America's Oil Imports: A Self-Inflicted Burden

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Burdensome dependence on crude oil imports is a key challenge for America's energy policy; its principal cause is excessive consumption of refined oil products, which is mainly the result of an inefficient automotive fleet, the virtual absence of diesel-powered cars, and the complete absence of modern high-velocity trains. Addressing these challenges will require major infrastructural investment, a reality that precludes any early attainment of energy independence. *Key Words: crude oil imports, energy consumption, energy independence, high-velocity trains, U.S. energy policy.*

对原油进口的累赘依赖是美国能源政策的一个关键挑战，其主要原因是成品油产品的过度消费，这主要是由低效的汽车车队，柴油动力车事实上的缺失，和现代高速列车的完全缺失所造成的。应对这些挑战将需要大量的基建投资，这一现实妨碍了能源独立的早日实现。*关键词：原油进口，能源消耗，能源独立，高速列车，美国的能源政策。*

La onerosa dependencia de importaciones de petróleo en crudo es un reto clave para la política energética americana; su causa principal es el excesivo consumo de productos refinados del petróleo, lo cual resulta principalmente de tener una flota automotora ineficiente, la virtual ausencia de carros movidos por diesel y la completa ausencia de trenes modernos de alta velocidad. Enfrentar estos retos demandará mayores inversiones infraestructurales, realidad que impide lograr una independencia energética en el corto plazo. *Palabras clave: importaciones de crudo, consumo de energía, independencia energética, trenes de alta velocidad, política energética de EE.UU.*

American energy debates have suffered from a surfeit of shallow generalities, from uncritical proffers of naive solutions, and from the persistence of many seemingly ineradicable myths. I have spent a lifetime trying to infuse them with a modicum of common sense and requisite doses of scientific and engineering realities, an endeavor that is summarized in three of my most recent energy books (Smil 2008, 2010a, 2010b). I use the limited space of this contribution to focus on a key problem, the continuing burden of which is overwhelmingly self-inflicted, and the negative impacts of which could have been minimized by actions that called for no extraordinary technical advances and were successfully accomplished by less affluent countries during a single generation.

America's crude oil imports burden the country with enormous strategic, financial, political, social, and environmental costs. A single number illustrates the strategic implications: In 2005, the year of record domestic oil consumption, the country imported 67 percent of its oil supply, and the share remained above 60 percent in 2009 (U.S. Energy Information Administration [USEIA] 2010). Financial considerations have become particularly important because of the new, post-2008 economic realities. During the first decade of the twenty-first century, the United States paid nearly $1.7 trillion for foreign oil, a total equal to 30 percent of its cumulative trade deficit between 2000 and 2009 (U.S. Census Bureau 2010). In 2008, high oil prices pushed the total to the annual record of nearly $350 billion and similarly wounding outlays will return once oil prices begin, yet again, their climb toward $150 per barrel. Higher costs are made more likely even if U.S. imports were to fall: Because international oil trade is denominated in dollars, any substantial weakening of the U.S. currency will be reflected by commensurately rising oil prices, and strong demand by large Asian economies (particularly China) will prevent any large supply surpluses by easily claiming any oil released by declining U.S. demand.

These large imports are not a consequence of America's low domestic oil extraction: The country was the world's largest oil producer until 1975 when it was surpassed by the USSR; two years later it was also surpassed by Saudi Arabia, but as Saudi output fell, the United States regained second place in 1982 and kept it until 1991 (BP 2010). By the year 2000, U.S. extraction was nearly 10 percent ahead of Russia's and equivalent to 77 percent of Saudi Arabia's rising output. In 2009, the United States held a firm third place, more than 70 percent ahead of Iran. The U.S. imports are not caused by a meager hydrocarbon patrimony but by the country's

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extraordinarily high per capita demand: If the United States consumed its oil at the French rate (1.35 rather than 2.70 metric tons [t] per capita), its 2009 imports would be only about 22 percent of its consumption.

Americans (ubiquitous media commentators and energy experts alike) consider any comparison with France insulting and view it with derision: Is it not obvious that America's huge territory, its climate, its superpower economic structure, and its military might combine to dictate significantly higher levels of per-capita energy consumption in general and crude oil in particular? Actually, they do not. The direct energy cost of America's military is surprisingly low: In 2009 the Department of Defense claimed less than 2 percent of the country's total crude oil consumption (USEIA 2010). Decades of American deindustrialization mean that the shares of gross economic value added by industry are now virtually identical in the two countries: In 2008 they were 21.8 percent in the United States and 20.5 percent in France (Organization for Economic Co-operation and Development [OECD 2010]), and the French industrial sector includes some of the world's largest companies specializing in such energy-intensive products, such as aluminum and steel (Pechiney and Arcelor-Mittal), aircraft (Airbus), and nuclear power plants (Areva).

Climate differences are also largely irrelevant when comparing the consumption of refined oil products: Natural gas and electricity are the dominant energizers of heating and cooling in both countries, and in the United States less than 6 percent of all residential energy used in the year 2009 came from petroleum and only about 1 percent of all electricity is generated from fuel oil (USEIA 2010). Differences are thus overwhelmingly due to the demand for transportation, above all to road transport, which accounts for more than 85 percent of the sector's petroleum demand in the United States and more than 95 percent in France. Average annual U.S. consumption of gasoline and diesel fuel was 1.73 t per capita in 2007, compared to just 0.65 t per capita in France, a nearly 2.7-fold difference, and the disparity for aviation fuel is even greater, with the United States consuming ten times as much per capita as France (OECD 2009).

America's size (8.08 million km^2 for the forty-eight contiguous states compared to 552,000 km^2 for mainland France, a nearly fifteen-fold difference) and intercity distances (almost 4,000 km from Los Angeles to New York compared to just over 900 km from Calais to Perpignan) are repeatedly cited as the most obvious reason for these differences. It is true that American drivers logged almost exactly twice the distance their French counterparts did in 2008 (European Union 2010), but distances dictate neither the typical performance of road vehicles nor the availability of desirable alternatives, and it is these realities that account for most of America's inferior performance. This failure has three major components: indefensibly low average efficiency of the U.S. vehicular fleet, a virtual absence of diesel vehicles, and an unpardonable absence of modern intercity trains.

Few Americans are aware of this inexcusable case of a gross technical retrogression: Average fuel efficiency of America's passenger cars actually declined during the two generations when impressive innovations and performance gains were sweeping entire industrial sectors (think of aviation, chemical syntheses, and electronics): Between 1936 (the first year for which the nationwide mean can be calculated) and 1973, it fell from more than 15 to just 13.4 miles per gallon (mpg; Sivak and Tsimhoni 2009). Introduction of Corporate Average Fuel Economy (CAFE) standards in 1975 ushered in a period of rapid gains: By 1985 the standard had reached 27.5 mpg, but in the subsequent twenty-five years, it has been kept at the same, now inexcusably low, level. Because of a massive adoption of inefficient light trucks and sport utility vehicles (SUVs) during the late 1980s and throughout the 1990s (their worst models had efficiency well below 20 mpg), the overall performance of the U.S. vehicle fleet was no better in 2006 (25.8 mpg) than it was in 1986 when it stood at 25.9 mpg (U.S. Department of Transportation [USDoT] 2010). These are truly stunning inefficiencies.

Post-2006 gains pushed the fleet average to 29.2 mpg by 2010, well below the average performance of the best fleets currently on the market and far below the technical possibilities attainable even without any electric or fuel-cell vehicles. In 2010 Honda's U.S.-made passenger car fleet averaged 34.7 mpg and imported models rated at 40.9 mpg, and the analogical figures for Toyota were, respectively, 36.4 and 44.4 mpg (USDoT 2010). If the CAFE standards were not frozen at 27.5 mpg in 1985 and continued to improve at just half the annual rate they had sustained between 1975 and 1985 (i.e., about 0.7 mpg/year), America's vehicular fleet would deliver at least 45 mpg in 2010, 54 percent better than its actual performance.

Achieving that efficiency would not have been contingent on any heroic measures or unprecedented technical advances: It could have been done by a dedicated pursuit of three lines of action. First, simply widely emulating today's best car manufacturers whose fleets

are, without any enforcement, already close to or above 40 mpg would have helped. GM behaving as Honda was an incomprehensible idea to pre-2008 (prebankruptcy) U.S. car executives but one that would have repaid in more efficient cars and in tens of billions of dollars of profit. The second element is vigorous promotion of steady technical improvements in the dominant automotive prime mover that will continue to power most American cars for many years to come: Otto-cycle gasoline engines can be made more efficient while concurrent adoption of lighter but stronger car bodies could further boost the overall performance. The third ingredient should have been a progressively expanding adoption of modern clean passenger diesel vehicles.

Diesel engines are inherently more efficient prime movers than Otto-cycle gasoline-fueled engines (Smil 2010c): The gain is at least 20 percent and a quick comparison of performance data for German vehicles now sold in the United States in both gasoline and diesel versions shows differences mostly between 25 percent and 30 percent and the highway rating for the VW Diesel Golf is 40 percent higher (42 vs. 30 mpg) than for its gasoline version (U.S. Department of Energy 2010). Moreover, new ultra-low-sulfur diesels conform to emission standards for gasoline-fueled cars and minimize the emission of nitrogen oxides (Mercedes-Benz 2010). Not surprisingly, in 2009 diesel vehicles accounted for more than 56 percent of the French car fleet (Institute National de la Statistique et des Études Économiques 2010), but they were only about 2 percent of all U.S. cars.

If the United States had followed this triple-pronged approach since the mid-1970s, its car fleet's performance would now average close to 50 mpg. Unfortunately, this has not been the only unrealized transportation opportunity. Missing trains have been the second most important ingredient of America's transportation neglect. Japan, with its Tokyo-Osaka *shinkansen* introduced in 1964, pioneered the era of modern rapid trains (Shima 1994), and France followed and surpassed that achievement. Its era of *trains à grande vitesse* (TGV) began in 1981 with the Paris–Lyon link, and by 2010 the TGV network operated on routes totaling 1,540 km and connecting Paris with the country's southeast (*Sud-Est*), west (*Atlantique*), north (*Nord-Europe*), the Alps region (*Rhône-Alpes*), the Mediterranean (*Méditerranée*), and the southwest (*Aquitaine*), as well as with its neighbors, traveling at speeds of between 250 and 300 km/h with a perfect safety record (Soulié and Tricoire 2002; TGVweb 2010).

But (the spatial objection rising once again), do not America's enormous territory and low population density make it a quite unsuitable place for emulating the French fast train model? This perennial argument is valid only if somebody would advocate TGV-like links between Miami and Seattle or between Los Angeles and Boston. But consider this: France, a nation of 65 million people, has a population density of less than 120 people/km^2 and nationwide connections centered on the capital require a radial rail network with its longest links close to 1,000 km. In contrast, the Northeastern U.S. megalopolis, an area with more than 50 million inhabitants, has population density three times as high (360 people/km^2), mostly in a fairly narrow linear arrangement along the Atlantic coast, with large cities regularly strung along a route of less than 700 km. Which one of these territories is more suited for rapid downtown-to-downtown train links?

Whereas the French zip at speeds close to 300 km/h more than 900 km from Paris to Nice, Americans unwilling or unable to drive have the less attractive option of taking shuttle flights from Washington to New York, Philadelphia, or Boston (still only 600+ km away) with all the attendant joys of taxi rides to and from the airports, check-in lines, security searches, and flight delays. Acela is an unacceptably poor substitute for the real thing: It is not a real fast train, as it averages only about 120 km, no better than the best steam engine-powered trains of the 1930s. The Northeastern megalopolis is not the only region that should have had rapid trains for decades. Thalys trains from Paris (11.2 million) to Amsterdam (2.5 million) run more than 500 km twelve times a day (Thalys 2010): Why could not their counterparts run between Dallas/Fort Worth (6.5 million) and Houston (5.9 million), a distance of 360 km that could take just a bit more than one hour? Or between Los Angeles and San Francisco or New York and Montreal?

America has lost its global technical leadership, its exemplary innovative drive, and its political will to invest in transformative infrastructures with inevitably substantial (but by no means crippling) initial capital costs that are repaid by decades of efficient and convenient service. Even its existing infrastructures are falling apart: In its latest report card, the American Society of Civil Engineers (2009) awarded D to the country's aviation and D– to its roads. Four decades of regressing automotive performance followed by a decade of improvements and then by two more decades of stagnation, virtual absence of diesel-powered cars, and an inexplicable refusal to participate in the greatest

land-transportation innovation of the past two generations, in building convenient and highly energy-efficient rapid trains, is a combination that has left the country with an extraordinarily inefficient transportation system.

America now looks inept even when compared with China, a country whose per capita gross domestic product (even when expressed by a liberally calculated purchasing power parity) is one seventh of the U.S. rate. By the summer of 2010 China had completed 6,920 km of high-speed rails, including nearly 2,000 km of links capable of speeds up to 350 km/h ("High-speed rail operations in China" 2010). Is the United States permanently incapable of investing in its essential transportation infrastructure as much as France has done since the 1980s or as much as China has done since the year 2000? No technical problems and no excessive capital costs could have prevented the United States from lowering its demand for transportation hydrocarbons and reducing its dependence on oil imports: Two dozen affluent countries now have considerably better automotive efficiency than does the United States and (besides the pioneering Japan and France and determined China) rapid train links have been built in such less affluent countries as South Korea and Spain.

In his State of the Union address in January 1974, Richard M. Nixon set a new national goal: "At the end of this decade, in the year 1980, the United States will not be dependent on any other country for the energy we need to provide our jobs, to heat our homes, and to keep our transportation moving" (Nixon 1974). That was a patently unrealistic goal, but during the subsequent decades the United States could have gradually reduced its crude oil demand at least to the level that would have required only imports from Canada and Mexico, its two North American Free Trade Agreement neighbors (in 2009 they amounted to about 22 percent of total U.S. crude oil consumption). Inexplicably, obvious opportunities are still ignored: CAFE standards were finally raised (to reach 35 mpg by 2020), diesels are slowly gaining a slightly larger market share, hybrid drives have become somewhat popular, and electrics are touted as a new solution, but all of this is still too little to make a real difference. Moreover, all plans for high-speed trains have been shelved indefinitely ("High-speed trains" 2010). America still waits to join the late twentieth century and get its first really fast train, but it is instead content to keep transferring trillions of dollars to the Middle Eastern theocrats and autocrats and pretending that it is possible to run permanently deep trade deficits.

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