VII. ENVIRONMENTAL SUSTAINABILITY

Advance environmentally sustainable policies and investments that reduce carbon and other harmful emissions from transportation sources.

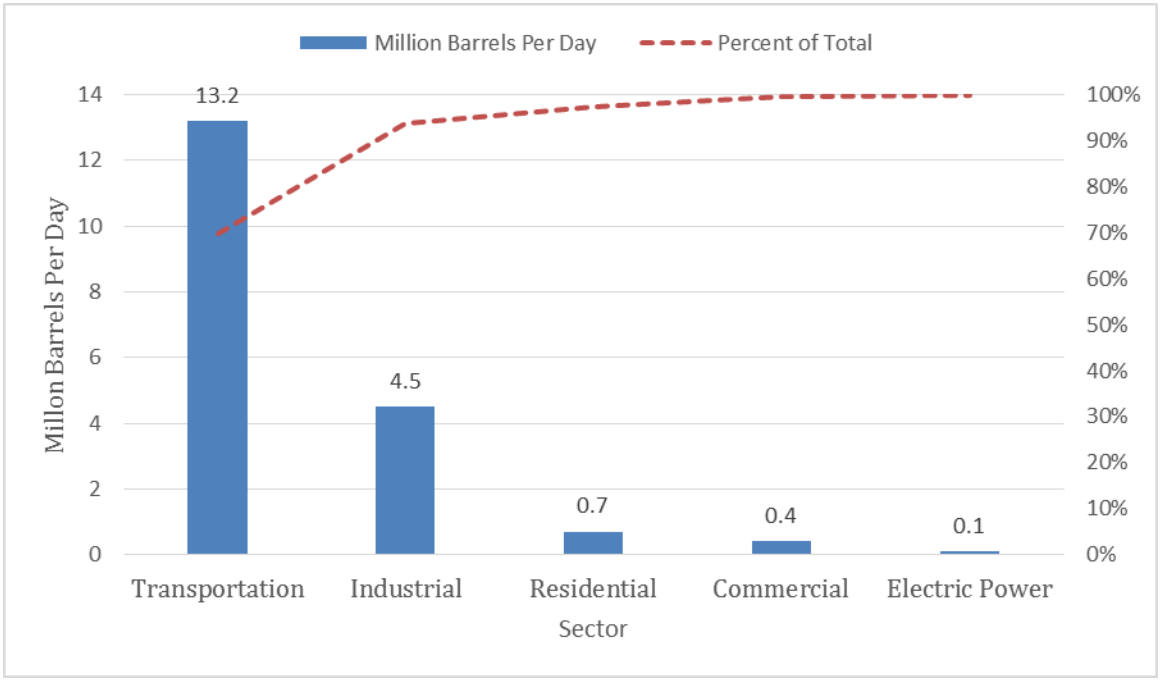
CHALLENGES AND STRATEGIES

Transportation is crucial to our economy and our quality of life, but there are environmental consequences to building, operating, and maintaining transportation systems. Today we face a new set of transportation challenges, which include limiting transportation's environmental footprint, reducing noise and harmful air emissions, promoting energy independence, addressing global climate change, and improving the resiliency of transportation systems. Our goal is to foster more sustainable approaches to transportation so that future generations will be able to enjoy even higher standards of living and mobility.

While energy use has declined since its peak in 2007, the transportation sector still accounted for about 28 percent of total U.S. energy consumption in 2011 (in BTUs). About 93 percent of the energy consumed was in the form of petroleum. [92] Consumption in the transportation sector was 13.2 million barrels per day, which represents 70 percent of all petroleum usage in the U.S. as illustrated in Figure 4. Of all petroleum consumed for transportation, use for motor gasoline represents 46 percent (in BTUs).[93]

Figure 4. U.S. Petroleum Consumption by Sector, in Million Barrels Per Day, 2011.

(Source: Energy Information Administration, Annual Energy Review, Figure 5-13A)



About 84 percent of total greenhouse gas (GHG) emissions in the U.S. are carbon dioxide (CO2) and the largest source of CO2 is fossil fuel combustion. Since most transportation activity is petroleum-based fuel consumption, the transportation sector is a significant contributor to total U.S. GHG emissions. In 2011, about 27 percent of U.S. GHG emissions

were due to transportation activities. Passenger cars, heavy and medium duty trucks, and light duty trucks were collectively responsible for nearly 83 percent of transportation-related GHG emissions as shown in Table H.

Table H. Transportation-related Greenhouse Gas Emissions by Mode, 2011.

(Source: U.S. EPA *Inventory of U.S. GHGs Emissions and Sinks, 1990-2011,* Table 2-15.)

Transportation Mode	GHG Emissions (Teragrams of CO2 equiv.)	Percent of Total Emissions
Passenger Cars	787.4	42.9
Heavy and Medium Duty Trucks	401.1	21.9
Light Duty Trucks	331.4	18.1
Commercial and Other Aircraft	149.9	8.2
Ships and Boats	48.2	2.6
Rail	48.0	2.6
Pipelines	37.7	2.1
Other (Buses, Motorcycles and Lubricants)	30.1	1.6

Total GHG emissions in the U.S. increased by 21 percent from 1990 to 2011, with over 60 percent of the total increase attributed to the transportation sector. [94] However, transportation-related GHG emissions declined 4 percent from 2008 to 2009, largely due to a decline in economic activity and personal vehicle travel. Between 2009 and 2011, GHG emissions declined further by 0.6 percent, even as the level of economic activity recovered.[95] During the same period, the Freight Services Index showed a 13 percent increase and VMT increased about 1 percent, suggesting that this small reduction in emissions was accomplished through some combination of improved light duty vehicle efficiency and improvements in overall freight system efficiency.[96]

Over the past three decades, significant reductions in emissions of criteria air pollutants have been achieved in the transportation sector, largely by progressively strengthening the regulation vehicle emissions and fuel quality under provisions of the *Clean Air Act.* Since 1990, national transportation emissions, defined as the sum of highway and off-highway nitrogen oxides have been reduced 52 percent, volatile organic compounds by 70 percent, and primary PM2.5 by 56 percent. Nonetheless significant challenges remain, particularly

as new National Ambient Air Quality Standards (NAAQS) are revised to protect public health. As of 2010, some 123.8 million Americans lived in counties or regions that exceeded health-based NAAQS for at least one regulated air pollutant.[97]

President Obama has recognized the vital role that the transportation sector can play in reducing greenhouse gas emissions, improving energy efficiency, and combating climate change. The President has challenged DOT to transform the way transportation serves the American people by encouraging transportation that is less carbon-intensive such as transit, car- and van-pooling, intercity passenger buses, rail, as well as active transportation like biking and walking that produces zero emissions.

Our recent emphasis on ecosystem approaches to determining the environmental impact of transportation projects has promoted broader mitigation and conservation strategies. For example, wetland acreage has been replaced at a rate exceeding losses from transportation projects. However, the Nation's investments in transportation systems and infrastructure will only be sustainable if we more broadly consider the secondary effects of construction and land use. Although transportation projects comply with requirements for management of stormwater runoff, and federal funds are available for restoration activities, more must be done to meet the challenge of reducing transportation's contribution to water quality problems.

Recent weather events such as Superstorm Sandy, which disrupted major portions of air, highway, transit, and rail line service in the New Jersey-New York metropolitan region, has prompted us to consider more carefully how we plan, design, and build transportation infrastructure. Superstorm Sandy was the largest tropical storm to impact the Northeast U.S. in recent history. Climate change research predicts that storms will become stronger, so we need to consider climate change impacts and the incorporation of adaptation strategies into DOT planning, operations, policies, and programs to ensure that taxpayer resources are invested wisely and that transportation infrastructure, services and operations remain resilient under extreme climate conditions. In anticipation of more extreme weather events, it is imperative that we create a more resilient transportation system, especially when rebuilding or replacing storm damaged infrastructure.

Our strategic objectives are presented below:

FY 2014-2018 STRATEGIC OBJECTIVES

- Reduce foreign oil-dependence and carbon emissions through research and deployment of new technologies including alternative fuels, and by promoting more energy-efficient modes of transportation. (ES1).
- Avoid and mitigate transportation-related impacts to climate, ecosystems, and communities by helping partners make informed project planning decisions through an analysis of acceptable alternatives, balancing the need to obtain sound environmental outcomes with demands to accelerate project delivery (ES2).
- Promote infrastructure resilience and adaptation to extreme weather events and climate change through research, guidance, technical assistance, and direct federal investment (ES3).

Our strategies for addressing each objective are discussed in the following paragraphs.

STRATEGIES TO REDUCE CARBON EMISSIONS, IMPROVE ENERGY EFFICIENCY AND REDUCE DEPENDENCE ON OIL

We are working across all modes to improve the energy and environmental performance of the transportation sector. The aviation industry has made significant gains in fuel efficiency. Modern aircraft are up to 70 percent more fuel efficient than early commercial jet aircraft. [98] Notwithstanding this success, there is renewed emphasis on improving the fuel efficiency of the NAS. Fuel currently represents the largest operating cost for U.S. airlines, and this cost category has grown dramatically in recent years.

We support the conversion of airport ground vehicles to alternative fuels through the Voluntary Airport Low Emissions (VALE) Program, and co-sponsor the Commercial Aviation Alternative Fuels Initiatives (CAAFI) focused on achieving drop-in sustainable alternative jet fuels for commercial aircraft. We launched the Continuous Lower Energy, Emissions, and Noise (CLEEN) program that will accelerate the development of new engine and airframe technologies and advance alternative jet fuels to reduce noise, emissions, and energy consumption.

DOT and the EPA have worked closely with auto manufacturers, the State of California, environmental groups and other stakeholders to develop a series of programs to increase fuel economy for the Nation's vehicle fleet. In, 2010, DOT and EPA jointly established new fuel economy and tailpipe carbon dioxide standards for light duty vehicles as well as medium and heavy trucks. Building on this accomplishment, the Administration announced an historic agreement in 2011 with thirteen major automakers to increase fuel economy to 54.5 mpg for cars and light duty trucks by model year 2025. By building on the 2012 to 2016 model year agreements, the proposal would save American families $1.7 trillion in fuel costs, and by 2025 result in an average fuel saving of over $8,000 per vehicle over the lifetime of the vehicle. Additionally, these programs would dramatically cut the oil we consume, saving a total of 12 billion barrels of oil, and by 2025 reduce oil consumption by 2.2 million barrels a day. The proposed standards will also curb carbon pollution, cutting more than six billion metric tons of greenhouse gas over the life of the program. This is more than the amount of CO2 emitted by the U.S. in 2010. [99]

In 2010, DOT and EPA announced the final rule for improving fuel efficiency in medium and heavy-duty trucks, which covers model years 2014 to 2018 for vehicles from three quarter-ton pickups and vans to delivery and utility trucks to big-rig combination tractors. These new standards are expected to save a projected 530 million barrels of oil and reduce carbon pollution emissions by approximately 270 million metric tons over the lifetime of the vehicles built for model years 2014 to 2018. [100]

We will take the following additional actions to address the challenges of reducing carbon emissions, improving energy efficiency, and reducing dependence on oil:

- Work with the International Civil Aviation Organization (ICAO) to advance international aircraft and engine emissions standards, and to recommend practices and guidance materials for solutions that are technologically feasible,

economically reasonable, provide measurable benefits, do not adversely affect safety, and take interdependencies between emissions and noise into account; [101]

- Promote maturation of technologies that lower aircraft energy consumption, emissions, and noise through the CLEEN program;
- Work with CAAFI stakeholders to advance the use of drop-in alternative jet fuels for aviation;[102]
- Improve operational solutions in aviation that include more precise and efficient flight paths, such as Optimum Profile Descents, as well as airport surface movement, and en route and terminal area traffic optimization for energy efficiency and reduction in aircraft noise and emissions;
- Conduct research and promote development and deployment of advanced vehicle-to-vehicle and vehicle-to-infrastructure communication technologies that can significantly increase the capacity of existing highways, move people and goods to their destinations more efficiently and effectively, and reduce fuel consumption and generation of greenhouse gases;
- Use efforts such as the Aviation Climate Change Research Initiative to increase understanding of the impacts from aircraft emissions, and expand international engagement on reducing aviation emissions by working with ICAO in coordination with the Department of State and the U.S. EPA; and
- In cooperation with other agencies, promote the deployment of advanced vehicle technologies, alternatives fuels and alternatives fuels infrastructure where feasible to reduce energy consumption and greenhouse gas emissions of transportation systems, including highway vehicles, transit systems ships and airport support vehicles.

STRATEGIES TO REDUCE TRANSPORTATION-RELATED AIR, WATER AND NOISE POLLUTION AND IMPACTS ON ECOSYSTEMS

Making transportation more sustainable requires reducing its impact on human health and ecosystems by reducing emissions of urban air pollutants, water and noise pollution, and waste from transportation sources. To accomplish these objectives, we will:

- Advance multi-jurisdictional and regional decision-making that enables States and local communities to take a broader view of how their transportation systems integrate into longer haul freight movements so that, potentially, they could collaboratively and more effectively use rail or maritime options in partnership with the private sector;
- Work to ensure that transportation projects meet national environmental and economic objectives and that project decisions are made in a timely and collaborative manner. DOT will improve internal project delivery processes and identify opportunities for enhanced interagency harmonization, through continued DOT initiatives, implementing E.O. 13604 and other efforts. [103]

- Promote the smart use of ITS to decrease air pollution by maximizing the efficient movement of goods and people across the entire transportation network, using data to facilitate green transportation choices by transportation system users and operators;
- Promote effective use of winter maintenance materials, such as salt and sand, to minimize environmental impacts while achieving safe and efficient levels of service through the implementation of ITS solutions, technical assistance, and capacity building programs;
- Ensure through inspections that hazardous liquid pipeline systems and operators are following the sound integrity management practices described in new rules, advance the safety of pipeline control room operations, and lead the national program for pipeline damage prevention;
- Conduct the ship recycling program for obsolete, Federally-owned, merchant-type vessels in an environmentally responsible manner that further reduces the risk of environmental contamination;
- Modernize the U.S. air transportation system through NextGen by setting investment and infrastructure priorities to support NextGen energy and environmental goals that will result in cleaner and quieter movement of aircraft in the air and on the ground; and
- Work with industry stakeholders and the U.S. Army Corps of Engineers to maintain the capability of the inland lock and waterway system.

IMPROVING PERFORMANCE OF FEDERAL PERMITTING AND REVIEW OF TRANSPORTATION PROJECTS

In 2012, President Obama signed E.O. 13604, which is intended to "significantly reduce the aggregate time required to make decisions in the permitting and review of infrastructure projects by the Federal government, while improving environmental and community outcomes." This order expanded upon an earlier Presidential Memorandum signed in March 2011 directing federal agencies to speed up project delivery. Six of the 14 infrastructure projects selected as a high-priority for job creation were transportation projects. Following the selection of these projects, we identified 12 additional projects of national or regional significance. Progress reports and current schedules for each of these projects are tracked on the Federal Infrastructure Permitting Dashboard. As a member of the steering committee on Federal Infrastructure Permitting and Review, we work closely with other Federal agencies to implement process improvements that result in fast delivery and better outcomes.

STRATEGIES TO INCREASE THE USE OF ENVIRONMENTALLY SUSTAINABLE PRACTICES IN THE TRANSPORTATION SECTOR

Our goal is to make the design of U.S. transportation systems more sustainable and ensure their operation is more efficient, which will in turn reduce the negative environmental effects of transportation and also reduce the use of scarce resources. This goal is most effectively achieved by changing the way that our transportation systems are planned, designed, and operated. Specifically, we will:

- Encourage and support research toward more sustainable and durable transportation materials, construction, and infrastructure;
- Promote best practices that increase sustainability in transportation planning, construction, operation, and maintenance; and economic sustainability;
- Advocate the use of Environmental Management Systems as tools to increase the sustainability of airports, highways, navigation aids, ports, transit systems, and other transportation facilities;
- Encourage industry to develop and implement innovative technologies that are more sustainable, and apply lifecycle analysis to products and processes;
- Conduct exploratory advanced research that promotes a more environmentally friendly highway template that mitigates environmental impacts and reduces environmental pollution; [104] and
- Conduct maritime environment and compliance activities that address improving marine air emissions, energy efficiency and alternative energy usage, and conduct cooperative efforts to advance development of effective ballast water treatment systems and compliance monitoring methods.

DOT SUSTAINABILITY PERFORMANCE PLAN

We strive to be a leader in the use of environmentally sustainable practices in Departmental operations. We are working to:

- Reduce petroleum consumption and increase alternative fuel use in DOT vehicles;
- Increase awareness and usage of renewable energy;
- Increase the number of buildings that meet the High Performance Sustainable Building criteria;
- Support programs for reductions in GHG emissions and energy use;
- Decrease potable water use; and
- Meet or exceed green purchasing requirements.

Our annual Strategic Sustainability Performance Plan outlines these initiatives in more detail. This effort also contributes to a federal, cross-agency priority goal. More information about federal agency efforts to achieve sustainability is available at: http://sustainability.performance.gov/

STRATEGIES TO ENSURE INFRASTRUCTURE RESILIENCE

We define resilience as the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment. [105] Specifically, resilience as applied to infrastructure includes the following elements;

> DOT will work with Congress and stakeholders to provide $200 million to communities that include enhanced resilience to extreme weather and other impacts of climate change in their planning efforts, and that have proposed, or are ready to break ground on, infrastructure projects to improve resilience.
>
> FY'14 President's Budget to Congress, April 2013

- ❖ Reducing the likelihood of failure through such options as hardening and relocation, maintenance, and support for natural barriers and ecosystem services;
- ❖ Reducing the consequences of failure through redundancy; and
- ❖ Improving recovery time in the event of a system impairment.

Resiliency projects may include hardening of existing facilities; relocation of facilities or elements of facilities to less vulnerable locations; maintaining existing facilities more frequently; supporting natural resources that provide ecosystem services to protect infrastructure; adding redundancy or redundant elements to facilities or systems; providing alternative power, fuel supply, or communications to facilities or systems; and acquisition of spares, supplies, repair materials, long lead-time items, auxiliary power, and lighting systems aimed at rapid repair or recovery of damaged systems.

Resiliency policies and programs should be informed by continual improvement, prioritization of assets, redundancy, and risk analysis and reduction. To guide decision making, DOT will use the best available science as identified by the Federal Emergency Management Agency (FEMA), which includes advisory data such as Advisory Base Flood Elevations, preliminary and final Flood Insurance Rate Maps, and Flood Insurance Studies. If FEMA data is mutually determined by DOT and the recipient to be unavailable or insufficiently detailed, other Federal, State, or local data may be used as the best available information in accordance with E.O. 11988.[106]

To advance DOT policies on resilience, we will:

- ➢ Encourage DOT funding recipients to perform climate change vulnerability assessments for their transportation infrastructure and integrate the results into their decision-making, including in the areas of transportation planning, asset management, project design, emergency management, maintenance and operations;

- Provide technical assistance and best practices information to DOT funding recipients:
- Coordinate the implementation of the President's Council on Environmental Quality climate adaptation planning initiatives, and participate in the Global Change Research Program working groups; and
- Work through the DOT Center for Climate Change to better coordinate climate-related activities, research and products.

STRATEGIC OBJECTIVES, PERFORMANCE GOALS, AND INDICATORS

We will monitor our progress in achieving the Strategic Objectives for the Environmental Sustainability goal using the Performance Goals and Indicators in Table I.

Table I. Performance Goals, Indicators, and Lead by Environmental Sustainability Strategic Objective.

Performance Goal	Performance Indicator(s)	Lead Office
Strategic Objective: Reduce foreign oil-dependence and carbon emissions through research and deployment of new technologies including alternative fuels, and by promoting more energy-efficient modes of transportation (ES1).		
Improve NAS energy efficiency by at least 26 percent by FY 2018, relative to the FY 2001 baseline.	Aviation fuel burned per revenue-ton-mile.	FAA
Set light-duty vehicle fuel economy standards, and medium-and heavy-duty vehicle fuel efficiency standards for each model year, and monitor manufacturer compliance to fuel economy and fuel efficiency standards.	TBD	NHTSA
Avoid and mitigate transportation-related impacts to climate, ecosystems, and communities by helping partners make informed project planning decisions through an analysis of acceptable alternatives, balancing the need to obtain sound environmental outcomes with demands to accelerate project delivery (ES2).		
Reduce environmental contamination risk from prolonged storage of federally-owned, non-retention vessels at DOT facilities by meeting a 1.0 rate for ship disposal. For every incoming vessel destined for storage and disposal at a DOT facility, dispose of at least one	Number of ships disposed per number of incoming vessels.	MARAD

ship.[107]		
Lead FHWA implementation of MAP-21 and future reauthorization environmental provisions through FY 2018.	Submit three reports to Congress annually on MAP-21 Section 1306 regarding the status of environmental impact statement and environmental assessment processes.	FHWA
Reduce the number of people exposed to significant noise around U.S. airports to less than 300,000 people in FY2018.[108]	Number of people exposed to significant noise (i.e., Day-Night Average Sound Level of 65dB or greater) around U.S. airports	FAA
Strategic Objective: Promote infrastructure resilience and adaptation to extreme weather events and climate change through research, guidance, technical assistance, and direct federal investment (ES3).		
Encourage at least 63 State DOTs and MPOs to undertake an assessment of vulnerabilities or negative risks posed by climate change effects or extreme weather events on transportation infrastructure by FY 2018.[109]	Number of State DOTs and MPOs that have conducted vulnerability assessments of the highway system to climate change and/or extreme weather events.	FHWA
Advance energy and sustainability goals within DOT practices by FY 2018.	Yellow or better score for at least 85 percent of the DOT indicators on the public OMB Energy and Sustainability Scorecard	OST/ALL

EXTERNAL RISK FACTORS

There is still a great deal of political and policy debate about the best way to address the environmental challenges posed by our transportation system, especially its effects on climate change, and the potential costs of migrating transportation from fossil-based energy to other alternatives. On a 20 to 40 year horizon, it is possible to predict an orderly transition to a variety of fuels that include fuel cells and hybrid fuel cells, battery, electric, hydrogen, green diesels and gasoline.

However, fuel cells, batteries or hydrogen engines that can provide travel distances equal to a tank of fossil fuel are not yet available. Current passenger-vehicle battery technologies provide less than 100 miles on a single charge, far below most consumers' expectations of a

250-300 mile range. While growing in use, hybrid electric vehicles continue to represent a small fraction of all vehicle sales. Some vehicle manufacturers are introducing all electric vehicles that have zero GHG emissions at the tailpipe, but consumer adoption will be slow until a nationwide infrastructure of charging stations is in place.

With the exception of 10 percent ethanol and five percent biodiesel, the requisite codes and standards are not in place that would allow the traveling public or commercial carriers to use alternative fuels. These codes and standards govern a wide variety of topics including safety, emergency response, and engine warranties.

Researchers are currently grappling with the technical challenges of adding alcohols and bio-oils to the petroleum infrastructure. High concentrations of these additives create corrosion and contamination issues that are solvable in the mid-term. There is a limited infrastructure for hydrogen fuels, which is primarily in California, and it will take decades to create a nationwide network. In addition, at present, only a limited number of natural gas pipelines can move hydrogen over long distances.

Natural gas production in the U.S. is forecast to increase by approximately 50 percent between 2011 and 2040; and almost all of this increase is due to projected growth in shale gas production, which is projected to more than double during this period.[110] Liquefied natural gas (LNG) holds some promise for long-haul trucking because it can be supported by a centralized refueling infrastructure. However, its use will depend on the costs of natural gas relative to oil.

The price of crude oil and other liquid fuels will continue to fluctuate significantly in response to price shocks that affect the global market. While U.S. oil production is increasing, fuel prices are still subject to fluctuations in response to changes in global supply and demand. Oil prices are forecast to remain stable between $90 and $100 per barrel through 2015-2016, but then increase slowly to about $180 per barrel in 2030. [111] Low or stable oil prices give consumers an impetus for additional spending including travel, but dampen prospects for wider acceptance of alternatives to petroleum. Higher oil prices over the longer term could cause the transportation industry and consumers to more readily accept alternatives.