Staring Down the Barrel: Israel's Oil Problem

Eugene Kandel and Netanel Oded

Over the last few months, the financial media in Israel and around the world have devoted numerous column inches and substantial airtime to what has become known as the "Qaddafi effect." After all, not even those who took no particular interest in the dramatic upheavals in the Arab world could avoid the economic ramifications of the civil war in which Libya has been embroiled since February of this year. Having produced, until recently, about 1.6 million barrels of crude oil every day—approximately 2 percent of global consumption—Libya had been among the leading exporters of this valuable resource. The chaos accompanying the ongoing battle between the eccentric tyrant's army and the Western-backed rebel forces resulted in an immediate jump in oil prices, which in turn led to a rise in the prices of gasoline.[1] Qaddafi himself allegedly ordered the destruction of oil fields and refineries in Libyan territory, with the aim of denying his domestic enemies a potential income avenue and wreaking economic havoc on foreign countries that would dare challenge his reign.[2]

The "Qaddafi effect" is a perfect example of the use of oil as an instrument of political and financial pressure. An earlier—and far more traumatic—example of this phenomenon was the oil embargo imposed on the U.S. for providing aid to Israel in the Yom Kippur War. As part of the embargo, which lasted from October 1973 through March 1974, Arab members of OPEC refused to sell oil to America and other "Israel-friendly" countries, including Holland, Portugal, South Africa, and Rhodesia. Nor were these sanctions the worst of it: By severely limiting oil production, the Arab countries ensured that oil prices quadrupled in just a few weeks—from $3 to a staggering $12 per barrel. Almost overnight, both the U.S. and Western Europe, long accustomed to importing mass quantities of inexpensive crude oil, faced a new reality for which they were woefully unprepared.

This calculated move on the part of Arab oil exporters had a dramatic impact: The Nixon administration was forced to implement a series of emergency measures designed to minimize American oil consumption, including a decrease in work hours, an extension of daylight savings time, a lowering of speed limits, and a restriction of gas-station activity. On the flipside, to avoid being caught off guard again, the Americans also launched a comprehensive program to promote domestic energy independence. Japan and the Western European countries, for their part, began to hoard oil, while simultaneously adopting a more deferential stance toward the Arab position. The message had been heard loud and clear: Support for Israel is not financially advantageous.

Following the diplomatic efforts of the Americans and their intense pressure on Israel to withdraw its forces from territories conquered in Sinai and the Golan Heights, the oil embargo was lifted after a relatively short period of time. The damage it caused was long-lasting, however. The West faced the worst recession it had known since the 1930s, oil prices remained high for almost a decade, and, worst of all, the Arab members of OPEC realized they had at their fingertips a remarkably effective weapon.[3] In time, American president Jimmy Carter would declare that the energy crisis of the seventies was the "moral equivalent of war."[4]

Over the years, various developed countries that weathered the onslaught of the Arab embargo have experimented with initiatives to reduce their reliance on oil. Yet there is no getting around the fact that a modern lifestyle is based on the massive consumption of gasoline and diesel. It is also the case that this dependence feeds some of the darkest, most fanatical regimes in the world—which also happen to be the most unfriendly to the Jewish state. And though there are other good reasons to seek out alternatives to the use of oil, its role in empowering those who actively seek to destroy the Jewish state is surely enough to make Israel take an active, if not leading, part in the search.

Why do oil exporters enjoy so much political and economic power? Clearly, the answer lies not in any intrinsic value of the "black gold"; there are, after all, far rarer and more expensive goods to be had. If we wish to understand how this natural resource became a strategic asset, we need to pay attention to a different factor—the centralized structure of the oil market.

The root of the problem is the global distribution of oil—or lack thereof. Unlike resources such as coal and natural gas, which are found in many places throughout the world, oil is concentrated in a few specific areas, primarily the Persian Gulf. Indeed, even though large deposits have, over the past four decades, been discovered in countries such as Canada, Brazil, and Norway—and even though Russia has superseded Saudi Arabia as the largest supplier of crude oil,[5] the Muslim and Arab countries of the Middle East and North Africa still control over one-third of global production. OPEC, of which these countries are all members (along with Venezuela, Angola, Nigeria, and Ecuador), controls approximately 80 percent of the world's crude oil reserves and 40 percent of production.[6] This astounding concentration of economic power has frequently enabled the organization to act as a cartel, influencing the price of oil by determining the scope of production and level of supply.[7]

In many ways, then, oil is the Middle East's lifeline, serving as a primary—if not exclusive—source of income for many countries in the region. It is thanks solely to the immense oil fields of the Persian Gulf, for example, that countries like Saudi Arabia, Qatar, Kuwait, and the United Arab Emirates are able to arm themselves with advanced weapons, recruit stronger allies, and hold sway in the international arena. Oil even grants these monarchies and emirates a measure of internal security: The elites that govern them, who enjoy legendary wealth, provide the broader population with valuable social services and, when necessary, spread around huge sums of money, all in order to ensure their continued reign. Just last February, when Saudi king Abdullah sought to safeguard his regime against the uprisings sweeping the Arab world (including his neighbors, Bahrain and Yemen), he announced that he would be bestowing on his subjects social benefits to the tune of about $36 billion.[8]

To Saudi Arabia's and the Gulf Emirates' credit, it should be noted that, despite their anti-democratic stance, they are generally politically moderate, and strive for economic stability. Indeed, Saudi Arabia has long served as the world's "oil bank": Boasting the greatest oil reserves after Venezuela,[9] it avoids maximum production; as such, it can increase supply (at a scope of about 3 to 3.5 million barrels a day, according to analysts' estimates[10]) if the need arises, whether on account of greater demand or a sudden blow to the production capabilities of smaller exporters. And indeed, the Saudis' promise to make up for the dearth created by Libya's civil war alleviated the "Qaddafi effect" and stemmed the panic that threatened to seize the market.[11]

Iran, the fifth-largest exporter of oil in the world, is a different story entirely. Not at all interested in maintaining the strategic status quo, Iran seeks instead to garner geopolitical strength and overthrow the pro-Western forces in the region. Its oil industry, which yields more than half the country's income, provides it with the means to attempt to realize these goals. Though international sanctions have inflicted no small amount of damage on the Iranian economy, the constant rise in oil prices has enabled

Ahmadinejad's government to enlarge the country's budget gradually in recent years.[12] A large chunk of this budget goes to funding an ambitious nuclear program, arming Hezbollah in Lebanon, aiding terrorist organizations such as Hamas in Gaza, and reinforcing the Revolutionary Guards and internal security forces, which brutally suppress any attempt to challenge the ayatollahs' oppressive regime.

Yet the Iranian economy has a conspicuous Achilles' heel: On account of relatively high production costs—a problem not shared by Saudi Arabia and the Gulf Emirates[13]—Iran is particularly sensitive to fluctuations in oil prices. For now, however, it has no reason for concern: The demand for oil continues to rise, on account of both global population growth (which stands at about 1 percent per year) and the rapidly expanding Asian economies. Supply, however, remains limited, and oil production is becoming only more costly with time. All available land deposits have already been discovered, restricting present searches to the depths of the sea, to regions characterized by extreme climates, or to countries suffering from political instability. In light of these obstacles, it is only logical to assume that oil prices will continue to climb in the future, to the great satisfaction of those who were blessed with an abundance of the resource.[14]

Significantly, Iran also enjoys geographical proximity to the vast Asian market. Oil is, of course, not a virtual product, whose trade is independent of the location of both seller and buyer. Rather, it must be transported, by land or sea, from the production site to a refinery to the consumer. As transporting expenses are considerable, consumers prefer to purchase it from regular suppliers in their vicinity. The world's largest consumer, the U.S., imports large amounts of oil from its neighbors Canada and Mexico.[15] China, the second-largest importer, relies primarily on Saudi Arabia and Iran.[16] Due to the growing demand for oil in the Chinese economy—which, according to predictions, will reach approximately 20 million barrels a day by 2020—and the concomitant paucity of import alternatives to Iran, which offers a relatively easy and quick supply, the two countries have tightened their cooperation in this area.[17] Another Asian

giant cultivating a growing dependence on Iranian supply is India, which will in all probability become the fourth-largest importer of oil in the world by the year 2025—after the U.S., China, and Japan.[18]

This state of affairs does not bode well for Israel. China is a central player in the global arena, and a burgeoning India will not lag behind for long. Both countries' addiction to oil serves the strategic interests of the regime in Tehran, and may hinder the efforts of the West and Israel to contain the Iranian nuclear threat through diplomatic and economic sanctions. To be sure, China and India are not interested in perpetuating this reliance; they would much rather achieve energy independence. At this stage, however, they seem content to secure a steady supply of oil from the Persian Gulf.

But the increase in oil prices is worrisome not only from Israel's and the West's perspective; it is a problem with global ramifications. It condemns developed countries to an economic slowdown, and their poorer counterparts to genuine catastrophe. Since oil is used not only as gasoline, but also as an important component of chemical fertilizers, its swelling price both inflates the cost of agricultural crops and increases transportation expenses, thereby causing a sharp rise in food prices. With their ability to feed their populations significantly curtailed, developing economies will become susceptible to popular unrest and outbursts of violence—a sure recipe for political and religious radicalization, with the active backing of those anti-democratic countries that control the oil resources in the first place. It is difficult to predict where such processes, in the Middle East or elsewhere, will lead. What is clear, however, is that it would be unwise to sit idly by without searching for a solution.

The geographical distribution of a natural resource is a *fait accompli*, one that we have no choice but to accept. Yet the strategic value of oil also results, to a great extent, from the fact that when it comes to its main application—transportation—a successful commercial alternative has yet to be found. Oil serves a variety of purposes: In addition to being a

source of fuel, it is also a central element in the industries of petrochemicals (plastic) and agriculture (chemical fertilizers). Nevertheless, what makes the broad global use of oil (consumption currently stands at 84 million barrels a day, as of 2009[19]) so dangerously addictive is the absolute dependence on gasoline and diesel for the propulsion of vehicles. Yet this dependence is not irrevocable. A concentrated effort could bring it to an end.

It is important to remember, in this context, that until thirty years ago, oil was considered a vital natural resource for the production of electricity as well. In the early seventies, one-quarter of global electricity was oil-dependent.[20] This dependence continued so long as oil prices were relatively low. The 1973 embargo, which darkened houses and disabled factories, put an end to this fool's paradise; suppliers and consumers were awakened to a reality of uncertainty. The industrialized world, and foremost the U.S., understood that its reliance on oil was incompatible with its need for a stable energy market.

The immediate reaction of the American regulator and his counterparts in other countries that had fallen victim to the energy crisis was a comprehensive attempt to decrease energy consumption through public awareness campaigns and streamlining efforts. These steps were only partially successful, however, and in any event were intended only as stop-gap measures. At the same time, developed countries began to invest substantial resources in the research and development of alternate means of generating electrical power. Before long, these efforts paid off: From the eighties onward, the Western energy sector managed to decrease its reliance on oil dramatically, thanks to the widespread use of power sources such as nuclear fuel, natural gas, coal, and running water. Though these substitutes are not without their problems—the recent disaster at the Fukushima nuclear plant in Japan is just one alarming example—no one misses the time when the OPEC companies had their fingers on the power switch.

The situation is very different in the transportation sector, where failure to employ a commercial replacement for gasoline and diesel has resulted in a rigid demand for oil. No matter what the price of oil, consumers are

forced to purchase it, or find other means of travel. The sad truth is, without a continuous supply of oil, hundreds of millions of vehicles would come to a halt on the world's roads. The vast majority of modes of transportation—by land, sea, or air—use refined petroleum products as a central source of energy. Each car that leaves the assembly line compatible with only this type of fuel thus becomes, in effect, a hostage of the oil industry.

Like the energy sector, the field of transportation also threw itself into research and development in the 1970s, actively seeking alternatives to oil. This trend was reversed in the 1980s, however, when the steep decline in oil prices made it a cheap, available resource once again. The short-sightedness of investors and governments, which stopped offering incentives for the identification of viable alternatives, led to a loss of the hitherto accumulated knowledge and skill; many researchers and entrepreneurs abandoned the projects they had undertaken in disappointment and anger. Nevertheless, the progress made in this area was considerable, and leaves some room for hope. A compelling example is afforded by Brazil.

As a developing country with a large population and vast territories, Brazil was an avid consumer of oil prior to 1973. The energy crisis that erupted in the wake of the Yom Kippur War sent shock waves throughout the South American country, which determined to put an end to its addiction to petroleum. Yet in contrast to other countries, which settled for securing the independence of the electricity sector, Brazil chose to minimize its reliance on oil in the transportation sector as well. It turned for a solution to another natural resource, this one found in abundance within its borders: sugar cane. Cane yields ethanol, or ethyl alcohol, a chemical that can function as a fuel for an internal combustion engine (much like gasoline). In 1976, Brazil required fuel producers to blend a certain amount of ethanol (10-25 percent) into regular gasoline, thereby curbing oil consumption in a relatively short period of time.

Thanks to the constant and cheap supply of ethanol from Brazil, in 1979 the Fiat car manufacturer presented a groundbreaking model powered solely by this fuel; other companies were quick to follow suit. Brazil's gas

stations were equipped with two different kinds of pumps, one for gasoline blended with ethanol, and the other for pure ethanol. Consumers could calculate the price difference and take it into account when purchasing a car. Not surprisingly, in the mid-1980s, the majority of vehicles purchased in Brazil were customized for ethanol only. Of course, as with every trend, this one, too, suffered from its ups and downs: Near the end of the decade, problems arose with the supply of Brazilian ethanol, whereas oil prices sharply declined. As a result, gasoline-powered cars gained renewed popularity, while the ethanol-adjusted cars all but vanished from the market. The current changed once more in 2003, when Volkswagen launched a vehicle that could be powered by either gasoline *or* ethanol. The flex-fuel engine allowed consumers to compare gasoline and ethanol prices not only when purchasing a car, but at each and every fueling. The continued rise of oil prices since has induced more and more Brazilians to buy this type of vehicle, and fuel it, in most cases, with ethanol. As of 2008, the vast majority of new cars bought in Brazil were flex-fuel vehicles, with only heavy diesel trucks still using refined petroleum products.[21]

Ethanol is only one of a variety of biological fuels that can serve as a replacement for oil. Entrepreneurs and researchers are showing increasing interest in "second-generation" biofuels, which originate in agricultural crops that are not suitable for human consumption. In principle, it is possible to mass-produce such biofuels in areas not used for agriculture, whether on account of the terrain or the climate. At the same time, researchers are hard at work producing biofuels from organic waste, algae, and other raw materials that can be processed without detracting from other needs.[22]

There are also considerable advantages to synthetic chemical fuels that are not oil derivatives. The price of these fuels, which are based on gas, coal, and other substances, is lower than that of refined petroleum products. Cars powered by the synthetic fuel methanol and by natural gas are already on the roads, even competing in races.[23] And of course, natural gas is a considerably more common resource than oil, is more equally distributed globally, and—as we are now discovering—is found in abundance in Israel's maritime area.[24]

Important as the search for alternative fuels might be, a radical shift in the car's propulsion system may render it almost irrelevant. In recent years, the electric car has gone from being a promising idea to a very tangible reality. Neither this vehicle nor the infrastructure that supports it require any oil. Transportation based on electric propulsion is more energy-efficient and, no less significant, does not spew enormous amounts of pollutants into the air. As electricity-producing technologies become more advanced, as well as cheaper and cleaner, this alternative will become increasingly appealing both economically and environmentally.[25]

Let us be clear: None of the abovementioned solutions are ideal, nor are any of them universally applicable. Brazil, which cultivates large sugar cane plantations, enjoys an abundance of ethanol, but it is doubtful whether widespread use of this biofuel is appropriate for countries with a different climate. Electric cars may flourish in an urban environment thanks to short driving distances and a multitude of charging stations, but it is unlikely that they could be used efficiently in rural areas that lack the necessary infrastructure. Keeping these limitations in mind, it would be more realistic to expect the market to offer a variety of solutions and allow consumers to opt for the alternative that best suits their needs.

But the road to this rather optimistic scenario is long, and not without its pitfalls. The rigid demand for refined petroleum products is not the only problem; the complexity of the transportation market also encumbers its change. All that was needed to change the energy sector radically was a decision on the part of suppliers, who control a variety of sources and facilities, to replace the means of production. In the transportation sector, by contrast, such a step would require a great deal of coordination. Understandably, no one would agree to invest in the industrial production of alternative fuel sources without knowing with a high degree of certainty that consumers would be able to purchase a car suited to that fuel at a competitive price; that gas-station owners would be willing to supply the product; and that it would be possible to transport the fuel from the refinery to the pump.

Clearly, a change of this scope could not take place without comprehensive preparation and close coordination between all active players in the transportation industry: car companies, fuel producers, gas-station operators, and government regulators. Above all, however, the intense investment necessary to make such an ambitious plan work demands patience and long-term vision—hardly characteristics common among the parties involved, particularly those of the private sector. The willingness of this sector to actively seek alternatives to oil is determined, to a great extent, by the state of the market: When oil prices are high, entrepreneurs and businessmen are prone to be more daring, investing resources in research funds and experimental scientific projects. But when the trend is reversed, and the oil market once again seems attractive, the men of means tend to abandon the men of vision.

Unfortunately, such economic and political short-sightedness is delaying a development that could prove extremely beneficial to the lion's share of humanity. The widespread application of technologies that diminish the need for oil would set a price limit on it, and curb the power and influence of the countries that produce it. A market in which such technologies were put into practice would offer new opportunities to countries not endowed with immense oil fields but otherwise blessed with crops, coal deposits, natural gas, and perhaps the most valuable of resources—a spirit of innovation and human creativity. Finally, ending the oil addictions will serve the global effort to minimize air pollution and greenhouse gas emissions. Thus do the economic, political, and environmental interests of billions of people converge here perfectly.

It is no secret that the Jewish state is one of the primary casualties of the world's dependence on oil, which strengthens those countries whose attitude toward Israel ranges from cool hostility to vocal hatred. Israel, then, has a vested interest in doing everything in its power to assist the global search for oil alternatives, and to reduce the world's reliance on petroleum.

Let us be clear: It is in Israel's interest to *limit* the price of oil, not to destroy the industry altogether. The collapse of the Gulf's main source of income would wreak havoc, and may well serve extremist elements—thereby only aggravating the tension between Israel and its neighbors. However, a stabilization of oil prices at $40 to $50 per barrel—about half of the present price—would cause no serious harm to the relatively moderate countries, like Saudi Arabia, whose petroleum production is quite inexpensive. Iran, on the other hand, would suffer a huge economic blow, which would threaten not only the current regime's ambitions, but also its very survival.

Such a scenario would undoubtedly benefit others besides Israel. Nevertheless, though many other countries would derive tremendous benefits from the lowering of oil prices, their hands are tied as a result of both internal and external pressures. It is in this regard that Israel enjoys a significant advantage: As opposed to the U.S., China, India, or Britain, it has no powerful and well-connected oil companies that can influence the corridors of power and sway public opinion. On the contrary, the discovery of immense deposits of natural gas off Israel's coast has only heightened the state's interest in promoting this alternative to oil. On this subject, a national consensus exists in Israel—to which the political system, the business elite, government officials, and the general public are all party.

Absent an oil lobby, the Israeli authorities can take a resolute and consistent stand, as well as support significant initiatives in the field. Indeed, in January of this year, the government decided to launch an ambitious multi-year program whose goal is to promote "technologies to reduce the global use of oil in transportation." The program—described, not for nothing, as a "national effort"—includes, among other things, generous funding for scientific research, incentives for investment in local companies developing oil alternatives, a scheme for implementing these alternatives in Israel as a preliminary application site, and cooperation with multinational organizations and countries seeking to reduce oil dependency, such as China and India.[26]

In many ways, then, Israel, for all its limitations, is the ideal platform for this type of project. The country's scarcity of agricultural lands and its

existing industrial infrastructure do not allow for the mass growth of biofuels or mass production of synthetic fuels; giants such as China, Brazil, or the U.S. are much better prepared to fill this role. Israel's strength lies instead in its *intellectual* resources: Israeli academia has trained world-renowned researchers who specialize in the relevant fields, and the Israeli market is teeming with large industrial clusters relying on quality human resources and advanced knowledge. The defense, chemical, bio-agricultural, software, and electronics industries can all take part in the combined and coordinated effort to develop applicable alternatives to oil. Attesting to the local potential is the fact that some sixty Israeli companies, with hundreds of millions of dollars in investments, were working in this field even before the government's decision to prioritize it.

The benefits Israel stands to gain from the global economy's liberation from its chronic dependence on oil cannot be overstated. Such a dramatic change not only would create a new geopolitical environment in the Middle East, one that would be—we may hope—more genial for Israel, but would also highlight the Jewish state's strength as a rich source of creativity and scientific and technological innovation. Is there any greater realization of the Zionist vision?

Eugene Kandel is the head of the National Economic Council in the Prime Minister's Office and a faculty member in the department of economics and the school of business at the Hebrew University of Jerusalem. Netanel Oded is an economist with the National Economic Council in the Prime Minister's Office.

Notes

1. See, for example, Paul Davidson, "What's Libya's Impact on Oil?" *USA Today*, March 10, 2011.

2. Robert Baer, "Gaddafi's Next Move: Sabotage Oil and Sow Chaos?" *Time*, February 22, 2011.

3. For a more comprehensive description of the embargo crisis, see *Daniel Yergin*, *The Prize: The Epic Quest for Oil, Money, and Power* (New York: Simon & Schuster, 1991), pp. 588-632.

4. Carter made this statement in a speech he gave on April 18, 1977. For a full transcript of the speech, see www.pbs.org/wgbh/americanexperience/features/primary-resources/carter-energy/.

5. Bloomberg News, "Russia Ramps Up Oil Exports as OPEC Cuts Back," *New York Times*, September 8, 2009.

6. For more on this subject, see the organization's website, "OPEC Share of World Crude Oil Reserves 2009," www.opec.org/opec_web/en/data_graphs/330.htm. See also "Oil: Crisis and Collusion," *The Economist*, September 14, 2010.

7. For an academic, empirical analysis of the organization's conduct, and for a consideration of whether it fits the economic definition of a cartel, see James M. Griffin, "OPEC Behavior: A Test of Alternative Hypotheses," *The American Economic Review* 75:5 (December 1985), pp. 954-963.

8. Glen Carey, "Saudi King Counters Dissent with $36 Billion as Clerics Scold Protesters," *Bloomberg News*, March 11, 2011.

9. Though Venezuela has enjoyed the greatest oil reserves in the world since January 2011—297 million barrels—the production process in Saudi Arabia is still cheaper. See Reuters, "Venezuela: Oil Reserves Surpasses Saudi Arabia's," ahramonline.beta, January 16, 2011, http://english.ahram.org.eg/News/4060.aspx.

10. "Oil Pressure Rising," *The Economist*, February 24, 2011.

11. "The 2011 Oil Shock," *The Economist*, March 3, 2011.

12. Iran's budget for the 2009-2010 fiscal year totaled $280 million. One year later it swelled to $347 million, and this coming year (2010-2011) it will stand at $508 million. See Farideh Farhi, "Iran's Budget May Add to Strains," *Asia Times*, March 23, 2010; Ali Akbar Dareini, "Iran Approves $508B Budget," *Bloomberg Businessweek*, May 9, 2011.

13. Low production costs enabled Saudi Arabia and the Gulf Emirates to garner handsome profits from this sector even when the price per barrel was quite

cheap—$20 in today's terms. See the speech of the Saudi minister of petroleum and mineral resources, Ali Al-Naimi, during a visit to Texas in October 1999, www.saudiembassy.net/archive/1999/speeches/page4.aspx.

14. In this context, see a report by Lloyds Insurance: Antony Foggott and Glada Lahn, *Sustainable Energy Security: Strategic Risks and Opportunities for Business* (London: Chatham House, 2010), www.chathamhouse.org.uk/files/16720_0610_froggatt_lahn.pdf.

15. See data on the EIA (U.S. Energy Information Administration) website, www.eia.gov/pub/oil_gas/petroleum/data_publications/company_level_imports/current/import.html.

16. In 2009, China imported 4 million barrels of crude oil a day, half of which were from the Middle East; 839,000 barrels a day were imported from Saudi Arabia, and 463,000 barrels a day from Iran. These figures are taken from the EIA website, www.eia.gov/emeu/cabs/China/pdf.pdf.

17. Reuters, "China Renews Oil Import Pact With Iran," Arab News.com, January 21, 2011, http://arabnews.com/economy/article239487.ece; "Factbox—Iran's Crude Export and Fuel Import Customers," Reuters, April 13, 2010, www.reuters.com/article/2010/04/13/iran-factbox-idUSLDE63A01120100413.

18. In 2009 India imported 2.1 million barrels of crude oil a day—70 percent of them from the Middle East; from Saudi Arabia, India imported 378,000 barrels a day, and from Iran—336,000 barrels a day. See the EIA website, www.eia.gov/emeu/cabs/India/pdf.pdf.

19. For a full breakdown of oil consumption by country, see BP, *Statistical Review of World Energy June 2010*, www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2008/STAGING/local_assets/2010_downloads/statistical_review_of_world_energy_full_report_2010.pdf.

20. International Energy Agency, *Key World Energy Statistics* (Paris: International Energy Agency, 2009), p. 24, www.iea.org/textbase/nppdf/free/2009/key_stats_2009.pdf.

21. For an analysis of the Brazilian case, see Daniel Budny, *The Global Dynamics of Biofuels*, Brazil Institute Special Report 3 (Washington, D.C.: Woodrow Wilson International Center for Scholars, April 2007), www.wilsoncenter.org/topics/pubs/Brazil_SR_e3.pdf.

22. For a discussion of the different aspects of growing and developing second-generation biofuels, see, for instance, Anselm Eisentraut, *Sustainable Production of Second-Generation Biofuels*, Information Paper (Paris: International Energy Agency, 2010), www.iea.org/papers/2010/second_generation_biofuels.pdf.

23. Many experts believe that in the short term, methanol is the most competitive alternative to gasoline and diesel fuel. Methanol is much cheaper than refined petroleum products; it is produced from a variety of raw materials such as natural gas, coal, and waste; it is better suited to existing vehicle and gas-station infrastructures (with minor adjustments); and its air pollution is not as severe. See George A. Olah, Alain Goeppert, and G.K. Surya Prakash, *Beyond Oil and Gas: The Methanol Economy* (Weinheim: Wiley-VCH, 2005); Leslie Bromberg and Wai K. Cheng, *Methanol as an Alternative Transportation Fuel in the U.S.: Options for Sustainable and/or Energy-Secure Transportation* (Cambridge: Plasma Science and Fusion Center, MIT, 2010).

24. David Caploe, "Israel May Hold the World's Third Largest Reserve of Shale Oil," OilPrice.com, April 11, 2001, http://oilprice.com/Energy/Crude-Oil/Israel-May-Hold-the-Worlds-Third-Largest-Reserve-of-Shale-Oil.html.

25. A comprehensive analysis of the advantages of the electric car and the possible ramifications of its use for the transportation sector can be found in David B. Sandalow, ed., *Plug-In Electric Vehicles: What Role for Washington?* (Washington, D.C.: Brookings, 2009), as well as in the report published by Deutsche Bank in 2008: Rod Lache, Patrick Nolan, and Dan Galves, *Electric Cars: Plugged In*, Global Markets Research, Technical Report (Deutsche Bank, 2008), www.d-incert.nl/wp-content/uploads/2011/05/deutch_bank_electric_cars.pdf.

26. For the text of the cabinet secretary's announcement on January 30, 2011, see www.pmo.gov.il/PMOEng/Secretarial/Govmes/2011/01/govmes300111.htm.