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Hearing to Examine Aviation's Impact on Global Warming

House Select Committee on Energy Independence and Global Warming

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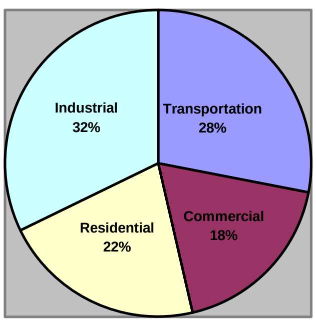
Thank you for the opportunity to testify today on the subject of aviation and its impact on global warming. My name is Deron Lovaas. I am co-director of the Transportation and Energy Project of the Air and Energy Program at the Natural Resources Defense Council (NRDC). NRDC is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has more than 1.2 million members and online activists nationwide, served from offices in New York, Washington, Los Angeles and San Francisco, Chicago and Beijing, China.

Launching the Apollo program to send man to the moon in the 1960s, President Kennedy made it clear that America should do it "not because [it is] easy, but because [it is] hard…because that challenge is one that we are willing to accept…" The nation now faces a similar challenge with climate change, and more specifically with aviation.

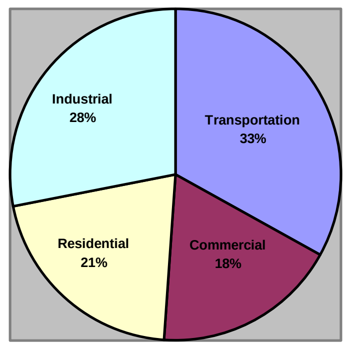
Aviation is central to the choice we face as a nation: Whether we will hew to a path that cuts heat-trapping pollution as well as oil dependence, or a path of less resistance but more carbon dioxide emissions and therefore dangerous climate change. Aviation, while dwarfed in pollution by its counterparts such as cars and trucks, plays an outsized role in the global warming challenge due to the dangerous allure of high-carbon substitute fuels and the difficulty of achieving leaps in efficiency via technology. Government can and must step up into a leadership role if aviation is to thrive in a carbon-constrained world, by taking the steps -- and others as necessary -- that will boost efficiency and develop cleaner alternatives as outlined at the end of my testimony.

Aviation plays an important role in the U.S. economy, and is also responsible as part of our nation's transportation sector for a growing percentage of our heat-trapping pollution. In fact, according to the Energy Information Administration, transportation will make up 28 percent of U.S. energy demand in 2008. Jet fuel will account for 11 percent of transportation energy demand and just three percent of total U.S. demand.[1] In the U.S. as of 2004 jet fuel accounted for roughly 12 percent of heat-trapping carbon dioxide (CO_2) emissions from the transportation sector.[2] The graphs below show the 2008 estimates of energy consumption and CO_2 from EIA:

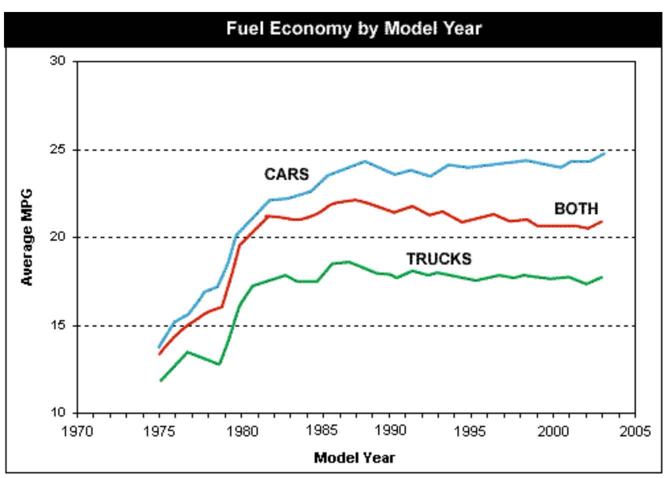
Energy Consumption by Sector



U.S. Carbon Dioxide Emissions by Sector



Reducing carbon emissions from transportation therefore requires a policy focus on our vehicle fleet. The policy which applies, the Corporate Average Fuel Economy program (CAFE), was enacted more than three decades ago to great effect.[3] However, as the graph below shows, light-duty vehicle fuel economy stalled after that initial boost due federal inaction coupled with growing incomes coupled and low petroleum prices. Stalemate in Congress on this important public policy and low oil prices yielded a trumping by other attributes (weight, size, power and accessories) of auto efficiency gains.[4] The net result was that fuel economy for the private vehicle fleet actually declined slightly over time as shown in the graph below.



Source: U.S. EPA, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2003*

Thanks to the wisdom of this Congress, which wrote the Energy Independence and Security Act of 2007, this trend line will look different as automakers adjust to a 40 percent increase in the fleetwide average by 2020.

By Contrast: A History of Efficiency Gains for Aviation

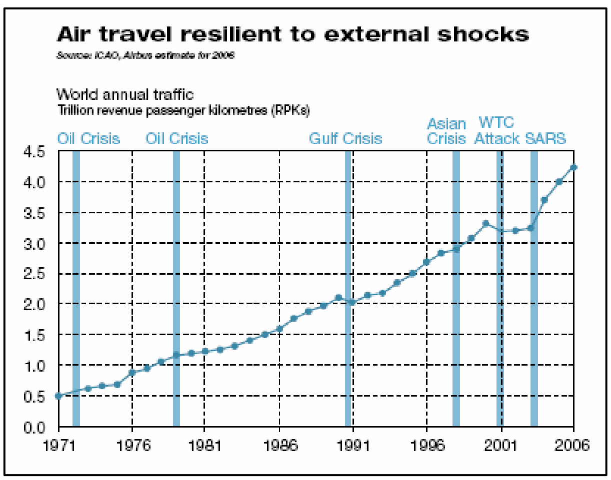
On the other hand, sensitivity to prices – fuel costs have always -- has pressured the industry to increase fuel economy of air travel.[5] Historically it has responded by boosting efficiency by 70% from 40 years ago and 20% from ten years ago, carrying more goods and passengers with less fuel used per mile of travel, in stark contrast with light-duty vehicles where that trend line has been flat since the late 1980s.[6]

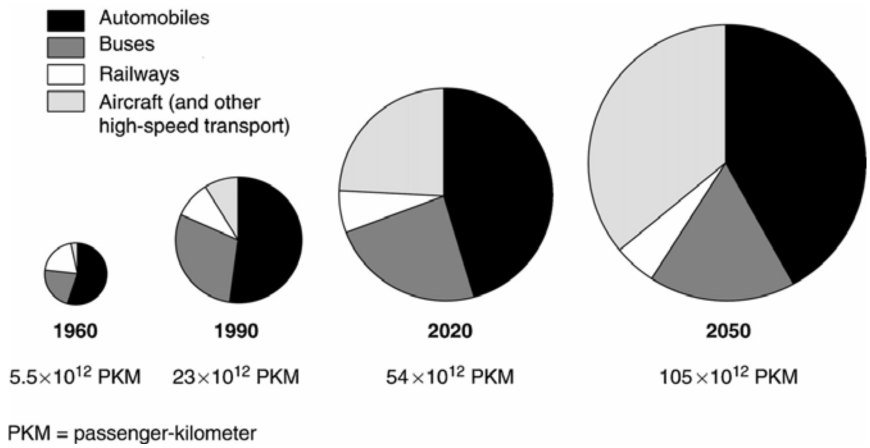
As summed up by the EPA in their new domestic greenhouse gas inventory:

CO2 from the domestic operation of commercial aircraft increased by 2.7 percent (3.7 Tg) from 1990 to 2006, well below the growth in travel activity (passenger miles traveled grew by 69 percent from 1990 to 2005, the most recent year of available data). The operational efficiency of commercial aircraft improved substantially because of a growing percentage of seats occupied per flight and steady improvements in the fuel efficiency of new aircraft. [7]

In the Greenhouse: Rising Travel Demand, Other Factors Outpace Efficiency Gains

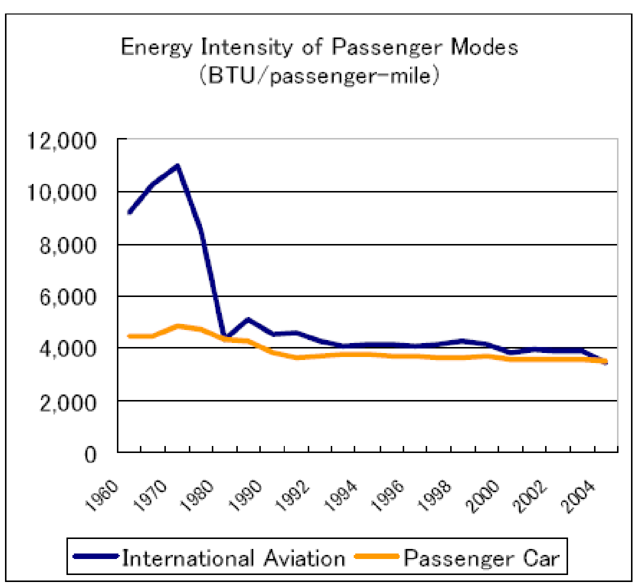
In spite of these trends, heat-trapping emissions continue to grow because aviation is one of the fastest growing sectors of the world economy. Historically, and looking forward, growth in air travel resembles other growth industries – especially compared to other transportation modes – as shown in the graphs below.[8]





A continuation of these trends means that efficiency gains will still be swamped by growth in travel, as projected by the IPCC which found that "projected annual improvements in aircraft fuel efficiency of the order of 1-2%, will be surpassed by annual traffic growth of around 5% each year, leading to an annual increase of CO2 emissions of 3-4% per year."[9] In short, although it is much smaller in absolute terms, greenhouse gas emissions from aviation are projected to increase more than 50 percent faster than surface transportation from now to 2030, growing about three percent per year in spite of efficiency improvements.[10]

And while the energy intensity of this mode of transportation was reduced substantially in the 1970s and early 1980s, that global trend has flatlined since as shown in the graph below from a recent report. [11]It should be noted that the trend line for U.S. airlines has continued its downward slope, but much more gently than the 1970s.[12] Plummeting energy intensity was in part driven by prices, which due to the oil crises of the 1970s, were as much as whopping 65 percent of U.S. airline operating costs and aircraft purchase prices.[13]Due to the remarkable activity in the oil markets in recent years, fuel costs are also high at present, making up 30-50 percent of operating costs.[14]If history is any guide, aided by policy as described below, this should press intensity of this important mode of transportation down further. Unfortunately, prices are a double-edged sword and are spurring interest in high-carbon substitutes as well (again pointing to the need for new policy).



Last but not least, altitude greatly enhances the climate-forcing properties of pollutants emitted from the combustion of jet fuel. In other words, the effect of pollutants generated during the burning of jet fuels at altitude is approximately double the effect on the ground.[15] Contrails – trails of water vapor and other chemicals in the wake of aircraft -- and oxides of nitrogen leading to ozone formation may contribute more than 60 percent of the total effect, according to the IPCC.[16] However, while altitudinal variations in CO2 effects are well-established, with respect to processes such as cirrus cloud formation, the effects of other pollutants in contrails on climate forcing are still being studied.[17]

<u>Wagging the Dog: Aviation Considers High-Carbon Substitutes</u>

Demand aside, compared to surface transportation aviation faces a daunting challenge as military and industry experts consider substitutes for liquid jet fuels derived from conventional oil sources.[18]Gasoline can be displaced by biofuels (specifically ethanol) and/or electricity (in plug-in hybrids), with both technologies providing hope for addressing the intertwined energy security and climate challenges posed by America's oil addiction.[19]

Substitutes for jet fuel, however, must perform under intense physical circumstances: At various altitudes, at various temperatures, and in aircraft engines. And all without unacceptable safety, range (ethanol, for example, has lower energy content and so reduces the range of a plane) and economic trade-offs. These stringent criteria have sparked interest in a hierarchy of three substitute types, as summed up in a recent paper from the International Civil Aviation Organization:

3.2 Of the current options, synthetic liquid fuels manufactured from coal, biomass or natural gas are viable, nearly identical replacements for kerosene, and in fact are in limited use today. The U.S. DoD is embarking on an aggressive program to promote synthetic fuels manufactured from domestic sources and conducted several successful tests with synthetic jet in the summer and fall of 2006. The DoD is working with manufacturers to procure significant quantities of jet fuel made from alternative sources. As military jet fuel is essentially identical to commercial jet fuel, the DoD efforts could stimulate alternative aviation fuel viability for the commercial sector.
3.3 Bio-jet – jet fuels made from agricultural oil crops – are deemed a midterm option but are handicapped by limited production capacity. Ethanol is not a good option for long haul aircraft but may be relevant to regional, short haul and general aviation. However, the interest of Virgin Airlines in renewable fuels may stimulate innovation and accelerate the introduction of these fuels.
3.4 Hydrogen is a very long-term option dependent on technological developments and potentially prohibitive infrastructure investment.[20]

The Department of Defense, specifically the Air Force, is in pursuit of synthetic liquid fuels, specifically derived from coal via the Fischer-Tropsch (FT) process.[21]Most recently, the Air Force actually certified the use of a 50-50 blend of jet fuel and synthetic kerosene for use in the B52H, and next up is the C-17.[22]By 2016, the Air Force's goal is to acquire at least half of its domestic-use fuel from domestic sources.[23]

To get there, the Air Force also proposes to build a coal-to-liquids facility at its Malmstrom base in Montana, an investment of substantial acreage and up to $5 billion.[24]This is likely to be one in a series, and Assistant Secretary William Anderson is clear on the intent: "With the Air Force paving the way, Anderson said the private sector would follow -- from commercial air fleets to long-haul trucking companies. 'Because of our size, we can move the market along,' he said…"[25]

This is a bold statement. While the military is the biggest single user of fuel in the United States, it still represents less than two percent of the total transportation fuel use, of which the Air Force is a subset.[26] As a report commissioned by the Department of Defense (DoD) itself found, "DoD is not a sufficiently large customer to drive the domestic market for demand and consumption of fossil fuel alternatives, or to drive fuel and transportation technology developments, in general."[27]

The aviation industry's interest in other fuels may not be as aggressive (or blunt) as the Air Force's quest for liquid coal, but it is part and parcel of the trend nonetheless. Currently, jet fuel makes up approximately 10-15% of the refined product from Canada's tar sands derived oil, and the vast majority of this is used by commercial aircraft.[28] The Midwest and Rockies regions are major ones for refining of tar sands and NRDC is aware of specific refineries producing jet fuel. There are direct links between refineries refining tar sands- derived oil and major U.S. airports, from the Conoco Philips Wood River refinery in IL to O'Hare International Airport and to the Lambert-St. Louis International Airport, and from the Suncor Commerce City refinery complex in CO to Denver International Airport.[29] The Flint Hills Resources' Pine Bend refinery in MN is also a major supplier of tar sands-derived jet fuel to the Minneapolis-St. Paul International Airport.

Both United Airlines and American Airlines are on record supporting the expansion of the pipeline system bringing tar sands-derived oil to the Chicago region.[30] While liquid coal has yet to be commercially developed in the U.S., Jet Blue is on record supporting its development.[31]

<u>The Costs and Consequences of Unconventional Fuel Production</u>

Liquid coal is an unsound fiscal and national security strategy because it is fundamentally at odds with other national priorities. According to the Department of Energy, liquid coal produces double the global warming emissions compared to conventional gasoline. Even if the CO2 released by liquid coal plants is captured and stored, the emissions would still be higher than the emissions from today's crude oil system. The coal industry is seeking federal dollars to support the launch of a liquid coal industry in the country and this would clearly move us in the wrong direction. The United States has made considerable progress moving towards a national climate policy. Prior uncertainties about global warming have been resolved for some time now. There is clear public urgency on the issue. If we are to address climate change in a material way, there are some technologies which are simply incompatible and it makes little sense to invest in them now.

In addition to financial risks, liquid coal plants have a wide range of environmental disadvantages. Conventional air emissions from coal-to-liquids plants include sulfur oxides, nitrogen oxides, particulate matter, mercury and other hazardous metals and organics. While it appears that technologies exist to achieve high levels of control for all or most of these pollutants, the operating experience of coal-to-liquids plants in South Africa demonstrates that coal-to-liquids plants are not inherently "clean." If such plants are to operate with minimum emissions of conventional pollutants, performance standards will need to be written—standards that do not exist today in the U.S. as far as we are aware. In addition, the various federal emission cap programs now in force would apply to few, if any, coal-to-liquids plants.[32]

Coal mining - and particularly surface or strip mining - poses one of the most significant threats to terrestrial habitats in the United States. The Appalachian region[33], for example, which produces over 35% of our nation's coal[34], is one of the most biologically diverse forested regions in the country. But during surface mining activities, trees are clearcut and habitat is fragmented, destroying natural areas that were home to hundreds of unique species of plants and animals. Even where forests are left standing, fragmentation is of significant concern because a decrease in patch size is correlated with a decrease in biodiversity as the ratio of interior habitat to edge habitat decreases. This is of particular concern to certain bird species that require large tracts of interior forest habitat, such as the black-and-white warbler and black-throated blue warbler.

The destruction of forested habitat not only degrades the quality of the natural environment, it also destroys the aesthetic values of the Appalachian region that make it such a popular tourist destination. An estimated one million acres of West Virginia mountains were subject to strip mining and mountaintop removal mining between 1939 and 2005.[35] Many of these mines have yet to be reclaimed so that where there were once forested mountains, there now stand bare mounds of sand and gravel.

The terrestrial impacts of coal mining in the Appalachian region are considerable, but for sheer size they cannot compare to the impacts in the western United States.[36] As of September 30, 2004, 470,000 acres were under federal coal leases or other authorizations to mine.[37] Unlike the East, much of the West– including much of the region's principal coal areas –is arid and predominantly unforested. In the West, as in the East, surface mining activities cause severe environmental damage as huge machines strip, rip apart and scrape aside vegetation, soils, wildlife habitat and drastically reshape existing land forms and the affected area's ecology to reach the subsurface coal. Strip mining results in industrialization of once quiet open space along with displacement of wildlife, increased soil erosion, loss of recreational opportunities, degradation of wilderness values, and destruction of scenic beauty.[38] Reclamation can be problematic both because of climate and soil quality. As in the East, reclamation of surface mined areas does not necessarily restore pre-mining wildlife habitat and may require scarce water resources be used for irrigation.[39] Forty-six western national parks are located within ten miles of an identified coal basin, and these parks could be significantly affected by future surface mining in the region.[40]

To develop another high-polluting alternative to conventional oil, industry is transforming millions of acres of Boreal forests and wetlands in Alberta, Canada to produce transportation fuel. The rush to mine and drill the tar sands is increasing greenhouse gas emissions – producing three times the CO2 per barrel as producing conventional oil -- and turning these pristine areas into a wasteland in order to supply the United States. The Boreal is a significant carbon storehouse and is the breeding ground for 30% of North America's songbirds and 40% of our waterfowl. Tar sands lying deep under the Boreal are composed of sand, silt, clay, water, and about 10-12% bitumen – a tarry substance that can be refined into synthetic crude oil. There are two ways to recover tar sands: open pit mining and drilling. The bitumen must then be upgraded before it can be refined into products such a gasoline, diesel, and jet fuel.

Last but not least, other high-carbon alternatives to conventional oil right here in the U.S. are attracting attention: Despite the huge risks and unknowns, the 109th Congress sought to rush the development of oil shale and tar sands on public lands in Colorado, Wyoming and Utah with the Energy Policy Act of 2005. Because of the arbitrary deadlines imposed by this law, the Bureau of Land Management has already issued a Draft Programmatic Environmental Impact Statement that would determine the fate of over 2 million acres of public land - even though there is not enough information to assess all of the environmental and community impacts that would result. We do, however, know that an enormous complex of coal-fired power plants would likely be needed to produce the energy required to develop these fuels. Producing one million barrels per day would require the energy equivalent of roughly ten giant power plants and five new coal mines. In addition to air pollutants, producing and using oil shale fuel would create far more greenhouse gas emissions than conventional fuel. It also threatens water supplies and would completely destroy sensitive wildlife habitat.

The Alternatives: Saving Oil Across the Transportation Sector, and Low-Carbon Substitutes

Aviation Technology and Operations

The first and most obvious alternative to high-carbon substitutes is to make the use of jet fuel even more efficient. In spite of slow fleet turnover – cradle-to-grave time from technology development to retirement of aircraft is 45-65 years compared to less than half that for light-duty vehicles – due to rapid growth in the sector there are opportunities to deploy more efficient technology.[41]

For example, in its 2007 Current Market Outlook, Boeing predicts that by 2026 more than 80% of the world airplane fleet will be new and will be 'better for the environment, better for the passengers, better for airlines.' In total, the report notes that meeting increased demand for international air transport will require 28,600 new airplanes at a cost of $2.8 trillion, and that only 20% of today's fleet will remain in use by the year 2026. However, without a unified vision for achieving this goal, it seems unlikely that the majority of these planes will achieve the highest goals of sustainability and efficiency.

To achieve lower costs, airlines will use more fuel-efficient airplanes and implement more efficient operating procedures. As they do so, emissions will be lowered and noise levels decreased. The relationship between airline cost cutting and the environment provides benefits for both.[42]

Most technological improvements have been achieved by reducing weight and improving engine technology. Options for further reducing energy use in aviation include laminar flow technology, carbon fiber reinforced plastic, and blended wing bodies, all of which reduce air drag, and further engine improvements and weight reductions.[43] The blended wing body is an advanced aircraft body design that combines efficient high-lift wings with a wide airfoil-shaped body. This design enables the aircraft body to contribute to lift, thereby improving fuel economy. In the United States, winglets were installed on 737s and 757s to help reduce drag and increase range, an effort which has achieved estimated savings between 100,000 and 140,000 gallons annually per aircraft.[44]

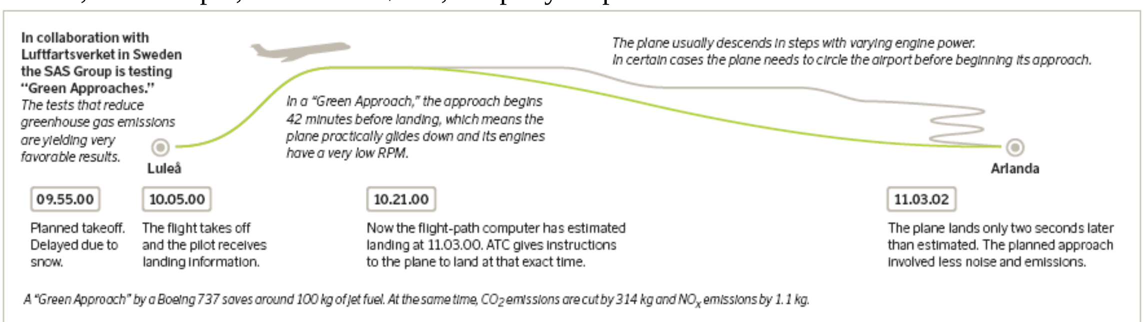
New engine designs offer promise as well. General Electric, for example, has recently announced the GEnx engine which promises a delivery of 15% better fuel consumption and designed to 'stay on wing 30% longer, while using 30% fewer parts.'[45] Pratt & Whitney have been developing geared turbofan technology for nearly 20 years, most recently they have release the two-spool Geared Turbofan to for the Mitsubishi Regional Jet which will enter commercial service in 2013.[46] In 2007, Rolls-Royce was selected by the US Air Force to produce a next-generation engine for military aircraft – the goal of which is to dramatically improve fuel efficiency and performance.[47]

More exciting still are new aircraft designs such as the new Boeing 787 Dreamliner, slated to use 20 percent less fuel. And Easyjet has proposed new planes that could cut carbon emissions by 50% and nitrogen by 75% per revenue passenger kilometers.[48] This next generation aviation model would use lower speeds, weight-reducing materials, and improved fuel efficiency.

Beyond technology, improved Air Traffic Control (ATC) can yield energy and CO2 savings. As Air Transport Association (ATA) CEO Jim May rightly pointed out in Congressional testimony last year: "Studies consistently have shown that modernization of the ATC system will improve fuel efficiency and reduce GHG emissions by 10 to 15 percent."[49] The most important change vis-a-vis aviation efficiency is the shift from a radar system to a satellite system. This transition would require substantive changes at all airports and control facilities in addition to all existing aircraft being fitted with GPS transmitting equipment.[50]

Referred to as ATM_cns (communications, navigation, and surveillance), as May states the potential aviation emissions reductions have been quantified in a variety of research studies. The International Air Transport Association IATA study Operational Measures to Improve Aircraft Fuel Efficiency and Reduce Emissions demonstrates that the accelerated introduction of ATM_cns could achieve a 9% improvement in global fuel efficiency by 2010. The IPCC has calculated that enhancements in air traffic management have the potential to reduce fuel burn by 6-12%, while 'operational improvements' can bring an additional 2-6% fuel saving.[51]

Improving air traffic management technology, infrastructure, and coordination will enable broader and faster adoption of fuel saving operational changes, including more efficient flight routes, continuous descent approach (illustrated below), and better coordinated overall flight patterns. Fuel savings from these efficiencies would also save serious money. Continuous descent, for example, could save $100,000 per year per aircraft.[52]



Source: SAS "Green Approach" Project as described in *Issues Concerning the Reduction of Carbon Dioxide in International Aviation*, Japan International Transport Institute, August 2007.

Low-Carbon Alternatives

In spite of the technical and cost hurdles, the nation should look past liquid coal for substitutes – if necessary, given that greater saving in much larger parts of the transportation sector could yield much bigger oil savings – that are lower in carbon intensity than jet fuel derived from conventional oil.

Biomass to liquids is a preferred option from an emissions standpoint, and it uses the same FT process used to liquefy coal. An additional candidate for alternative aviation fuel is biobutanol, a low-carbon fuel that might meet the needs of the aviation industry as it has higher energy content than ethanol. It is a high performance fuel produced from agricultural feedstock rather than petroleum, the feedstock can include sugar beet, corn, wheat, straw and corn stalks. Since 2003, DuPont and BP have been working together to develop advanced biofuels, biobutanol is the focus of these efforts.

Feedstock such as soybean may require significant area for growth, some estimates citing an area the size of Florida, to provide 15% of jet fuel. Another feedstock is algae, which is both a net absorber of carbon dioxide, and a huge source of energy-rich oil that can be turned into fuel. Aviation experts note that the world's fleet could be run on biomass to liquids using algae as a feedstock with a biojet fuel bioreactor the size of Maryland.[53] Commercial tests and estimates predict that this fuel switch option will not be available for at least a decade. To stimulate this next-generation biofuel, Chevron Corporation and the U.S. Department of Energy's National Renewable Energy Laboratory announced on October 31, 2007, a joint collaborative research and development agreement to study and advance technology to produce jet fuels using algae.[54]

The private sector is pushing the envelope on low-carbon possibilities. Last fall, for example, a 1968 Czechoslovakian jet dubbed "Biojet 1" flew for 37 minutes at altitudes up to 17,000 feet over Nevada on B100 – 100 percent biodiesel derived from canola oil, provided by a private company.[55]Since fighter jet technology differs from commercial craft, more applicable innovations are being tested by a partnership between Boeing, GE Aviation, and two airlines: Virgin Atlantic and Continental.[56]Virgin Atlantic already successfully tested the use of a blend of jet fuel and biofuel in a flight from London to Amsterdam, and Continental plans a similar experiment in early 2009.[57]

While it's becoming clear that "low-carbon" is a relative term for biofuels, depending on how they're processed, the feedstock, as well as direct and indirect land use effects of increased cultivation, these liquid substitutes can still play an important role in meeting transportation fuel demand, including from aviation.[58]

Planes to Trains: A Modal Shift for Short-Haul Goods and People Movement

Although not yet an option for passengers in the U.S., intercity rail transit should be a part of any strategy to reduce carbon heat-trapping emissions from aviation. The International Energy Agency included an alternative to oil and transport in its 2006 World Alternate Policy Scenario by identifying 1400 energy saving policies to reduce energy and greenhouse gas emissions. A projected cut in oil consumption by aviation of seven percent would be achieved in part via a gradual modal shift from aviation to high-speed rail where economically competitive and feasible, initially in Europe.[59] A full high-speed electric train emits anywhere between a tenth and a quarter of aircraft greenhouse gases.[60] International travelers on a return flight between London Heathrow and Paris Charles de Gaulle generate 122 kilograms of CO2, in contrast with 11 kilograms for the same journey by train.[61] And China is certainly investing in rail capacity, introducing a high-speed train service in April 2007 and by the end of the year is expected to increase operations from 140 trains to 257 trains.[62]

Domestically, should the U.S. also decide to enhance rail capacity, recent trends show there is growing potential shift of short-haul air traffic to surface transportation modes, as summed up by Reconnecting America and the Center for Neighborhood Technology in a recent analysis:

Short-haul flights -- those under 500 miles, and particularly those less than 300 miles -- have declined as a percentage of all flights, from 61 to 57 percent. The number of markets served in this category has dropped from 58 to 54 percent. This drop is in part the focus of "Legacy" airlines focusing their recovery [from the recent industry downturn particularly after 9/11] on the longer distance and international flights. Over 20 percent of returned air traffic is for flights less than 200 miles in length, short routes that can be effectively served by bus and rail service.[63]

The Dog Wags the Tail: Saving Oil in Other Sectors

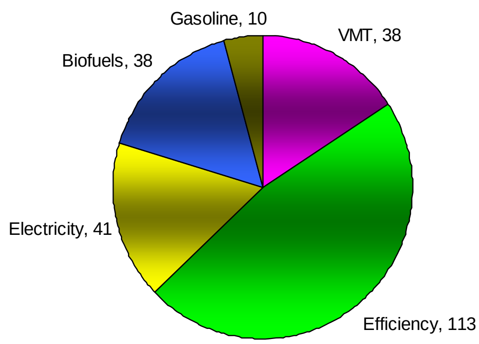
Thankfully, in the Energy Independence and Security Act of 2007, Congress enacted several policies that will have a much bigger effect on our oil consumption. Specifically, the bill includes the first major increase in light-duty vehicle fuel economy standards since the 1970s, a big boost to the renewable fuel standard including more and more reliance on ethanol derived more sustainably from the cellulose of plant matter, and a requirement that the Department of Transportation establish heavy truck fuel economy standards for the first time. NRDC projects that these new policies will save almost four million barrels of oil a day by 2030.

These new policies are a good start, and Congress should go further. The International Energy Agency pointed this out in respect to light-duty vehicle fuel economy in a recent assessment of U.S. policy:

The IEA commends the decision by the US government and Congress to pass the Energy Bill in December 2007, and with it the significant increase in CAFE (the corporate average fuel economy) standards. But it comes after almost two decades of inaction on this front, and the final standards will not be achieved before 2020. Given the technologies being implemented in vehicles today, it is doubtful whether such a long time-frame is really necessary to allow carmakers to adapt and it will leave consumers with vehicles that fall short of the technological possibilities.[64]

The potential to reduce demand for oil is greater in surface transportation, by demand-side reductions achieved via higher vehicle efficiency and reduced car traffic (shifting to alternatives such as rail transit) as well as substitutes such as biofuels and electricity (i.e., plug-in hybrid electric vehicles). In fact, NRDC projects that if we addressed this challenge aggressively we could virtually eliminate gasoline use by 2050 as shown in the scenario below.

Displacing 240 Billion Gallons of Gasoline Demand in 2050



The relevance to aviation, if not obvious, is this: The more oil we save elsewhere in the sector by eliminating gasoline use in the ground transportation sector, the lower the necessity to develop substitutes for aviation. This obviates the need for high-carbon substitutes such as liquid coal.

<u>Putting New Policy in Place</u>

Achieving a low-carbon transportation future will require serious, new public policy and investment. The aviation sector faces huge challenges such as high fuel prices, intense competition and increased scrutiny for its environmental performance. With this backdrop, there are four policy areas where Congress can act.

First and foremost, aviation must be part of policymaking to reduce global warming pollution. I will point to two recent developments of interest to this Committee:

1) First do no harm: Section 526 of the 2007 Energy Bill (Public Law 110-140, the Energy Independence and Security Act) is a federal procurement law that provides a much needed backstop to ensure the federal government does not use its purchasing power to buy fuels that produce more global warming pollution than conventional gasoline. Now Representatives Hensarling and Conaway have introduced a bill to repeal this law and are circulating a Dear Colleague about it. This provision is of vital importance and ensures that American tax dollars are not used to incentivize fuels that make global warming worse.

2) NRDC has joined the states of California, Connecticut, New Jersey, New Mexico and Pennsylvania, the District of Columbia, as well as fellow organizations Earthjustice, the Center for Biological Diversity, Friends of the Earth and Oceana in petitioning the EPA to regulate emissions of heat-trapping pollution pursuant to the authority in Section 231(a)(2)(A):

The Administrator shall, from time to time, issue proposed emissions standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.

EPA has regulated emissions from aircraft in the past, but not those that contribute to global warming.[65]Now is the time for that to change.

3) In historic committee action on December 5, the Lieberman-Warner Climate Security Act (S. 2191) was approved 11-8 by the United States Senate Environment and Public Works Committee. Although there are additional improvements to the bill that should be made, the Lieberman-Warner bill as passed by the Committee is a very strong start. The bill includes another historic first: A Low Carbon Fuels Standard (LCFS) LCFS is a performance-based, greenhouse gas (GHG) pollution standard (grams of CO_2-eq per BTU sold) on the mix of transportation fuels sold in the U.S. As a technology-neutral and performance-based standard, it provides industry tremendous flexibility to innovate in order to find the most effective, lowest cost solutions.

We urge the House to take similar action on a mandatory carbon cap and fuel performance standard soon. Those two provisions would ensure that aviation, and the nation, hew to a low-carbon trajectory as we tackle our oil addiction. In fact, in testimony before the House Science and Technology Committee, Joseph Romm observes that in its assessment of the McCain-Lieberman Climate Stewardship and Innovation Act, EIA predicts allowance prices of $22.20 per ton of CO2 in 2020 and $47.90 per ton in 2030. Under these moderate prices, none of 15 CTL plants built in the EIA reference case come online. In the reference case, CTL plants consumer 109 million tons of coal in 2030. The market signals sent by any climate policy will undercut the financial viability of liquid coal development.

In addition to these important carbon-constraining policies, Congress should help reduce fuel use and therefore pollution by eliminating inefficiencies in air traffic control and developing breakthroughs in aircraft technology. Specifically, Congress can take two big steps:

1) NRDC agrees with Jim May of the Air Transport Association that “Congress should ensure

that our outdated, inefficient air traffic control [ATC] system is modernized... inefficiencies in the current ATC system are responsible for at least 10 to 15 percent of the GHGs from commercial aviation."[66]The solution, as the Energy Security Leadership Council called for in its 2006 recommendations for reducing oil dependence, is for Congress to require the FAA to improve commercial air traffic routing.[67]

2) NRDC also agrees with ATA on the need to "reinvigorate NASA and FAA environmental aeronautics research and development (R&D) programs."[68]Breakthroughs in technology in this sector are hard to come by, as evidenced by the fact that big improvements in energy efficiency were achieved pre-1970, and until Boeing announced the design of the new 787 use of composites in aircraft structures was nonexistent; they have been 90 percent metallic by weight for 35 years.[69]

The bottom line is that federal policymakers must take bold action which will inspire innovation in the public and private sectors alike. This will in turn spark investment in technologies like those being demonstrated by pioneers including Virgin Atlantic and Boeing. Government can and should help bridge the gap that lies between aviation and a cleaner future, by making an unwavering commitment to pollution reductions and public investment in cutting-edge technological breakthroughs.

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[13] Lee, Joosung J., et al.
[14] According to the Air Transport Association,
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[16] Penner, Joyce E., et al.
[17] For example, see Williams and Noland's Comparing the CO2 emissions and contrail formation from short and long haul air traffic routes from London Heathrow, Transportation Research Board 2006.
[18] Unconventional oil is defined by the Encyclopedia of Energy (Cleveland, Cutler J. and Christopher Morris, Elsevier Press 2006) as "oil that cannot be economically extracted by traditional methods such as well drilling; e.g., oil obtained from tar sands or oil shale, or from the conversion of natural gas to liquids or from biofuels."
[19] For more information see http://beyondoil.nrdc.org

[20] "The Potential Use of Alternative Fuels for Aviation," Information Paper from the International Civil Aviation Organization 1/24/07.

[21] As defined by the Encyclopedia of Energy, it is a "process used to convert natural gas or coal to liquid fuels that can be used in conventional vehicles. These processes primarily produce fuel suitable for use in compression ignition (diesel) engines. Such a process can used to convert biomass into fuel or to utilize associated gas at oil fields."

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[28] Based on EIA data, only a small proportion of jet fuel produced in Illinois is for military use. For example, in June 2007 the jet fuel production in Illinois, Indiana and Kentucky was 4, 037 barrels. Of this, 98.5 percent was produced for military use.

[29] Suncor supplies about a third of Colorado's gasoline and diesel fuel, and is a major supplier of jet fuel to the Denver International Airport, Suncor Energy, Inc., *About Suncor U.S.A. A Summary of Suncor Energy (U.S.A.), Inc.'s operations and strategies*, February 2006.

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