Riding the Green Wave: Green Transportation

WINSLOW
MANAGEMENT COMPANY

April 2008

Hop in the car, turn the key and hit the gas. In the rearview mirror, see the exhaust plume belch from the tailpipe – an obvious cause and effect. For many people, driving – and transportation, broadly – may be the activity with the most visible and easily understood environmental consequences. That white vapor trailing from an automobile, bus, train or plane engine consists mostly of carbon dioxide (CO2), the most prevalent greenhouse gas (GHG) in the Earth's atmosphere. The exhaust also contains smaller quantities of other GHGs such as nitrogen oxide and methane. Air conditioned vehicles may leak hydrofluorocarbons (HFCs), the potent GHGs which have replaced ozone-depleting chlorofluorocarbons (CFCs) in A/C units.

Climate change isn't the only negative environmental outcome of transportation, of course. Precursors to ground level ozone – also known as smog, a leading cause of asthma – are created during fossil fuel combustion and is a leading cause of asthma; small particulate matter is emitted from diesel engines and is another contributor to asthma; and sulfur oxide (SOx) emissions, which contribute to acid rain, are created from fuel combustion. Less visible environmental impacts are no less important, such as the effects that road building and expansion have on local wildlife and biodiversity, as cities expand into formerly rural areas and infrastructure is built to carry commuters increasing distances.

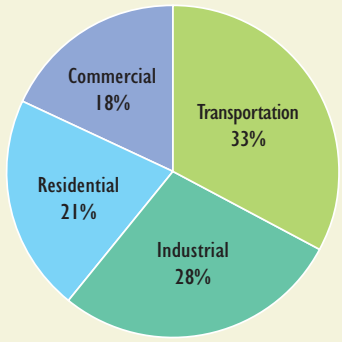
Viewing the environmental implications of transportation from a climate standpoint is useful for a few reasons. While there is often a technological tradeoff between improving efficiency and reducing emissions from cars, reducing transportation's climate impact can reduce many other impacts as well. Conversely, climate change will generally exacerbate many problems, particularly at the local level. We believe public awareness of climate change has increased to the point where people and politicians in the U.S. are finally ready to do something about it. Transportation is such a large contributor to the U.S.'s climate burden that if society is to combat climate change caused by GHG emissions -- by reducing GHG emissions to a level below that of 1990 as stipulated in the Kyoto Protocol, for example -- it will need to tackle transportation emissions as one of the first steps. Specifically, it will need to make significant changes in the way that people and goods are moved around. Some of these changes will be relatively easy; some will require new technology. Some will be obvious; some will be extremely difficult and complex. As the

transportation system changes, interesting opportunities for green investors will arise. This white paper explores the climate-changing impacts of transportation, and some alternatives and innovations that could help reduce those impacts.

Scope of the Problem

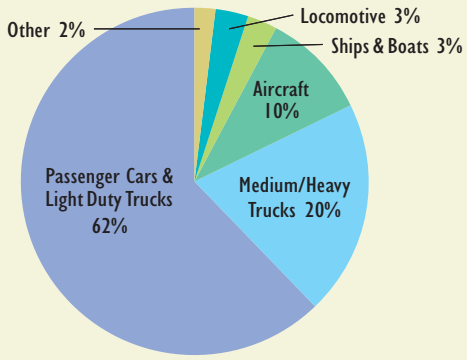
How important is transportation to climate change? In 2005, transportation was the biggest climate culprit in the U.S., in terms of CO2 emissions from fossil fuel combustion. According to the U.S. Environmental Agency's (EPA) 2007 *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005*, the sector was responsible for 33 percent of CO2 emissions in 2005, as shown in Figure 1. Between 1990 and 2005, transportation CO2 emissions grew more rapidly than overall emissions, increasing by 29% versus 22% growth in overall emissions.

FIGURE 1
CO2 Emissions by Economic Sector, 2005



Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005

FIGURE 2
Transportation GHG Emissions



Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005

Figure 2 shows the breakdown of GHGs within the transportation sector. Including emissions of all GHGs in terms of CO2 equivalents (CO2e's) based on their global warming impact, the EPA *Inventory* demonstrates that passenger cars and light-duty trucks are by far the worst environmental offenders. While emissions of other GHGs are not insignificant, the magnitude of CO2 emissions was nearly 20 times the combined CO2 equivalents for the other GHGs emitted from transportation sources in 2005.

Passenger Cars and Trucks

Figure 2 reveals that light-duty vehicles, including passenger cars and light-duty trucks (SUVs, pickup trucks and vans running on gasoline or diesel), contributed a combined 62 percent of transportation GHG emissions in 2005, split fairly equally between cars (53 percent of the group's emissions) and trucks (47 percent). Between 1990 and 2005, two main factors contributed to a 25 percent increase in GHG emissions from these vehicles.

1) How much we are driving. According to a March 2006 EPA study, Greenhouse Gas Emissions from the U.S. Transportation Sector, 1990-2003, vehicle miles travelled (VMT) by light-duty vehicles during that period increased 34 percent, more than twice as fast as population growth. Where are all the drivers going? Frequently to work; according to the Census Bureau, 76 percent of all workers in the U.S. drove to work alone in 2006, and the average commute time was 25 minutes, an increase of 14 percent since the 1990 census.

2) What we are driving. Even in the first two months of 2008, with gas prices climbing, more than 50 percent of all new vehicles sold were less efficient light-duty trucks, which were originally excluded from fuel efficiency rules because they were not used as passenger vehicles. The continued popularity of light-duty trucks on the road has had a significant impact on the emissions profile of American passenger vehicles. The average fuel economy of new light-duty vehicles peaked in 1987-1988 at 22.1 miles per gallon (mpg), and has been declining ever since; EPA projected a light vehicle average of 20.2 mpg for 2007. While there have been technological innovations, EPA's Transportation GHG Emissions Report notes that "Changes in light-duty vehicle technologies have not significantly impacted CO2 emissions. For the most part, these technologies have been used to improve vehicle power, safety and driving performance, rather than to increase vehicle fuel economy."

Medium/Heavy Trucks

As shown in Figure 2, the second largest source of transportation GHGs is from heavy duty vehicles, predominantly trucks used in freight transport. According to the *Inventory*, CO2 emissions from freight trucks increased by 69 percent between 1990 and 2005, the largest increase for any major transportation mode. Why? EPA reports that "fuel economy for the freight truck fleet was relatively constant over this period, while miles traveled increased by 51 percent."

This increase in truck travel appears to be the result of a shift away from other shipping methods. EPA's Transportation GHG Emissions Report notes that, "Collectively, freight sources emitted 13 percent more GHGs per ton-mile in 2003 than in 1990," while "trucks' share of freight ton-miles increased from 26 percent in 1993 to 32 percent in 2002."

Aircraft

Between 1990 and 2005, overall aircraft CO2 emissions increased approximately 3.4 percent. However, the climate impact of domestic air travel may actually have improved. As described by EPA's 2006 *Inventory*, "while CO2 emissions from commercial aircraft grew approximately 14.8 percent, passenger miles traveled increased by 69 percent," reflecting "improvements in the fuel efficiency of planes and an increasing percentage of occupied seats per plane."

On the freight side, however, the news is less positive: the Transportation GHG Emissions Report also points out that while still a small percentage of total freight

ton-miles travelled, air the fastest growing mode of freight transport. What's more, "based on the energy used per ton-mile, aviation is the most energy intensive mode of freight haulage."

Ships and Boats

Representing three percent of total transport CO2 emitted in 2005, ship and boat emissions increased 17 percent between 1990 and 2003. Significantly, this increase coincided with a decrease in share of domestic water shipments of 27.3 percent, according to the Transportation GHG Emissions Report. Indeed, as a share of total domestic freight, ship and boat haulage declined from 24 percent of ton-miles in 1993 to 16 percent in 2002.

Rail

Locomotives were responsible for approximately three percent of CO2 emissions in 2005, as shown in Figure 2. According to the *Transportation GHG Emissions Report*, approximately 89 percent of rail GHGs in 2002 were produced by freight transport, with the rest from passenger travel via commuter rail or regional trains. Between 1990 and 2003, rail emissions increased 18 percent. But like air transportation, the net environmental consequences declined. During the time period, freight ton-miles increased by 50 percent and the number of vehicle miles of rail transit operations increased by 21.6 percent. The Report notes that "rail [freight] fuel economy has improved steadily from 1990 to 2003…which can be attributed to a number of factors, including the introduction of more efficient locomotives and lighter weight railcars." Similarly, "passenger-miles traveled on urban transit and commuter rails increased at an even higher rate than vehicle miles and fuel consumption."

Solutions

There are two very fundamental solutions to the problem of excessive GHG emissions from the transportation sector: less transportation and more efficient transportation.

Reducing Transportation

Reducing the amount of demand for both personal and cargo transportation may seem draconian and unrealistic. However, there is much that can be done to decrease both. There are already numerous alternatives available, and many more will be possible with technological and other innovations. Reducing transportation emissions is part of the drive for increasing amounts of teleconferences and telecommuting. It is one of the benefits of locally grown food touted by environmentalists. It is the reason why locally produced building materials earn points toward certification under the U.S. Green Building Council's LEED certification program.

One significant tool to decrease transportation-related GHG emissions is through improved urban design and policies. According to a September 2007 study by the Urban Land Initiative, incorporating the concept of "smart growth" – meaning the creation of more compact communities rather than increasingly sprawling suburbs

and farther-out exurbs – into new community development could "reduce total transportation-related CO2 emissions from current trends by 7-10 percent as of 2050. Shifting 60 percent of new growth to compact patterns would save 85 million metric tons of CO2 annually by 2030. The savings over that period equate to a 28 percent increase in federal efficiency standards by 2020."

Increasing Efficiency of Transportation

As this white paper is being written in March 2008, the price of oil seems to hit new records every day and predictions for summer gasoline prices are creeping into ranges previously unimaginable. These prices are not expected to retreat any time soon. According to the Department of Energy's somewhat optimistic Short Term Energy Outlook for March 2008, published on a day when the cost of oil hit $108.75, the price of oil "is projected to average $94 per barrel in 2008, but ease somewhat to about $86 per barrel in 2009." Several days before this estimate, Goldman Sachs analysts raised their oil price projections, with an article from Marketwatch noting, "Goldman now sees average selling prices of $95 a barrel for 2008, $105 a barrel for 2009 and $110 a barrel for 2010. The high end of its range is now $135 a barrel -- but Goldman hinted that prices could be headed even higher."

While elevated fuel prices are creating financial hardship for many businesses and families, they are also creating momentum for more efficient usage of these fuels and therefore reduced transportation emissions. Responding to the rapidly increasing price of gasoline over the past few years, the government has twice updated the Corporate Average Fuel Economy (CAFE) standards, which set the minimum efficiency level for cars and, beginning with model year 2008, light-duty trucks. By model year 2011, the Department of Transportation will set a combined CAFE standard for passenger cars and light-duty trucks that will achieve 35 mpg by 2020, and continue to increase through 2030. In the meantime, consumers are reacting; while overall vehicle sales dropped by 2.5 percent in 2007, according to J.D. Power and Associates, sales of small cars increased four percent as sales of large vehicles declined five percent.

The opportunity for greener transportation extends beyond the broad adoption of smaller vehicles. With oil prices sustained at the high levels projected, a variety of high- and low-tech solutions can contribute to significant reductions in emissions of CO2 and other GHG from transportation.

Mode Switching

CO2 emissions from cars and light-duty passenger trucks dwarf those from other modes of personal transport because people travel far more miles in passenger vehicles than via other modes. According to the Department of Energy, Americans travelled six times as many miles in cars and light-duty trucks as they did in airplanes in 2004; 31 times as many as in urban, intercity or school buses; and 150 times as many as on trains. If the share of miles travelled in cars were reduced, would emissions be reduced as well, assuming total miles travelled remained constant? In

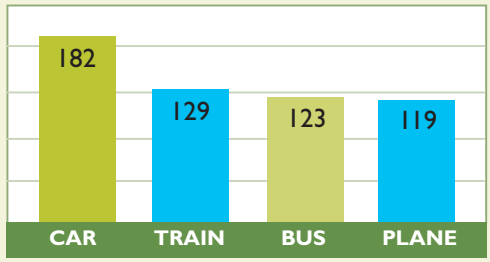
other words, what is the most climate-friendly way to travel?

Consider the often-travelled Boston-New York City route, for which cars, buses, planes and trains are feasible options. Figure 3 compares the GHG implications of each mode for a one-way trip, as calculated by carbon offset provider Terrapass using the World Resources Institute Greenhouse Gas Protocol, and not including transportation needed to get to an airport or bus or train station.

Several interesting conclusions can be drawn from Figure 3. First, it shows that any type of mass transportation is more efficient than driving a car that gets 20 miles per gallon over this medium-length distance. Second, adding a passenger to a car halves the emissions per person, while adding a passenger to a train, bus or plane has virtually no impact on each passenger's share of the emissions. However, the bus, train or plane is going to travel with or without any particular passenger, so any incremental emissions from driving, no matter how efficiently, will add to the total amount of GHGs emitted.

FIGURE 3

CO2 Emissions (lbs) from Boston to New York Cvity (186 miles)



Source: Terrapass estimates

Finally, Figure 3 suggests that for the relatively short flight between Boston and New York, flying is the most carbon efficient option. However, EPA's *Transportation GHG Emissions Report* points out that the total climate change impact of aircraft is not entirely understood, as planes' contrails may act as a GHG by "allowing most of the solar radiation to pass and by absorbing infrared radiation from the earth." Another unknown, according to Terrapass, is that the effect of GHGs emitted directly into the atmosphere, rather than at ground level, is still not well understood and currently being studied. These factors led Terrapass's Chief Environmental Officer Tom Arnold to conclude that for trips such as this, "When I have to travel, and have a choice, I take the train."

Variation in freight transport is even greater. According to EPA's

First Group (LSE: FGP) operates buses and trains in the U.S. and U.K. In the U.K., the company operates local buses in 40 cities as well as regional, intercity, commuter and freight rail lines. In the U.S., the company operates First Student school bus lines and Greyhound intercity bus service.

In March 2007, First Group presented a Climate Change Strategy, setting commitment for GHG emission reductions. Key elements of the plan include commitments to:

- improve the fuel efficiency of existing vehicles;
- purchase new vehicles with greater fuel efficiency;
- use alternative fuels;
- improve the energy efficiency of owned properties;
- reduce business travel and develop green travel plans; and
- promote the use of public transport to combat climate change.

Transportation GHG Emissions Report, the amount of energy needed to "move a ton-mile of air cargo was 7.5 times greater than heavy-duty trucks, over 17 times that of ships, and 83 times greater than rail." Put another way, switching a ton of freight from a plane to a truck would reduce the amount of energy needed by 87 percent, to a ship would save 94 percent, and to a train would save 99 percent.

Improving current technologies

While new technologies may hold the promise of massive cuts in GHG emissions in the future, revisions to current technologies will allow for emissions reductions before new technologies are ready. More efficient, more lightweight and more streamlined designs allow for improved fuel economy and decreased emissions for cars, trucks, buses, trains and planes.

Bombardier (TSE: BBD-B) began its corporate life as a snow mobile manufacturer. But after spinning off its recreational products division in 2003, the company is now focused on sustainable mobility in two divisions: aerospace, focused on regional airplanes; and transportation, providing trains and transportation systems, including high-speed inter-city trains. By incorporating environmental considerations into design of new products, Bombardier is working to reduce the climate footprint of travel. For example, the CRJ1000 regional jet will emit up to 30 percent less carbon dioxide compared to similar aircraft, and the company's modern trains use 25 percent less energy per passenger mile when compared to the older generation trains.

For example, when GE launched its "Ecomagination" environmental campaign in 2005, designing cleaner locomotives was a major highlight of the program. In 2008, GE's Ecomagination website details the Evolution, a currently-available locomotive that produces 40 percent fewer emissions compared to prior models, while also highlighting the in-progress development of a hybrid locomotive that will achieve up to 50 percent emissions reductions.

Hybrid cars are increasingly seen as a bridge between current and future technologies. Beginning in 1999 with Honda's introduction of the Insight, the first mass-market hybrid offered in the U.S., hybrids have become increasingly popular, and according to the Financial Times, Americans bought more of Toyota's hybrid Prius in 2007 than Ford's iconic SUV Explorer. Current hybrids use an electric engine and an internal combustion engine, and have markedly greater fuel efficiency, and correspondingly lower GHG emissions, than traditional cars. For example, EPA rated the Toyota Prius first in vehicle efficiency in 2008, averaging 48 mpg in the city and 45 mpg on the highway, while the top con-

Borg Warner (NYSE: BWA) is a 125 year old auto components manufacturer that specializes in two areas, engines and drive trains. The company uses its rich history of innovation and expertise to develop strategies and products to manage engines for fuel efficiency and reduced emissions. For example, the company's turbocharger boosting system can increase fuel efficiency by 15 percent while improving torque and driveability. Other products that increase efficiency include variable cam timing, smart thermal systems, instant starting systems, engine timing and dual-clutch modules. Borg Warner is currently partnering with U.S. Environmental Protection Agency to develop advanced air management technologies that will enable the automotive and trucking industries to utilize EPA's Clean Diesel Combustion and high-efficiency gasoline combustion technologies.

ventional car, the fifth-place manual Toyota Yaris, averages 29 mpg in the city and 36 on the highway. Technologies used in hybrids, such as the batteries, will contribute to the development of next generation technologies.

Developing New Technologies

While improvements to current transportation modes are key to cutting GHG emissions, new technologies hold even more promise for reducing GHG emissions. For example, electric vehicles are powered by batteries that are externally recharged, potentially by plugging into the electricity grid, and are moving closer to becoming a mainstream reality. Certainly, significant challenges remain, especially with regards to the battery, but electric cars are increasingly able to achieve the desired range and driveablity required to become a large part of the vehicle fleet.

A123 Systems, a private company based outside of Boston, is a leading supplier of lithium ion batteries. A123's batteries utilize nanotechnology to offer higher power, longer life and better safety profiles than other Li-ion batteries, often at a lower cost per watt. The batteries are currently used in hybrid cars, and the company is working with a variety of car manufactures and government agencies on developing a plug-in hybrid vehicle.

One example is Tesla Motors' electric Roadster, which can travel up to 245 miles between battery charges. Tesla has made a splash since unveiling its concept car in 2006, and the waiting list for the $100,000 sports car has included many celebrities and politicians, attracted to considerations of performance and environmental benefits. At the time of production, the 2008 models were all reserved, and the company was taking orders for the 2009 version.

GM has also made a big commitment to its electric concept car, the Chevrolet Volt. The Volt is a plug-in hybrid with a gasoline engine that powers the battery, currently made by A123. While not projected to be available until 2010 at the earliest, GM is aiming for a more affordable price, in the range of $30,000, and recently reaffirmed its commitment to the Volt at the March 2008 New York International Auto Show.

Fuel cell-powered vehicles, another new technology, have been a goal of researchers and car companies for years. While not expected to be commercially ready until at least 2010, according to an optimistic estimate from EPA, hydrogen powered fuel cell cars would represent a dramatic change in transportation technology. Fuel cell vehicles are similar to electric ones in that an electric motor, rather than internal combustion engine, powers the vehicle. But unlike electric cars, fuel cell cars use their internal fuel cell to generate electricity rather than relying on a battery to store energy. According to EPA, fuel cell vehicles could be twice as efficient as comparable conventional vehicles. The development of fuel cell vehicles has been a long, bumpy road, and in early 2008, fuel cell vehicle pioneer Ballard sold its automotive fuel cell program to Daimler and Ford.

Even more dramatic new transportation solutions are on the way as well. For example, a kite ship is exactly what it sounds like: a ship pulled by a kite. American company KiteShip and German SkySails are both working on the idea of using a kite to reduce the amount of fuel needed for trans-ocean freight haulage. The first voyage to test this technology took place in early 2008, with a SkySails kite pulling a ship from Hamburg, Germany to Guanta, Venezuela, using approximately 20 percent less fuel than a conventional ship on the same voyage.

Alternative Fuels

The subject of alternative fuels receives much attention globally. Biofuels in particular have the attractive characteristic of providing theoretically "carbon neutral" fuel while also supporting agricultural economies. Many governments, including in the U.S, have mandated use of a certain amount or percentage of biofuels per year. While some biofuels, especially those made from wastes or cellulosic materials, may have an overall positive impact on GHG emissions, their total climate change impact and commercial viability remain unclear. In particular, biofuels made primarily from agricultural crops that would otherwise be part of the global food system or that require conversion of land not currently used for agriculture may have net negative GHG impacts. What's more, diverting food crops into the energy stream is causing volatility and increased prices in the global food market. For these reasons, governments may revisit their commitments to biofuels.

For example, in January 2008, the European Commission proposed a rule that, according to New Energy Finance, would ban the import of biofuels grown on lands that were previously untouched or continuous forest, biodiverse grasslands or wetlands. The rule would also require biofuel producers to demonstrate that use of their products resulted in at least a 35 percent reduction in GHG emissions. If passed by the E.U. member governments, the rule would prevent much palm oil-based biodiesel and corn-based ethanol from counting towards the group's 10 percent biofuels target. So while biofuels likely will have a role to play in reducing transportation GHGs in the future, that role and its magnitude are still to be determined.

Clean Energy Fuels Corp. (NASDAQ: CLNE) operates over 170 CNG and LNG fueling stations These stations provide fuel for over 14,000 vehicles in 250 fleets including taxis, airport transportation, refuse hauling and public transportation. They particularly focus on serving fleets that travel in a clustered area that can be served by a base fueling station.

For example, the company operates an LNG station adjacent to the Port Of Long Beach in California, supporting the harbor commissioners' recently approved plan to replace half of the old diesel trucks operating in the port with LNG trucks, reducing GHGs by 20 percent and air pollution by 80 percent.

In the meantime, alternative fuels such as compressed natural gas and liquid natural gas (CNG and LNG) are also being used, particularly for fleets such as buses. According to FuelEconomy.gov, a joint project of EPA and the Department of Energy, natural gas vehicles emit 30-40 percent less GHGs than gasoline or diesel powered ones. In addition, they also emit up to 90 percent less

smog-forming chemicals, which is one reason they are frequently found in urban areas already facing air pollution. According to Green Car Journal Online, "While not as glamorous as hydrogen fuel cells, natural gas vehicles (NGVs) are a popular and readily available technology that's displacing petroleum use and cutting emissions every day." Indeed, the U.S. Postal Service has over 8,000 CNG and LNG trucks in service in North America.

Innovative Policies

The regulatory system for fighting climate change in the U.S. is far from determined. As this paper is being written in the spring of 2008, all major-party presidential candidates have publically committed to enacting laws to limit GHG emissions and the EPA has yet to act on a 2007 Supreme Court ruling which found that it does have authority to regulate GHG emissions from vehicles. However, much uncertainty remains about what any eventual regimes might look like.

In the meantime, all levels of government are intensely interested in improving the transportation system. Local governments may be particularly concerned with local air quality and quality of life, while national governments may worry about meeting international GHG reduction commitments. A variety of regulations, some mentioned previously, are addressing the issues, from increasingly strict efficiency and emissions standards to fuel blending requirements. Industry groups are even participating, such as the international shipping industry's current work on creating rules to reduce their overall impact. Some governments are trying even more innovative polices.

For example, in February 2003, the City of London began charging a fee, known as a congestion charge, to drive in the city during business hours. Under the plan, motorists wishing to drive in the congestion zone in central London between 7 AM and 6 PM currently pay a daily fee of £8, or approximately $16, with the money being used to improve the city's public transportation facilities. According to the *program's fifth Impacts and Monitoring Report*, published by the Mayor of London in July 2007, the scheme "is seen to have …reduced road traffic accidents and emissions" and to have reduced congestion "whilst having a broadly neutral impact on general economic performance." With London's success serving as an example, other cities such as New York are considering adopting a similar plan.

Conclusion

There is no doubt that transportation will remain the source of a significant amount of CO2 and other GHGs in the future. However, there are a variety of options to switch from GHG intense modes of transporting people and freight to less intense modes. There are also currently available technologies that can improve the vehicles on the road, riding the rails, or in the air. Even as some innovative technologies are under development, many more are still to be invented. Curbing transportation emissions of GHGs is an achievable goal, but will require considerable investment of brainpower and capital. At the same time, opportunities to invest in the green solutions that are helping to curb these emissions will continue to increase.

Bibliography

All websites accessed March 31, 2008

Energy Information Administration. *Short Term Energy Outlook*. March 11, 2008. http://www.eia.doe.gov/steo.

Ewing, Reid, et al. "Growing Cooler: The Evidence on Urban Development and Climate Change (Executive Summary)." *Urban Land Institute*. 2007. http://sgusa.convio.net/site/DocServer/Executive_Summary.pdf?docID=4021.

GE. *GE Ecomagination*. http://ge.ecomagination.com/site/products/evol.html.

Gelsi, Steve. "New 'super-spike' might mean $200 a barrel oil." *Marketwatch*. March 7, 2008. http://www.marketwatch.com/news/story/goldman-sachs-raises-possibility-200/story.aspx?guid=%7B4B702F7F%2D41F8%2D45F0%2DA133%2D630F12F2C764%7D.

GM-Volt. *Chevy Volt FAQs*. http://gm-volt.com/chevy-volt-faqs/.

Gorham, Roger. "Air Pollution from Ground Transportation." *Global Initiative on Transport Emissions. 2002*. http://www.un.org/esa/gite/csd/gorham.pdf.

Green Car Congress. "Cumulative Reported US Sales of Hybrids Edge Past the One Million Mark in 2007." January 9, 2008. http://www.greencarcongress.com/2008/01/cumulative-repo.html.

Hammonds, Don. "U.S. Automakers stay in the game." *Pittsburch Post-Gazette*, January 30, 2008: 2008.

Lepisto, Christine. "First Transatlantic Voyage of Kite-powered Ship." *treehugger*. January 29, 2008. http://www.treehugger.com/files/2008/01/transatlantic_kite_ship.php.

Lloyd's List. "Shipping unites on CO Plan." March 26, 2008. http://www.wbcsd.org/plugins/DocSearch/details.asp?type=DocDet&ObjectId=MjkyNTU.

New Energy Finance. "EU Directive Leaces Governments in Control of How to Meet Targets." January 24, 2008.

Siuru, Bill. "Hybrids and Alternative Fuels Delvier the Goods." *GreenCar.com*. http://www.greencar.com/features/clean-fuels-deliver/.

Terrapass. Personal communication, March 2008.

Tesla Motors. "Tesla roadster 'Signature One Hundred' Series Sells Out." Tesla Motors. August 15, 2006. http://www.teslamotors.com/media/press_room.php?id=29.

"Text of the Energy Independence and Security Act of 2007."

The Wall Street Journal. Auto Sales – *Markets Data Center.* http://online.wsj.com/mdc/public/page/2_3022-autosales.html.

"Toyota Prius sales pass Ford Explorer." *Financial Times*. http://articles.moneycentral.msn.com/Investing/Extra/ToyotaPriusSalesPassFordExplorer.aspx.

Transport for London. "Central London congestion Charge Impacts and Monitoring; Fifth Annual Report." 2007. http://www.tfl.gov.uk.

Triple Pundit. *Kite-Driven Beluga Skysail Completes 12,000 Mile Journey and Proves Concept.* March 14, 2008. http://www.triplepundit.com/pages/kitedriven-beluga-sky-sail-comp-002956.php.

U.S. Census Bureau. *ACS Ranking Tavles - American Fact Finder*. 2006. http://factfinder.
census.gov/servlet/GRTSelectServlet?ds_name=ACS_2006_EST_G00_&_lang=en_sse=o

U.S. Dept. of Energy, Energy Efficiency and Renewable Energy. *Transportation Sector -Total Energy*. http://intensityindicators.pnl.gov/total_transportation.stm.

U.S. Environmental Protection Agency and Department of Transporation. *Natural Gas*. http://www.fueleconomy.gov/feg/bifueltech.shtml.

U.S. Environmental Protection Agency. *Fuel Economy Leaders: 2008 Model Year*. http://www.epa.gov/fueleconomy/overall-high.htm.

U.S. Environmental Protection Agency. *Greenhouse Gas Emissions from the U.S. Transportation Sector*, 1990-2003. 2006.
http://www.epa.gov/oms/climate/420r06003.pdf.

U.S. Environmental Protection Agency. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005*. 2007.
http://www.epa.gov/climatechange/emissions/usinventoryreport.html.

US. Environmental Protection Agency and Department of Energy. *Fuel Cell Vehicles*. http://www.fueleconomy.gov/feg/fuelcell.shtml.

WINSLOW
MANAGEMENT COMPANY

99 High Street
Boston, MA 02110
T 866-804-5414
www.winslowgreen.com