

Testimony of Frederick W. Smith
Chairman, President and CEO, FedEx Corporation
Co-Chairman, Energy Security Leadership Council
Member, Electrification Coalition
Before the U.S. Senate
Subcommittee on Energy and Water Development
February 23, 2010

Good morning, Chairman Dorgan, Senator Bennett, and members of the Committee. I would like to thank you for giving me this opportunity to speak to you regarding one of the great challenges facing our country today: ending the very real and pressing threats posed to our nation by our dependence on petroleum.

These are threats, Chairman Dorgan, that I know you are very familiar with. You have been one of the Senate's most stalwart champions in finding real solutions to our energy security challenges, and I thank you for your dedication and leadership.

I am proud to serve both as co-Chairman of the Energy Security Leadership Council and as a member of the Electrification Coalition, two organizations dedicated to facing these threats head on.

The Energy Security Leadership Council, formed in 2006, is a coalition of business executives and retired national security leaders who believe that our dependence on oil, much of it imported from unstable and hostile regimes, poses an unacceptable economic and national security threat.

The Electrification Coalition, formed in 2009, is 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.

I became involved in these organizations for a single reason: it is my belief that after terrorism and the proliferation of weapons of mass destruction, our increased dependence on petroleum represents the biggest single threat to our nation's economy and national security.

I can speak to this issue personally. FedEx delivers more than 7 million packages and shipments per day to more than 220 countries and territories. In a 24 hour period, our fleet of aircraft flies the equivalent of 500,000 miles, and our couriers travel 2.5 million miles. We accomplish this with more than 275,000 dedicated team members, 670 aircraft, and some 70,000 motorized vehicles worldwide.

FedEx's reliance on oil reflects the reliance of the wider transportation sector, and indeed the entire U.S. economy. Oil is the lifeblood of a mobile, global economy. We are all dependent upon it, and that dependence brings with it inherent and serious risks.

In 2008, 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.

At the crux of America's oil dependence is the energy demand of the transportation sector. Transportation accounted for almost 70 percent of American oil consumption in 2008. Cars and trucks were 94 percent reliant on oil-based fuel for their energy, with no substitutes immediately available in anything approaching sufficient quantities.

The volatility of oil prices affects every American. 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.

We are all aware of the sharp financial burden on U.S. households that faced—and still face—resets in their adjustable rate mortgages. But it is important to understand that increases in energy costs have been on the same, or even a greater, order of magnitude for the entire American economy. A typical subprime borrower with a poor credit history who bought a \$200,000 house in 2006 with a 2 year/28 year ARM with a 4 percent teaser interest rate for the first two years would have seen monthly mortgage payments increase from about \$950 a month before the reset to about \$1,330 after the reset—an increase of about \$4,500 a year. In the meantime, between 2001 and 2008, the average retail price of gasoline increased from \$1.46 to \$3.27, costing typical households \$1,990 a year in increased fuel expenses. And that increase in energy costs affected *all* U.S. households—not just the one household in 20 that held a subprime mortgage.

This burden, multiplied across millions of households, was a major contributor to the ensuing economic slowdown. We saw an explosion in home ownership, with many purchases being made by people who had heretofore not qualified for mortgages. When the price of oil and the price of gasoline began to rise, and inflation on commodities began to take hold, and interest rates began to increase, you had a tremendous diminution in purchasing power and cash flow, which contributed to people having to walk away from their mortgages. The rise in oil prices was the match that lit the fuse of the mortgage mess and the subsequent recession.

The U.S. economy lost more than 700,000 jobs between December 2007 and the beginning of September 2008, and the unemployment rate increased from 4.5 percent to 6.1 percent—all before the financial crisis truly hit later in September. In fact, as early as August of 2008, many economists believed the U.S. economy was already on the verge of recession, largely driven by sharply rising and volatile oil prices.

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 the past eight years was spent on higher gasoline bills.

All told, U.S. families and businesses spent more than \$900 billion on refined oil products in 2008, representing 6.4 percent of GDP. Today, prices have receded. But for how long? Many

of the underlying fundamentals that pushed oil prices up are still present today, and once demand—temporarily reduced due to the recession—begins to pick up again, prices are likely to follow. Our oil dependence could strangle an economic recovery just as it is beginning to take hold.

The threat to American national security is equally as urgent. 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 50 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 Qatar. Even a failed attempt to close one of these strategic passages could cause global oil prices to skyrocket. A successful closure of even one of these chokepoints 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.

Oil dependence also constrains U.S. foreign policy. Whether dealing with uranium enrichment in Iran or a hostile regime in Venezuela, American diplomacy is distorted by the need to minimize disruptions to the flow of oil. Too often, oil dependence requires us to accommodate hostile governments that share neither our values nor our goals, putting both the United States and its allies at risk.

Finally, petroleum consumption poses a long-term threat to global environmental sustainability. Curbing emissions is a global issue, and there is not yet an international consensus on a long-term stabilization objective or on the changes in emissions trajectory needed to meet such a goal. International discussions are increasingly centered on a stabilization level that ranges between 450 and 550 parts per million (ppm) CO₂ equivalent (CO₂-eq). Regardless of the exact nature of a final emissions stabilization target, what is clear is that the transportation sector is going to have to play a major role in virtually any carbon abatement scenario.

We cannot continue down this path. We cannot continue to send untold billions of dollars and jobs overseas to pay for our addiction. We cannot continue to send men and women into harm's way to protect an increasingly vulnerable supply line. We cannot continue to put our future in the hands of hostile nations or fanatical terrorists who can turn off our crucial oil lifeline at the drop of a hat.

There is a solution. The lynchpin of any plan that is serious about confronting oil dependence must be a transportation system that today is almost entirely dependent on petroleum. 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 2008 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 approximately 16 percent of the natural gas we consume, more than 90 percent of those imports were from North American sources (Canada and Mexico) in 2008. 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 GEVs 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.
- 5) **Electric Miles are Cheaper Than Gasoline Miles:** Operating a vehicle on electricity in the United States is considerably less expensive than operating a vehicle on gasoline. In large part, this is due to the high efficiency of electric motors, which can turn more than 90 percent of the energy content of electricity into mechanical energy. In contrast, today’s best internal combustion engines have efficiency ratings of just 25 to 27 percent. With gasoline at \$3.00 per gallon, the operating cost of a highly-efficient internal combustion engine vehicle (30 miles per gallon) is 10 cents per mile. For current pure electric vehicles, assuming an average electricity price of 10 cents per kilowatt hour, operating costs are only 2.5 cents per mile. Recent research confirms the potential savings of electric propulsion. The Electric Power Research Institute (EPRI) has determined that a compact size plug-in electric hybrid vehicle will use only 160 gallons of gasoline a year, compared to 300 in a gasoline electric hybrid and 400 in a conventional internal combustion engine compact car. With gasoline at \$3 a gallon, a plug-in hybrid would save its owner \$10,000 over the course of the vehicle’s lifetime compared to a conventional vehicle.
- 6) **Electric Miles are Cleaner Than Gasoline Miles:** Vehicle miles fueled by electricity emit less CO₂ than those fueled by gasoline. Several well-to-wheels analyses conclude that vehicles powered by the full and proportionate mix of fuel sources in the United States today would result in reduced carbon emissions. As renewable power increases its share of the electricity portfolio, and to the extent that new nuclear power comes on line, which I believe is important, the emissions profile of the U.S. power sector and the GEVs powered by it will continue to improve over time. Moreover, to the extent that GEVs are charged overnight using power from baseload nuclear or off-peak renewable power, their emissions footprint can be nearly eliminated. In 2007, the Natural Resources Defense

Council and the Electric Power Research Institute published a well-to-wheels analysis of several different automotive technologies fueled by a range of sources commonly used to generate power. Their analysis concluded that using a PHEV would reduce carbon emissions as compared to a petroleum-fueled vehicle *even if all of the exogenous electricity used to charge the PHEV was generated at an old (relatively dirty) coal power plant*. Whereas a conventional gasoline vehicle would be responsible for emissions, on average, of 450 grams of CO₂ per mile, a PHEV that was charged with power generated at an old coal plant would be responsible for emissions of about 325 grams of CO₂ per mile, a reduction of about 25 percent. Emissions attributable to the vehicle could be reduced to as low as 150 grams of CO₂ per mile if the exogenous power was generated at a plant without carbon emissions and ranged between 200 and 300 grams of CO₂ per mile if the power used was generated using other fossil fuel generation technologies. In other words, no matter where the power consumed by a PHEV is generated, the overall level of emissions attributable to its operation are lower than those of a conventional gasoline vehicle.

In short, high penetration rates of grid-enabled vehicles—vehicles propelled in whole or in part by electricity drawn from the grid and stored onboard in a battery—could radically minimize the importance of oil to the United States, strengthening our economy, improving national security, and providing 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. This is not to say that other alternatives have no role to play in a post-petroleum transportation sector. On the contrary. Natural gas, for example, may be used successfully in fleet vehicles, particularly those that can be centrally refueled, such as taxis, buses, specialized harbor and airport vehicles, and refuse-collection trucks. Even more importantly, natural gas will play a crucial role in providing electricity, a role in which it can be far more efficiently deployed than in actual vehicles. Other alternatives may also offer advantages in niche uses. But none offers the array of advantages that electricity does.

We also recognize that there may be unforeseen challenges to an entirely new transportation system. For example, some have raised concerns about the supply of lithium, which is crucial for the batteries that will drive the cars and trucks of the future. We have examined this issue and found that, because the vast majority of material in lithium ion batteries is recyclable, the increased use of grid-enabled vehicles does not present the United States with additional resource dependency. Particularly when recycling is assumed, global lithium reserves are adequate to support even the most bullish GEV deployment scenarios. Moreover, at a structural level, dependence on lithium is unlike dependence on oil. Vehicles do not deplete batteries as we drive; they deplete the energy stored within them. In other words, batteries are like the engines in conventional vehicles of today; though their life span is finite, they last for many years. Coupled with the fuel diversity of the electric power sector, grid-enabled vehicles generally insulate consumers from volatile commodity markets.

The logical next question is how we can successfully devise and deploy an electrified transportation system.

Make no mistake: electrification at a mass scale is a complex undertaking. We are not only talking about cars here. We are talking a highly-integrated system of batteries, vehicles, generation, transmission and charging, in which every part depends on the other. We would see few results if we improved transmission in the northeast, created a smart grid in the northwest, and introduced more electric cars in the deep south.

In November 2009, the Electrification Coalition released its *Electrification Roadmap*, a sweeping report outlining a vision for the deployment of a fully integrated electric drive network. The report details the dangers of oil dependence, explains the benefits of electrification, describes the challenges facing electric cars—including battery technology and cost, infrastructure financing, regulatory requirements, electric power sector interface, and consumer acceptance issues—and provides specific and detailed policy proposals to overcome those challenges.

Perhaps most importantly, the *Roadmap* proposes the selection and creation of specific geographic areas in which all of the elements of an electrified transportation system are deployed simultaneously and beyond early adopters, thus providing a crucial first step toward moving electrification beyond a niche product into a dominant, compelling, and ubiquitous concept. These geographic concentrations of electrification would:

- 1) **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.
- 2) **Demonstrate Proof of Concept Beyond Early Adopters:** 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. Most Americans are familiar with traditional hybrids, having seen them on the road for most of the past decade; far fewer drivers are familiar with electric vehicles. 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.

- 3) **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. It will 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.

The success of this path will require focused and sustained public support. Ideally, the technology and deployment of electric vehicles would emerge through regular market mechanisms. Unfortunately, events conclusively demonstrate that this path to wide-spread electrification is unlikely.

We understand that this is a challenging time for suggesting increased government expenditures for any project, no matter how worthwhile. We also, however, believe that certain aspects of the threat of oil dependence and the solutions we recommend 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. The total cost of provisions that we recommend in the Electrification Roadmap is approximately \$120 billion spread over eight years. But Department of Energy researchers have estimated that U.S. oil dependence costs were *\$577 billion in 2008 alone*, including \$333 billion from transfer of wealth, \$168 billion from economic dislocation, and \$76 billion in foregone GDP.

Shortly after completing the Electrification Roadmap, the Electrification Coalition commissioned the Interindustry Forecasting Project at the University of Maryland and Keybridge Research to study the long-term economic effects of our policy proposals. This expert modeling team collectively has decades of experience building and performing simulation studies with large-scale econometric models and conducting public policy research on energy and macroeconomic issues. Our goal was to produce a detailed, sober analysis based on conservative, realistic assumptions stretching out over the next 20 years.

We have not yet released the resulting report, but I wanted to share with the Committee some of the key findings in advance.

If the policies we recommend were passed today, the resulting effect on the annual federal deficit would turn positive by 2020. Even more importantly, on a cumulative basis, the budget effect would turn positive by 2025. By 2030, the total positive impact on the federal budget would be \$336 billion (in between \$135 and \$156 billion in current dollars).

It is important to remember that one of the results of our oil dependence is the direct transfer of enormous amounts of wealth and capital overseas. Our economy benefits when we reduce oil dependence because we are using more of our own wealth productively here at home instead of sending it to others.

Job creation would also benefit. Enacting these proposals would result in a total of 1.9 million new jobs by 2030, mostly in the manufacturing sector and in direct or indirect support of the motor vehicle industry. Job creation would start immediately with 227,000 in 2010 alone, growing to 700,000 in 2015 and almost 900,000 in 2020. Most importantly, these would not be jobs that we stimulate once and go away once the stimulus is gone. These are jobs that would be a permanent part of a new, ongoing industry.

The U.S. trade balance, which remains one of our nation's greatest fiscal challenges, would improve by \$127 billion—0.35 percent of GDP—by 2030 under the policies we recommend.

The final report, when we release it shortly, will detail additional economic and fiscal benefits, including to household income and GDP.

In short, this economic modeling makes explicit what common sense perhaps already should make clear: if we can spend approximately \$15 billion a year for eight years in order to eventually end an addiction that would otherwise cost us upwards of \$600 billion a year in perpetuity, does it not make wise budgetary sense to do so?

The dangers we face are not going to go away on their own. We have before us a responsibility, a necessity to act to put our nation on a pathway toward once and for all ending our dangerous dependence on petroleum and leaving a stronger, safer America in its place.

It is also an opportunity to strengthen our economy, create jobs, reduce our carbon footprint, and help to balance our budget in the long term.

This is not a question of technology. The technology is there. If anyone on this Committee has been watching the Olympics, you've seen the commercials for the Nissan Leaf. You know the Chevy Volt is just around the corner. You're about to hear from business leaders what they can already produce. But the technology is not enough without the support needed to build infrastructure, encourage manufacturing and consumer acceptance—in short, to create in a few short years an entirely new transportation system. This is not pie-in-the-sky. It's simply a matter of organization, and—more importantly—a matter of will and a matter of execution.

Here is what I know, as the leader of a company that both depends on and helps to strengthen the mobility upon which our global economy is built: If the government supports this new path, if it helps to build these concentrations of electrification that are so crucial to jumpstarting a new, national transportation system, then that is a game changer. It is a game changer for businesses like mine, for employees, for consumers, for the economy, and for the country. A new future is ours for the taking, but only if we choose it and support it.

Thank you for your attention.