Delivery of Affordable Alternative Energy Resources Today and Tomorrow: Facing up to the Fossil Fuel Problem

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Abstract

The bounty of fossil fuels - coal, oil, and gas - which biology conspired to trap underground millions of years ago, is limited, and is not being replaced. Once a barrel of oil is burned, it is gone forever. For decades world leaders have been coming up with plans to deal with the fact that one day the world will run out of its key sources of energy, hydrocarbon fuels. When oil no longer flows from rich Middle Eastern fields, there is no way, over the long run one can reverse the decline of crude-oil reserves worldwide. Alternative energy technologies offer the promise of clean, abundant important benefits compared to those of conventional fossil energy sources.

Keywords: Earth, fossil fuels, plants, sun, wind, water, power.

Introduction

From the dawn of human civilization to about 100 years ago, the sources of energy used by mankind were predominantly human and animal muscle and wood, with lesser amounts of solar, wind, hydro, and geothermal energy. With the discovery of oil, the development of natural gas fields, and the widespread distribution of electricity from coal-powered central power plants, fossil fuels became the predominant sources of energy in the world (Bull 2001). Unfortunately, geology limits the outlook for domestic oil and gas, finding additional huge oil fields is much less possible than in the past. Coal and nuclear power face political barriers. They inflict penalties or side effects paid for not directly by utility customers, but by the general public. These include air pollution caused by burning coal, unsightly damage caused by strip mining, fear of a nuclear accidents, and the dislike of passing nuclear wastes along to future generations (Stobaugh 1981).

Scope and Objectives

The scope of this study is limited to the decline of the availability of fossil fuels and the progress of alternate energy technologies, which are cost-effective today and are making steps to broader commercialization.

The objectives of this research are listed below:

- Replacement of fossil fuels - coal, oil, and natural gas.
- Alternative energies - solar, wind, photovoltaic, biomass, biofuels, hydrogen, geothermal, and nuclear energy.

Fossil Fuels

The three most universally used fossil fuels are: coal, oil, and natural gas, all of which are hydrocarbons. Each contains mainly two elements: hydrogen and carbon. Statistics about world reserves and consumption of these fuels must be in terms of their conversion to other forms, such as mechanical power, electricity, and synthetic materials, in addition to their familiar use in direct combustion for heat.

Coal

As the most plentiful fossil fuel in the world, coal has the potential of filling a growing proportion of the demands for energy, but problems such as underground coal fire plague this promising old fuel.
Coal is found around the globe, but three countries (the United States, Russia, and China) own nearly two-thirds of all known coal reserves. At present rates of consumption, these reserves would last more than 200 years, according to conservative estimates. However, geologists think the world probably has 15 times this amount. United States coal mining began in the mid 1700s. As recently as 1925 this country relied on coal for 70% of its energy. Coal was replaced by both oil and gas in the late 1940s because they were cheaper and easier to transport. To produce and use substantially more coal than we do today, a number of problems will have to be tackled such as: capital shortages at high interest rates, manpower (potential strikes and declining productivity), and transportation, including inadequate rail facilities. Environmental concerns include the proper reclamation of mine sites, potential changes in global climate caused by increased carbon dioxide (CO$_2$) from burning coal, and the emissions from coal stacks that erode buildings, poison lakes, and damage human lungs (Gore 1981). Coal gas and soot bring acid rain and disease to more than 100 Chinese cities, and problems spill over into Japan, Korea, Taiwan and the Philippines. In China alone, notes the director of the Dutch company, ‘Environmental Analysis and Remote Sensing’, “Satellite data suggest that as much as 200 tons of coal could be going up in smoke every year.” If so, China’s emission of CO$_2$, the principal ‘greenhouse’ gas that is believed to be a cause of global warming, is equivalent to three-quarters of all passenger car emissions in the US (Dyson 2004).

**Oil**

In 1859, outside Titusville, Pennsylvania, ‘Colonel’ Edwin Drake drilled a hole 70 feet deep, struck oil, and gave birth to America’s oil binge. Petroleum quickly became the foremost fuel for lighting and lubrication. When the huge Standard Oil Trust monopoly was broken into 34 separate companies in 1911, several of its fragments remained among the world’s largest firms. Within a century after the Pennsylvania discovery, oil shouldered aside coal as the leading source of energy. By 1948, the US had become a net importer of petroleum. Oil’s convenience particularly suited it for use in motor vehicles. A 42-gallon barrel of crude oil packs the same wallop as 5,700 cubic feet of natural gas or about a quarter ton of coal (Gore 1981).

The king of oil is the Saudis, now and until the wells run dry. The desert kingdom holds a quarter of the world’s proven reserves. The Saudis not only sit on the greatest share of global reserves, they are also the only nation with so much spare production capacity that they can flood the oil markets anytime they choose. As one Saudi official boasts, “We can always turn on the faucet and really screw the other producers.” The Saudis are the single biggest source of foreign oil for the US market, but that is only part of the picture. Lots of countries pump oil, more than 60 in all, producing upwards of 76 million barrels a day. But just about all of them run flat out, using or exporting every drop they can suck out of the ground. Not the Saudis. They can boost output from their current 7.2 million barrels a day to as much as 10.5 million in a very short time to prevent prices from spiking at times of crisis (Dickey 2002).

Released in May 2001, the Bush energy policy warns the dwindling supplies of oil and gas, an antiquated power grid and burdensome regulation threatens to drag the US into the ‘worst energy-supply since the 1970s’. In his introductory speech, Bush spelled out a scary 20-year scenario in which America becomes increasingly ‘vulnerable to price shocks, supply interruptions and, in the worst case, blackmail’. Bush’s projections were ever true, they still are raising a scary question: “Is there really an energy crisis ahead?”

For decades the US presidents have been coming up with plans to deal with the fact that one day the world will run out of its key source of energy, oil. President Bush’s rallying cry has become ‘freedom from foreign oil’. But there is no definition of freedom as there is a need of 1.7 million barrels a day to replace imports from Saudi Arabia, 650,000 barrels to replace supply from Iraq? There is no explanation of where the US might realistically find so much oil. There is no recognition that any crisis in the US would
be inextricably linked to energy supplies and demand everywhere in the world. The global view suggests, in fact, that there is no supply crisis. We know there is a lot more oil worldwide now than in the 1970s. Using increasingly advanced probes and sensors, surveys that once estimated total global reserves at 650 billion now find more than a trillion barrels. At present-day consumption rates, it looked in 1970 as if oil would run out in 33 years, that is, in 2003. In 2002, the same calculation puts the day of reckoning in 2046 (Emerson 2002).

**Natural Gas**

Since 1978, when a gradual decontrol of prices began, a surge in oil and gas exploration had revealed vast new gas fields in the Rocky Mountain region and in the Gulf coast of Louisiana, though their potential is still undetermined.

Meanwhile, policy makers advocate turning to new gas sources, including imports from Canada and Mexico, shipments of liquefied natural gas (LNG) from Arab states and Indonesia, the construction of a gas pipeline from Alaska, and the costly process of coal gasification.

Researchers are also looking more seriously at unconventional gas resources, long considered uneconomic to develop. Huge volumes lie docked in the Devonian shales of the Appalachia, in the nation’s enormous coal beds, and in the deep, brine-filled aquifers of the Texas-Louisiana Gulf coast region. According to the (US) National Petroleum Council, the most promising unconventional resource may be found in concrete-hard geologic formations called ‘tight sands’, which underlie many regions of the country. Tight sands in the contiguous US may yield between 192 and 574 TCF, the council says, although other estimates place total deposits, including Alaska, as high as 800 TCF (Gore 1981).

**Concentrating Solar Power**

Most people think of solar power as a flat panel on every rooftop. Concentrating solar power, sometimes referred to as ‘solar thermal’, systems use the sun’s heat to meet a variety of needs, such as: generating electricity, heating water for industrial processes, domestic water supplies or community swimming pools, preheating building ventilation air, and direct heating of building interiors.

In California, nine commercial concentrating solar power plants with a total generating capacity of 354 MW have been operating since the mid-1980s (Bull 2001). High in the Mojave Desert, 130 miles southeast of Los Angeles, lays a vast field of mirrors. Crisscrossing rows of glass and metal, glinting in the sunlight, cover a full square mile of dirt. It is a fully operational array of power plants churning an average of 180 MW of electricity, and offering a glimpse of a world in which the grids’ electricity comes from the sun.

The Thailand Solar Energy Park was set up in 1998 on the premises of Naresuan University in Phitsanulok Province. It is the biggest center of its kind here in Thailand, advocating the use of solar energy and serving as a headquarters for the study of solar energy, as well as research and development efforts in the use of solar energy (Trakullertsathien 2002).
Programmed Use of Solar Power in Thailand

The key objective of this program is to enhance the industrial sector’s awareness of alternative energy and energy conservation and spur solar cell manufacturing within the country. The first phase, began in late 2002 and was concluded at the end of last year, ten factories owned by the Federation of Thai Industries member companies installed solar power generators with a capacity of 4.2 kW at a cost of Baht 1.1 million each. The first phase had helped each participant save 525 kW per month, enough power to operate about 300 standard light bulbs.

This public/private pilot project involved the cooperation between the Federation of Thai Industries and the ‘Energy Conservation Fund’, which is managed by the Energy Planning and Policy Office (Bunyamanee 2004). It provided technical support to manufacturing plants that participated in the program for the installation of solar panels on their factory roofs, as well as to their entire solar systems.

Many manufacturers are now eager to participate in the second phase of the solar power for industry project, following the successful completion of the first phase (Bunyamanee 2004).

Wind Energy

While windmills still account for only a fraction of 1% of the electricity produced in the US, they no longer are the exotic playthings of a few dreamers. Windmills now account for only 2,500 MW of generated capacity nationwide, however the industry anticipates that in two decades wind power will grow to 100,000 MW and account for 6% of the country’s electricity.

The basic principle maybe the same; today’s windmills can hardly be compared to models built in the 1980s when the first wind fans were developed and soon ran into problems. The principle of the wind turbine has changed little. It is still a rotor, a gearbox, and generator and control systems. But today’s turbines are taller, lighter, cheaper, and easier to install, more durable and work more efficiently. The new designs address some past environmental concerns.

Turbines are now sleeker, more tubular, so that birds cannot perch on them. They are larger but also quieter. Along southeastern Washington and into neighboring Oregon, 450 Danish-built windmills with sleek white towers 60 m high with rotors 60 m across will churn out enough power for 75 families served by Pacificorp, one of the Northwest’s leading electric utilities (Hebert 2001).

Wind resources are abundant throughout the world. In the US, good resources can be found in 34 of the 50 states. For example, the wind resources in North Dakota alone could supply 36% of all the electricity consumed by the lower 48 states. More than 3,900 MW was installed worldwide since 2000. According to the American Wind Energy Association, and as much as 13,500 additional MW of wind capacity maybe installed worldwide in the next decade (Hebert 2001).

Still Fighting the Windmills in La Mancha?

During the time of Miguel de Cervantes, the windmills were used to turn grain into flour. In his famous classic, Don Quixote jousts with the windmill he mistakes for an ogre. Four centuries on, a new kind of windmill dotting the countryside of Spain’s La Mancha region (has as much wind power as the Netherlands) has led the people of this small town to take up Don Quixote’s battle against the giants. The 100 people of Luzaga in La Mancha about 200 km northeast of Madrid are mobilizing against a project by a Danish company to install 33 windmill turbines outside town. “We are not against wind power, but if they build a wind park here it will destroy the ecosystem surrounding the town”, said an ecologist (Lifschitz 2003).

Photovoltaic Energy

Photovoltaic devices use semiconductor materials such as silicon to covert sunlight to electricity. They contain no moving parts and produce no emissions while in operation.
Extremely modular, photovoltaic devices can be used in small cells, panels and arrays. Photovoltaic systems require little servicing or maintenance and have typical lifetimes of about 20 years. Photovoltaic markets, which passed the US$1 billion level in 1998, have been growing steadily and experienced a large boost over the last two years. Researchers in government, universities, and industry are working together to lower production cost (Bull 2001).

**Biomass**

Direct-combustion systems burn biomass in a boiler to produce steam that is expanded through a turbine/generator to produce power; cofiring substitutes biomass for coal in existing coal-fired boilers; gasification converts biomass to a fuel gas that can be substituted for natural gas in combustion turbines. Coal adds to global warming.

If all organic waste was collected and used to generate power in Thailand, it should produce more than 1,300 MW of electricity per year.

However, the current level of power generated by biomass totals only 178 MW, or 0.15% of Thailand’s total output, said a spokesman of Biomass One-Stop Clearing House (Danththaola 2002). A study made by the Clearing House found that about 49 million tons of sugar cane grew in Thailand every year, with about 14 million tons going to waste in the production process. Leaves and stems not used in the production of sugar added with 7.6 million tons of organic waste per year. This waste has the potential to generate 481 MW of electricity, said the spokesman.

The Energy Policy and Planning Office currently supported 31 small power producers, which used renewable energy sources to generate a combined 511 MW of electricity.

Of this total 312.4 MW came from rice husks, 79.9 MW from sugar cane bagasse and 40 MW from wood chips. The remainder was generated using water and cassava (Danthhaola 2002).

“It is really difficult to develop biomass projects because villagers keep protesting and being unreasonable,” told the Energy Secretary during a workshop. The government should encourage developers to work with local villagers before buying land and specifying production details. The success of the Philippines depended upon small-scale projects and required local villagers to be part owners (Kongrut 2003).

**Bio-fuel Ethanol**

Fuel ethanol distilled from crops such as corn and rapeseed could be a solution for countries seeking an outlet for huge agricultural surpluses. Bio-fuels could raise farmer’s incomes, cut large bills for oil imports, improve energy security and combat oil pollution and ground water contamination, said experts gathered in Singapore for international conference (Anon. 2002).

Although these fuels are far more expensive than fossil fuels, interest is picking up as agricultural commodities prices flounder at historic lows and concerns about global warming grow.

The September 11, 2001 terrorist attack on the US and violence in the Middle East pushed up crude oil prices and underlined the dependency on conventional energy sources.

“Renewed enthusiasm for biofuels is set to unleash massive growth in global demands for ethanol,” said a senior economist at Britain’s LMC International Ltd. If new policy initiatives in the US and the EU are fully implemented, the demand for ethanol will match, if not exceed, that of Brazil, currently the largest market for biofuel, she said.

With annual consumption of about 11 billion liters, Brazil has long been the world number one after introducing alcohol-powered vehicles in the 1970s to make use of its massive sugar crop.

Many nations including Australia, India, Thailand and Mexico are now working on ethanol projects to convert their farm surpluses into fuel for blending with diesel or petrol.

The EU is planning to mandate the use of ethanol in diesel by 2005, while the US is gradually replacing the toxic oxygenating additive methyl tertiary butyl ether (MTBE) with bio-fuel in gasoline.
Fuel ethanol, which also can be produced from palm oil or cassava, cuts greenhouse emissions that are held responsible for global warming. China, which is committed to improving air quality for the 2008 Olympics, is building the world’s biggest fuel ethanol plant in Jilin in the heart of the country’s corn belt, capable of churning out 600,000 tons a year when completed in 2003.

The experts said a major improvement in technology over ethanol is to narrow the gap in price with fossil fuels, although it still needed legislative or financial support such as tax concessions.

The city of Graz in Austria successfully runs bus services with ethanol made from recycled food oils, including frying oil collected from restaurants.

It is now technically possible to produce fuel ethanol not only from multi-feed stocks but also to change the mix from day to day depending on prices, said a spokesman of the Austrian Biofuels Institute. Many carmakers now provide engine warranties as quality standards were being set in Europe, he said.

Hydrogen

For years, folks laughed at Bragi Arnason’s vision of a society powered by the ‘H’ in H2O. Now the first test is about to be launched in his native Iceland. The process involves bombarding H2O with electric ions to split off the hydrogen, which is recombined with oxygen in a fuel cell that makes charged ions to run a motor, and water molecules as a byproduct. In short, Arnason plans to use natural energy to make a powerful hydrogen fuel that emits only water mist as a waste, promising a bottomless well of clean energy that produces no greenhouse gases and no threat of global warming.

It was a portentous discovery. Iceland grew up energy poor, a harsh reality that rankled an independent-minded nation founded in the 900s by Norwegian Vikings. With no fossil fuels of its own, and huge energy needs due to the cold weather and the economy’s reliance on gas-guzzling fishing vessels, Iceland was heavily dependent on foreign oil. It reeled from oil shocks, and its inflation rate averaged a staggering 17.6% between 1944 and 1995. From the beginning, Arnason saw hydrogen as the answer. He delivered his first paper on the subject in 1978 with trepidation. His mentor read it and said, “If you really believe this could be realized in 20 to 30 years, you should start talking about it now.” He did, mostly to Rotary clubs, his classes and other small groups in Iceland, where he soon gained a reputation. The energy people called him a guru, “Professor Hydrogen”. Then the world caught up. Arnason’s work began to pay off in the 1990s, when global oil and auto companies started to take seriously the idea of hydrogen as the “next oil”. The first breakthrough came in 1992, when Ballard Power Systems of Vancouver, British Columbia, demonstrated the first hydrogen-powered bus, the precursor to the models that will roll onto the streets of Reykjavik. The big surprise; Ballard’s bus produced 150 KW, or 15 times more power than most engineers expected from a hydrogen motor. “People kept looking around and asking, ‘Where’s the rest hidden?’” recalls the CEO of Ballard. “They never thought it could be done.” Daimler-Benz stepped up and invested $250 million, and together they turned to Iceland. Shell Hydrogen figures it would cost at least $19 billion to build hydrogen fuel plants in the United States, $1.5 billion in Britain and $6 billion in Japan. Whatever happens, when the new energy dawns, Arnason will have the satisfaction knowing that the first seeds of the hydrogen economy grew in Iceland, which is unusually ambitious. Cities from Vancouver to Palm Springs have already deployed hydrogen buses, but Iceland represent the first attempt to phase out fossil fuel entirely, and thus become the first society to eliminate greenhouse emissions. One key hurdle is cost: even under the most favorable estimates, Icelandic New Energy expects the hydrogen to eventually cost about twice as gas, though it would generate twice as many miles per gallon (Piore 2002).

Geothermal

Geothermal (earth heat) energy is one of our most plentiful resources. It results from the radioactive decay of rocks, which raises the
earth’s temperature an average of 25°C with each km of depth. Experts estimate that 32 million quads of energy are simmering within ten km of the surface of the US. Most can never be utilized, but interest in exploitable areas is quickening. The most common surface manifestation of geothermal energy is simply hot water. In Boise, Idaho, hot springs have heated homes since the 1890s. The earth’s heat is also used for industrial processing (Gore 1981).

The geysers’ steam power plant in California is the oldest and largest geothermal power plant in the world, with a capacity of 2000 MW. Hot-water plants have been developed more recently and are now the major source of geothermal power in the world. Total US capacity is about 2,800 MW, enough electricity for three million people, at a cost of $0.05-0.08/kW.h. Hot water from geothermal resources is used directly to provide heat for industrial processes, drying crops, or heating buildings, for a total US capacity of about 500 MW. Geothermal heat pumps do not generate electricity, but they reduce the consumption of electricity by using heat exchangers and the constant temperature of the earth several meters under the ground to heat or cool indoor air. The market for geothermal heat pumps has been growing rapidly and expectations are that they will soon reach the level of installation on more than 400,000 homes and commercial buildings per year (Bull 2001).

Many developing countries have geothermal resources, and continue to be an attractive market. Iceland is one country that uses geothermal energy to heat water and make electricity (Piore 2002).

**The Atom Option**

Pennsylvania, which saw the birth of the oil industry, has also witnessed the milestones in the US nuclear development, from the first commercial reactor at Shippingport in 1957, to the highly publicized nuclear accident at Three Mile Island in 1979 (Gore 1981).

The benefits of nuclear power are fairly clear. For one, it does not depend on the weather. And, since it is concentrated, it meets a specific need for supplying cities and factories, for which wind and solar power are inappropriate. Nuclear plants emit no carbon into the atmosphere and can be built in inaccessible locations. And, unlike the infant technology of hydrogen-powered fuel cells, we have 10,000 reactor-years of operating experience, not to mention the lesson of many failures, to learn from. What about those troublesome drawbacks; catastrophic accidents, nuclear waste, terrorism, proliferation, etc? Ever since the accidents at Three Mile Island in 1979 and Chernobyl in 1986, most people have come to see this technology as far too dangerous to contemplate, making it a foundation of our civilization. The Three Mile Island released only a small amount of radiation – statistically speaking, resulting in less than one death. The Chernobyl explosion was indeed a catastrophe. Fundamental design flaws and incompetent operation allowed the reactor power to surge. All told, about 24,000 people will die from exposure to radiation from the accident (Garwin 2002).

Yet, nuclear energy has carved a vital niche, especially in New England and the Midwest. Reactors produce 80% of the electricity in Vermont, 60% of Maine’s electric power, half of that in Connecticut and Nebraska. Research abroad and in the US promises substantial improvements in reactor efficiency. The breeder reactor produces more fuel than it uses. Breeders could multiply the reactor fuel supply 70-fold. But breeders convert uranium to plutonium reactor fuel, only a few pounds of which are needed to make a powerful bomb (Gore 1981).

A single, moderately sized nuclear power reactor can be used to turn uranium into plutonium to make three or four dozens bombs a year. Agreements are in place with the UN International Atomic Energy Agency to ensure that the so-called civil plutonium is not diverted to military purposes. As for terrorism, one threat to homeland security may now very well be the risk of nuclear plants’ being struck by heavy airplanes.

Embracing nuclear power would be a relatively inexpensive way to reduce carbon emissions. The cost of injecting CO$_2$ from coal plants into underground wells has been
estimated at about $100 for each ton of coal. A one-gigawatt coal plant burns three million tons of coal per year, releasing about 11 million tons of CO\textsubscript{2} into the air. Given the chance, nuclear power could be a safe and economical source of energy (Garwin 2002).

Hydro-Electric Power

Talks of the Nam Thuen II Dam Project, the largest and most controversial of all hydropower projects in Laos, began in 1993, with a projected cost of US$900 million. Delays hiked the project costs to US$1.2 billion, 30% of which will be financed by shareholders, and 70% by international loans. According to the Nam Thuen II Electricity Consortium (NTEC), work will start early in 2004. The commissioning of the dam will be in progressive steps, with full commercial operations set to begin in the second half of 2008.

Most people living along the banks of the Xe Bangfai River, which is being dammed, seem to believe official predictions of prosperity. They were given hope for new housing, roads, electricity, water, new schools for their children and hospitals in the villages. Although this project claims to help reduce poverty among the Laotian residents along the river, the International River’s Network strongly opposes the project, and lists the following reasons: destruction of livelihood, negative environmental impact, serious economic risk, and uncontrolled logging at the site of the dam.

Anyway, it seems certain that if the dam is built, Laos will earn a lot of money from it. The Nam Thuen Dam II is projected to sell 995 MW of electricity to Thailand in 2008 alone, as well as supply 75 MW to Electricite du Laos. An Electricity Generating Authority of Thailand (EGAT) official said the Nam Thuen II dam would benefit northeastern Thailand because current electricity supply for the region is insufficient (Tansuphabol 2002).

Conclusion

Imagine a world in which oil is irrelevant. At the moment, this is practically improbable; a world no longer dependent on fossil fuels, free from reliance on wholly unreliable surging oil energy costs.

Nobody knows how much oil is left and how much will it cost to extract. Meanwhile, global demands for energy will soar as the economies of China, India, Brazil and other countries grow. If the Middle East is already at a breaking point, imagine what could happen if competition for Middle East oil intensified among America, Europe, China, India, Japan and others (Sachs 2004).

For decades world leaders have been coming up with plans to deal with the fact that one day the world will run out of its key source of energy - oil (Emerson 2002). Meanwhile, reliance on fossil fuel to generate power contributes to global warming. With some 85% of all energy now produced by fossil fuels; blamed for producing the greenhouse gases, many scientists believe are behind global warming (Quinn 2001).

For nearly five decades, many scientists and energy experts have advocated the pursuit of alternative energy forms; a radical turn away from fossil fuel and its related pollution now available, low pollution renewable energies, and with respect to global warming, the burning of fossil fuels contributes three-fourths of the CO\textsubscript{2} emissions in the US today. Within the broad variety of technologies that constitute alternative energy, some are already making inroads in the marketplace.

Many scientists envision nuclear fusion as the ultimate answer to the energy problem. To achieve fusion, scientists must re-create the extreme conditions that exist inside the sun, where heat reduces matter to an ionized gas called ‘plasma’. At present fusion technology is so complex that some feel it will never be inexpensive enough to use (Gore 1981). Despite years of ostracism, alternative energy researchers are ever faithful. To many researchers, the upside is large, limitless, cheap energy (Beals 2001).

Efficiency improvements, followed by ‘soft technologies’ (renewable energies), are the fastest energy savers. Just by weatherizing buildings and replacing inefficient cars could reduce oil imports (Lovins 1981). The car of the future looks something like this: It has no
engine, no steering column and no break pedal. It requires no gasoline, emits no pollution (just a little water vapor) yet handles like a performance Porsche. It may sound like an environmentalist’s fantasy, but there it was on display at the Paris Auto Show in September 2002: the Hy-wire, a politically correct, fully functional prototype that General Motors claims could be road ready by 2010. Instead of an internal combustion engine, for example, the Hy-wire is powered by fuel cells like those used in the orbiting space station. Power is generated by an electrochemical reaction of hydrogen and oxygen that yields as its by-product only heat and hydrogen. No smelly exhaust, no smog, no greenhouse gas. The heart of the Hy-wire, however, is the aluminum, skateboard-like chassis that runs the whole length of the vehicle. Nested within are the fuel cells, an electric motor, tanks of compressed hydrogen and all the electronics. For one thing, the roadside infrastructure that fuels and services today’s gas-guzzlers would have to be redesigned to dispense hydrogen and reprogram faulty control system (Hamilton 2002).

If we are serious about reducing pollution to slow global warming, we need to agree on collective actions for the affordable development of alternative energy sources and the adoption of environmentally safe technologies.

References