have been beyond our imagination a decade ago.

The problem is that consumers are not aware of the opportunities presented by GEVs and are not yet convinced that they can operate reliably and affordably at scale. Concentrating investments and other efforts in a limited number of communities will accelerate the opportunity to demonstrate that grid-enabled vehicles can meet drivers' needs. In addition, these projects will demonstrate that a community is capable of putting the infrastructure in place, operating the vehicles over their lifetimes, and disposing of them after their useful life has ended, all in a manner that profits the participants in the value chain.

2) **Facilitate Learning by Doing:** While GEVs present a great opportunity, their deployment also raises a number of questions. Deploying large numbers of GEVs in concentrated areas will allow for the collection of information and experience that is needed to successfully deploy GEVs nationwide. It will help automakers learn how much consumers are willing to pay up front for a car that costs less to operate and has a lower total cost of ownership over its lifetime. It will allow utilities and charging station providers to learn when and where drivers want to charge their vehicles. It will allow utilities and other aggregators to learn who can best sell power to drivers and what types of rate structures meet both drivers' and utilities and aggregators' needs.

Deployment communities will also help determine whether there is a viable business model for public charging infrastructure. It is clear that for GEVs to succeed there must be a model in which each party in the value chain is able to operate profitably, or in which the government determines that, as a matter of public policy, certain aspects of the system should be publicly supported in a manner that facilitates further competition. Deploying GEVs in a series of geographic regions around the country where resources can be concentrated and data can be collected and studied will ultimately accelerate wide-scale GEV deployment. Therefore, rather than allowing the market to develop scattershot across the country, it is critical that the market be encouraged to develop at a deliberate pace in clearly identified geographic regions in which a large number of vehicles can be deployed in a relatively short period of time.

3) **Drive Economies of Scale:** Concentrating resources in a limited number of geographic areas will allow participants in the GEV value chain to take advantage of economies of scale, particularly with respect to the deployment of charging infrastructure. Utilities will incur fixed costs to support the operation of GEVs; those costs will be more affordable if spread over a greater number of vehicles. Power providers also can reduce the cost of charging infrastructure through economies of scale. While it is unclear how many public vehicle chargers will be necessary for a GEV transportation system to operate smoothly in a given community, it is clear that some public charging facilities will be needed.



Previous pilot studies demonstrate that the cost of installing charging facilities can be reduced significantly when groups of facilities are installed at once. Furthermore, these geographic concentrations will stimulate demand for grid-enabled vehicles at a rate that is likely to be far greater than if the vehicles are simply purchased by early adopters scattered around the United States. Early on in the process, this higher level of demand will simply be the result of magnified consumer incentives. Subsequently, as individual metropolitan areas gain exposure to GEVs and confidence increases, adoption rates should be measurably expedited.

In order to be selected, a community will need to present a comprehensive proposal, similar to bids to host the Olympic Games. Such a proposal would need to show capability and buy-in from a wide range of public and private players, including local governments, utilities, major employers, and more.

Cities and communities throughout the nation will be eligible to compete for selection as a deployment community. And the bill makes it clear that in selecting deployment communities, DOE should seek areas that are diverse regionally, geographically, climactically, in terms of their urban and suburban composition, size, typical commuting patterns, and type of electric utility.

We believe we will also see an important diversity in the business models that innovators and entrepreneurs will present to explore the most effective and efficient models for deployment. Again, the advantage of a competitive, market-based plan like this is that the best ideas have the opportunity to rise to the top.

We believe the result of passing this legislation will be a great competition, a race to the top as communities fight to present the most fertile ground for an exciting new technological rollout. Even those that are not ultimately selected will have, in order to compete, taken steps that will ultimately make the adoption and deployment of electric vehicles and infrastructure more achievable within their borders.

We've already seen cities and other localities across the country taking the first steps toward electrification, whether it is installing charging infrastructure, buying the vehicles for city fleets, or some combination of both and more. They see the benefits and are eager to take the next step. If we pass this legislation, I think we will see cities once again, as they have in the past, playing the role of experimenters and leaders in this exciting new technology.

Incidentally, let me address a concern that others have brought up about this very aspect of the deployment community idea: that it overly concentrates resources in a small number of communities.

I strongly disagree with this criticism.

First, these plans do nothing that would limit or impede the current nationwide incentives for electric vehicles. Today, a maximum tax credit of \$7,500 on qualified electric drive vehicles exists nationwide. Additional credits exist for infrastructure. This bill does not in any way impact the maximum vehicle tax credit available to consumers nationwide. What we are talking about is added incentives, which will spur added demand.

Second, the benefits accrue far beyond the deployment communities themselves. While money will flow into these communities, they should more correctly be thought of as funnels through which a substantial portion of the funds will flow on their way elsewhere around the country. Much of the money that flows through deployment communities will end up in the towns and cities where the vehicles and charging infrastructure and their components are manufactured. When a factory reopens in a depressed area to build or support these vehicles—as we've already seen in places like Elkhart, Indiana and Livonia, Michigan—that is a real and tangible benefit for hardworking Americans.

Third, if this program succeeds, it will drive down costs for electric vehicles for consumers throughout the nation. It will also set the nation on a path toward greater energy security and economic prosperity through sharply reduced oil dependence. This effort is about building a new transportation system from the ground up in a fiscally responsible, competitive fashion. That's good for the entire nation.

While electrification of the light-duty, personal-use passenger vehicle market is the most important long-term objective for increased energy security, the early development of the GEV industry will benefit from a more diverse market. Particularly during the period from 2011 to 2015, commercial and government vehicle fleets could represent a large share of the market for plug-in hybrid and fully electric vehicles. In fact, recent purchase announcements by a host of commercial entities—General Electric, FedEx, Frito Lay, Hertz, Enterprise, and PG&E to name a few—suggest that this dynamic is already rapidly emerging.

Commercial and government fleet operators should be well-prepared to address a number of the early challenges constraining adoption of grid-enabled vehicles. By

matching the proper vehicle, battery and drivetrain technology to required payload requirements, drive cycles, and usage profiles, fleet operators can minimize upfront investment costs. Total investment in public and private charging infrastructure can also be efficient and optimized. Perhaps most importantly, grid-enabled vehicles could appeal to a significant number of fleet operators in a short timeframe. In that case, fleet operators would account for important early demand volumes in the development of the large-format battery industry in addition to catalyzing the ramp-up of electric drivetrain component supply chains.

Nonetheless, the supply chains for many of the grid-enabled vehicles that will appeal to fleet operators—particularly light-and medium duty trucks—are still developing, and vehicles are being produced annually in the tens, not the thousands. This translates into a high cost structure—one that will certainly come down over time as the industry grows. However, cost reductions could be accelerated through limited public policies designed to minimize risk to early adopters.

Recognizing these opportunities, the Promoting Electric Vehicles Act offers targeted, temporary incentives to both the public and private sectors to encourage early fleet adoption of plug-in vehicles. Commercial entities that commit to purchasing significant volumes of GEVs would be eligible for grants to help offset upfront costs of vehicles and infrastructure. The bill also authorizes funds to be made available to federal agencies to help offset the incremental costs of electric drive.

In summary, this bill recognizes a simple fact: electrification will not move past niche product status without careful policy coordination designed to overcome early obstacles. I fully understand that this is a challenging time for suggesting increased government expenditures for any project, no matter how worthwhile. However, certain aspects of the threat of oil dependence and the solutions contained in this bill make this a unique issue.

First is the urgent national security threat posed by our dependence on oil. While we cannot and should not ignore costs, threats to national security have always occupied a unique place of priority in our budget considerations. And make no mistake: the dangers posed by our oil dependence are not theoretical. Our safety and security are threatened by oil dependence, and every single day that we do not act is another day that we remain vulnerable.

Second is the economic cost of inaction. Department of Energy researchers have estimated that the economic costs of U.S. oil dependence were \$500 billion in 2008 alone—and more than \$5 trillion since 1970.

And perhaps most telling: every American recession for almost four decades has been preceded by—or occurred concurrently with—an oil price spike. Simply put, you cannot have a healthy economy when energy prices are too high. This is something I cannot emphasize strongly enough: electric vehicles in general, and these proposals to deploy them in particular, not only can help strengthen our economy, but are critical to it.

I work in a manufacturing business.

Right now, we are spending more than \$100 million to expand our operations in the United States, in places like North Carolina, Michigan, and Nevada.

Now here is the truth: Rockwood Holdings is expanding, and will continue to expand wherever electric cars are made. As Chairman and CEO, I can tell you that Chinese EVs need the materials we supply just as much as any other country's automobiles. But as an American, I can tell you this: I want those cars made here.

Let's not go in the same direction we have gone with personal computers: designed by Americans and made overseas. A strong manufacturing sector is critical to a strong economy, and a strong auto industry is critical to a strong manufacturing sector. So how can our auto industry revive itself, and regain the global stature it once had? It can be the world leader in a game-changing technological leap forward by making the electric cars of the future.

The opportunity before this Committee, and indeed before the entire Senate, is tremendous. It may also be one of our last chances. I truly believe that oil dependence is a clear and present danger to the national security and the economic stability of the United States. We have made some progress in recent years, but now it is time to take the leap. We can end our dependence on oil once and for all, and the first step is passing the Promoting Electric Vehicles Act of 2011.

Thank you again for your time and attention.

The CHAIRMAN. Thank you very much. Appreciate your being here to testify.

Ms. Cullen, go right ahead.

**STATEMENT OF GENEVIEVE CULLEN, VICE PRESIDENT,  
ELECTRIC DRIVE TRANSPORTATION ASSOCIATION**

Ms. CULLEN. Good morning, Chairman Bingaman, Ranking Member Murkowski, members of the committee. I'm Genevieve Cullen, Vice President of the Electric Drive Transportation Association. I'm pleased to be here today to discuss S. 948, the Promoting Electric Vehicles Act and S. 734, the Advanced Vehicle Technology Act.

The Electric Drive Transportation Association is the cross industry trade association promoting the advancement of electric drive technology and electrified transportation. Our members represent the entire value chain of electric drive including the leading and emerging vehicle battery and component manufacturers, as well as electricity providers, smart grid and infrastructure developers. Collectively our membership is building the vehicles, hybrids, plug-ins and fuel cells, as well as the infrastructure of an electrified fleet. We are investing aggressively and moving forward rapidly in expanding electric drive options to consumers. Plug-in passenger cars and trucks are already on the road and more than 20 models of battery electric, plug in and hybrid vehicles will be available by 2013. Across the country collaborative efforts between utilities, charging infrastructure providers, governments and auto makers are underway. They are preparing communities, grids and consumers to take advantage of grid connected vehicles.

In addition to the consumer interest in the arrival of grid fueled or plug-in vehicles. The ability of the grid to displace oil consumption also has significant national security and economic implications. The acute pain currently being felt at the pump, while not inconsequential, is just a recurring symptom of the larger problem, our dependence on foreign oil.

We import more than half of our needs, as has been noted here today. Transportation accounts for 72 percent of that consumption. Electricity on the other hand is domestically produced from diverse, conventional and renewable resources.

The energy security benefits of electric drive are accompanied by the economy wide benefits of growing U.S. technology and manufacturing leadership. Electrification of the fleet also has substantial documented benefits to public health and the environment. Still with all these potential benefits reaching commercial scale on a national basis is an enormous undertaking.

There are 250 million light duty vehicles on the road. It will take about 20 years to turn the fleet over. The industry is working to bring multiple vehicles to market in the next couple of years. We, our members, are working to ensure that consumers in communities have the information they need to maximize their benefits. For national security, economic and environmental reasons we can and we should accelerate these electrification efforts with Federal policy.

My statement for the record provides more detail, but I just wanted to highlight a couple elements of the bills before the committee.

S. 948, the Promoting Electric Vehicles Act, takes a comprehensive approach to plug-in vehicle development and deployment. We support the establishment of a national program that includes

planning, technical assistance and work force training. These programs are vitally important to achieving mass market penetration at a national scale in the near term.

Support for community deployment as part of a national effort can help move regional markets and can help aggregate information on charging needs and habits, grid integration and successful collaborative models between public and private stakeholders. We support giving the Department of Energy flexibility in determining the size and number of communities with the goal of maximizing both the distribution and the effectiveness of the effort. We would like to continue to work with this committee to identify the most effective balance between the national and community deployment programs.

Further as vehicle electrification includes diverse technology configurations that meet equally diverse transportation needs. We also believe it is appropriate to include recognition of the applicant community's efforts in deploying fuel cell electric vehicles in the program as the House counterpart bill does. We also support the bill's effort to promote electrification in private and Federal fleets which can play a significant part in moving markets and in helping manufacturers achieve economies of scale. However, we would like to see a comprehensive approach that recognizes all the electric drive technologies including fuel cells and hybrids and provides flexibility in meeting fleet needs while reducing oil consumption in building markets.

S. 734, the Advanced Vehicle Technologies Act provides an important road map for Federal vehicle technology research and development. The bill would ensure that the Department of Energy pursues a portfolio of technologies that includes near, medium and long term technology development. We strongly support such an approach.

Another key element of S. 34 is its recognition of the extraordinary potential for efficiency advances in the medium and heavy duty segment. Although they are 4 percent of the vehicles on the road, they represent 20 percent in gas and diesel consumption. The U.S. is a leader in medium and heavy duty vehicle electrification, but emerging technologies are expensive to develop and to deploy. Public/private investment can help speed the performance advances in technology cost reductions in this segment of the market.

Taken together these bills can advance us toward our national goals of reduced dependence on foreign oil, increased competitiveness in the global energy technology market and a more sustainable transportation sector. I thank you for the opportunity to testify. I look forward to your questions.

[The prepared statement of Ms. Cullen follows:]

PREPARED STATEMENT OF GENEVIEVE CULLEN, VICE PRESIDENT, ELECTRIC DRIVE  
TRANSPORTATION ASSOCIATION

Good morning, Chairman Bingaman, Senator Murkowski, and members of the committee. I am Genevieve Cullen, Vice President of the Electric Drive Transportation Association. I am pleased to be here today to discuss S.948, the Promoting Electric Vehicles Act of 2011 and S. 734, the Advanced Vehicle Technology Act of 2011.

I would also like to express our appreciation for this Committee's early and ongoing work on alternative fuels and vehicles and your recognition of the importance

of electric drive technologies in reducing dependence on foreign oil in the transportation sector.

The Electric Drive Transportation Association (EDTA), founded in 1989, is the cross-industry trade association promoting the advancement of electric drive technology and electrified transportation. EDTA members include the leading—and emerging—vehicle, battery and component manufacturers, as well as electricity providers, smart grid and infrastructure developers and others.

Collectively, our membership is building the vehicles—hybrids, plug-ins and fuel cells—and infrastructure of an electrified fleet. Because electric drive can be configured in many combinations and applied across vehicle platforms (including cars, trucks, buses and even bulldozers), it is able to meet the multiple, diverse demands of consumers and industry while displacing imported oil with domestically produced electricity.

Industry is investing aggressively and moving forward rapidly in expanding electric drive options to consumers. Plug-in passenger cars and trucks are already on the road today and more than twenty models of battery electric and plug-in hybrid vehicles will be available by 2013.

Across the country, in states including Arizona, Washington, Oregon, California, Michigan, Tennessee and Texas, collaborative efforts between utilities, electricity infrastructure providers, governments and auto makers are underway, preparing communities and consumers to take advantage of grid-connected vehicle options.

In addition to the consumer interest in the arrival of grid-fueled (or “plug-in”) cars and trucks, the ability of the grid to displace oil consumption also has significant national security and economic implications. Reliance on oil, and hence the global oil market, is extremely costly to us as a nation. The acute pain currently being felt at the pump, while not inconsequential, is just a recurring symptom of the larger problem of our dependence on foreign oil. We import more than half our oil needs and transportation accounts for 72 percent of that consumption. Electricity, on the other hand, is domestically produced from diverse conventional and renewable sources.

The energy security benefits of electric drive are accompanied by the economy-wide benefits of growing U.S. technology and manufacturing leadership—instead of spending about \$380 billion a year to pay our foreign oil bill. At the micro-level, electricity is 1/4 to 1/5 the cost of oil—3 cents versus 12-15 cents per mile.

Further, electricity prices are more stable and do not exhibit the volatility of gas prices. It is estimated that each one dollar increase in the annual average price of a gallon of gasoline reduces average American household discretionary spending by roughly ten percent.

Electrification of the fleet also benefits public health and the environment. According to an EPRI/NRDC study, plug-in vehicles, even charged from a national grid that is dominated by coal, will reduce greenhouse gas emissions by one third compared to conventional vehicles. Pure battery and fuel cells vehicles use no petroleum and have zero tailpipe emissions.

Still, with all of these potential benefits, reaching commercial scale on a national basis is an enormous undertaking. There are 250 million light duty vehicles on the road and it takes an estimated 20 years to turn over the fleet. The industry is working to bring multiple vehicles to market in the next couple of years and we are working to ensure that consumers and communities have the information they need to maximize the benefits of grid-connected vehicles. For national security, economic and environmental reasons, we can—and we should—accelerate these electrification efforts with federal policy.

As set out in the EDTA Policy Action Plan, we support a comprehensive push toward electric drive that includes a robust public and private commitment to advancing technology breakthroughs with research and development. The Action Plan also calls for a national initiative to promote deployment of plug-in electric drive vehicles that includes support for regional deployment efforts.

The bills before the committee today will help to advance electrification in the near term and ensure our technology leadership over the longer term. Deployment support and a consistent research and development policy will reinforce and expand what the market is doing, while creating U.S. jobs, increasing global competitiveness and enhancing our national security.

My statement for the record provides more detailed comments on the bills, but I would like to briefly highlight some particular areas.

S. 948, the Promoting Electric Vehicles Act of 2011, would create a national program that includes deployment planning on a national scale, technical assistance, that would include training on codes and standards for building and safety inspectors, best practices for infrastructure permitting and inspections, as well as workforce training for state and local government who need assistance in designing and

implementing their deployment programs. These programs are vitally important to the goal of achieving mass market penetration at a national scale in the nearer term.

Support for community deployment, as part of a national effort, can help move regional markets and can help aggregate information on charging needs and habits, grid integration and successful collaborative models between public and private stakeholders. We support giving the Department flexibility in determining the size and number of communities, with the goal of maximizing the both the distribution and the effectiveness of the effort. We would like to continue to work with the committee to identify the most effective balance between national and community deployment programs.

As vehicle electrification includes a variety of technologies and configurations, we also believe it is appropriate to include recognition of the applicant communities' efforts in deploying fuel cell electric vehicles in the program, as in the House counterpart bill.

The bill includes important provisions to promote adoption of plug in vehicles in private and federal fleets, which can play a significant part in moving markets and achieving economies of scale. However, we would like to see a comprehensive approach that recognizes all of the electric drive technologies, including fuel cells and hybrids. A comprehensive approach will provide flexibility for meeting fleet needs while reducing oil consumption and helping to build markets for advanced vehicles, components and infrastructure.

S. 734, the Advanced Vehicle Technologies Act, provides an important roadmap for federal vehicle technology research and development. The bill recognizes the importance of a portfolio approach, not only in electric drive, but across conventional and alternate vehicle technologies. There are many synergies in vehicle systems improvements; federal research and development policies should maximize the overlapping values of these developments. Advances in battery and energy storage technology and reductions in costs can benefit hybrid, plug-in and fuel cell vehicles.

The Advanced Vehicle Technologies Act would also ensure that the Department of Energy maintains a portfolio of near, medium and long term technology development activities. We strongly support such an approach. Incremental advances in existing technologies can have great benefits for the current fleet. But, as has also been noted here today, a consistent and forward-looking energy research policy is also needed to identify the transformational technologies whose development cycles may be longer than industry can support alone.

Another key element of S. 734 is its recognition of the extraordinary potential for advancement in the medium and heavy duty segment. Medium and heavy duty vehicles consume more than 52 billion gallons of fuel each year and are responsible for 21 percent of U.S. greenhouse gas emissions from transportation. Efficient hybrid and plug-in hybrids can increase the vehicles' efficiency by 20 to 50 percent. Battery electric medium and heavy duty vehicles eliminate oil use entirely. Increased efficiency also means reduced emissions. For example, putting 10,000 hybrid electric trucks to work would reduce diesel fuel use by 7.2 million gallons per year and reduce carbon dioxide emissions by 83,000 tons.

The U.S. is a leader in medium and heavy duty vehicle electrification but emerging technologies are expensive to develop and deploy. Public/private investment can help speed the performance advances and technology cost reductions in this segment of the market.

Together, these bills can advance us toward our national goals of reduced dependence on foreign oil, a more sustainable transportation sector and increased competitiveness in the global energy technology market.

I thank you for the opportunity to testify here today and look forward to your questions.

#### COMMENTS ON SPECIFIC PROVISIONS

S. 948

#### *TITLE I National Programs*

EDTA supports the establishment of a national program to help deploy plug-in electric vehicles and infrastructure. With an overall goal of electrification of the fleet, we recommend that the required planning and petroleum reduction goal-setting include all the electric drive technologies.

For grid connected vehicles, EDTA supports a robust national-scale effort that helps communities to plan and execute transportation electrification.

We support establishing national Technical Assistance and Workforce training programs as part of that effort. These should be of sufficient scale to meet national needs and national scale goals.

#### REGIONAL DEPLOYMENT

It is important to establish the right synergy between the national program and the community deployment strategy to ensure that the overall effort moves us toward electrification nationally: The combined program should reinforce the efforts that are underway, help new ones begin and serve as a real time information source for the public and private stakeholders. We agree with the discretion provided to the Department to determine the appropriate number of communities and size of awards.

As vehicle electrification includes a variety of technologies and configurations, we also believe it is appropriate to include recognition of the applicant communities' efforts in deploying fuel cell electric vehicles in the program, as in the House counterpart bill. Alternatively, the criteria for evaluating applications to communities could also recognize communities that are also planning for, and investing in, fuel cell vehicles and infrastructure.

#### ACCESS TO CAPITAL

EDTA supports expansion of loans and loan guarantees for fleet and battery purchases and infrastructure installation. Easing access to capital helps to build industry economies of scale, speed deployment and advance energy storage options for utilities and others power providers while minimizing federal outlay.

#### FEDERAL FLEETS

S. 948 also promotes the adoption of plug-in electric drive vehicles in federal fleets by providing funds for purchasing vehicles as well as transparency and accountability for their use, which EDTA strongly supports. However, EDTA supports increasing the overall electrification of the federal fleet and we would also like to see a comprehensive approach that recognizes all of the electric drive technologies, including fuel cells and hybrids, which will provide flexibility for meeting fleet needs while reducing oil consumption and helping to build markets for advanced vehicles, components and infrastructure.

#### PRIVATE FLEETS PROGRAM

Accelerating the adoption of electric drive in private fleets will help manufacturers achieve economies of scale while helping businesses reduce their fuel costs. We support the bill's proposed private fleet program but would like to work with you to identify the most effective size for eligible fleets. While it is appropriate that the program leverages large volume purchases by setting a 100 vehicle threshold, it may also be useful to provide a mechanism to allow smaller fleets to access this option. Including a small fleet-set aside or a purchase aggregation option would help smaller businesses with car and truck fleets to avail themselves of more efficient vehicle options.

#### *TITLE II Research & Development*

We support S. 948's expanded commitment to research and development Public and private investments are essential to accelerate technology breakthroughs for vehicles, components, infrastructure and grid integration and will help us reduce dependence on foreign oil and enhance our ability to compete in the global advanced energy market.

Regarding the Section 204, authorizing a National Academy of Sciences study on collection and preservation of data collected from plug-in vehicles, due to the privacy and potential record-keeping liabilities for multiple information stakeholders, we would suggest that there be an opportunity for stakeholder input in the required recommendation for procedures, technologies and rules relating to the collection, storage and preservation of such data.

#### *TITLE III Miscellaneous*

#### UTILITY AND DISTRIBUTION PLANNING

Title III establishes a utility planning process for plug-in electric drive vehicles under the Public Utility Regulatory Policies Act. As fuel and power providers, utilities need to identify demand and energy management and smart grid integration strategies. Protocols for the interaction of utilities and charging infrastructure entities will also need to be identified. The key is establishing the right balance between

national standards for charging technologies and flexibility in business models. Our members are currently reviewing the Section 301 federal regulatory directives to ensure that these are achieved.

BATTERY DISPOSAL

Regarding the bill's provisions prohibiting disposal of advanced batteries used in plug-in electric drive in landfills, we believe that at this time it is more appropriate to conduct a study to identify specific environmental risks and the best options for safe recycling and ultimate disposal before an outright ban is imposed on all advanced battery disposal. In the interim, promoting secondary uses of automotive batteries and advanced materials will ensure that these batteries remain in use beyond their automotive life and that their valuable components are recovered

S. 734

EDTA also strongly supports Senator Stabenow's portfolio approach to vehicle technologies research, development and deployment. The bill authorizes a comprehensive program that recognizes the increasing role of sensing technologies and telematics and the need for advanced manufacturing to accompany advanced technology. Electrification has enormous potential in medium and heavy duty vehicles and will be critical in meeting new fuel economy and emissions standards. Establishment of a program to advance medium and heavy duty commercial and transit vehicles will provide a path for greater industry and government cooperation in speeding the development and adoption of electric drive truck technologies.

Battery recycling research and development is also important in establishing secondary value streams of critical components and helping industry meet the highest environmental standards for recycling.

The CHAIRMAN. Thank you very much.  
Mr. Van Amburg, go right ahead.

**STATEMENT OF BILL VAN AMBURG, SENIOR VICE PRESIDENT,  
CALSTART, PASADENA, CA**

Mr. VAN AMBURG. Chairman Bingaman, Ranking Member Murkowski, committee members and guests, thank you very much for this opportunity to talk about how to reduce oil use in transportation via advanced vehicle technologies and fuels.

As we noted in our written testimony, the U.S. really stands at a very important opportune point right now in its history. Several of the technologies that we're really talking about today and would be affected by these bills represent areas of keen American leadership in technology. They can support expanded job growth, both in our manufacturing base and in new high tech jobs that we hope to create.

These are jobs that would be in our traditional manufacturing sectors. Such as the upper Midwest, Ohio, Michigan, Indiana, Illinois, but as well in manufacturing in high tech sectors all across the United States. These efficient technologies also lead directly to reducing oil consumption.

Now my organization, CALSTART, has been intimately involved with advanced transportation technologies since 1992 when we were founded, across all fuels and tech. Our mission is really to grow this industry with the goals of creating jobs out of it, reducing emissions and increasing energy security in the transportation sector. We work with more than 150 companies and agencies to achieve this, everything from the large truck and car OEMs and suppliers down through mid and small sized technology innovators bringing new technologies to the market.

Now we've said this several times, but transportation does account for 70 percent, roughly, of the petroleum used in this coun-



try. So it's a key target. The committee is right to focus its efforts on this. It often is not a well recognized fact. If we want to move the needle on energy security, we really need to focus on the transportation sector.

Now a driving force of our work and for policies that we would recommend is to avoid what we call silver bullet single solutions. To support and encourage something we call silver buckshot. A portfolio approach of multiple technologies and multiple fuels which we think is what it will take to achieve oil use reduction and other co-benefits that we're trying to achieve such as emission reductions.

Now at its core there are really 2 strategies on the vehicle side, if we want to attack oil consumption, use less fuel to do the same work, really efficiencies such as in hybrids and electrics. Switch the fuel you use to alternative or biofuel or non-petroleum sources such as natural gas. Even better and we're starting to really see this capability grow right now is to combine these 2 strategies such as approaches as biofuel or natural gas hybrids that we're starting to see.

It's also, of course, important to know that we make sure that policies promote change across vehicle platforms. Now we all know passenger cars are pretty frankly, sexy. They get a lot of attention. But when we really look at, as we noted from some of the other speakers, for our goods movement, for commerce in this country, trucks and buses do the bulk of the work and they use about a third of the fuel.

So it's very timely. These bills do take on looking at how do we address bringing in the medium and heavy duty sector. It also happens on a per vehicle basis that it's big bang for the buck. These large vehicles use far more fuel on a platform basis than cars do. They have a tremendous opportunity for cost effective fuel savings, as we go forward.

It's also an industry segment and I've spent my last 10 years in this. That is, facing new regulatory requirements from EPA. It's set for greater fuel economy in this sector. Partnerships to assist this sector would be especially timely.

The technologies and fuels needed to reduce oil consumption are just available though. That's something that really has changed. It's been a sea change in this country from the last 10 years. They are ready to move forward as we outlined in our written comments. Certain sectors, in fact, our prime areas of U.S. leadership, and I would call out medium and heavy duty hybrid and electric vehicles as an area where the United States currently leads the world in that technology sector.

Now in working with manufacturers, suppliers and fleets trying to look across multiple technologies and fuels, they've identified with us kind of the key areas that would help the industry to move forward.

They believe that this would be in purchase assistance to these early vehicles.

Getting deployment going when we have low volumes and high costs.

Longer term partnerships on research and development focused on efficiency and oil consumption reduction.

Partnerships with industry to help them shift their manufacturing to these new technologies.

Now in terms of the legislation you're considering based on the policy drivers I've mentioned, CALSTART supports the Advanced Vehicle Technology Act.

It does focus on greater efficiency as a policy outcome.

It encourages innovation across vehicle platforms, not just light duty.

It addresses a key concern which is consistent R and D.

We believe it will drive continued job growth in areas of strategic advantage to the United States.

We're also very intrigued with the Promoting Electric Vehicles Act.

It is bold.

It targets vehicle deployment across multiple vehicle types which is key.

It really aligns with the Administration's goals of expanding Federal Government purchases of advanced and all fueled vehicles.

All of which are good. We would encourage that we look at these bills across a portfolio approach though, not a single issue. Really try and build a portfolio for this Nation across multiple, all fuels and technology approaches.

Again, going forward we believe good policy that establishes performance goals is inclusive of a range of technologies and fuels and targets key areas of need that help encourage industry growth will reduce oil consumption, enhance energy security and also create jobs in this country.

Thank you very much for the time to address you today. Looking forward to questions.

[The prepared statement of Mr. Van Amburg follows:]

PREPARED STATEMENT OF BILL VAN AMBURG, SENIOR VICE PRESIDENT, CALSTART,  
PASADENA, CA

CALSTART thanks the Senate Committee on Energy and Natural Resources, its chairman, ranking member and its members for the opportunity to testify and share our knowledge with you on policies to effectively reduce oil consumption in transportation via advanced vehicle technologies and fuels, including electric drive technologies.

The United States stands at an opportune moment with these new transportation technologies. Several of these technologies are areas of U.S. leadership with significant job growth potential if they are expanded. They also directly reduce oil use via increased energy efficiency or fuel switching, providing an avenue for reducing oil imports, cutting operational costs for users, as well as reducing air emissions and improving air quality. The adoption of advanced technologies also importantly supports U.S. manufacturers building these leading-edge products here and for export to the international market.

CALSTART via its national programs together with its industry, fleet and public partners, is working to speed the development and market adoption of high-efficiency, clean transportation technologies, such as hybrid and electric drive, and alternative and clean fuels, for the light (passenger car), medium and heavy-duty vehicle platforms—cars, trucks and buses. Via specific programs, such as our national Hybrid and Advanced Truck Users Forum (HTUF) partnership with the U.S. Army, our renewable natural gas (RNG) efforts, electric vehicle infrastructure and biofuel projects, we have identified the key benefits and also barriers to progress which we welcome the chance to explain. There is an opportunity for smart, targeted partnerships between industry and government to speed the impacts—in oil reduction and job growth—from these new capabilities.

Our testimony will follow this outline: A brief introduction to CALSTART; the Multiple Solutions Needed to Reduce Oil Use; a brief overview of the State of the

Industry; and Gaps and Barriers. The legislation you are considering will be discussed as part of this structure.

*What is CALSTART?*

CALSTART is North America's leading advanced transportation technologies consortium. It is a national, fuel and technology neutral, non-profit organization with more than 150 private industry company as well as public agency members. It is dedicated to expanding and supporting a high-tech advanced transportation industry that addresses energy security through reducing imported oil use while also reducing air emissions and creating economic opportunity. We operate across all fuels and technologies, and across all vehicle platform sizes, from two-wheeled vehicles through heavy-duty trucks. We target those solutions that can achieve multiple benefits.

CALSTART serves as an unbiased, strategic broker to spur advanced transportation technologies, fuels, systems and the companies that make them. It works across four areas to expand and support this industry: operating technology development and demonstration programs with industry partners; consulting to ports, fleets and others on implementation of new fuels, vehicles and technologies; providing services to industry members to expand their capabilities; and supporting and guiding the creation of policies that increase the efficiency and reduce the emissions of U.S. transportation.

CALSTART plays a leading national role in facilitating the development of advanced propulsion systems and alternative fuels. For example, it helped create the capability for heavy-duty hybrid drive systems in transit buses in program partnerships with DARPA, and now leads efforts in advanced commercial vehicle hybrids, fuels cells, hydrogen and biofuels. Founded in 1992, CALSTART is headquartered in California but operates nationally in its programs.

As one example of CALSTART's work across multiple technologies and fuels, one of our major programs in efficiency and oil reduction is the Hybrid and Advanced Truck Users Forum (HTUF). HTUF is operated by CALSTART in a unique partnership with and under contract to the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC)—National Automotive Center (NAC)<sup>1</sup>. Its focus is to speed the development and deployment of dual-use (military and commercial) technologies to increase the efficiency of commercial and military vehicles.

It initially targeted market growth in promising hybrid-electric and hybrid-hydraulic medium-and heavy-duty drivelines and then electric vehicles, and now is expanding focus on alternative fuel-hybrids. The goal is to build a competitive, sustainable medium-and heavy-duty hybrid and efficient vehicle market. By working with first-mover fleets and targeting their vehicle performance needs for efficiency with industry partners, HTUF has proven to be a highly successful program to jump-start the commercial hybrid, electric and efficient truck industry in North America. Its track record of success, and the results in terms of industry development and product launches, has benefited truck makers and suppliers as well as military planners keen on supporting a dual-use commercial manufacturing capability for advanced trucks. HTUF is credited with removing one to two years from the product development cycle, and now works with more than 80 national fleets representing more than 1-million vehicles on the road, and all major truck makers and system suppliers.

Another example is in renewable natural gas (RNG), a domestic, bio-based form of natural gas that adds additional domestic supply and can even further reduce emissions from clean natural gas. CALSTART developed first partnerships with Sweden, an early leader in the use of RNG for transportation, and has helped focus partnerships and funding on its production and use in the U.S. Each region of the nation has unique fuel opportunities, from waste and bio sources, that can be tapped to create transportation fuel. CALSTART has been active in working with second generation biofuel companies to assist their growth, as well.

Similarly, besides work on the vehicle development side, CALSTART since its beginnings has been very active in electric vehicle infrastructure deployment and technology and built out with partners an initial 500 site recharging network for EVs in the mid 1990s. Today the organization is active in understanding with first movers the best strategies for new recharging site deployment at home and work site, and in particular the opportunities for commercial vehicle recharging.

<sup>1</sup>The NAC is the Army's outreach arm to the commercial transportation industry, and is charged with both understanding the capabilities of the commercial vehicle industry and working to increase the capabilities of the industry to build advanced vehicles and technologies that can support emerging Army and military needs.

## MULTIPLE SOLUTIONS NEEDED TO REDUCE OIL USE

To successfully increase our national energy security and reduce our dependence on oil, particularly imported oil, requires a suite of technology and policy options and approaches. While it is tempting to fix on attractive single solutions, CALSTART strongly believes there is no “silver bullet” able to address our national energy challenges, no one fuel or technology that alone can effectively reduce our petroleum use to the degree needed. Rather, we have followed and recommend a “silver buckshot” strategy, advocating a portfolio approach to policy, technology development and market support decisions.

However, it is also important to note that focus is critical when it comes to the long term goal of reducing our oil dependence and imports. In considering the bills before you and others that may be proposed, this committee is rightly addressing the most important single sector when it comes to oil use: transportation. Nearly 70 percent of the oil used in the United States goes for transportation according to the U.S. Energy Information Agency. Some assume that there is more oil used in power production or other uses. However, that is not the case. Therefore, to effectively address energy security and oil use, we must make transportation the top focus of our national efforts.

There are two main strategies to successfully reduce oil use in transportation, and both are required to be effective:

1. Use less fuel to do the same work—in other words, increase efficiency, such as with hybrid, electric drive and other technologies; and
2. Switch to non-petroleum fuels, such as natural gas and bio-based fuels.

Where these strategies can be combined, as in alternative fuel hybrids or other approaches, you can further increase your effectiveness in cutting oil use on a per vehicle basis. This is an area of high interest for technology and product development going forward and CALSTART is operating several projects around this combination strategy.

At the same time, while it is critical to support technologies and fuels furthering these strategies, it is equally important to drive these strategies across all vehicle types. Partly because they achieve the highest visibility, passenger cars have received the bulk of the attention in the past when it comes to research and development partnership funding and in manufacturing assistance and market introduction. However, there is both a need and a strategic opportunity for greater focus on commercial vehicles—the medium-and heavy-duty trucks and buses that move most of the goods and provide the services in our country. Medium-and heavy-duty vehicles use roughly a third of the fuel consumed in U.S. transportation, and on a single vehicle basis are easily the highest fuel use vehicles on our roads. The fuel saved by a single truck can equal the fuel savings from ten to thirty or more cars. They represent a “big bang for the buck” opportunity for oil reduction that has been insufficiently addressed. However, this is not an argument to switch efforts from cars to trucks; rather, it is a request to include trucks (medium-and heavy-duty vehicles) with cars in all your policy decisions to increase their effectiveness.

There is a strategic opportunity in this sector, as well, for economic leadership and job growth. The U.S. is currently the world leader in advanced efficiency technologies for trucks and buses, particularly in hybrid and electric drivelines, presenting a tremendous opportunity for job growth and even for expanded exports. A recent Duke University—Center on Globalization, Governance and Competitiveness report identifies these technologies as areas in which the United States has a strategic advantage as an early leader. The particular areas it researched were electric hybrid and hydraulic hybrid drive systems and the growing high tech component industry supply chain in the United States to produce them. Indeed, CALSTART sees a tremendous opportunity for export of such components and products, given U.S. leadership. We are currently working on a program to develop industry partnerships for product export opportunities in these technologies to China with our U.S. industry partners. We have already seen growth in exports of such products as advanced natural gas engine systems from North America.

Additionally, UCS and CALSTART last year completed a report on the economic and job growth opportunities from high efficiency trucks. Called “Delivering Jobs,” it documented that 124,000 jobs can be created along with \$24 billion in economic savings over the next two decades through expansion of efficiency throughout medium-and heavy-duty vehicles.

This is of even greater importance given the emerging regulatory pressure to increase efficiency from the National Highway Transportation Safety Administration (NHTSA) and the Environmental Protection Agency (EPA). They are currently in a joint rule making process leading to the first standards for fuel efficiency in me-

dium-and heavy-duty vehicles. The rules should be finalized this summer and go into effect as early as 2014. Policies that can support the industry's work to develop and produce these new technologies will be extremely timely and helpful.

In view of the above observations, the Advanced Vehicle Technology Act (AVTA) you are considering can be of great assistance to industry to address both greater efficiency and the integration of non-petroleum fuels in vehicles. We applaud its inclusion of medium-and heavy-duty vehicles together with passenger cars and light trucks, as we strongly believe this properly acknowledges the contributions of both segments of transportation to oil use and its reduction. We need strategies to reduce oil use across all vehicles platforms, and the approaches will vary across vehicle sizes. It may sound trivial, but a big rig or refuse truck is not a car! While the high level strategies required are the same, as noted above, the state of technology and the effectiveness of different solutions will vary by size, use and type of vehicle. The AVTA could provide this segmented approach, because of its design, allowing custom strategies by vehicle type across all vehicle types.

The proposed legislation also sends an important longer term signal that is critical to manufacturers and suppliers in the light, medium-and heavy-duty vehicle industry. Research and development efforts to date have often suffered from on-going changes in focus and sometimes the selection, in our view, of single solutions rather than encouraging multiple solutions based on performance outcomes. They also have short funding horizons that do not align with the four to five year development cycle of technologies into products, or the longer cycle needed to justify investment in new technologies. A multi-year horizon for a partnership and development process better fits what industry has said would assist it to focus its investments in new efficiency and fuel technologies.

By way of example, recently CALSTART completed the report, "Speeding High Efficiency Truck Adoption: Recommended Policies, Incentives and Investments." It was performed via research and a task force of industry stakeholders, including fleet vehicle users, manufacturers and suppliers. The findings from the report are highly instructive. First, they identify the top measures the industry feels would speed the development, production and purchase of more-efficient vehicles.

The top measures identified by industry were those measures to assist vehicle purchase, thus encouraging greater production and supporting industry investment, and longer term R&D efforts, to partner with industry to keep the next generation of technology in the product "pipeline" and moving to market. The AVTA would address one of the top two areas of need that industry has identified as prime barriers to its progress and therefore to achieving faster and greater oil reduction.

Secondly, it makes a strong case that R&D and other investments and partnerships need to focus on results that achieve multiple benefits, or co-benefits. For instance, while reducing oil use is critical for energy security, it would be counter-productive to reduce oil use through policies that increase emissions and therefore reduce air quality, or which export jobs from the nation. The most valuable approaches achieve these multiple benefits. Greater efficiency and targeted fuel switching can meet these goals.

The report attempts to quantify and monetize these co-benefits, in the form of the public value provided—in this specific case—by greater efficiency in vehicles (in the report, trucks and buses). There are significant co-benefits that can be achieved with efficiency in vehicles, including direct energy security savings and criteria emission reductions. In place of efficiency as a metric, oil reduction could be a metric as well, assuming emission reductions and other benefits are met. In the face of limited resources and increasing needs for reductions in oil and emissions, we likely cannot afford only single benefit outcomes. Driving multiple solutions that can achieve these multiple benefits is smart public policy and also supports industry competition and growth.

It is also worth noting in this context that the Obama Administration has just announced its plan to form a partnership with private fleets to speed their purchase of advanced technology and alternative fuel vehicles. As part of this partnership, the President also made a commitment that by 2015 the federal government will purchase only alternative fuel, hybrid or electric vehicles for replacement vehicles in its fleets. This is a dramatic proposal, and one in principal CALSTART very much supports as it has the government "walking the talk" on petroleum reduction with its own assets. If actually enacted, this will send a strong signal to industry as well as contribute useful purchase volumes to help decrease costs. In this regard, the Promoting Electric Vehicles Act certainly aligns with part of the Administration's goals and could help to support it. It will be important to understand potential overlaps between the legislation and executive branch commitments.

This legislation also rightly encourages electric drive vehicle deployments across vehicle weight classes, taking advantage of the breakthroughs now occurring in elec-

tric trucks and buses. By also targeting deployments in those regions most interested in and supportive of the technology, it can also support regional energy solutions, which, as highlighted earlier in these comments, is an important consideration for successful U.S. energy policy.

There is certainly pragmatism and some focus to be gained from legislation and approaches encouraging important segments of this overall portfolio, which can be centered on specific driveline technologies or specific fuel types. CALSTART supports many of these specific approaches, but strongly encourages their consideration as part of a larger policy strategy and portfolio. Individual solutions should be supported as they combine as part of a broader strategy—for instance, a balanced policy of both increased efficiency and increased fuel switching. Longer term, CALSTART strongly supports moving to performance-based approaches to encourage this balance, with incentives and R&D driven and rewarded by their ability to achieve the multiple outcomes (oil reduction, emission reduction, job growth) desired.

#### STATE OF THE INDUSTRY

Advanced technologies for efficiency, and effective alternative and bio-based fuels available for switching, are at a new threshold level in America: they are ready for greatly expanded deployment, support and use. Approaches that ten years past were still in early or developmental stages are more mature and increasingly cost effective, particularly on an operational basis when capital costs for ownership can be reduced at the time of purchase. The currently high cost of fuel is an important additional inducement to consider these technologies and fuels. However, the great price volatility of fuel confuses manufacturers and users alike in terms of when to make investments in vehicles with these technologies and fuels. Both the bills the committee is reviewing attempts to address the reality of these technologies and address some of their barriers.

Higher vehicle capital costs—in the form of incremental cost beyond the conventional vehicle—are generally still relatively high because of low volume production and first or second generation designs. This is certainly the case with hybrid electric and hybrid hydraulic technology in commercial vehicles, and to a similar extent with natural gas and other dedicated alternative fuel vehicles, still in low volume early production. Hybrid technology in trucks, for instance, is roughly ten years behind its introduction in cars—they are different market segments. Additionally, there are also some barriers in terms of first-time costs for fueling infrastructure in the case of certain fuels and technology. This is true of the re-emergence of electric drive in passenger cars and its new emergence in all-electric commercial trucks. It is also one of the barriers to be addressed with natural gas and other gaseous fuels, though growing business opportunities exist for private infrastructure development.

Having observed the early market stage of these technologies and fuels, it is important to note their potential effectiveness. Natural gas has made a strong case for itself in high fuel-use medium-and heavy-duty bus and truck platforms, particularly in locations where there is sufficient fueling demand to support investing in fueling infrastructure. All truck makers now have natural gas models. Transit and school buses, refuse collection trucks and cargo haul tractors are examples of growing early markets for natural gas vehicles. Infrastructure installed for these uses can have multiple uses for other natural gas vehicles, including light duty cars and pickups. The business case for a user is the low cost of the fuel which is significantly under current diesel and gasoline costs. Natural gas, while currently certified to the same emission levels as diesel and gasoline, has the potential for significantly lower emissions, as well. Several current and potential R&D projects are aimed at the next generation of ultra low emission natural gas engine. Hybrid technology, now established in cars, is just now entering early production in trucks but has attracted every truck maker to the early market with several platforms. The first production units were hybrid electric designs; this year the first hybrid hydraulic systems will enter production. Best uses include and provide options to transit bus, refuse collection, as well as any type of delivery vehicle, from parcel and package through heavy food and beverage tractors. Hybrid technology is now expanding into the tractor-trailer market in heavy regional delivery applications. While it provides some value today in long haul trucks, it is not as well suited to provide reductions in that application currently as are other technologies, though that is likely to change over time. The business case is highly driven by fuel savings and some maintenance savings (such as brakes). All electric vehicles can perform exceptional roles in the light duty arena for commuting, urban delivery, and fixed route, return-to-base operations. Similarly, the medium-and heavy-duty electric truck and bus market is starting to grow by targeting similar applications. Ranges of 70-100 miles per day in delivery

and shuttle operations are starting to show potentially strong business case benefits and are proving out their ability to perform the mission. The advances in energy storage during the last fifteen years has provided this base and will now continue to improve, at reduced cost, over time.

From this plateau and these initial capabilities, the focus of development efforts is now on better system integration and design engineering to reduce manufacturing costs in most of these systems. There is also increased interest in designs that can, in the future, combine alternative fuels with greater efficiency, such as with natural gas hybrids. Transit bus users are exploring this potential, and there is interest in refuse and other higher fuel use applications. Because of increasing pressure to reduce emissions under new EPA ozone rules now under review, there is also growing interest in zero-emission transportation, including zero emission freight haul, particularly in larger urban regions with large port and distribution operations. CALSTART is now working to outline a multi-year project to commercialize zero-emission freight haul vehicles around a major corridor in Southern California which will have need of further developments in all the technologies and fuels mentioned above.

So far, unlike what befell the U.S. automotive industry until just recently, the leaders in these medium-and heavy-duty technologies are U.S.-based manufacturers. This is a significant advantage to the nation. However, that leadership is not assured. More than six truck makers and ten system makers are now developing products in first applications, but the effort has not yet achieved critical mass. To break out, these first efforts must succeed and expand.

#### GAPS AND BARRIERS

Given these observations, CALSTART has identified with its industry and fleet partners the core needs for continuing momentum in technologies and fuels that reduce oil use, and they fall along the general stages of development:

- Need for consistent, targeted funding of research and development in advanced vehicles systems and partnerships to assist manufacturers transition to new technologies
- Need for funding partnerships with fleets and manufacturers to speed pilot projects and validate performance and reliability
- Need for fleet-focused purchase assistance in the early market stage to speed introduction and rapidly increase manufacturing volume

In terms of R&D, the core technology development needs now are for improved system integration and manufacturability, reduced energy storage costs specific to commercial vehicle designs, efficient components (to enable even greater fuel economy gains in all vehicles, and more capable hybrid and electric vehicles), optimized and downsized engines, advanced combustion schemes, power generation, lightweight materials, and advanced control systems.

The commercial vehicle segment has not been a high enough priority for funding in the past. It has also been assumed that investments made in passenger cars are sufficient to support commercial vehicle needs. The truth is, there are important differences between commercial and consumer—truck and car—vehicles in terms of duty cycles, system architectures, market needs and business cases. A portfolio of smart, targeted funding over a multi-year period and covering all the stages identified above and aimed at the needs of the commercial industry would have significant impacts.

No one approach alone will provide the full solution needed. Similarly, no one policy approach is sufficient. We strongly encourage a portfolio approach to technologies and fuels, balancing the strategy to achieve the end goal of reduced oil use via efficiency and fuel switching, or their combination.

It is important to note that assistance is needed now. The industry is at a critical stage and on the threshold of a successful launch. However, this launch can also be viewed more broadly as the first stage of a transformation of transportation technology. What is required is a commitment to a portfolio of change over a longer term to send clear policy signals to the end user and manufacturer. Ideally, the level of partnership should be commensurate with the needs and the challenge.

Again, thank you to the committee, members and staff for the opportunity to provide this testimony and share the progress to date we have seen in advanced efficient technologies and fuels that can reduce oil use and emissions in cars, trucks and buses of all sizes. These technologies are areas of U.S. national leadership, and together with the other benefits, can be important for job creation, export opportunities and economy growth.

The CHAIRMAN. Thank you very much.

Mr. Crane.

**STATEMENT OF DAVID CRANE, PRESIDENT AND CEO, NRG ENERGY, INC., PRINCETON, NJ**

Mr. CRANE. Thank you, Chairman Bingaman and Ranking Member Murkowski, Senator Stabenow, Senator Franken.

For the average American commuting in a gasoline fuel vehicle, \$4 a gallon equates to approximately \$200 a month. In Houston and Dallas, where our eVgo electric vehicle fueling package is being sold now, we offer an electric vehicle owners the opportunity to downsize that \$200 a month to \$89 a month, allowing an extra \$111 a month or more than \$1,300 a year. Money that can be used to build a better life.

Above that with each electric vehicle that displaces a conventional vehicle we take a little step as a Nation toward eliminating our country's 4 decade long dependence on foreign oil. We take a little step toward improving the air quality in our cities and towns which is deteriorating from tailpipe emissions. We take a step toward a consumer product driven revolution that will foster American technology, American entrepreneurs and American jobs. What will be a new and exciting sector of the economy.

The goal of Congress at this critical juncture in the electric car revolution must be to turn each such little step into tens of millions of little steps that collectively make a giant leap forward toward national energy independence. 100 million electric vehicles, which would represent one out of every 3 vehicles on American roads, would eliminate our country's oil imports from the Middle East. This is a worthy objective and we applaud you for focusing on this compelling national opportunity.

As you do, however, we ask you to keep in mind that the electric vehicle revolution, like all great consumer product revolutions, will be driven primarily by the private sector and by the American consumer. There is much that you can do to enhance and accelerate the EV breakthrough. So long as everyone recognizes that the government's role is to support and supplement, not super cede private sector initiative.

So let me tell you a little bit about what the private sector is already doing to accelerate EV deployment. Significant market penetration of electric vehicles depends on 4 things, the car, the sticker price, the cost of use and the convenience of use. The car and the sticker price depends upon the auto makers. At NRG we're taking on the cost of use and the convenience questions.

Principally by attacking range anxiety, which is the single greatest drawback commonly associated with electric vehicle ownership. Our new enterprise called eVgo has begun a \$25 million program to install a network of fast chargers around both Houston and Dallas/Fort Worth. By next year any EV driver in those cities typically will never be more than 5 miles away from one of our convenience chargers.

We bundle unlimited and free access to these public chargers with a home charger purchased and installed in the EV owner's garage and with all the electricity that EV owners can use for the flat fee of \$89 a month. No matter what happens in the Middle East that fee is fixed for 3 years.



It's cheap, easy, convenient and with it, the EV owner's range anxiety instantly becomes range confidence. I can tell you while it's still early days, we have gotten a very high percentage of EV owners in Texas signing up for our plan. We're working on plans to bring this eVgo network to other suitable locations around the country. Other companies are developing similar plans in other cities.

So what is it that the government can do?

The government can help by assisting American consumers get over the high initial cost of owning EVs during this period when manufacturers are still going through the expensive process of ramping up large scale production both of electric vehicles and of electric vehicle battery packs.

The government can help by creating and encouraging a range of convenience benefits for electric vehicle owners including most notably, giving electric vehicles access to HOV lanes on the Federal highway system.

The government can help starting right here in your committee by reporting out S. 948. We suggest only that you scrub the bill to ensure that it in no way disadvantages communities and companies that take early action to promote electric vehicle ownership. Provide electric vehicle infrastructure on their own initiative.

For as we have seen in the area of mobile telephony is where the U.S. Government facilitates rather than frustrates the private sector that American jobs are created and the American consumer benefits. In this case from a revolutionary product that ultimately will make the average American's daily life cheaper, easier, cleaner and more fun.

Thank you very much.

[The prepared statement of Mr. Crane follows:]

PREPARED STATEMENT OF DAVID CRANE, PRESIDENT AND CEO, NRG ENERGY, INC.,  
PRINCETON, NJ

Thank you, Chairman Bingaman. Mr. Chairman, Ranking Member Murkowski, and distinguished Members of the Committee, I appreciate the opportunity to testify before you today on the topic of one of the most exciting technological innovations of our era—the electric vehicle.

#### INTRODUCTION

Today America is experiencing "déjà vu, all over again". As the U.S. summer driving season approaches, gasoline prices have risen above \$4/gallon in large parts of the country and the cost of one fill up of a full size SUV is trending towards \$100. And not only is there absolutely no assurance that the gasoline price increases will moderate, every American knows that their hard won income going into their gas tank is headed from there straight overseas to help less than friendly foreign regimes.

With the continued instability in the oil producing regions, we all face the prospect that soon may come a day when the long lines and short tempers of the 1979 oil crisis again visit our shores and make us wish we could procure gasoline at any price. Back then, the U.S. Government responded by enacting higher CAFE standards and lower speed limits and by encouraging car pooling through the creation of "HOV" lanes, none of which have worked over the ensuing thirty plus years to curb our country's addiction to foreign oil.

But now, for the first time, technological innovation has produced a solution that has the potential to break our dependence on foreign oil. Mass produced plug in electric vehicles, powered by batteries with a range double that of the distance driven by the average American vehicle on any given day, are coming to various markets around the country as we speak produced by multiple American and global car manufacturers and start ups and more are on the way.

The electric vehicle revolution is happening and it will be driven, as it should be in the United States, by the private sector and by the American consumer. What the U.S. Government needs to decide is whether it wants to be a catalyst or a hindrance to the accelerated deployment of electric vehicles. Given the enormous geopolitical and balance of trade benefits to that will inure to the United States as a result of substantially reduced dependence on foreign oil, we feel strongly that the Government should support and supplement, but not supersede, the private sector's initiatives in this critical area.

#### EVGO

Our view is that vehicle ownership in the United States is primarily about the car, the cost (sticker price and operating cost) and the convenience of ownership and use. The car and the sticker price depend upon the automakers. Our company, NRG Energy, aims to address comprehensively the cost of use and the convenience questions. We have established a new enterprise, called eVgo, which has announced and begun implementation of a plan to turn the "range anxiety" normally associated with electric vehicle ownership into "range confidence". In order to do this, we already have begun a \$25 million program to install a network of convenience fast chargers around both the Houston and Dallas Fort Worth metropolitan areas.

We bundle free and unlimited access to this "freedom station" charger network with the purchase and installation of a 220 volt "home charger" in the EV owner's garage and all the off-peak electricity the EV owner can 'pump' into \$89/month charged through the car owner's home electricity bill. Not only is our eVgo package exceptionally convenient, both from an ease of use perspective and from a billing perspective, it provides the opportunity for breathtaking cost savings to the American driver who otherwise will be averaging \$150-200/month in gasoline bills at \$4/gallon.

Our subscription model is a very different approach from the way Americans are used to paying for fuel, but I can assure you that they get it. While it is still early days, we are pleased to report that an overwhelming majority of electric vehicle buyers who have received our eVgo sales presentation have signed up for one of our plans.

What we have done is just the beginning. Our freedom charger network in Houston and DFW will be fully built out by next year. We also are working on plans to expand these comprehensive charging networks to other cities around the United States. And we are not alone. Other companies, some in similar lines of business as NRG, have announced plans and begun efforts to deploy public charging infrastructure.

#### ROLE OF GOVERNMENT

Like most new technologies, the cost of electric vehicles must come down in order to bring about mass adoption. But we have also learned through talking with our own customers and many others around the country, that auto buyers are becoming more and more excited about the value proposition of electric vehicles. Drivers have started to become enamored of the idea of conveniently charging their electric vehicles in their home overnight while sleeping, filling up their cars with fuel at a fraction of the cost per mile of gasoline, and the reduced maintenance on a car that requires no oil changes or tune-ups.

The growth in demand and supply of electric vehicles can be accelerated with smart government policies designed both to enhance the convenience of electric vehicle ownership and to provide direct and indirect financial support aimed at helping consumers and businesses get over the initial high costs of new technologies like EVs, advanced batteries, and charging networks.

Regarding convenience, there is much the Government can do at low to no cost. It can train. It can promote electrical standards and processes to expedite the installation of home and community chargers. It can require preferential parking allocations for EVs at Government facilities and can encourage the same at privately owned parking facilities. Most importantly, the Government can acknowledge that its decades-long attempt to promote car pooling has failed and it can declare that all HOV lanes in the interstate highway system henceforth are instead zero emission lanes. All of this, as I said above, the Government can achieve for little to no money.

At today's hearing, we are discussing the Promoting Electric Vehicles Act of 2011 (S. 948). This act would authorize the funding of deployment communities to encourage the more rapid deployment at scale of electric vehicles. We think there is a very real role for deployment communities as envisioned in the current Senate bill provided that the bill is modified to reflect that the leading deployment communities,

to a certain extent, are already being identified by private sector decisions, such as charger networks sufficient to provide full range confidence, as well as the current EV makers selection of the markets to which they wish to allocate their EV product.

To our way of thinking, such communities are best thought of as “early deployment communities”—places that the private sector has identified as having most of what it takes to make it attractive to invest in EV infrastructure. Of course, residents of these communities still need the key policy drivers for EV deployment—a break on the initial cost of the first wave of electric vehicles.

However, not all communities are such attractive targets—for example, they may be too small or have too weak a distribution grid to attract early private infrastructure investment. Despite this, we believe EV infrastructure deployment should occur across the country, in a variety of communities, and for that reason the deployment community concept as laid out in the bill is a great way to jump start early EV adoption in such communities.

But we think the bill should also be clarified to ensure that any community in which a private entity commits to deploy a critical mass of charging infrastructure should also qualify for additional cost sharing for cars and chargers—and additional incentives for the community itself to deploy convenience benefits. In fact, by leveraging private investment, we believe this approach, in combination with the existing deployment community concept, can spread existing federal dollars over more communities in more states, and help deploy more electric vehicles—leading to an earlier end to our dependence on foreign oil.

In closing, let me say that this is an exciting time to be in the electric vehicle infrastructure business. I believe electric vehicles represent the next great consumer revolution, much like we have seen with the personal computer and cell phones. Buyers around the country have had the chance to see these cars and test drive them. A lucky few now already own a Chevy Volt or a Nissan Leaf. Their response, and the EV ownership experience more generally, have been overwhelmingly positive. Government policy obviously affects the auto industry but, for all Americans, the car purchase decision fundamentally is consumer-driven. At NRG, we believe electric vehicle policies like those I have described today actually represent something we have needed as a country at least since 1979—a consumer-driven energy policy for the United States.

Thank you Mr. Chairman, this concludes my remarks.

The CHAIRMAN. Thank you. Thank you all very much for your testimony.

Senator Coons has to be over on the Senate Floor to give a speech. So I—at least I was advised of that. I wanted to give him a chance to ask his questions so he can take my place as the first questioner. Then we’ll go to Senator Murkowski and the other members and then I’ll ask my questions after the others have completed.

Senator Coons.

Senator COONS. Thank you very much, Mr. Chairman for accommodating my schedule. Thank you very much for convening this hearing on these 2 important pieces of legislation by Senator Stabenow and by Senator Merkley and Senator Alexander, who were here before.

I’m from a State that happens to have a strong and early interest in the electrification of vehicles. I believe, as I think many of us do, that this has enormous potential for America’s manufacturing future, for America’s energy independence, for allowing us to retake the lead in the global manufacturing and delivery of cutting edge vehicles. So I’m strongly supportive of the Merkley/Alexander bill and hope to be joining them in actively supporting its adoption.

Mr. Davis, if I might. One of my concerns is about the speed of the adoption of some of the critical provisions of the bill. In particular, deployment communities if we are to authorize a significant investment that will, I think, result in valuable learnings about what kinds of consumer issues are arising in the deployment of

charging stations and in the adoption of electric vehicles, not just by 2 to 3 percent of the population, but more broadly by up to half.

There are some critical learnings there. If it takes 3 to 4 years for the Department to issue regs and do the competition and roll it out, it may miss a critical window. What reassurance can we have that the Department is prepared and able to rapidly act on the deployment community's concept?

Mr. DAVIS. Thank you, Senator for the question.

I think we would act very quickly as we did in the Recovery Act projects where a month after passage of that legislation we had a solicitation on the street. We had projects selected approximately in August of that year. So that's about 6 months after passage of the legislation. Then we went through the contracting process and most of those projects were in place within a year of passage.

So we would act, hope to act, as quickly in this regard to implement this program.

Senator COONS. Thank you. I think that would add a lot of confidence to folks who are looking to support this because I think early adoption speed is critical.

Second, as we move forward in advancing battery technology and battery research. As Senator Stabenow referred to earlier, there was some key investments being made. Ms. Cullen, I'd just be interested in your assessment of vehicle to grid potential.

The University of Delaware has done some fairly cutting edge work in this. There's an early stage deployment underway. I've been really struck at the capacity of a future electric vehicle fleet to do what a number of the panelists have referred to, use the excess capacity, the enormous excess capacity that's there. Then help with grid load balancing.

What's your view about how promising vehicle to grid technology is?

Ms. CULLEN. Senator, you are right. It is a promising part of the grid fueled equation. At the moment we are making the vehicles work as vehicles.

But the grid has enormous spare capacity. Vehicles can serve as an energy storage device and can maximize the efficiency of the grid's existing capacity. Going forward vehicle to grid capabilities will enable the consumer and the utilities to both maximize the benefit of grid fueled transportation and allow the energy stored in the mobile load in the cars to serve as load leveling as in managing variable sources like renewable power. Over time if we reach the mass penetration that we're hoping for that serve, as in fact, you know, a larger mobile load available to the grid.

Senator COONS. Thank you, Ms. Cullen.

Mr. Crane, if I might. You raised some questions about making sure that the bill as it comes out of committee as it goes to the floor, not needlessly compete with or interfere with private sector efforts. I just want to commend NRG for the eVgo deployment you're describing.

My hope is that we will work to find a way that the match level and the timing and the details of the deployment community's portion of this bill will in fact, complement those places in the country where there is some early stage deployment. Any more detailed comments about how you'd accomplish that objective?

Mr. CRANE. A couple things. We've had experience in the past couple years dealing with the executive branch of the Federal Government. There's a strong strain in the Federal branch that if the private sector is willing to do something than the government shouldn't be spending money in that area.

So what—since this bill, if passed and appropriated, you know, put some pretty big incentives to become a deployment community. You don't want the private sector to hold off investment hoping that, you know, that you could get that money. The other thing is we don't want to have to compete against people who are getting things for free from the Federal Government. Even as we speak the package we're offering in Houston has been duplicated in the city of Austin at a much lower rate because they were given a bunch of free chargers as part of the stimulus package.

Of our \$89 package, approximately \$30 a month is actually to pay for the cost of the charger that goes into your home. So you just have to be careful about the effect, the potential for distortions. Having said that, we think if the deployment community thing is done right, it can be very effective. As long as early—as long as communities that go early are not prejudiced relative to other people who may be waiting to start.

Senator COONS. Thank you for the input. Thank you to all the members of the committee. I am particularly grateful for the hard work the Electrification Coalition has done and SAFE has done in advocating for this. I look forward to supporting this bill.

Thank you, Mr. Chairman for accommodating my schedule.

The CHAIRMAN. Thank you very much.

Senator Murkowski.

Senator MURKOWSKI. Thank you, Mr. Chairman. Thank you to the witnesses here this morning. I have to tell you that when we first looked or when I first looked at the community deployment, I thought this is not going to work in my State. The range is just too great.

I forget which one of you mentioned range anxiety. But when it's 365 miles from one big town to the only second other big town, there's a lot of anxiety along the road. But we've got a lot of island communities. Island communities that are powered by hydropower, clean energy resource that we're looking at and saying we could make a difference here. So again the technologies are exciting.

I wanted to ask you a question, Mr. Davis, about the legislation that we have before us, S. 948. The proposal there as contrasted with the Administration's proposal. Their FY 2012 budget request seeks to provide up to 30 communities with up to \$10 million each to help deploy the electric vehicles under 948 the number is going to rise 25 fold, 250 million per community.

So we've got 2 proposals. One with \$300 million in total funding. Another with \$2 billion in total funding. Which is the right number to begin really moving out? Is it somewhere in between or can you speak? Because there's a lot of ground in between \$300 million and \$2 billion.

Mr. DAVIS. Yes, I appreciate your question, Senator. Fully recognize the large difference between the 2. However, the goals of the 2 programs are similar.

To work with cities to remove barriers to EV adoption.

To streamline permitting.

To put in place policy measures.

Ultimately to help install charging infrastructures as well as encourage vehicle adoption.

In the Administration's program, which was a \$200 million total effort, we envisioned up to 30 awards up to about \$10 million each. We did envision that as a shorter term program than what's envisioned in the bill. We would like to get it out quickly and help jump start this market.

Obviously the larger program in the bill would last longer term. Help us move farther down the road, if you will. Sorry for the driving metaphor.

But I think ultimately the most important thing is to balance the roll out of vehicles with programs like this. So obviously our shorter term and smaller effort as proposed by the Administration needs to be—needs to work in concert with the roll out of vehicles and the numbers of vehicles as they roll out. Same thing with the larger program, you wouldn't want to pre-build infrastructure before the vehicles are there.

So we would have to look carefully at the proposed introduction of those vehicles and time it with the implementation of the larger program.

Senator MURKOWSKI. Let me ask a question that is often asked here in this committee. That's whether it's appropriate that we be picking winners and losers. We're talking about electric vehicles here. Sometimes we don't have a very good track record when we try to pick who we think the winners should be.

Should we consider allowing natural gas and other alternative fuels to at least qualify, especially if it looks like these fuels are going to be more cost effective or if perhaps electric vehicles aren't going to be available in sufficient quantities? I throw that out to the panel. Because I think it is something that we need to discuss here.

Mr. Ghasemi.

Mr. GHASEMI. Thank you. Our proposition here is that our national security and economic stability is threatened by imported oil. Whatever we can do to reduce imported oil, we are for it.

If we can drill more and we have the reserves, do that. We should support that.

If we can increase fuel efficiency so that we use less gas, that would be good.

If we can use natural gas to power our heavy trucks, that's a good idea.

What we are saying is that electrification of transportation is a technology that we have. The technologies in your hand or in your pocket, or in front of you in form of the cell phones and laptops that you have, that—a bigger version of that lithium ion battery will drive the car. There is nothing new about this.

We have the infrastructure. Every house in this country has a garage. Every street has a lamp post.

Therefore, electrification of coalition presents a very immediate and interesting option. That's what we are asking for your support. We are not asking for your support at the exclusion of other alternatives.

The other alternatives are good. They have their own merit. I hope that there is enough money to push all of these programs.

But electrification is a technology which is here and it can be done very quickly. I think adoption of that and the rate of production, you mentioned about are the cars available? The cars are going to be made available if the consumers demand them. The consumers will demand that if the infrastructure is there.

Senator MURKOWSKI. You all seem to be nodding your heads. So I will take that as assent.

Mr. Van Amburg.

Mr. VAN AMBURG. I would just build on that in the sense that I think 2 things. I firmly believe that electric drive technologies, hybrid, electric and others are real strategic opportunity for our country right now. I do think that we have some opportunities we do want to push forward.

Having said that, I do think that we really do need to have this portfolio of approaches. So as you, as a committee, and as the Senate looks at these various bills that will be coming forward. I think it would be good to be looking at having a portfolio of choices that we can have.

Whether those happen in one very large bill which is often very difficult to pass or a smart collection of smaller bills that can put together the different fuels and technology approaches that really are on the cusp and need to be pushed forward. We would certainly approve of that.

I think down the road I would recommend that one of the things we should be thinking about is performance standards. I think having incentives of R and D based around the performance goals we want to achieve. Let's say it's energy security, petroleum reduction.

Then allowing whatever can best achieve that to move forward and get incentives or support would be a wise strategy to look at. I think now we certainly see a couple of key strategic opportunities for key technologies to move forward. But I think long term we should be thinking about performance based standards.

Senator MURKOWSKI. Thank you. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Franken.

Senator FRANKEN. I think it's a great hearing. I'm just really glad we're having this. Thank you both to the chairman and the ranking member.

Electric vehicles and hybrid electrics along with biofuels are going to be key to reducing our reliance on fossil fuels and imported oil in the future. Mr. Ghasemi, I agree with you. It's a national security issue.

I'm proud to say that according to the Department of Energy's Clean Cities Program, St. Paul based twin cities, Clean Cities Coalition displaced 134 million gallons of gasoline, more than any other coalition from 2005 to 2009. St. Paul has been partnering with the Department to roll out electric vehicle charging stations and purchase electric vehicles for the city fleet which is something that government can do. So I think they would be well positioned to take advantage of the policies that we're discussing in these bills.

I have a few questions just about the overall technology and the different models for charging vehicles. I'd just like to throw this out. I'll throw this to anybody.

The Israeli model to me is very interesting which is essentially if you use propane you use your propane tank and then you go in and you go to the hardware store or the propane store and get a full tank. You hand in your empty tank and get a full tank. So in Israel what they're talking about is you drive up to the charging station, I guess. They just,

[pop], pull out your battery and,  
[pop], and put in a charged one.

I mean, I think it's good mainly because of the sound effects.

[Laughter.]

Senator FRANKEN. But also it seems it would be fast and then the charging station would have the technology to charge. You wouldn't have to do that yourself at home. Although I think doing it at home is not such a bad idea.

What are the strengths of that in this country and the shortcomings? I understand Israel is a smaller country.

Mr. CRANE. If I could—well first the fact that it's a smaller country is important.

Senator FRANKEN. That's why I mentioned it.

[Laughter.]

Mr. CRANE. Yes. I think the second thing is that in Israel a large number of the cars are company cars. Apparently, I'm no expert on this, but Israelis are used to a uniformity of car choice that we think American consumers would not accept that people want to want them because one of the things about taking batteries in and out is you have to have a fairly standard configuration of where that battery is on the car and what it looks like.

The third thing from our perspective and I should say the company that's doing that in Israel also wants to do things in the United States. So they would have a very different point of view, you know, from our company. But I think the third thing that concerns us is that the battery pack is the most expensive part of the electric vehicle.

So the battery switching model requires that you have an inventory of spare batteries and the equivalent of service stations in this country. From our perspective we don't see how that could possibly be the most cost effective model to have to stockpile an inventory of what's the most expensive part of the car.

Senator FRANKEN. Yes, but presumably, you know, you'd just be charging it and then giving that one to the next car. I mean, it wouldn't be that—

Mr. CRANE. No, but I mean when you limp into a station if they don't have a charged battery, you know, so—

Senator FRANKEN. Right and you'd have to have—yes, yes.

Mr. CRANE. Yes, there needs to be a cushion, you know, in terms of—

Senator FRANKEN. OK, but you're a kind of company there being competition. Is anybody from a company or from a standpoint of not in competition?

Ms. CULLEN. Senator, I have members who are in various models of—



Senator FRANKEN. Right.

Ms. CULLEN. Charging. As Mr. Crane points out there are areas in which battery swapping actually is suitable. It's Hawaii, Israel, perhaps the island communities that Senator Murkowski talked about where there is a uniformity in battery and in cars.

Again, as was pointed out there is a great diversity in cars and batteries and that cost carrying an inventory of these batteries is expensive. The beauty of the electrification—the suite of electrification technologies is there's a lot of different vehicles and configurations. There's a lot of ways to go about charging.

If you want to be a person like Senator Alexander said, he doesn't even have a charger. He just uses the 120. He just, you know, plugs in at home. Whether you want to have a 220 charger to speed things up. Whether you want to charge at work and have that as your primary charge spot. There are lots of options that—

Senator FRANKEN. What I liked about charging at night, of course, is something you mentioned, which is you can do it in off peak hours. I think that would be a wonderful way. I know I'm running out—I'm out of time.

But I think that's a wonderful aspect of this which is that we have this excess capacity that we could be using at night. That's when the wind blows more often than during the day. So this intermittent technology, like wind, could be of greater use.

I think that's another—that's an advantage to doing it, obviously at home. But at the charging station they could use the benefit of that as well.

Thank you. I'm out of time. But this is, you know, an unbelievable potential. Thank you.

The CHAIRMAN. Senator Stabenow.

Senator STABENOW. Thank you very much, again, Mr. Chairman and Ranking Member Murkowski for holding the hearing. To all of you, I think this is a very, very important discussion. Personally I believe that as whether it's from jump starting the economy or getting off of foreign oil or jobs. I mean, when you look at what we can do around energy, having a comprehensive energy policy, being aggressive, being focused on where we can save dollars, save energy. This really is the discussion that I think we need to be having.

I would say just to start and I have some questions. But I think it's important to note that we really have moved down the road. I mean, we're half way down the road on advanced batteries and electric vehicles. I think this is important to note.

I mean, we—just as we have done, I think, back starting maybe before but certainly 1916 with incentives on oil and gas exploration which made sense to be able to drive a new industry. We were putting incentives in. We put incentives in on loan guarantees or on nuclear.

We do various things to be able to encourage technologies that we think are important. We did that in the Recovery Act with the \$2 billion in batteries investments. Which have really exploded in terms of what we've been able to do already.

But we've also done that in tax policy with things like up to 7,500 to purchase a new vehicle. I mean, we have started down this road. So my interest and sense of urgency about what we're

talking about with Senator Merkley and Senator Alexander's legislation is it completes that.

So we're not leaving it half way there because it deals with concerns of anxiety of consumers about can I use this? Is it comfortable? Is it easy? It deals with the infrastructure and the other needs that we have.

At the same time I think, as I said, regarding my legislation, it is very important that we look at everything. So that we're—and I think it's very compatible to do both. My question is, starting with Mr. Davis, talking about batteries.

We're told that because of the investments we've already made, we're starting from making 2 percent of the world's advanced batteries and that by 2015, it will be 40 percent. If we can actually make that happen, that's pretty extraordinary in just a few years. But and a lot of that's happening in Michigan. I'm very proud of that.

But can you speak about steps that the Advanced Technologies Program can take to work with private businesses to drive down costs, to really help, continue to help create the batteries and other ways that the Department of Energy can help to deploy these new technologies effectively?

Mr. DAVIS. Thank you for the question, Senator. Also thank you for the State of Michigan and the battery manufacturing facilities, that are being built there and the cost share provided that matched the government \$1.5 billion with their own \$1.5 billion to build \$3 billion in battery manufacturing. That is partly what is going to bring the cost down.

But in addition to the cost reductions through high volume manufacturing there will be an evolution of that manufacturing process. In addition we're seeing great improvements in the laboratory that are going further reduce that cost. We think today we're looking at a model battery cost of about \$600, \$650 per kilowatt hour just a couple—just last year we were at \$800 per kilowatt hour, the year before about \$1,000 per kilowatt hour. We measure that cost in a peer reviewed modeling process that looks at the cost of today's best technology if produced in mass quantities.

So we're very confident that the cost of batteries is coming down. We see things in the laboratory now that are going to lead to a battery cost in the middle of this decade of about \$300 per kilowatt hour. Still not where you would ultimately want to be, but getting pretty close.

So, as was pointed out by Mr. Crane, the battery is the most expensive component in electric vehicles today. It is critical to get that cost down. But the good news is we're on the right pathway to get to do so through our R and D supported by the Department of Energy. We have a clear pathway to get to a reasonable cost in the middle of the decade.

Senator STABENOW. Thank you. Just very quickly, Mr. Van Amburg, when you talked about trucks, medium and heavy duty vehicles, could you just speak for a little bit more about the opportunities that exist in that area and what Department of Energy can do to help facilitate that?

Mr. VAN AMBURG. I think it's a twofold strategy right now. No. 1 it is a very exciting area because I think it's been underserved.

I think we have focused and rightly, we have focused on light duty. But I think we've left a big area underserved.

There is this current technology area and I would say it's hybrid electric, hybrid hydraulic—

Senator STABENOW. Yes.

Mr. VAN AMBURG. Plug in electric and pure electric. There's just a range of technologies available are really world leadership areas. I think the 2 biggest areas we need to do there are we need to focus on better engineered and integration designs for future versions. I think the Department of Energy can be of tremendous help I think in the Advanced Vehicle Technology Act. That could be one of the target areas.

But No. 2, I think we need to deploy vehicles. One of the concerns that I have right now with our growing leadership in advanced batteries is that we have to have the vehicles to put them in or we won't have the markets for this great production capability we now have. So I think the bills that really can move vehicle volumes forward are critical. I don't think that's been a primary areas that DOE feels is within its purview for the most part. They do try to sync up with it.

I think if there can be more efforts to really push what's the good work out of the lab into the next step in deployment and linking those efforts together that would be very beneficial. But getting more vehicles on the road in trucks, in particular right now, would be critical to getting the volumes up and the prices down.

Senator STABENOW. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Let me just follow up on this idea of how do we get more vehicles deployed. It seems to me that maybe I'll address this to Mr. Davis. The Federal Government is a very large purchaser of vehicles. Do we have an idea as to what percent of the vehicles the Federal Government is planning to purchase in 2012, for example, Fiscal Year, will be electric or electric hybrid vehicles or vehicles even operating on natural gas, something other than just gasoline powered vehicles?

Mr. DAVIS. Thank you for the question, sir.

We'd be glad to follow up with the precise numbers. I'm going to work from memory here. The Federal fleet is about 600,000 vehicles. We purchase about 60,000 vehicles per year.

The good news there is with the Presidential directive issued earlier this year we're moving to by 2015 essentially having all those purchases be alternative fuel vehicles. So we are very rapidly moving in that direction. I don't have the precise number of vehicles that would be purchased in 2011 or 2012 that meet those criteria, but be glad to follow up.

The CHAIRMAN. Are those criteria performance based? Is that like Mr. Van Amburg was talking about? I mean are those—do you say to agencies and departments of the Federal Government through that directive, you know, choose something other than gasoline or something that gives us substantially improved vehicle fuel efficiency to the extent it does use gasoline?

Mr. DAVIS. So the goal is by 2015 to have all those vehicles be alternative fuel vehicles. What are we talking about there? We're talking about electric vehicles. We're talking about vehicles that

run on biofuels or natural gas or propane. So they are vehicles that essentially supplant petroleum.

The CHAIRMAN. So a hybrid electric Prius, that I now drive, would not qualify.

Mr. DAVIS. I'm not—

The CHAIRMAN. Because it does use gasoline.

Mr. DAVIS. I think I'd have to follow up on that.

Senator STABENOW. I'm just going to interrupt. If it was a Chevy Volt, it would qualify.

The CHAIRMAN. I see.

Senator STABENOW. Yes.

The CHAIRMAN. Even though it uses gasoline.

[Laughter.]

Mr. DAVIS. I'm not sure all the rules that would govern those purchases have been finalized yet. But we'd be glad to follow up and—

The CHAIRMAN. I think it would be useful to know the extent to which the Federal Government is leading by example in this area and how it's chosen to do so.

On the issue of local governments, you know, every city and town in the country has a fleet of garbage trucks. What is in place now to encourage and assist those communities and towns, cities and towns, to find alternative fueled garbage trucks whether they're electric or natural gas or whatever? Does anybody know?

Is this something that you look at, Mr. Van Amburg or not?

Mr. VAN AMBURG. We do look at it. We've had a partnership for the last 10 years with the U.S Army actually, the National Automotive Center out of Warren, Michigan, with a hybrid truck users forum. Now it's dealing with electric and advanced trucks.

We've tried to work with the refuse industry. There's been a pretty good penetration actually, of natural gas vehicles into the refuse. Industry is about on the order of around 17,000 or so—or actually around 3,000 refuse trucks that are natural gas right now.

The CHAIRMAN. Out of how many?

Mr. VAN AMBURG. The fleet is around 90,000 plus. So there's still a huge backlog of potential vehicles that could be—

The CHAIRMAN. So a little over 3 percent?

Mr. VAN AMBURG. Yes. Yes. So we have a long way to go in that area. I think some of what could be helpful is incentives or goals that people could set out with some assistance to achieve those goals in each of these sectors.

There's opportunities in each of the vehicle sectors including the medium and heavy sector.

The CHAIRMAN. Ah, yes, Mr. Davis.

Mr. DAVIS. I would like to point out that are Clean Cities Program operates almost 100 clean city coalitions across the country and works with local communities to promote alternative fuel vehicle purchases and infrastructure. One of the things that has been stressed in the almost 20 years of their existence is natural gas vehicles and vehicles such as delivery trucks and refuse vehicles. As pointed out by Mr. Van Amburg, natural gas is particularly good choice in that area as well as hybridizations since refuse vehicles stop and start a lot.

The CHAIRMAN. But I'm right, am I not, that the Clean Cities Program is a program to share information and provide technical assistance. It is not—it does not carry with it any financial incentives or requirements or anything like that?

Mr. DAVIS. Primarily what it does is help local communities and share information and facilitate, but we do run an annual solicitations through the Clean Cities Program that help pay a percentage of the incremental cost of vehicles or more importantly in the case of natural gas, establish infrastructure because the infrastructure in natural gas fueling station can be a significant barrier to putting in place vehicles.

The CHAIRMAN. OK. My time is up.

Senator Murkowski.

Senator MURKOWSKI. Mr. Chairman, I'm just curious to know whether the garbage trucks that are run on natural gas are any quieter at 5:30 in the morning than the garbage trucks in my neighborhood which I have to believe are probably not powered by natural gas. But if it is that's a huge breakthrough and we want to encourage that.

[Laughter.]

Ms. CULLEN. Senator, there are electric garbage trucks that are silent.

Senator MURKOWSKI. Are they? There we have it. There we have it.

Mr. Davis, I want to ask you about the situation with the batteries and Senator Stabenow is gone now. But you were discussing just a moment ago about the joint venture with DOE and the State of Michigan and the benefits that we have seen there. Just this morning I was just handed this article a few minutes ago.

But apparently in Energy Daily, this morning there's a story about what they call a corporate breakup between Johnson Controls and SAFT. Those 2 were working on this joint battery venture. They got \$300 million from DOE from stimulus funds, another \$150 million from the State of Michigan that you just referred to.

But apparently there's been this breakup here. The article goes on to say that this is clearly a bad time for this to be coming about because a whole handful of other—of vehicle manufacturers are in line waiting for these batteries. Whether it's Ford's first plug in, they're scheduled to go to market 2012. They're waiting for these batteries.

The point of the article is it says, it's pretty unclear as to the impact that this breakup might have on what's going on with the development and deployment of the batteries. Can you give me an update or let me know what's happening here?

Mr. DAVIS. Sure, I'd be pleased to. Thank you.

The battery manufacturing portion of the Recovery Act includes 6 major battery manufacturing facilities. So we're talking about one here. That one is a contract with Johnson Controls. They're subcontractor is this joint venture between Johnson Controls—SAFT.

Senator MURKOWSKI. OK.

Mr. DAVIS. So our relationship, our contractual relationship, is with Johnson Controls, the parent of that. The subcontract is with

Johnson Controls-SAFT. I have talked to the head of Johnson Controls battery work. This should not impact our program at all, should not impact the building of their facilities which is underway right now.

There will be some, you know, legal actions between those 2. They're going to work out their dissolution. But we don't expect it to impact our project or the delivery of batteries.

Senator MURKOWSKI. So even though they had the contract to build this out and this contract is not going forward, that's not going to somehow or other, delay the roll out or—I mean, we've got a lot of Federal dollars that are on the line here that we want to see deployed and moving. You seem pretty confident this isn't going to be an issue.

I appreciate it may just be one of 5. But again, you've got \$300 million here from DOE. I think we'd like to know that that's going to actually end up in advancing these technologies.

Mr. DAVIS. Sure. Under that contract they are building 2 separate facilities. Johnson Controls—now of course, this just happened.

Senator MURKOWSKI. Right.

Mr. DAVIS. It just happened yesterday. So we are going to be working with Johnson Controls to work through this process and ensure there's no delay. But our initial read is it shouldn't delay the construction of those factories.

My understanding is that part of the reason that the dissolution is happening is the—as you look forward there's disagreement about how much investment is going to have to be provided by companies to keep these—this technology and these factories viable. So in Johnson Controls position is this is actually a step forward to ensure viability in the long term.

Senator MURKOWSKI. I'm sure DOE will be keeping a close eye on it.

Mr. Ghasemi, you have spoken very clearly, very articulately here about our need to reduce and eliminate our dependence on foreign oil. I absolutely concur. I agree with you. We need to do more. It goes back to Senator Alexander's very neat bumper sticker. We need to produce more and use less.

One of the things that concerns me is our growing reliance on foreign sources for our minerals. When we're talking about batteries as we just are here, I think we recognize that whether it's permanent magnets or batteries, we've got to get back to these raw component parts that come from the Earth. Unfortunately when we're talking about rare Earth minerals the vast majority, some 97 percent of that right now is coming from China.

Do you worry as much about our increasing reliance on others for those very critical elements that we need to reduce our reliance on foreign sources of oil? I'd hate to trade our reliance on foreign oil for our reliance on foreign minerals. So I'm just curious for your perspective on that.

Mr. GHASEMI. Thank you, Senator. That's an excellent question, obviously.

I think that the difference between electric cars and gasoline cars when it comes to that issue is that if you have an electric car every morning for it to go the distance you don't need to put any rare

Earth into it or any mineral into it. You just put electricity in. So making electric car battery is a onetime effort. Once you have it the cars can drive for many years.

The second thing is that we have enough of these cars most of these materials can be recycled. I mean, if you had 150 million of these cars running around and each year we were recycling 10 percent of them that would almost give you enough of these materials to make the new car. So the reliance on those critical materials is an issue that should be addressed.

I think the United States needs to make sure that those sources are there. I'm very happy to say that a few—2 years ago we worked very closely with the Department of Energy to make sure that one of those resources which is lithium is properly made in the United States. So I think those efforts should continue.

But the magnitude of the dependence gets significantly reduced if you are driving these electric cars verses gasoline which we need every morning.

Senator MURKOWSKI. I appreciate that. I thank all the witnesses.

The CHAIRMAN. Senator Franken.

Senator FRANKEN. Just 2 real quick questions.

One, we're talking, Mr. Van Amburg, you talked about silver buckshot. There's one piece of the buckshot that I didn't hear about today and it was hydrogen. Does anyone have—and I notice that the Administration in their budget request reduced the request for funding for hydrogen.

Where are we on hydrogen because it, you know, I've been driven in hydrogen vehicle that was fabulous.

Mr. DAVIS. Thank you, Senator. I should note that in the State of Minnesota one of the major leaders in this areas, 3M, is helping push the technology forward. DOE has funded hydrogen for some years and fuel cell technology and happy to report that the cost of fuel cell technology has decreased rapidly, approximately 80 percent since 2002. Right now we're at about \$51 per kilowatt with our ultimate goal to get to about \$30 per kilowatt to be competitive with current technology.

We do recognize that our strategy is to sustain a balanced research and development portfolio with an emphasis on nearer term technologies such as batteries and electric drive. The fuel cell program is still robustly supported and looking at nearer term applications such as stationary fuel cells and a fork lift as an early market opportunities to get fuel cell manufacturing ramping up to the point where it could more readily enter the vehicle market.

Mr. VAN AMBURG. Senator, if I could just add to that. I think Pat rightly identifies where some of the key first markets really are looking to be in fuel cells. But there is another one and that interestingly is the transit bus marketplace.

A transit bus is often because of their platform size and the fact that they're out in the middle of cities and get seen a lot and the emissions are pretty critical, are early leaders in technology. They led in natural gas. They led in hybrid.

We've been working on a national program with the FTA, the Federal Transit Administration on this. What we're seeing, as what Pat said, not only the costs come down on the fuel cells. But the

life cycle lengthen out because you really need it to be much longer than it is.

We're seeing 6,000 to 10,000 hours now which really starts to get us into some interesting useful lives in a transit bus platform. But it's also using a fuel cell that's more similar to a stationary fuel cell in size so the cost points don't have to come down quite as much as you would in a car. So we're thinking transit bus operations may be another place where we'll see fuel cells in the nearer term.

Senator FRANKEN. Miss Cullen.

Ms. CULLEN. If I may, the Electric Drive Transportation, as I pointed out, we represent the whole spectrum of electric drive technologies, which includes fuel cells because that's what a fuel cell creates is electricity. So hydrogen powered fuel cells are very much within the gambit of the technologies that we're promoting. My members in the automotive and in the medium and heavy duty side are very much pushing forward on fuel cell vehicle applications.

They've made substantial investments on their own and worked with the Department of Energy. They're hoping that the Department of Energy will continue its commitment to those technologies. They are pushing toward, as you're probably aware, rolling out automotive in the light duty segment in the 2015 timeframe.

Senator FRANKEN. Thank you. One last and it may sound like a small concern, but I think there's concern among the blind community about electric vehicles and that they don't make sound. We're talking about the garbage truck at 5 in the morning or whatever.

Is there—what is the consideration there for pedestrians and, I mean, most of us hear before we step off a curb. We hear the thing coming. What kind of considerations are being made there?

Ms. CULLEN. The automotive industry is working closely with NHTSA and they are communicating with each other on establishing a uniform set of sounds, a safety standard. For instance on creating a signal to those who need it without—while maintaining the lower noise profile of electric drive vehicles.

Senator FRANKEN. Right.

Ms. CULLEN. For instance the Nissan Leaf has a low speed sound that you can hear outside the vehicle but not inside the vehicle. Standardizing the sound is another consideration that the companies are talking about so that everyone would recognize it as an oncoming vehicle opposed to having a series of ringtones, for instance.

Senator FRANKEN. Right. OK. Thank you.

The CHAIRMAN. Senator Murkowski, did you have additional questions?

Senator MURKOWSKI. I don't.

The CHAIRMAN. Thank you all very much. I think it's been a useful hearing. We appreciate your excellent testimony.

That will conclude our hearing.

[Whereupon, at 11:42 a.m., the hearing was adjourned.]



## APPENDIXES

---

### APPENDIX I

#### Responses to Additional Questions

---

##### RESPONSES OF DAVID CRANE TO QUESTIONS FROM SENATOR BINGAMAN

*Question 1.* I'm happy to hear you've been able to design a charging network to provide charging for electric vehicles in the Houston and Dallas areas with your own funds. Obviously, it's too early to tell how the economics of those plans will work out. With regard to other cities where you might roll this out in the future, are there common features you'll be looking for? Are there communities that because of size, density, or other factors, where you don't currently see your model working? Do you see the government only having a role in those communities, or can they simply take a lesser role in communities with a higher commercial potential for private actors?

Answer. We've seen very encouraging early results in Houston and Dallas, and our hope is to soon expand beyond Texas. There are three key factors we analyze initially when considering new markets: 1) Projected supply of electric vehicles; 2) Regulatory framework and its potential impact on third-party charging providers; 3) The interest of local utilities in working with us. Of these, projected EV supply is particularly important; the success of our business depends on generating subscription package revenues.

When companies like ours make significant private sector investment in communities, there is less of a need for government support and, as a result, more government dollars can be sent to smaller, less dense communities. We believe it is crucial for the government to focus on cost effectiveness: deploying the most vehicles, in the most cities—for the least number of public dollars.

*Question 2.* You obviously see the potential for enough market penetration in electric vehicles to support your business model. What gives you the confidence in the market to make the substantial up-front investments you're currently making?

Answer. First, we are encouraged by automakers' commitment to EVs. Nissan and GM have rolled out production vehicles, while Ford, BMW and others have models on the way. Another key driver is the significant private investment we've seen in EV charging infrastructure, batteries and other technologies—from companies like ours and others. Third, we see a growing weariness from consumers when it comes to high and volatile gasoline prices, and a general sense that shipping billions of dollars overseas for oil is not a good thing. EVs are gaining popularity as a potential remedy for these things. Finally, we see enormous potential for EVs to bring about the next consumer technology revolution—and there is real value in NRG being a first-mover in this area.

##### RESPONSES OF DAVID CRANE TO QUESTIONS FROM SENATOR MURKOWSKI

##### TAX CREDITS VS NEW PROGRAMS

*Question 1.* As you know, the tax credit for alternative fuel infrastructure expires at the end of this year. If it comes down to a decision between creating new programs and extending existing tax credits, which would you consider more important?

Answer. The existing tax credits—both for EV infrastructure and for EVs themselves—are important to our business. Building our public networks comes at significant cost. For example, each of our public "Freedom Stations", containing a Level 2 and a DC charger, costs well over \$100,000 installed. As we build out our networks in early years, defraying these costs through the infrastructure tax credit is

extremely important. That said, we do see a cost-effective “Deployment Community” playing a very important role in bolstering EV readiness in typical cities across the country, and especially in smaller, less dense communities.

## EVGO

*Question 2.* Please summarize the scale of investments that NRG is making in Dallas and Houston. How many customers will those programs be able to accommodate?

Answer. Our initial investment in Houston will be around \$10 million, and we plan to exceed that number in Dallas. Every EV charging package we sell today includes a Level 2 home charger installed at no up-front cost to our customer. This robust home charging network combined with the 50 Freedom Stations we plan to install in Houston and the 70 planned for installation in Dallas-Forth Worth will accommodate more than the projected number of EV buyers in each city in coming years.

## TEXAS

*Question 3.* NRG chose two cities in Texas to launch its eVgo program. Can you describe any competitive advantages those cities, and potentially the state of Texas itself, hold for the deployment of electric vehicles? What made NRG choose cities in Texas over communities in other states?

Answer. NRG has a large presence in Texas today, including our retail businesses Reliant Energy and Green Mountain Energy. As a state, Texas has long prided itself on welcoming new ideas and clearing regulatory hurdles to realize these new ideas. Texas also has a competitive retail electricity market, which enables us to work with a variety of energy retailers, to offer eVgo to a variety of customers. In addition, Houston has a robust electric distribution system that can accommodate significant EV penetration. For all these reasons, Houston has proven to be a great launch pad for eVgo. The city, one of the country’s energy hubs, has a robust car culture and an intense focus on public and private sector innovation.

## NONFINANCIAL BENEFITS

*Question 4.* In your testimony you mentioned there are several policies that the government could enact at very little cost, including convenience measures such as zero emission lanes and preferred parking spots. Please describe the impact you believe those policies could have on electric vehicle sales and deployment.

Answer. Convenience benefits excite consumers, and that is very important to us because the success of our business depends on the sales of charging packages to actual EV buyers. A recent Accenture consumer survey on EVs confirmed that benefits like priority parking and zero emissions lanes are potentially large consumer catalysts in the decision to buy an EV. Americans spend a lot of time in their cars, and EVs represent a new and exciting way to drive. If we can add further conveniences to the EV driving experience like those mentioned above, we will add even greater momentum to the overall EV movement.

## COMMUNITY DEPLOYMENT PROGRAM (S. 948)

*Question 5.* How can a community deployment program for electric vehicles be structured to ensure that public money does not crowd out private investment? Do you believe S. 948 strikes an appropriate balance?

Answer. When companies like ours make significant private sector investment in communities, more government dollars can be sent to smaller, less dense communities. We believe it is crucial for the government to focus on cost effectiveness: deploying the most vehicles, in the most cities—for the least number of public dollars. We believe that S.948 could this crucial role, with certain changes to the bill to ensure cost effectiveness and to make sure the procedural requirements for a successful application do not prevent or inhibit private investment in publicly available charging equipment.

## COMMUNITY DEPLOYMENT PROGRAM (S. 948)

*Question 6.* In your testimony, you introduced the concept of “early deployment communities” and recognized that significant private investment is already being made in some communities to facilitate the deployment of electric vehicles. Please expand on this concept, and any advantages it may offer.

Answer. The key to the early Deployment Community concept—to any Deployment Community concept—is that taxpayer dollars need not be spent to duplicate charging infrastructure investments being made by the private sector. For example,

if significant private charging equipment investment has already been made in a community, it would not make sense to require that community to start over from square one—e.g., by building a wide ranging stakeholder group to support investment in charging equipment—in order to qualify for federal benefits. If such a community can show that it has the proper investments, agreements, and plans in place, its citizens and in certain cases businesses, should qualify for convenience benefits, and additional incentives to buy EVs and install charging equipment.

RESPONSES OF BILL VAN AMBURG TO QUESTIONS FROM SENATOR BINGAMAN

*Question 1.* You make a strong case for increased focus on medium and heavy-duty trucks for research and development, as Senator Stabenow's bill outlines. Arguably, existing R&D authority as well as such programs on the deployment side such as Clean Cities should be sufficient to allow the Department to address this need. In your view, what's the main value of the structure laid out in S.734?

Answer. The structure laid out in S.734 has several very valuable elements, not least of which is the specific recognition of medium and heavy-duty vehicles as a targeted area of R&D. S.734 provides and providing a suggested allocation of resource for this segment that matches its fuel use impact. In the past, medium-and heavy-duty vehicles have not received commensurate support in Department budgets, normally funded—if at all—to significantly lower levels than light-duty passenger cars. Indeed, many of the specific heavier vehicle programs were funded via Congressionally-directed projects. Even the Department's 21st Century Truck Program (21CTP) often lagged for insufficient resources, as noted in the National Academy of Sciences report. Again, this is not an argument against light-duty vehicle investments, but is an argument for balanced investments that include the larger and higher fuel use commercial vehicle platforms. U.S. firms are now world leaders in several important technology categories for commercial vehicles (hybrid and electric technology in particular, to a great degree thanks to programmatic support and focus from the Department of Defense), in contrast with other technology areas that are dominated by companies outside of the U.S. This is important from a job creation and retention perspective, and there is a strategic opportunity to maintain our leadership through consistent and focused R&D co-funding with industry.

Another important design element of S.734 is its language opening up Department program considerations to a broader array of firms, especially medium-and heavy-duty vehicle component and system suppliers and technology developers. Original Equipment Manufacturers (OEMs) are vital players and have always been included at the center of Department programs, but spurring innovative new technology requires tacit inclusion of the supply and developer segment. These companies have been arguably under-served, yet they are increasingly where innovation and new technology originates and where early support, in particular R&D, needs to focus resources. This approach matches what is a concurrent trend in the automotive and truck industry to increasingly "push down" technology and system development from OEM to Tier 1 and other suppliers. The current and successful ARPA-E program has shown a strong model for assessing and targeting technology innovators at the early stage of development. Previously, the DARPA Advanced Vehicle Program of the mid 1990s stood out for its portfolio approach to technology development, funding innovative technology developers in a fast-track approach to drive power system and alternative fuel development and demonstration. Heavy-duty hybrid drivelines were a significant and notable outcome of these efforts. In the national Hybrid Truck Users Forum (HTUF) program which CALSTART operates in partnership with and under contract to the U.S. Army TARDEC-National Automotive Center (NAC), the focus has been to move from R&D to broader deployment and validation stages, which is another under-served but critical stage in vehicle commercialization. Yet even at this stage, a continued focus on the supplier segment, together with the OEMs, is vital for successful pre-production and production launches. New technology commercialization benefits from and requires greater inclusion of the industrial segments most active in developing innovative designs and systems. S.734 recognizes this and includes the "wiring instructions" in its language that encourages it. It also encourages the Department to connect its programs more explicitly with other complementary programs which operate at different stages of the commercialization process. This echoes another observation of the National Academy of Sciences review of the 21CTP. This could assist with a more seamless and connected national approach to driving innovation, from R&D to validation and demonstration through early deployment.

One final area of design in S.734 that we believe would be of crucial importance is its longer timeline and consistent focus on developing higher efficiency tech-

nologies. We have researched the key barriers to faster and more effective advanced vehicle development and deployment with OEMs, suppliers and vehicles end-users, and their responses have been unambiguous. They can most benefit from three areas of support: 1) End-user purchase assistance (such as vouchers or tax credits) to speed early production vehicle deployments; 2) Consistent and multi-year R&D and validation funding partnerships; and 3) Assistance to shift manufacturing capabilities to new technologies. S.734 addresses the issue of consistent and longer term R&D partnerships.

The Department has tried to address this on its own but resources have varied considerably year by year and the focus has shifted across various technology and fuel solutions making longer term investments by industry more difficult. More consistent long term investment signals would give industry greater confidence in their own investment decisions and would better leverage any public funding. S.734 does not pick a specific technology or fuel solution, but instead targets outcomes: greater efficiency. In essence, it is outlining a performance standard against which R&D decisions can be measured, without specifying the specific fuel or technology to achieve it. We believe this can open up and spur innovation. Those technologies of high interest, such as electric drive systems, would benefit under such a design, but so would other innovative approaches such as hydraulic hybrids, alternative combustion cycle engines, active aerodynamics and other technology.

Moreover, the longer program horizon would set this goal in place over multiple years, rather than just a single year or program solicitation. It would send a signal that for half a decade at least, greater fuel efficiency was the driving force of Department R&D efforts across all vehicle platforms. Given the new, first-time fuel efficiency regulations being placed upon medium-and heavy-duty vehicles, and the expanded fuel efficiency requirements for light-duty cars and pick-ups, the timing and timeline of such an R&D effort could not be more opportune.

The Chairman is right to observe that existing authority likely exists for the Department to proceed in the manner outlined above but funding allocations have not matched this model, in particular for medium-and heavy-duty vehicles. S.734 would provide strong Congressional wiring instructions for the Department in funding allocations and program focus for spurring greater efficiency in vehicles.

*Question 2.* I'm interested in the programs you've seen to aid in the deployment of heavy-duty fleet vehicles such as buses and refuse trucks. Beyond research and development are there gaps remaining in the federal programs that we could help fill in order to allow more deployment of alternative fuel vehicles in this segment?

Answer. The single biggest gap at the federal level is assistance that directly spurs the purchase of early production (low-volume) advanced, efficient and alternative fuel vehicles. The U.S. would greatly benefit from more consistent R&D funding, as noted in question one, but we have generally done a better job at the R&D level than at the deployment level. From a commercialization perspective, it is the equivalent of leaving the race when the finish line is in sight. Indeed, the U.S. has been a world innovator in several technology categories but often does not reap the benefit of its inventions when it comes to production and manufacturing because it does not consistently help new technology "cross the chasm" from demonstration to deployment. This has a social cost in terms of lost jobs and manufacturing.

This is particularly an issue with new vehicle technologies, which often face a steep cost premium in early low volume production because of limited production scale, supply chain costs and initial engineering designs. Limited, short term assistance at the right time in these markets could have a huge benefit in moving U.S. technology more effectively from prototype to product.

This is a major issue in the medium-and heavy-duty vehicle arena even more so than light-duty. For instance, while there is a \$7500 tax credit for electric passenger cars at the federal level, there is no equivalent for what are the first hybrid and electric trucks and buses. Given that a truck or bus can use ten to thirty times or more fuel than a car, targeted federal assistance could also have huge fuel efficiency leverage and outcomes for the same amount of funding. For instance, a hybrid refuse truck would likely reduce its fuel burn by 20-30 percent, cutting petroleum use by well over a thousand to two thousand gallons per year per vehicle. A passenger car rarely even uses 500 gallons total. Again, this is not an argument against light-duty incentives at all; it is an argument for balanced and commensurate assistance aimed at policy outcomes. Indeed, there is currently no federal level deployment assistance, including no tax credits, for medium-and heavy-duty hybrid, electric or natural gas vehicles.

The most successful current program to change purchase decisions and spur advanced vehicle purchase and deployment is a state program, operated by the California Air Resources Board (ARB). Known as the Hybrid Truck and Bus Voucher Incentive Program (HVIP), the program is designed as a point-of-sale purchase

voucher for medium-and heavy-duty hybrid (all types, electric and hydraulic) and electric trucks. These trucks are in their initial early production, low volume stage. HVIP voucher amounts have been set at roughly half of the incremental cost of these vehicles—the level fleets and manufacturers agreed was sufficient to cover the extra costs not yet paid for by the fuel saving benefits of the trucks. HVIP is slated to last roughly 4-5 years and is in its second year; to date this single state program has spurred nearly 1,000 hybrid and electric truck purchases and deployments in fleet use. The California Energy Commission recently built on HVIP's success by adding funds to HVIP to better assist electric trucks, and then crafted a separate but equivalent program for natural gas and propane truck purchases. The design is the same: to reduce the upfront cost of early production vehicles sufficiently to spur fleet purchase.

Illinois' EPA office operates another interesting program called the Illinois Clean Diesel Program. While not as targeted as HVIP, it does greatly streamline the grant funding process for the Diesel Emission Reduction Act (DERA). Fleets and manufacturers alike agree that long form, proposal-based grant programs are costly for them to pursue, delay timing on purchases and have little to no certainty of outcome. They are useful, but not as effective at deployment as would be desired. In contrast, the Illinois Clean Diesel program is notable for streamlining the process by establishing set funding amounts available for different technology options fleets can choose, and then a first-come first-served short application form to qualify. This greatly reduces fleet proposal writing and quantification effort, and allows them to focus on procurement decisions.

It is worth noting that in the heavy transit bus world there is an existing structure in place to assist with alternative fuel and advanced bus purchase. Under the Federal Transit Administration (FTA) formulas, the federal government pays for 80 percent of new bus purchase costs with local agencies paying 20 percent. This formula has encouraged agencies to increase their purchase of natural gas and hybrid transit buses because it has the effect of reducing the incremental cost impact to them. There is no such support for school buses or smaller privately run shuttle or circulator buses, however. These were some of the successful operating examples noted in a recent study "Speeding High Efficiency Truck Adoption: Recommend Policies, Incentives and Investments", CALSTART 2011 ([http://calstart.org/Libraries/Publications/Speeding\\_High-Efficiency\\_Truck\\_Adoption.sflb.ashx](http://calstart.org/Libraries/Publications/Speeding_High-Efficiency_Truck_Adoption.sflb.ashx)). Highlighting the success of these examples, and based on research and data from fleets and industry, the report then recommended that the ideal structure for spurring faster deployment of high efficiency trucks and buses would be a performance-based purchase voucher at the federal level. In essence, the voucher would provide a purchase incentive to a range of solutions that achieved different levels of fuel efficiency improvement (above any levels required by regulation). In the report, a draft voucher framework was proposed that would be partly based on the early market incremental costs and partly on the "co-benefits" achieved through greater efficiency. For instance, beyond the direct fuel savings to fleets, a more efficient truck through its operation has petroleum reduction and energy security benefits to the nation, in addition to emission reduction benefits. These were factored into the voucher levels to reflect the higher benefits provided by reducing fuel use in the highest fuel using vehicles. A potential high efficiency voucher based on these parameters is illustrated below, as cited in the report.\*

This voucher uses fuel efficiency as the metric. Petroleum reduction could also be used as a metric, in which case emission reduction benefits would need to be ensured in to qualify.

Such a voucher could be managed through existing federal programs but would require a change in approach for those programs. For example, Clean Cities could serve as a logical channel for expanding deployment via purchase vouchers. However, the program would need to be both better funded, and then operated—at least in part—as a disperser of vouchers to qualified purchasers, rather than as occasional source of grant fund solicitations. This change actually could serve to greatly strengthen and better utilize the Clean Cities structure and role in deployments.

The downside of Clean Cities is that it does not reach the entire nation; though it does touch most of the regions with impacted air quality. Alternately the Department's national solicitations that do focus on deployment could do so in the form of a performance-based purchase voucher.

Another possible approach would be to authorize a voucher structure via the national Energy Efficiency and Conservation Block Grant program, which currently is partly allocated to each state by formula. Some of the block grant funds could be

\* Graphic has been retained in committee files.

dedicated or allocated specifically to vehicle deployment using a voucher formula, with disbursement authority left to the state.

A third structure could be to add additional descriptive language for the use of Congestion Mitigation and Air Quality (CMAQ) funds emphasizing that they may be used for advanced and alternative fuel vehicles, and suggesting a performance-based voucher as an effective tool for streamlined success. CMAQ funds can be used for clean vehicle deployments, but this is not widely used or understood by the receiving agencies. Such language could clarify and encourage the practice.

Finally, a structure like the Diesel Emission Reduction Act could be augmented with a directive that some of the funds be used for streamlined deployment. DERA funds have been popular but focus mostly on retrofit kits and involve complicated long-form proposals be submitted. A simplified voucher approach could be a useful addition to the program and could be administered by each region, allowing regional differences to be reflected. Having noted this, DERA funding is currently zeroed out in the Administration budget. EPA's SmartWay program is an example of an existing program that programmatically could administer such a streamlined voucher, though additional funding would be required.

---

#### RESPONSES OF GENEVIEVE CULLEN TO QUESTIONS FROM SENATOR BINGAMAN

*Question 1.* Critics of this approach might argue that powering vehicles from the grid requires too many changes in behavior from the consumer so it is unlikely these vehicles will be able move beyond niche markets. Can you give us any insights from the manufacturers in your coalition on how they see electric vehicles moving to mass-market status?

Answer. Increased electrification of the vehicle fleet is already occurring, but the speed of adoption is variable, based on technological advances, reduced market hurdles for vehicles and infrastructure, and consumer education about grid-connected vehicles and their benefits.

Announced production plans, as assembled in the Department of Energy status report issued in February of this year, show aggressive production schedules for the manufacturers included in the survey. The report illustrates that leading vehicle manufacturers (not all leading manufacturers were included in the tally) already have plans for cumulative U.S. production capacity of more than 1.2 million electric vehicles by 2015.

EDTA member companies have announced varying production targets and have plans for (or are already) rolling out vehicles in initial markets to be followed by national expansion. While their plans differ, they share an ambitious commitment to achieving electric vehicle adoption on a national scale. The right national policy initiatives can help speed the fulfillment of that goal.

Demand has been rightly noted as an essential component of commercial-scale adoption in the near term. Grid-connected transportation options provide consumers with savings on fuel and maintenance, freedom from price-volatility and the opportunity to reduce oil use and emissions. But consumers need to understand how these benefits apply to them and how these vehicles fit their driving needs.

While "plugging-in" is a new practice for fueling, it is not new to consumers who now routinely come home and recharge their phones, laptops and iPods—or seek out an outlet at a coffee shop or airport when travelling. Daily and opportunistic charging is increasingly integral to the way we live and work.

Multiple market analyses show that consumers want electric alternatives in transportation, either because electricity is cheaper than gas, is cleaner than gas, is a domestic fuel that they can access at home or because electric drive has great performance. Often, consumers realize it's all of the above.

However, consumer education is clearly needed. Buyers need credible, accessible information to identify the best configuration for their driving needs and their options for recharging.

It is expected that most drivers would do the vast majority of charging at home. Their workplace would be second. While plug-in hybrid electric vehicles (PHEVs) will have longer absolute range without charging, drivers with pure battery electric vehicles (BEVs) and those who want to extend the battery-only propulsion of their PHEVs will want accessible and convenient public charging options, in parking garages and retail stores, for instance.

EDTA is engaging in a national consumer education effort through our website GoElectricDrive.com and with coordinated efforts with our members in roll out markets and service territories. There are also numerous independent initiatives being undertaken by electric utilities, local governments and public interest organizations.

As part of a national electrification effort, information sharing and coordination across these initiatives will help reduce the costs of assembling and disseminating important information about vehicle and charging choices, performance, safety and costs. Coordinated education efforts also leverage research and readiness efforts that have already been completed.

*Question 2.* In your written testimony, you pointed to the need for access to capital in order to achieve economies of scale. Obviously, the members of your association are in very capital-intensive industries. Can you talk at all about why the existing programs at the Department of Energy, such as the Advanced Technology Vehicles Manufacturing Program and the Loan Guarantee Program, are unable to meet the need?

Answer. The Advanced Technology Vehicles Manufacturing Program (ATVM) and the Loan Guarantee Program are both important programs that help reduce the cost of capital and leverage private sector investment in advanced vehicle manufacturing. The programs are already building U.S. manufacturing while contributing to job growth in the advanced energy sector. And because the loans are repaid with interest, taxpayers get a return on their investment while the national return on investment includes jobs and increased competitiveness in the global advanced energy market.

The scope of these successful programs could, however, be expanded to recognize other advanced vehicle opportunities. For example, the ATVM program is limited to light duty vehicles. Medium and heavy duty vehicles and related component manufacturing in the U.S. would grow with access to the program.

Support for fleet purchases is also a worthwhile expansion as first-cost hurdles are even more challenging in large purchases. Beyond the benefit to the fleet buyer, those large purchases also help to build the market for new technologies and speed achievement of economies of scale that will bring costs down.

#### RESPONSES OF GENEVIEVE CULLEN TO QUESTIONS FROM SENATOR MURKOWSKI

##### TAX CREDITS VS NEW PROGRAMS

*Question 1.* As you know, the tax credit for alternative fuel infrastructure expires at the end of this year. If it comes down to a decision between creating new programs and extending existing tax credits, which would you consider more important?

Answer. Recognizing that sobering economic realities require tough choices, we believe that reducing our dependence on foreign oil must be among our priorities. To achieve that major goal, there is no single silver bullet policy. Changing the way we transport people and goods will require a comprehensive approach. Such an approach should include incentives to reduce market hurdles, such as the critically important tax credit for alternative fuel infrastructure that will help consumers and businesses install recharging equipment for plug-in vehicles.

A comprehensive approach should also reinforce deployment efforts that cities and regions around the country are making—or planning to—make. By leveraging individual, business and local and state government interest and investments, a comprehensive electric drive policy will accelerate adoption of the technology and help us achieve a more secure country, a stronger economy and a cleaner environment.

##### COMMUNITY DEPLOYMENT PROGRAM (S. 948)

*Question 2.* In your written testimony, you note that you would like to “continue working” with the committee to strike the right balance between national and community-oriented deployment programs. Can you provide further thoughts on what type of changes, if any, you’d seek to this bill?

Answer. Our goal is national-scale deployment of electric drive vehicles and infrastructure. In establishing national programs for technical assistance and workforce training alongside concentrated community efforts, we would like to ensure that one effort does not supplant the other. While we have not, as an organization, identified the exact proportions of the complementary efforts, we would like to see the national program on a scale that meets the national opportunity, and we would like to see the deployment efforts be sufficiently numerous to reinforce the national effort while serving as area-specific deployment models.

##### HOUSE BILL

*Question 3.* To the extent possible, please summarize EDTA’s views on H.R. 1685, the Electric Drive Vehicle Deployment Act.

Answer. EDTA has not taken an official position on H.R. 1685. Directionally, our goal is national-scale deployment of electric drive vehicles and infrastructure. In es-

tablishing national programs for technical assistance and workforce training alongside concentrated community efforts, we would like to ensure that one effort does not supplant the other. While we have not as an organization identified the exact proportions of the complementary efforts, directionally we would like to see the national program be on a scale to meet the national opportunity and the deployment efforts be sufficiently numerous to reinforce the national effort while serving as area-specific deployment models.

RESPONSE OF GENEVIEVE CULLEN TO QUESTION FROM SENATOR STABENOW

*Question 1.* Ms. Cullen, as you note in your testimony, my Advanced Vehicle Technology Act (S.734) would ensure that the Department of Energy is working with industry on a wide range of technologies such as electric vehicles, hybrids, medium and heavy-duty trucks, fuel cells, batteries and other technologies. Can you please describe the benefits of such an approach and what steps the Department of Energy can take to offer a level playing field for all advanced vehicle technologies

Answer. A portfolio approach to vehicle technologies is important because the transportation sector is both large and diverse. A research and development policy should look at all of the options that can meet the needs of the sector, and the programs should reflect the varying stages of development, deployment challenges and petroleum displacing potential of the portfolio's technologies.

For instance, electrification is a continuum of technologies. The U.S. will need efficient hybrids, zero-petroleum battery electric and fuel cell vehicles for different applications and for meeting petroleum and emissions reduction goals

The Department of Energy should operate under a consistent, long-term framework that ensures continuity in their efforts across the portfolio and allows the Department to pursue near, medium and long term solutions.

---

RESPONSES OF SEIFI GHASEMI TO QUESTIONS FROM SENATOR BINGAMAN

*Question 1.* As you may know, we've been working on a number of proposals to help accelerate the deployment of advanced technologies in the United States. We've heard testimony in the past that our competitors, such as China, are moving aggressively to provide market support and insure low-cost capital is available for these new technologies. Based on your experience with an international company, how do you assess the current position of the United States in terms of competitiveness in these growing markets?

Answer. As a general matter, the United States is at a competitive disadvantage to European nations, Japan and China with respect to the deployment of advanced electric drive vehicle technology, particularly with respect to vehicle adoption in the short-to medium-term. Although there are several challenges that plug-in vehicles must overcome to become mainstream products, the threshold challenge may be their substantial up-front cost premium, a premium that is unlikely to be recovered over the vehicle's life based on current vehicle costs, in the absence of any government incentives.

Plug-in vehicles typically are more expensive than gasoline vehicles, primarily due to the cost of their batteries. That additional cost is offset by lower fuel and maintenance costs. Because gasoline costs are substantially higher in Europe than in the United States, cars that operate on electricity have a comparative advantage in Europe over the United States. Moreover, smaller electric cars that travel shorter ranges may be more consistent with the typical European car than the typical American car, easing the consumer transition from a gasoline to an electric drive vehicle. At the same time, if Europeans drive fewer miles overall than Americans, that could increase the payback period of the vehicle, perhaps dampening demand somewhat.

Electric drive vehicles may also be at an additional comparative advantage in Europe because they are needed to meet European greenhouse gas (GHG) emission requirements. Europe's regulation of GHG emissions is more stringent than the United States' approach. In order to meet their regulatory obligations, European automakers are looking increasingly at alternative fuels. Electricity offer the greatest opportunity for GHG emission reduction for vehicles, suggesting greater interest in electric drive vehicles to help meet emissions requirements.

China also appears to be at a comparative advantage to the United States with respect to the deployment of electric drive technology, however, for different reasons. Chinese leaders have identified vehicle electrification as a high strategic priority, viewing domestic deployment of GEVs as a relatively straightforward energy security strategy. As the Chinese economy has grown rapidly, oil consumption has out-



paced production, requiring an increase in imports. Between January 2004 and September 2009, Chinese oil imports grew by 80 percent.

Growing Chinese oil demand has been driven by the transportation sector. In 2007, the International Energy Agency (IEA) forecast that annual light-duty vehicle sales in China would surpass those of the United States in 2016, but did so in 2009. Total light-duty vehicles sales in China were 13 million compared to 10.4 million in the United States, and this growth is forecast to continue for decades. In 2008, there were 65 million registered vehicles in China, a figure forecast to rise to 150 million in 2020 and nearly 230 million by 2030.

The impact of this growth in vehicle ownership will depend heavily on technology. Based on existing technology and policies, the IEA forecasts that roughly two-thirds of global oil demand growth will occur in China and India in coming decades, with nearly one-third of all growth occurring in the Chinese transport sector. If electric drive technologies are deployed in high concentrations, the growth in Chinese oil demand clearly could be curbed, and imports could be reduced from their current baseline forecasts.

Chinese leadership also is dealing with consequences of urban pollution. Many cities are highly polluted and adding hundreds of millions of cars to the nation's fleet will exacerbate this problem. Therefore, China has also identified electrification as a critical environmental sustainability measure that will support economic growth with cleaner transportation services.

Perhaps most importantly, China has identified electric vehicle manufacturing as a strategic industry that will allow it to maintain its global manufacturing dominance. Chinese automotive production in China in 2009 was 13.6 million vehicles making China the largest auto producing nation in the world. Production is expected to reach 30 million vehicles by 2030. While this growth is significant, the bulk of this production currently feeds domestic demand. Due to the significant technological and scale advantages that the established global automotive manufacturers have in internal combustion engines, it is also unlikely that Chinese automakers will be able to organically establish a strong global presence.

Electric drive vehicles, however, will introduce a value chain shift that could favor China from both a technological and from a supply chain perspective. As a major supplier of lithium batteries for cell phones, China has established the production capability and value chain to cost-effectively produce lithium batteries in scale. China also is advantaged in electric motors due, in part, to its position in rare earth materials production. Rare earth materials, specifically neodymium, contribute approximately 30 percent of the material cost of permanent magnet motors, one of the key motor types used in electric propulsion systems.

China has supported its electrification strategy with credible, long-term public support. In 2009, the central government began an initiative to develop sufficient electric vehicle infrastructure for large scale deployment in about 20 cities. Wuhan, a city of more than 9 million people, is the lead city in the project. It is working with Nissan to develop the infrastructure, and the automaker will provide the city with 600 EVs at no cost. This will be followed with infrastructure investments over the succeeding four years in the cities of Shanghai, Beijing, Shenzhen, and several other cities ranging in size from 1 to more than 10 million people. The government's initial goal was to have installed capacity to produce 500,000 grid-enabled vehicles by 2011.

These initiatives are naturally supported by government funding. Ten billion yuan (\$1.5 billion) has been set aside to nurture research and development. The government is also offering a 60,000 yuan (\$8,800) per-vehicle incentive for EVs and a 500,000 yuan (\$73,000) incentive on bus purchases. China has provided battery and GEV companies with generous low-interest loans from state banks and has a multi-year technology development program on which it spent over \$160 million between 2006 and 2008. State Grid, the largest state-owned utility, is planning the construction of charging infrastructure.

Despite the aggressiveness of China's approach to EVs, it still faces many of the same challenges that EVs face elsewhere. Consumer acceptance is still a large unknown. The costs of ownership will have to come down significantly as government subsidies and incentives disappear. Even when the total cost of ownership becomes favorable for EVs, the up-front vehicle cost will still be significantly higher than conventional vehicles and the payback period is longer than most consumers or commercial fleet owners are willing to accept. A vehicle financing market, virtually nonexistent in China, could help overcome this challenge, as could a market for used automotive grade batteries. Notwithstanding these challenges, there is no doubt that China is making a substantial effort to make EVs work in an effort to become world leaders in this technology.

The comparative advantage that plug-in vehicles have in Europe as a result of fuel prices and in China by virtue of the government's commitment to their success is one that poses meaningful risks to the United States. The automobile manufacturing value chain is worth hundreds of billions of dollars to the United States economy each year. We do not want plug-in vehicle technology that was developed in the United States to be exported and manufactured abroad, further eroding the United States' manufacturing base and exporting U.S. jobs.

That concern can be seen, for instance, in the global development of the advanced battery industry. The battery is likely to be the single the most expensive component in most plug-in vehicles. In fact, over the life cycle cost of owning and operating a plug-in vehicle, much of the value that currently is captured by gasoline suppliers and the gasoline supply chain will be captured by the battery manufacturers and their supply chain. We should all prefer to see as much of that value as possible stay in the United States and support American jobs. Without proper support, however, that may not occur. As the Department of Energy data depicted in the accompanying chart<sup>zzzz8</sup> shows, most of the global production of advanced batteries takes place in Asia, with growth in China and Korea eroding Japan's dominance in this market. In the absence of U.S. government assistance, this trend might continue, foretelling the continued decline of the automotive sector in the United States with all of its attendant consequences.

We believe that in the very long run, electrification of light-duty vehicles may be nearly inevitable because electricity is more secure, stable, reliable and cleaner than petroleum. If we do not take the steps necessary to accelerate that transformation beyond what might occur in the absence of government incentives, other nations will make that transformation first, capturing much of the value created by the new transportation economy. Government incentives are needed, therefore, to accelerate the transformation in the United States and promote our competitiveness in this market for decades to come.

*Question 2.* The capital intensity of both the manufacturing and supporting infrastructure for electric vehicles seems like it would be daunting for new entrants. Yet, that's where much of the early technological innovation is usually introduced. Can the grant programs envisioned in this bill be sufficient to entice entrepreneurs as you describe in your testimony?

Answer. We believe that the grant programs envisioned in the Promoting Electric Vehicles Act will be sufficient to entice entrepreneurs to participate in the plug-in vehicle market. First, many of the companies that are involved in the plug-in vehicle value chain already are relatively small and/or new companies, and possess the entrepreneurial character I described in my testimony. New companies have been established to develop and market electric vehicle supply equipment (chargers), software to support the vehicle charging process, vehicle batteries, and vehicles themselves. In fact, there may be more startup companies developing plug-in vehicles than any other category of alternative vehicles in recent decades. Even when existing companies are entering this space, they often are doing so through their non-traditional business units.

Second, we believe that the deployment community approach facilitates the entrance of entrepreneurs into this market. There are several challenges to the wide-scale adoption of plug-in vehicles where government incentives can help overcome crucial obstacles. The nature and character of those obstacles, however, may vary from community to community. By focusing some portion of the government's overall commitment to plug-in vehicles in a limited number of communities through a flexible grant program, it is possible to narrowly tailor the use of the funds to address specific problems in the participating communities. Reducing the size of the challenges to ones faced by particular communities may allow smaller companies without the resources of larger established companies to compete and provide their solution. This approach not only creates opportunities for smaller entrepreneurial companies that may have solutions to the challenges faced by a particular community, but also will help ensure that the government earns the greatest payback on its investment in plug-in vehicles.

---

#### RESPONSES OF PATRICK DAVIS TO QUESTIONS FROM SENATOR BINGAMAN

*Question 1.* With regard to deployment communities for electric vehicles; the Administration's approach appears to contemplate distributing smaller grants to a greater number of communities, than is contemplated in S. 948. Has the Department been able to gather any information on the needs of various communities in

---

\* Chart has been retained in committee files.

order put in place the various pieces of infrastructure that will be needed? How can we be certain that the grants are the right size to have the desired effect?

Answer. While the proposed competitive community grant program, by itself, would not be enough to achieve the President's goal of putting one million electric vehicles on the road by 2015, it would help to achieve this ambitious goal by providing an incentive for communities to invest in infrastructure, complementing investments that have already been made under the Recovery Act Transportation Electrification demonstration program. Moreover, the grants through this program, modeled after "Race to the Top," would leverage benefits beyond their immediate monetary value by rewarding communities that can demonstrate a broader plan to facilitate EV readiness through steps like streamlining codes and regulations to make it easier to install infrastructure. The Department has examined various ways to implement the proposed program, considering options for the potential number of communities and amount of funding per award, among other factors. Although there would be a cap on the amount of funds available for an individual award, communities will be able to propose funding amounts that they believe will meet their needs and allow them to implement the programs proposed in their applications. In addition, to help inform decision-making, the Department has obtained input from various stakeholders over the last year. For example, in July 2010, Clean Cities hosted the Plug-In Vehicle and Infrastructure Community Readiness Workshop, which provided both an opportunity for the Department to hear from local communities about their needs as well as a forum for technology deployment experts to share best practices and lessons learned. While the Department does not share the details of its solicitation plans with potential applicants, the Clean Cities network, which includes more than 80 locally-based coalitions, is an important resource for understanding community experiences with vehicle and infrastructure deployment and is helpful for identifying ways in which the Department can support local efforts.

*Question 2.* In your comments on S. 734 you mention that the section on "Sensing and Communications Technologies" appears to be duplicative of a Department of Transportation program. Does DOE currently conduct research in this area within the Vehicle Technology Program? Is the language in S. 734 on "coordination and nonduplication" requiring the Secretary to ensure activities do not duplicate programs in other research agencies ineffective to deal with this?

Answer. The Department's Vehicle Technologies Program does not currently conduct vehicle-to-vehicle sensing and communications technology research, but in accordance with non-duplication provisions in S. 734, would work closely with the Department of Transportation to leverage and complement, rather than duplicate, their ongoing research activities with regard to vehicle-to-vehicle and vehicle-to-infrastructure communications.

*Question 3.* You spoke a bit about advances in fuel economy technology in such things as electric drive that can make a big difference in coming years. Can you speak a bit more about the opportunities with existing technologies like turbo or super charging? What are the emissions and fuel economy opportunities there?

Answer. Engine downsizing and technologies such as turbo charging can increase fuel economy by 7.5% or more.<sup>1</sup> The auto industry is relying, in part, on these technologies to meet corporate average fuel economy (CAFE) standards through 2016, while simultaneously meeting applicable emissions standards. Both turbocharging and supercharging enable engine downsizing and higher efficiency by compressing air entering the cylinders, thereby increasing power produced from a given engine displacement. In case of turbocharging, additional benefit is utilization of waste heat energy of the engine exhaust for the compression of intake air. We envision the future CAFE regulations to necessitate broader introduction of these technologies. R&D opportunities in this area include cost reduction through novel high strength, high temperature materials and innovative bearing technologies, improving modeling capabilities for high speed gas flows, as well as development of designs suitable for very small air charging devices. It is important to note that air charging devices for turbocharging and supercharging represent just one of many technologies that will allow continuing improvements in the fuel efficiency of internal combustion engines. Others include new combustion regimes, advanced fuel injection systems, novel propulsion materials, advanced sensors and control algorithms, and reduction in friction and parasitic losses.

<sup>1</sup>See [http://www.fueleconomy.gov/feetech\\_engine\\_more.shtml](http://www.fueleconomy.gov/feetech_engine_more.shtml)

## RESPONSES OF PATRICK DAVIS TO QUESTIONS FROM SENATOR MURKOWSKI

## COMMUNITY DEPLOYMENT PROGRAM FUNDING (S. 948)

*Question 1.* Please state the administration's views on the most appropriate funding levels, per community and overall, for a one-year, three-year, or five-year deployment program.

Answer. The Administration has proposed a \$200 million competitive community grant program, which would support up to 30 awards of up to \$10 million each. The Department views this as a nearer-term effort that, if funds are appropriated, it would execute quickly, with projects of 1–3 years in length.

## ADDITIONAL TECHNOLOGIES (S. 948)

*Question 2.* Please state the administration's views on whether alternative fuel vehicles aside from electric vehicles should be eligible for the targeted community deployment program.

Answer. The Administration is committed to taking bold steps to make the transportation sector more energy efficient. These efforts include the historic investments in advanced vehicle and fuel technologies, public transit, and high speed rail under the Recovery Act, as well as the ambitious new fuel economy standards put into place for cars and trucks—which will raise average fuel economy to 35.5 miles per gallon by 2016, and save 1.8 billion barrels of oil over the lifetime of the vehicles covered. The Administration is also taking steps to encourage the use of biofuels. The Department continues to support programs such as the Clean Cities Initiative that cover a broad portfolio of petroleum reduction strategies.

These actions are already helping to lower transportation costs by reducing our dependence on oil, provide more transportation choices to the American people, and revitalize the U.S. manufacturing sector. But we need a sustained effort, and focusing on electric drive vehicles offers an opportunity to quickly reduce our dependence on petroleum, which is why the President set an ambitious goal that by 2015 we would have 1 million electric vehicles on the road, becoming the world's leader in advance vehicle technologies. To help reach this goal, the Administration supports a number of steps to speed up the adoption of electric vehicles, including more effective tax credits for consumers, research and development, and a new competitive grant program to support communities that create an environment for widespread adoption of these advanced vehicles in the near term.

With new electric drive vehicles beginning to enter the market, and with auto manufacturers announcing new roll outs over the next couple of years, now is the right time to support local community efforts to overcome critical barriers to successful market introduction and initial growth. The competitive community grant program would support highly-leveraged projects to deploy an early electric vehicle charging infrastructure, appropriately streamline permitting processes, and implement innovative incentive programs that facilitate market growth and catalyze private-sector investment.

## CURRENT VTP FUNDING REQUEST (S. 734)

*Question 3.* The Department requested \$588 million for the Vehicle Technologies Program for Fiscal Year 2012. How is that funding split between light duty and heavier vehicle classes? How is it split between various technologies and research areas?

Answer. With the President's fiscal year (FY) 2012 budget request of \$588 million, the Vehicle Technologies Program plans to continue its support of a broad range of advanced vehicle technologies including electric drive, advanced combustion, fuels, and materials technologies that are applicable to light-, medium-, and heavy-duty vehicles (see table below for split among research areas). Of the total requested amount, \$200 million would support a new competitive grant program to help communities accelerate the deployment of electric vehicles, with a focus on efforts related to electric charging infrastructure. The remaining \$388 million would support work related to light-, medium-, and heavy-duty vehicles, as well as work that cross-cuts vehicle classes, including enabling technologies and outreach, deployment, and analysis activities. The precise division of FY 2012 funds for work supporting different vehicle classes will depend on the selection of projects under a recently-closed FY 2011 solicitation and new solicitations planned for FY 2012. The program's best estimate at this time, however, is that approximately \$290 million would support work related to light-duty vehicle technologies, approximately \$46 million would support work related to medium- and heavy-duty technologies, and approximately \$250 million (including the \$200 million for the competitive community grant program referenced above) would support activities that do not easily align with a par-

ticular vehicle class. It is important to note that the program's support for light-duty vehicle technologies generally reflects their significant contribution to highway transportation use, compared to other vehicle classes: light-duty vehicles account for 76% and heavy trucks account for 19% of U.S. highway transportation energy use (buses and medium trucks account for the remaining 5%).

VEHICLE TECHNOLOGIES PROGRAM FY 2012 CONGRESSIONAL  
BUDGET REQUEST

Activity	FY 2012 Request (\$000)
Batteries and Electric Drive	\$188,000
Vehicle and Systems Simulation and Testing	\$58,000
Advanced Combustion Engine R&D	\$49,000
Materials Technologies	\$38,000
Fuels Technologies	\$18,503
Outreach, Deployment, and Analysis	\$236,500
<b>TOTAL</b>	<b>\$588,003</b>

VEHICLE TECHNOLOGIES PROGRAM (S. 734)

*Question 4.* Please provide the committee with a list or table showing federal appropriations to the Vehicle Technologies Program over the past ten years.

*Answer.* The following table outlines federal appropriations to the Vehicle Technologies Program over the past ten years:

VEHICLE TECHNOLOGIES (DOLLARS IN THOUSANDS)

FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
195,855	190,403	185,095	177,620	171,952	186,271	183,580	208,359	235,916	304,223

VEHICLE TECHNOLOGIES PROGRAM (S. 734)

*Question 5.* S. 734 would authorize work on basic research, applied research, development, demonstration, engineering, construction, manufacturing, and commercial application activities. It would also create several new programs. Will you compare what this bill authorizes and requires to the current scope of activities at DOE? How are DOE's resources currently split between those processes?

*Answer.* Within the Department's Office of Energy Efficiency and Renewable Energy (EERE), the Vehicle Technologies Program (VTP) supports applied research, development, demonstration, and deployment. Approximately 90% of its current budget covers applied research, development, and demonstration, and approximately 10% covers deployment activities. The Department's Office of Science supports basic research, and the Advanced Research Projects Agency-Energy (ARPA-E) focuses on high-risk, high-payoff, early-stage applied research, which, if successful, is transferred to VTP or to the private sector for continued development. All three offices/programs coordinate very well with one another and staff communicate regularly. While S. 734 would authorize construction and manufacturing, historically, VTP has not been involved in the installation of manufacturing facilities. American Recovery and Reinvestment Act of 2009 (Recovery Act) manufacturing projects are the exception. The Recovery Act provided an opportunity to grow our nation's domestic manufacturing capacity for electric drive vehicle components—with Recovery Act funds, VTP awarded \$1.5 billion to U.S.-based manufacturers to produce batteries and their components and to expand battery recycling capacity and \$500 million to U.S.-based manufacturers to produce electric drive components for vehicles, including electric motors, power electronics, and other drivetrain components.

## VEHICLE TECHNOLOGIES PROGRAM (S. 734)

*Question 6.* Last Congress, in questions that were asked for the hearing record, the Department noted that it had no issue with this bill as long as it was “intended as a supplemental authorization to previous authorizations.” Please explain that statement. Does the Department support the consolidation of all of its existing vehicle technology authorities into one simpler and more straightforward authority?

Answer. Generally, the Department supports the consolidation of existing vehicle technologies R&D authorizations for appropriations into a simpler and straight-forward authority. The previous bill covered a broad technology portfolio that included the advanced technologies currently addressed in the Vehicle Technologies Program, as well as hydrogen and fuel cell vehicle technologies currently addressed in the Hydrogen and Fuel Cell Technologies Program; however, it authorized specific funding levels that the Department believed may not have been alone sufficient to appropriately support activities in both programs. In contrast, S. 734 authorizes funding levels “as may be necessary.”

## RESPONSES OF PATRICK DAVIS TO QUESTIONS FROM SENATOR STABENOW

*Question 1.* The Department of Energy via the National Energy Technology Laboratory awarded approximately \$45 million in grants to automotive and engine manufacturers under the Systems Level Technology Development, Advanced Technology Powertrains for Light-Duty Vehicles program. What is the status of the program including the project teams led by Ford, Delphi and Bosch, specifically regarding the federal funds already allocated, the stage of each project, the federal funds pending for each project, and the timeline for project completion and their subsequent fuel economy gains?

Answer. The Advanced Technology Powertrains for Light-Duty Vehicles Program includes projects with Ford, Delphi, Bosch, and Cummins. All projects are well under way and making progress. The status of the Ford, Delphi, and Bosch projects, specifically, is as follows:

- Ford has been allocated \$6,478,340 and has completed concept evaluation of new engine architecture and systems, performed single cylinder engine and flow reactor analyses for advanced lean combustion capability, and initiated CAD design of the new multi cylinder engine components and systems. The pending Federal funds are \$8,521,660. The project is scheduled to end on 12/31/2014 with a demonstration of a 25% fuel economy improvement in a mid-sized sedan using a downsized, advanced gasoline turbocharged direct injection (GTDI) engine while meeting Tier 2 Bin 2 emissions on the FTP-75 cycle (Federal Test Procedure).
- Delphi has been allocated \$4,788,205 and has completed initial development work on needle bearing camshafts, electric cam phasers, electric water pump, electric oil pump, cooled Exhaust Gas Recirculation (EGR), thermal management, and advanced valvetrain systems and has begun integration/testing on a base engine. Work has also commenced with single-cylinder engine testing. The pending Federal funds are \$2,692,377. The project is scheduled to end on 8/31/2014 with a demonstration of a 35% fuel economy improvement over the base engine while meeting Tier 2 Bin 2 emissions on the FTP-75 cycle.
- Bosch has been allocated \$5,500,000 and has completed an initial 1D engine model and installed a homogenous charge compression ignition (1-ICCI) mule engine at the University of Michigan. An initial prototype boosting system has been designed for the test engine. The pending Federal funds are \$6,182,468. The project is scheduled to end on 9/29/2014 with a demonstration of a 25% fuel economy improvement over the base engine while meeting Tier 2 Bin 2 emissions on the FTP-75 cycle.

*Question 2.* Mr. Davis, I noticed in your testimony that the Department of Energy was still reviewing my legislation, but had a possible concern about duplication with efforts at the Department of Transportation regarding sensing and communication technologies. I know that the Department of Transportation has been working on sensing technologies to promote safety, but this section is intended to encourage research and development of sensing technologies specifically interacting with the electric grid and even vehicle to vehicle interactions.

I agree that we should be taking steps to avoid duplication, which is why I'd like to point out for you that within Section 101 of my legislation, page 11, there is a phrase to ensure that the Department of Energy does not duplicate work being done by other agencies.

Therefore, I'd like to ask you if there are any other areas where you see the possibility for duplication and encourage you to work with me to ensure that we address those issues.

Answer. The Department agrees that R&D of sensing technologies is important, especially for vehicle-to-grid applications, and the Department has efforts helping to establish standardized vehicle-to-grid communications. We will work closely with the Department of Transportation (DOT), which is very active in this area (and in vehicle-to-vehicle interaction, in particular), to leverage resources and expertise and avoid duplication of effort. We understand that the Department of Transportation is conducting research related to battery safety that may lead to regulation and we will need to coordinate with DOT in that area as well. We know of no other R&D areas of obvious duplication and will continue to work closely with our Federal partners at DOT, the Environmental Protection Agency, and Department of Defense to ensure our programs are well-coordinated and highly-leveraged to make the best use of taxpayer dollars.

*Question 3a.* I like the idea of helping communities coordinate to deploy electric vehicles and charging stations, provide technical assistance, and upgrade various local and state regulations. This all can help to spur these technologies nationwide.

With so much interest in deploying these technologies, how will you determine which communities will receive this grant funding, and how many communities do you anticipate will eventually receive funding?

Answer. The Department would select proposals for award using a robust merit review process that involves an independent panel of subject matter experts who carefully evaluate each proposal against the specific criteria published in the funding opportunity announcement. While the specific selection criteria have not been finalized, we envision factors such as the following as being important to a successful application:

- Does the community have credible plans to overcome permitting barriers?
- Has the community engaged the right partners and key stakeholders to be successful?
- Has the community proposed innovative incentives to promote adoption?
- How is the community using local and private funds to highly leverage the available Federal funds?
- Does the total number of charging points proposed represent a very high value for the funding?

With the amount included in the budget request, we plan to award up to 30 grants to strategic, local community partnerships across the country, with individual awards of up to \$10 million each. Given auto manufacturers' plans to sell electric vehicles in cities across the country, we do not expect to focus on a limited number of geographic areas and instead expect to select projects based on their merit using criteria such as those listed above.

*Question 3b.* I like the idea of helping communities coordinate to deploy electric vehicles and charging stations, provide technical assistance, and upgrade various local and state regulations. This all can help to spur these technologies nationwide.

As a follow up, how will DOE work to ensure fairness for neighboring communities that are not chosen, but are close to deployment communities? Will this policy hamper development in areas not chosen?

Answer. The Department would select proposals for award using a robust merit review process that involves an independent panel of subject matter experts who carefully evaluate each proposal against the specific criteria published in the funding opportunity announcement. Cities and communities would be encouraged to form strategic local/regional partnerships and submit a single proposal. Areas that are not selected for funding under this competitive opportunity, however, would still benefit from the library of resources available through the Department's Clean Cities initiative. These include cost calculators and electric vehicle supply equipment (EVSE) mapping tools, guidebooks to facilitate permitting, and a host of other training and information resources. Another important attribute of the Clean Cities initiative is its unique ability to share information across its nationwide network of more than 80 local coalitions, as well as to neighboring communities. Not only would the competitive grant program provide an excellent opportunity to document valuable lessons learned and best practices that can be communicated publicly, but the areas selected would comprise a new network of experts to serve as models and a resource for other communities interested in electric drive vehicle deployment.

*Question 4.* I support the idea of using deployment communities to assist with electric vehicle adoption nationwide. I also believe that it is important to establish the right balance between national and community deployment. Most vehicles remain idle at home or at work 80 percent of the time. While it is important to up-

grade the communities' ability to provide public charging to consumers, I also believe we should give incentives directly to the consumer to install charging stations at home. For early adopters, the majority of charging will be done at home.

How do we find the right balance between incentivizing electric vehicle deployment within particular communities and ensuring we are allowing for this development nationally?

Answer. Although the Department cannot provide funds to support electric drive vehicle deployment in every community across the country, there are programs and policies that can support any community interested in accelerating local market growth. For example, the Department would select projects for award under the competitive community grant program giving consideration to factors including (but not limited to) whether it has credible plans to overcome permitting barriers, whether it has engaged the right partners and key stakeholders needed to be successful, and whether it has proposed innovative incentives to promote adoption. Programs and policies to address these factors may be easily transferable, and communities that meet these criteria and are selected for funding would serve as models that provide important lessons learned, share their experiences, and communicate best practices to the benefit of communities nationwide. In addition, the existing tax credit of up to \$7,500 for electric drive vehicles provides an incentive to potential users nationwide. The President has proposed transforming this tax credit for purchasers into a credit for the seller or the person financing the sale. The credit would be passed through to consumers, giving them the ability to receive the benefit of the credit at the point of sale to provide an even greater, up-front incentive for consumers interested in electric drive vehicles. These programs and policies are designed to enable early market success, reduce technology cost, and remove barriers such as onerous permitting processes—which, in turn will facilitate technology introduction across the country.



## APPENDIX II

### Additional Material Submitted for the Record

---

May 9, 2011.

THE DETROIT NEWS

ASIAN POWER EMBRACES ADVANCED-TECH VEHICLES

By *CHRISTINE TIERNEY*

Shanghai—During the first 80 years of the auto industry, American and European automakers didn't have to worry about pollution or oil supplies. Oil was plentiful and gas was cheap. But by the time China got into the car business, those concerns loomed large.

China's huge cities already were choking in smog, and the world's oil reserves were expected to dwindle. Even while Chinese automakers were learning the basics of carmaking a few years ago, planners in Beijing set out to develop an electric car industry that wouldn't rely on oil.

China's automakers don't seem any closer now than others to solving the technological challenges that have stumped the industry: how to pack more energy in batteries while reducing their size and cost. Chinese auto executives admit they have a long way to go to master the technology.

But American, European and Japanese auto executives and officials are taking China's efforts very seriously. The Chinese government has set ambitious production targets and will provide close to \$15 billion between now and 2020.

Half the money will go toward research and development of "new energy vehicles," a term that covers plug-in and electric cars. But money also will be spent on infrastructure, such as the installation of 36,000 charging outlets in Beijing within three years, and pilot projects in 25 cities.

"Where they're ahead is at the political commitment level," said Oliver Hazimeh, a partner at PRTM, a Waltham, Mass.-based consulting firm, which conducted a study with the World Bank on China's electric car plans.

"The Chinese government is very strongly behind electrification, and they also have the raw materials," lithium and rare earths used to make components for electric cars, Hazimeh said.

The implications for the United States and other countries are huge: Because of the size of its market, China is likely to influence standards and technological choices, and its carmakers will want to compete globally with plug-in and electric cars.

LAWMAKERS SLAM INCENTIVES

BYD Ltd., a leading Chinese automaker, aims to export electric cars to the United States and Europe next year.

Already, U.S. lawmakers claim that some of China's electric car policies, notably its incentives, discriminate against U.S. and other foreign brands.

According to China's New Energy Vehicle Development Plan, the government wants 1 million hybrid vehicles and 500,000 plug-in and all-electric vehicles on China's roads by 2015. By 2020, it wants 5 million plug-in and electric cars in circulation, with some private analysts estimating the figure will be higher.

By then, China aims to have between three and five proficient electric car manufacturers and two or three battery specialists.

"People are taking this seriously," said Michael Dunne, president of Hong Kong investment advisory firm Dunne & Co. "What the government wants to happen usually happens in China, even though the road getting there often looks muddled."

The motivation driving China's strategy is geopolitical, he said. "It's 90 percent about energy security, and less than 10 percent about the environment."

Other countries also have set goals, emission rules and incentives to encourage the use of electric cars. President Barack Obama said in 2008 he wants to see 1 million plug-in and electric cars on American roads by 2015. Chancellor Angela Merkel wants to have 1 million electric cars in Germany by 2020.

A bill before Congress would offer grants and other incentives to help establish 10 electric car “deployment communities.”

Meanwhile, the Chinese are ready to offer as much as \$15,000 in incentives in some cities—more than what’s available to consumers in California. And “they have large-scale pilot projects, much larger than those in other regions,” said Hazimeh.

#### EXECS AWARE OF CHALLENGES

At the Shanghai auto show last month, Chinese automakers displayed a raft of electric cars—the BYD e6, a Great Wall electric SUV, the Chery Riich M1-EV and the BAIC C30.

U.S., European and Japanese executives touring the show said Chinese production methods had improved, but didn’t see any technological breakthroughs. Chinese auto executives are candid, too, about the challenges.

At a conference in Shanghai last month, an executive with Jianghuai Automobile Co., a state-owned firm that has sold 585 electric cars to its employees and those of other state-owned firms on a trial basis, said it’s not ready to sell electric cars to retail customers.

“Our technology doesn’t allow us to sell to retail customers,” Yan Gang, vice president of Jianghuai Automobile, told the CBU 2011 Global Automotive Symposium. “Retail customers are too demanding.”

Wu Jianzhong, chairman of Zotye Holding Group, was clearly discomfited when asked at the conference about a Zotye-made electric taxi that caught fire in April in the city of Hangzhou. Wu apologized and said a center would be established to monitor the electric taxis. But he wouldn’t discuss the event, pending an official inquiry.

“The incident caused huge damage to us,” Hu Jiangyi, deputy sales director of State Grid Corp., commented later.

Despite the mishaps, China’s automakers are ramping up plans to produce electric cars, with most of the output slated for municipal, provincial and federal fleets in the next few years.

State-owned BAIC Group, a Beijing-based manufacturer, is new to the electric car business but expects to produce 150,000 new energy vehicles by 2015, up from 3,500 this year, Deputy Chief Engineer Lin Yi said.

Jianghuai Automobile, based in Hefei, hopes to be making 100,000 new energy vehicles a year by 2015.

But some manufacturers question how the government’s funds are being allocated. “Money is going to those who don’t need it,” said Deng Zhongyi, vice president for sales at BAK Batteries. “Most battery producers are private companies, and most battery producers are pretty weak.”

In China’s fragmented auto industry, many firms will fall by the wayside in the years ahead, but a few contenders are likely to emerge, analysts say.

BYD, a leading manufacturer of lithium-ion batteries, has won investor backing from U.S. billionaire Warren Buffett and has joined forces with Germany’s Daimler AG to develop electric cars for the Chinese market.

“There’s a favorable environment here for electric vehicles,” Daimler CEO Dieter Zetsche told reporters at the Shanghai auto show.

Given the size of China’s market—more than 18 million vehicles were sold last year—the government’s push to develop alternative technologies is logical, he said. “They can’t develop the way Europe and the United States did, with the current technology.”

---

#### STATEMENT OF NGVAMERICA

##### 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 bio-methane. NGVAmerica represents more than 130 member companies, including: vehicle manufacturers; natural gas vehicle (NGV) 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 May 19, 2011 is to receive comments and hear testimony concerning "policies to reduce oil consumption through the promotion of advanced vehicle technologies and accelerated deployment of electric-drive vehicles." The hearing announcement specifically references S. 734 and S. 948.

#### NATURAL GAS VEHICLES SHOULD BE A PART OF FUTURE ENERGY LEGISLATION

Today, natural gas vehicles are uniquely positioned to help the United States achieve a number of critical policy objectives. The increased use of natural gas vehicles can reduce our dependence on foreign oil while reducing greenhouse gas emissions and urban pollution. And, equally important, increased use of natural gas vehicles will benefit the economy by stimulating demand for domestic natural gas and by lowering fuel cost to businesses, fleets and consumers that operate natural gas vehicles. Thus, energy legislation that is intended to reduce reliance on oil consumption should also seek to promote the use of natural gas vehicles. We are pleased to see that S. 734, "The Advanced Technology Vehicle Act of 2011," specifically recognizes the need to include natural gas vehicles, compressed natural gas and liquefied natural gas vehicles in future federal research, development and demonstration activities. We agree with the bills focus on targeting near-term strategies as well as long-term strategies that will reduce transportation reliance on petroleum. And we agree with the focus on assisting and partnering with industry in the development of light and heavy duty natural gas offerings. One area where we would offer a recommendation for improving the bill would be to point out that the medium and heavy duty program called for in Title II should also include liquefied natural gas fueling infrastructure in addition to compressed natural gas fueling infrastructure. Given the fact that the bill specifically identifies LNG elsewhere, this omission appears to be unintentional.

Another area where, in our estimation, the bill could be improved would be to specifically identify natural gas utilities as stakeholders and partners who can aid in the development of natural gas vehicles. The bill specifically identifies electric utilities but does not apparently recognize a similar role for natural gas utilities.

Prioritizing among the many technologies identified in S. 734, however, will be difficult. We hope that the committee and members of Congress will work with the Department of Energy to ensure that adequate funding is provided for natural gas-related activities given the significant near-term and long-term opportunities it presents for reducing petroleum reliance.

The House of Representatives has already introduced HR 1380, a bill intended to promote the use of natural gas vehicles. We would urge the Committee Members to support the HR 1380 when it is introduced in the Senate. HR 1380 is discussed in greater detail below.

#### AN ABUNDANT AND ECONOMICAL DOMESTIC RESOURCE

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 (2008—2010), the US spent nearly \$700 billion on imported petroleum. More recently, the tab for imported oil has been much higher as oil prices have once again exceeded \$100 per barrel. In the coming decade, the EIA forecasts total expenditures for petroleum imports to top \$3.3 trillion dollars. See EIA, 2011 Annual Energy Outlook, Table 11 (April 2011). 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 results 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. In the past several years, a wealth of new data has been developed demonstrating that the U.S. has an abundant supply of readily available, economically priced natural gas.

The U.S. Energy Information Administration, the Potential Gas Committee and other expert bodies now estimate that we have up to a 100 years 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. This is 89 Tcf more than estimated in the 2009 report. As was the case with the 2009 report, the 2011 report includes the highest resource estimate in the Committee's history; PGC has now been estimating natural gas supplies for 46 years.

Increased demand for natural gas helps to 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 ("The Contributions of the Natural Gas Industry to the U.S. National And State Economies", IHS Global Insight 2009, p.1) Even a modest increase in demand for natural gas as a transportation fuel could create tens of thousands of jobs associated with producing natural gas.

Natural gas also 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 many years. The current contract price for natural gas (NYMEX May delivery) is \$4.377 per million Btu, which equates to a per-barrel of oil price of only \$25.39 at a time when oil is trading well above \$100 a barrel. The difference in price relates to the fact that petroleum prices are set by world markets. An increase in demand in China or India leads to an increase in the cost of oil consumed here in the U.S. However, the same is not true for natural gas. The U.S. market for natural gas is currently insulated from most overseas events. Given the fact that large quantities of natural gas cannot be readily shipped from North America to other markets, the supply and demand for natural gas here in the U.S. set the price that U.S. consumers pay. Because of the abundant supply of natural gas that exists here in the U.S., natural gas prices relative to oil prices are expected to remain much lower in the coming years. In fact, the EIA estimates that differential between diesel fuel and natural gas for transportation could be as much as \$2 per diesel gallon equivalent in the future.

#### TRANSLATING OPPORTUNITY INTO ADVANTAGE

How should we use this natural gas? Market price signals tell us that transportation fuel and vehicles are the highest valued application of all natural gas uses. Outside the U.S., demand for natural gas vehicles is growing at a rapid pace. In the last seven years the 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 13.2 million NGVs in operation worldwide. This rapid growth points to the fact that rapid scaling up of NGVs is possible. 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 fourteenth in the world in total number of NGVs.

Most of the new natural gas vehicles sold outside the U.S. are either conversions of light-duty gasoline vehicles or are produced by light duty OEMs, including: Ford, GM, Toyota, Honda, Nissan, Hyundai, Fiat, Volkswagen and Mercedes. Fiat alone makes 14 separate NGV models, and more than 100,000 NGVs were sold in Italy in 2009, comprising some 7% of the new vehicle market. Most U.S. manufacturers currently offer natural gas vehicles in places like Europe, South America and Asia, but only Honda currently offers a light duty OEM NGV product—the Honda Civic GX.

For a number of reasons, including the sheer geographic size of America, the strategy of the US NGV industry has been to focus on high fuel-use fleets: trash trucks, transit buses, short-haul 18-wheelers, school buses, urban delivery vehicles, shuttles of all kinds, and taxis. 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, last year, natural gas vehicles used about 43 billion cubic feet of natural gas. That is the equivalent of about 320 million gallons of gasoline that was not imported. At today's fuel prices, this represents about a billion dollars not spent on foreign oil.

Fortunately, 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.

Manufacturers are betting that the U.S. will get serious about its desire to displace petroleum demand and increase the use of alternative fuels like natural gas. With proper government policies, like those proposed in S. 734, and incentives, like those proposed in HR 1380, sales of these trucks and use of natural gas could grow substantially in the coming years. NGVAmerica estimates that current fuel consumption of natural gas for vehicles could grow to one and a quarter trillion cubic feet or the equivalent of about 10 billion gallons within 15 years. At the level of fuel prices currently projected, that would lower fuel costs to businesses by up to \$20 billion a year and reduced payments for imported petroleum by more than \$40 billion per year.

NGVAmerica believes that there could be a substantial market for natural gas vehicles 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. As noted above, America currently has a large selection of medium and heavy duty vehicles available here in the U.S. This is significant since trucks are the economic lifeblood of America. Everything we buy moves by truck. Reducing the cost of trucking reduces the cost of everything, benefiting businesses and consumers alike.

#### ENACTING MEANINGFUL POLICIES

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. H.R. 1380, the New Alternative Transportation to Give Americans Solutions (NAT GAS) Act of 2011 provides the means to accelerate demand for NGVs and to help manufacturers achieve economies of scale and build-out much needed fueling infrastructure. HR 1380 would provide federal incentives for the production, purchase and use of natural gas vehicles and the expansion of the NGV fueling infrastructure.

It is important to note that there is no free market when it comes to the leading transportation fuel, i.e., petroleum. It is significantly distorted by the cartel power of OPEC. All other transportation fuels and technologies are at an extra-market economic disadvantage. Nothing would please OPEC more than for Congress to assume that, left on its own, the marketplace would solve the problem of our addiction to foreign oil. Federal intervention to offset the policies of OPEC is essential.

That is why NGVAmerica strongly supports H.R. 1380, and hopes similar legislation will be introduced in the Senate soon. There is broad bipartisan support for this bill. Although only introduced on April 6th, H.R. 1380 already has 186 bipartisan co-sponsors. As proposed, these incentives would be available for only a five year period. During that time and long thereafter, it would make NGVs the economic choice for many more fleets. This legislation would accelerate NGV use, which, in turn, would bring more NGV manufacturers into the market, increase competition and drive down the first-cost premium of NGVs.

NGVs are a here-and-now technology. This fact is highlighted by the investments and commitments by fleets already taking place in the market place in the U.S. Highlighted here are some of the growing examples of how natural gas is helping meet the needs of fleets:

- AT&T operates more than 2,400 vehicles powered by natural gas and has a goal of expanding the fleet to 8,000 by 2013;
- UPS has more than 1,100 natural gas powered vehicles, and is expanding its fleet of vehicles powered by liquefied natural gas. The company has said it would convert a much larger share of its trucking fleet to LNG if the fueling infrastructure was in place;
- The Los Angeles County Metropolitan Transportation Authority earlier this year held a retirement ceremony for its last diesel bus, and 2,221 of its buses are now running on compressed natural gas; a number of the other smaller transit agencies around the country have successfully switched their entire fleet over to using natural gas. In Washington, DC, the local transit authority operates nearly 500 natural gas transit buses, and several feeder systems (outlying counties) also operate natural gas buses.
- Ryder System Inc. is purchasing 202 heavy-duty natural gas vehicles that will be used in its Southern California network;
- Waste Management, the largest refuse company in the country, has more than 900 vehicles running on either compressed natural gas or liquefied natural gas;
- The Dallas Area Rapid Transit system recently announced it will purchase 452 natural gas powered transit buses—the largest single order of natural gas transit buses currently in place.

As these fleet examples highlight, 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 the way and providing incentives will make this happen. By providing critical incentives, the NAT GAS Act would help jumpstart that growth. In addition, federal agencies can help by implementing rules that are favorable to the increased use of

natural gas and by leading by example through the purchase of natural gas vehicles for their fleets. And while NGVs do not need technological breakthroughs to be commercial, NGVs can be further improved by, for example, integrating hybridization technology with natural gas power. Therefore, it is important that the federal government support research, development and demonstration programs, like the ones proposed in S. 734, because, as that bill notes, manufacturers have “increasing limited resources” for such activities. Federal assistance and public private partnerships can ensure that natural gas vehicles continue to improve over time, delivering increased performance and delivering increased fuel efficiency.

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.

THE PEW,  
CLEAN ENERGY PROGRAM,  
*Washington, DC, May 18, 2011.*

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

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

DEAR CHAIRMAN BINGAMAN AND RANKING MEMBER MURKOWSKI:

In light of the Committee’s May 19 hearing on policies to reduce oil consumption, the Clean Energy Program of the Pew Charitable Trusts would like to urge prompt consideration of legislation that would accelerate the deployment of electric drive vehicles in the United States. Such legislation includes Senator Stabenow’s Advanced Vehicle Technology Act of 2011 (S. 734) and Senator Merkley and Alexander’s Promoting Electric Vehicles Act of 2011 (S. 948), each of which would make great strides in weaning our nation from oil and developing clean and home-grown transportation alternatives.

National policies that promote vehicle electrification are critical to reducing America’s dependence on foreign oil, reinvigorating U.S. manufacturing and minimizing environmental impacts while enhancing the nation’s competitiveness in the global clean energy economy. As the attached Detroit News article illustrates, rapid expansion of the Chinese electric car industry is of potential concern to U.S. executives and officials. If the United States committed to deploying 10 million charging stations and making 25 percent of new vehicles electric by 2020, it would yield benefits that could help strengthen economic, national and environmental security far into the 21st century.

In 2009, this country imported 11.7 million barrels of crude oil and refined petroleum products per day. At \$100 a barrel, this amounts to sending foreign countries—some of them hostile to U.S. interests—more than \$1.1 billion to meet our daily energy needs. To ensure stability in the world oil markets, American troops are deployed on oil-security missions, costing U.S. taxpayers \$67 billion to \$83 billion a year, according to the Rand Corporation. Furthermore, increasing domestic crude oil production—by 11 percent in the Obama administration—has not prevented gas prices from rising at the pump.

Meanwhile, increasing demand for electric vehicles has resulted in new battery and component manufacturing facilities across the United States. The Department of Energy estimates that the United States will have the capacity to produce 40 percent of the world’s advanced vehicle batteries by 2015, and other experts predict that battery manufacturing could grow to \$100 billion a year by 2030. Investments in charging infrastructure offer significant economic opportunities as well. The U.S. market for supply and installation of residential charging points alone is expected to reach almost \$1 billion by 2020.

Electric vehicles emit far fewer greenhouse gases than conventional vehicles. Although power plants use various types of fuel to generate electricity, even plug-in hybrid electric vehicles powered by older coal plants emit approximately 25 percent fewer greenhouse gases compared with conventional vehicles. With transportation accounting for nearly one-third of all U.S. greenhouse gas emissions, broad adoption of electric vehicles will dramatically lower this sector's greenhouse pollution.

To fully realize the benefits from large-scale adoption of electric vehicles, national policies are needed to help stimulate demand and ensure that electric vehicles do not encounter technical or logistical obstacles. The Advanced Vehicle Technology Act would call for a broad research and development program on advanced vehicle materials, technologies, and processes that can substantially reduce or eliminate petroleum use and emissions by passenger and commercial vehicles. The Promoting Electric Vehicles Act of 2011 would create short-term deployment communities across the country to help spur market penetration of electric vehicles and to serve as laboratories for modeling nationwide electrification. These bills embrace positive and significant steps towards relieving our oil dependence, and we urge their passage in Committee and in the full Senate.

Thank you for your consideration. If you have any questions, please feel free to contact Shannon Heyck-Williams in our government relations department at (202) 887-8801, or sheyck-williams@pewtrusts.org.

Sincerely,

PHYLLIS CUTTINO,  
*Director.*

BETTER PLACE,  
*May 20, 2011.*

Hon. AL FRANKEN,  
*309 Hart Senate Office Building, Washington, DC.*

DEAR SENATOR FRANKEN:

We noted with interest your question regarding various paradigms of electric vehicle (EV) infrastructure deployment and charging services at the Senate Energy Committee's May 19th hearing on legislation to promote transportation electrification technologies. In particular, we were pleased to learn of your interest in the battery switch model currently being deployed by Better Place in country-wide networks for Israel, Denmark, and Australia, as well as commercial demonstrations in China and the US. The mission of Better Place is to eliminate our dependence on oil and the way we do that is by making cars that don't use oil less expensive and more convenient than ones that do.

With that said, please allow us to clarify some things that were not made clear at the hearing.

The battery-separation model pioneered by Better Place is designed to eliminate three major barriers to mass adoption of electric cars—cost, convenience and range. With our service, the consumer buys the car—but not the battery. As a result, electric cars on the Better Place network are NOT premium cars—they are priced similarly to their gasoline equivalents. The first car on the Better Place network will be the Renault Fluence ZE, a five-passenger, high performance sedan that consumers in Israel and Denmark will be able to purchase later this year together with an eMobility subscription to Better Place at roughly the same price they would pay to own a comparable gas car.

To address convenience and range, Better Place deploys infrastructure in two parts. First, charge points enable the car to be plugged and charged at home, at work, and at strategic public locations. Second, Better Place deploys a network of battery switch stations, which switch a depleted battery out for a full one in about two minutes—faster than it takes to fill a tank of gas. Better Place demonstrated this “instant charge” technology in a Tokyo taxi commercial scale pilot in 2010, in which the automated battery switch process averaged 59.1 seconds.

The net result of the Better Place model is a guaranteed mobility service that can move electric vehicle adoption from a niche product to a mass market solution, giving consumers a vehicle ownership experience that is not subject to the volatility of prices at the pump. That, we believe, is a market-based solution that tips the market and breaks dependence on oil for cars in a decade or less.

The issues raised at the hearing appeared based on perceived complexity and cost of battery switching. The solution is not free, but it is far more economical, even in the US, than sending billions of dollars overseas for foreign oil. Moreover, the global economics of electrification and the Better Place solution is sound, since there are two driving market forces at work today, rising oil prices and the declining cost

of batteries. That is why Better Place has raised \$700M from private investors, including some of the world's largest banks such as HSBC and Morgan Stanley.

Our commercial networks in Israel and Denmark are slated to open at the end of this year, and our network in Australia will get underway in 2012. At the same time, the Chinese government is taking aggressive action to become the capital of the electric car industry, and government and industry there are increasingly embracing the battery switch model. Recently, we announced an agreement with China Southern Grid, one of the world's largest utilities, to collaborate on EV charging and battery switching technology, starting with the metropolitan area of Guangzhou, the third largest city in China.

With our first global headquarters in Silicon Valley, we are actively engaged in leading EV markets in North America (California, Hawaii, Toronto) to pilot and scale EV charging networks. You may want to speak with your colleague from Hawaii, Senator Daniel Inouye, who was present last month as we inaugurated a demonstration charging network in his state. Next year Better Place plans to launch a public-private partnership program in the San Francisco Bay Area that will deploy a regional corridor of battery switch stations to serve a fleet of sixty zero emission taxicabs.

Witnesses at the ENR hearing appeared to discount the applicability of the model beyond small countries; however, the fact of the matter is that there is no way to offer unlimited drive in an all-electric car along vast distances without switchable batteries. We have had the pleasure of hosting several of your Senate colleagues at our Global Visitor Center in Israel, as well as former Governor Tim Pawlenty, and we invite you to do the same.

By visiting our home page at <http://www.betterplace.com> you can see a short video explaining our solution and showing our battery-switch system, called "Drive \* Switch \* Go."

Once again, thank you for your interest in EVs in general and the battery switch model in particular. We hope these clarifications are useful to you, and we would welcome the opportunity to answer any questions that you or your staff may have about Better Place.

Sincerely,

MIKE GRANOFF,  
*Head of Oil Independence Policies.*

---

STATEMENT OF KYLE PISTOR, VICE PRESIDENT, GOVERNMENT RELATIONS, NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

Chairman Bingaman and Ranking Member Murkowski and Members of the Committee, the National Electrical Manufacturers Association thanks you for allowing us the opportunity to provide testimony as the Committee considers S. 948, the Promoting Electric Vehicles Act of 2011, introduced by Senators Merkley and Alexander.

NEMA is the trade association of choice for the electrical manufacturing industry. Founded in 1926 and headquartered near Washington, D.C., its approximately 450 member companies manufacture products used in the generation, transmission and distribution, control, and end-use of electricity. My comments are submitted on behalf of the member companies of the NEMA Electric Vehicle Supply Equipment and Systems (EVSES) Section which manufacture products or assemblies installed for the purpose of safely delivering and managing electrical energy between an electric vehicle and an electrical source.

NEMA is committed to the integration of EVs into our transportation economy. We applaud the leadership demonstrated by Senator Merkley and Senator Alexander in crafting a bill that takes a major step forward in preparing our infrastructure for the deployment of electric vehicles.

Rapid deployment of electric vehicles requires robust market penetration of charging infrastructure—at home, at the office, and on the road, from coast to coast.

EVSES put the consumer in control of their recharging needs. With various payment methods, voluntary interaction with the electric grid, and the ability to charge the vehicle when power is at its cheapest, EVSES makes owning and operating an electric vehicle cost-effective, safe, and convenient.

NEMA supports many provisions in S. 948. Investment in deployment programs will help to identify the challenges facing EV adoption and best practices for overcoming these challenges. When shared with other communities across the country, our national approach to incorporation of EV and EVSE will be much more informed. NEMA also supports programs designed to assist both the federal government and private sector in upgrading their fleets to electric vehicles. Fleets often



lead the way in adopting new technologies and in this case, have the most to gain in terms of energy savings. Reducing barriers to adoption is important.

We recognize that in addition to this Committee, other committees of jurisdiction will have an important role to play a successful legislative strategy, and we hope this Committee will work closely with them. NEMA supports a multi-year extension and expansion of the Section 30C Alternative Fuel Vehicle Refueling Property tax credit, currently set to expire in 2011.

Because safety is paramount, NEMA believes this credit should expressly allow all necessary electrical equipment, infrastructure, and installation costs that are necessary to deliver power to charge the electric vehicle. Further, NEMA is committed to the proposition that installation of EVSES and related equipment be done in compliance with the National Electrical Code.

Because the rollout of EVs requires a robust infrastructure strategy, we are pleased to offer our support of these provisions in the Promoting Electric Vehicles Act.

Thank you for the opportunity to provide this testimony.

---

STATEMENT OF SHANE KARR, VICE PRESIDENT, FEDERAL GOVERNMENT AFFAIRS, THE ALLIANCE OF AUTOMOBILE MANUFACTURERS

The Alliance of Automobile Manufacturers (Alliance) appreciates the opportunity to express our views on S. 734, the Advanced Vehicle Technology Act of 2011, and S. 948, the Promoting Electric Vehicles Act of 2011. The Alliance is a trade association of twelve car and light truck manufacturers including BMW Group, Chrysler Group LLC, Ford Motor Company, General Motors Company, Jaguar Land Rover, Mazda, Mercedes-Benz, Mitsubishi Motors, Porsche Cars, Toyota Motors, Volkswagen Group and Volvo Cars. Auto manufacturing is a cornerstone of the U.S. economy, supporting 8 million private-sector jobs, \$500 billion in annual compensation, and \$70 billion in personal income tax revenues. Together, Alliance members account for nearly 80 percent of annual motor vehicle sales in the U.S.

We commend the sponsors of S.734 and S.948 for their leadership in promoting the successful deployment of advanced technology vehicles. Automakers are fully engaged in development of vehicles and advanced technologies to help reduce gasoline consumption and emissions, including greenhouse gas (GHG) emissions. There is no silver bullet or single technology that will solve this nation's energy and environmental challenges. Meeting the diverse and complex requirements of the transportation sector will only be possible through a portfolio of advanced powertrain technologies. We'd like to take this opportunity to provide general feedback on both S.734 and S.948.

S. 734: ADVANCED VEHICLE TECHNOLOGY ACT OF 2011

Even in the face of the worst economic circumstances in decades, automobile manufacturers have worked hard to maintain our research and development efforts on a broad portfolio of advanced vehicle technologies. We are pleased that S. 734 recognizes the critical importance of ongoing research to develop and commercialize next generation technologies. As you know, the Department of Energy's Vehicle Technologies Program, enables the Department to partner with automobile and truck makers, suppliers, academia and the national labs to carry out a broad array of advanced technology vehicle and component part research and development programs. S. 734 reauthorizes and updates the program, emphasizing the need and opportunity for automakers and suppliers to partner with DOE to develop and implement technologies for more fuel efficient vehicles. The research, development, deployment, and commercial applications projects promoted by this legislation will help accelerate the production of the next generation of vehicle technologies, which in turn will help reduce our nation's dependence of foreign oil and cut greenhouse gas emissions. The Alliance appreciates Senator Stabenow's efforts to promote jobs in the auto sector and speed the production of advanced vehicle technologies.

S. 948: PROMOTING ELECTRIC VEHICLES ACT OF 2011

We agree with the vision of the bill's authors that strong federal involvement is needed to help make communities across the nation ready for greater deployment of electric drive vehicles. Achieving widespread acceptance of these technologies will require aligning regulatory efforts; developing a supporting infrastructure; providing research and development; providing incentives for consumer adoption; and removing other market barriers. S. 948 includes provisions that contribute to progress on many of these fronts.

As an industry, however, we have concerns about an approach that would limit investments to a handful of communities, particularly at such an early stage of electric vehicle deployment. Attempts to prejudge the market bring tremendous risks, and the problem is compounded by making just a few large bets, particularly so early in the process. Using the grant program to “seed” activities in as broad a number of communities as possible is a more appropriate and equitable solution for the American public—avoiding limitations on automakers’ potential customer base for these vehicles and maximizing the chances of success for public investments overall—even if this means that any individual deployment community would receive less total funding.

In addition, electric drive vehicles need to be developed in the broadest possible ways—with hybrid, battery electric, plug-in hybrid, and fuel cell vehicles offering unique benefits in different vehicle segments. For this reason, we believe this legislation should allow manufacturers, fuel providers, and communities the flexibility to invest in multiple electric drive pathways, including fuel cell electric vehicle and related hydrogen infrastructure, which are not currently included in S. 948.

Finally, for any technology to be successful it must be consumer driven, and a national program that helps the consumer with the most pressing need, residential charging, offers the best opportunity for sustainable growth and deployment of electric drive vehicles. Business models must be developed that will allow the private sector to deploy charging infrastructure in the full range of residential situations including high rise, garden apartments, town houses. A range of innovative solutions to address the challenges facing both residential and workplace charging should be funded and we believe the most efficient solution is to build on the Department of Energy’s existing programs.

Automakers are committed to advancing electric mobility. Our member companies have already announced plans to launch plug-in hybrid, extended range hybrid, battery electric, and fuel-cell vehicles in the coming model years, and are hard at work developing the next generation of electric drive vehicles that will follow. We look forward to working with the Committee, Senator Merkley, and Senator Alexander to address the infrastructure and consumer acceptance issues that will be so important to the ultimate success of these vehicles, and their contribution to our national goals.

#### CONCLUSION

S. 734 and S. 948 highlight the role advanced technology powertrains will play in enhancing energy security and reducing GHG emissions. Automakers are investing and will continue to invest in these technologies. Their success will depend on consumer acceptance, affordability, and an infrastructure to support these vehicles.

We also want to remind and encourage the Members of the Committee to support an approach to vehicle fuel economy requirements that results in a single, national fuel economy standard—one that recognizes and balances the challenges inherent in bringing these technologies into the marketplace, understanding and effectively accounting for the technological feasibility, safety, and economic practicability, including impact on U.S. jobs. Automakers are currently working constructively with the Environmental Protection Agency, the National Highway Traffic Safety Administration and the California Air Resources Board on a single, national program for model years (MY) 2017-2025. This is a difficult process involving significant assumptions and uncertainties. It is imperative that the necessary analyses and studies be completed and fully evaluated prior to these standards being set. This will help ensure that a single, national program for fuel economy and GHG emission standards exists and that it continues to provide clarity and certainty, without pricing consumers out of the market or preventing them from choosing from a broad range of vehicles and technologies that can meet their diverse needs.

The Alliance looks forward to working with the sponsors of these bills and the members of this Committee. Thank you for considering our views.

---

#### STATEMENT OF THE NATIONAL PROPANE GAS ASSOCIATION

In the past several Congresses, numerous pieces of legislation were introduced that would have incentivized the development, production and use of various alternative fuel vehicles, notably vehicles that operate on compressed natural gas (CNG), biofuels, ethanol, hydrogen and electricity. Unfortunately, in many cases this legislation neglected to also support propane autogas as a vehicle fuel and propane autogas vehicle alternatives. This makes no sense, considering that propane autogas is also defined in law as a clean alternative fuel.

The National Propane Gas Association is concerned that legislation such as the Advanced Vehicle Technology Act of 2011, while well-intentioned, falls short because it would fund Department of Energy (DOE) research and development and commercial application projects for hybrid, electric, hydrogen, and compressed natural gas vehicles and related technologies, but leaves out equally useful and relevant propane autogas vehicle alternatives. Passing legislation that incentivizes only one, or a select few, fuels places the Congress in the position of “picking winners” among alternative transportation fuels. Alternative fuel choices should be made by the marketplace, by the companies, fleets and consumers across the country who are tasked with making individual decisions about which alternative fuels and vehicles suit their needs best. The government should not intercede in this process.

At the end of the day, the propane industry is seeking parity in government treatment of alternative fuels. In fact, we believe that, given a level playing field, propane autogas and autogas vehicles can play a lead role in addressing many of the stated objectives outlined in the Advanced Vehicle Technology Act of 2011, most notably improving United States-based vehicle technologies that reduce our dependence on petroleum based fuel, improving emissions, and improving consumer choice of vehicle technologies. Propane autogas has everything going for it except inclusion in this legislation:

- Propane autogas is a clean American fuel.—98.7% of U.S. propane supply is produced domestically, the balance coming largely from Canadian imports. 66% of propane supply is derived from natural gas production. This compares very favorably to the current U.S. transportation sector which is 95% reliant on petroleum, 60% of which comes from overseas. Even better news is that U.S. propane production from natural gas is expected to increase rapidly between 2010 and 2020 (See Appendix).
- Propane autogas vehicles have a positive emissions reduction profile.—Propane autogas vehicles are 19% lower in CO2 emissions than gasoline powered vehicles. Propane autogas vehicles also produce significantly lower particulate matter, carbon monoxide, nitrogen oxide and hydrocarbon emissions than gasoline or diesel vehicles.
- Propane supply is abundant.—In 2010 the North American market (U.S and Canada) was a net exporter of propane. This trend is likely to continue as shale gas, and natural gas liquids production in conjunction with shale gas, increase.
- Propane autogas vehicles are here now.—Over the past several years, more and more commercial, state and local government fleets have been transitioning to propane autogas as a cost-effective, environmentally sensitive domestic fuel.

Propane autogas is easily the most accessible alternative transportation fuel currently available in the marketplace and is the most popular alternative transportation fuel worldwide. Recognizing this market, Ford and General Motors are now producing propane autogas vehicle platforms and many smaller companies are now converting existing vehicles to run on propane autogas. With gasoline and diesel prices rising fast and our country’s continued reliance on foreign oil it would be a mistake for the government to limit consumer choice in the alternative fuel vehicle marketplace by promoting one or more alternative fuels to the detriment of others.

In sum, propane autogas is a clean, domestic and abundant fuel that is already displacing imported petroleum products in the American marketplace. The propane industry conceptually supports the goals of the Advanced Vehicle Technology Act of 2011. However, we strongly urge the Committee, when considering this legislation, to abide by the principle of fuel neutrality by including an equitable “all of the above” approach that includes propane autogas opportunities to federal alternative fuel vehicle programs.

As an industry, we look forward to working with the Energy and Natural Resources Committee, as well as our partners in the broader alternative fuel industry to craft smart equitable alternative fuel transportation solutions for the American public.

APPENDIX.—NPGA STATEMENT ON THE ADVANCED VEHICLE TECHNOLOGY ACT (S. 734)

PROPANE IS A DOMESTICALLY PRODUCED ENERGY SOURCE.

DOMESTIC PROPANE SUPPLY IS EXPECTED TO GROW OVER TIME

*Sources of U.S. Odorized Propane Supply*

In 2010:

- Domestic refinery and natural gas plant production of propane accounted for 98.7 percent of total U.S. consumer grade (odorized) propane supply, with net

propane imports accounting for the remaining 1.3 percent. Most of the net imports came from Canada, with the remainder imported via LPG tanker ship from a variety of international sources.<sup>1</sup> Hence, more than 99% percent of U.S. odorized propane supply was produced in North America.

- From a resource perspective, about 78.5 percent of the odorized propane consumed in the U.S. was sourced from hydrocarbon resources (crude oil and natural gas liquids) produced in the U.S. An additional 5.5 percent was sourced from hydrocarbon resources (crude oil and propane from natural gas liquids) produced in Canada. Hence, about 84 percent of the odorized propane consumed in the U.S. in 2010 was produced from North American hydrocarbon resources.

—This percentage has been increasing for the last several years. In 2007, about 75 percent of odorized propane consumed in the U.S. was produced from North American hydrocarbon resources.

- 66 percent of the odorized propane consumed in the U.S. was produced as a co-product of natural gas production, and separated from the natural gas stream at gas processing fractionation plants, along with ethane, butane, and other LPG products. Gas processing plants separate the natural gas liquids—ethane, propane, and butane—from wet gas that comes from producing gas and oil wells.
- 32 percent of the odorized propane consumed in the U.S. was produced by U.S. crude oil refineries alongside the production of gasoline and distillate fuel oil.<sup>2</sup>

—We estimate that 13 percent of the odorized propane consumed in the U.S. was produced in U.S. refineries from oil produced in the U.S., about 5 percent of the odorized propane consumed in the U.S. was produced in U.S. refineries from crude oil imported from Canada, and one percent from crude oil imported from Mexico.

#### PROPANE SUPPLY OUTLOOK

The propane supply outlook is very positive. The percentage of odorized propane produced from North American hydrocarbons has been increasing for the last few years, from 75 percent in 2007 to 84 percent in 2010. This trend is expected to continue as recent changes in domestic natural gas supply outlook are expected to increase the volume of propane produced from natural gas processing facilities.

- The propane supply outlook is primarily dependent on North American natural gas and crude oil production trends. More than 84 percent of the odorized propane consumed in the U.S. is produced from natural gas and crude oil produced in North America.
- The U.S. EIA is projecting domestic crude oil production to increase steadily over the next 10 years, increasing by more than 10 percent between 2010 and 2020.
- ICF and most other industry experts are projecting U.S. natural gas production to increase substantially in the next 10 years. The U.S. EIA is projecting total dry gas production to increase by 10 percent between 2010 and 2020, with shale gas production increasing by 71 percent. ICF is projecting higher growth with U.S. natural gas production to increase by about 30 percent between 2010 and 2020. The growth in natural gas production is expected to result in significant growth in liquids production.

—U.S. reserves of natural gas liquids have been increasing steadily since 2003, with a total increase of about 37 percent from 2003 through 2009. Growth in 2009 alone exceeded nine percent.

- Most of the growth in natural gas production will come from the new shale gas resource base. Much of the shale gas resource base is “wet” gas with a high proportion of natural gas liquids.

—ICF estimates that shale gas resources that would be economically producible at \$5.00 per Mcf (slightly above today’s natural gas prices) exceed 800 TCF, and include more than 25 billion barrels of natural gas liquids. These new

<sup>1</sup>In both 2009 and 2010, excluding Canadian imports, the U.S. was a net propane exporter to the rest of the world.

<sup>2</sup>Refineries produce both propane (60%) and propylene (40%). Propane and propylene are both widely used in the chemical feedstock market. Only a very small amount of propylene is sold into the consumer market for niche uses such as welding; the vast majority of propylene is used as chemical feedstock. Natural gas plants produce almost entirely propane, with very little propylene.

resources are roughly equivalent to the total level of existing proven reserves for U.S. natural gas liquids production, and are expected to result in steady growth in natural gas liquids production as these resources are developed.

- On a \$/Btu basis, the value of natural gas liquids currently is well above the value of the natural gas itself. Given recent changes in natural gas supply outlook, this disparity is expected to continue.
  - As a result, the economics of natural gas exploration and development have shifted in favor of “wet” gas with a higher percentage of liquids—and a higher percentage of propane.
- Production of propane from natural gas is expected to increase rapidly between 2010 and 2020, leading to a substantial increase in North American propane supplies exported to international markets if domestic demand does not increase.

#### IMPACT OF POTENTIAL NEW CONSUMER PROPANE DEMAND ON PROPANE MARKETS

- Since 2004, domestic production of propane and propylene has been relatively stable, while total demand has been falling.
  - According to API, consumption of consumer grade propane has fallen by about 23 percent from peak demand levels in 2000.
  - Demand for propane/propylene used as a petrochemical feedstock has varied from year-to-year around the long term average.
- Since 2004, propane/propylene imports have been declining, while propane/propylene exports have been increasing.
  - In 2009 and 2010, excluding Canadian imports, the U.S. was a net exporter of propane/propylene.
- These trends are expected to continue in the future.
  - Continuing improvements in end-use propane efficiency due to higher appliance energy standards and improved building efficiency codes are likely to offset most if not all growth in consumer propane demand in the next few years.
  - Propane production from natural gas is expected to grow steadily as natural gas production increases, providing additional propane supply for both the petrochemical and consumer propane markets.
- The existing propane supply and distribution infrastructure was designed for a significantly larger market than exists today, and remains generally sufficient to support significant growth in propane demand.
  - Regional changes in demand and supply patterns are likely to require new infrastructure investment regardless of potential growth in demand.
- Despite the decline in U.S. demand, propane/propylene prices have remained more closely linked to the international oil price and propane prices than to natural gas prices. This price relationship is likely to continue regardless of foreseeable increases or decreases in domestic demand for propane/propylene. However, as propane supply increases, propane prices are likely to decline somewhat relative to gasoline and diesel fuel prices.