Sustainable Energy: Shifting the Paradigm

An Idea Whose Time Has Come

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Today's dominant world energy systems, relying on fossil, nuclear and biofuels, endanger the very existence of humanity. The world is faced with a crisis that requires a total transformation in the way we create energy, shifting to sustainable energy that flows freely from the sun, the wind, the tides, and the center of the earth. Accelerating weather catastrophes – tsunamis, hurricanes, drought, the melting of the polar ice caps – underline the urgency to heed the scientific consensus that we are endangering our very survival on the planet with the continued use of carbon-based fuels.

Just this spring, we heard disturbing reports of food riots in more than 25 poor countries around the planet,[1] caused by food shortages, due to drastic changing weather conditions and tragic efforts to grow food crops for fuel, pitting affluent car owners against the two billion poor on our planet who struggle to get enough to eat, without even offering any significant benefits to the environment.[2] The push for biofuels is driven by massive industrial agricultural corporations, seeking ever-larger profits, as they misrepresent the actual costs to society of their polluting energy programs, in league with the fossil and nuclear fuel industries. They spend tens of millions of dollars on huge public relations operations, grinding out distorted facts and hiring false witnesses to confuse the public about the real solutions to our energy needs – harnessing the abundant free energy from the sun, wind, tides, and geothermal from deep within mother earth – because corporations are unable to control the production of free earth energy or turn it into profit. [3] How can you sell the sun, the wind, the tides?

Moreover, the recent failures of the Non-Proliferation Treaty Review Conference, the Millennium Summit and the General Assembly to meaningfully address issues of nuclear disarmament and nuclear proliferation should serve as a wake up call to nations that we cannot continue "business as usual." The drums of war are beating once again, as the United States seeks to deny Iran its "inalienable right" under the Non-Proliferation Treaty to pursue so-called "peaceful" nuclear technology.

International Renewable Energy Agency (IRENA)

Fortuitously, this April, the German government convened a preparatory meeting of 60 countries to plan for the establishment of an International Renewable Energy Agency which would empower developing countries with the ability to access the free and abundant energy of the sun, wind, marine, and geothermal sources; would train, educate, and diseminate information about implementing sustainable energy programs; organize and enable the transfer of science and know-how of renewable energy technologies; and generally be responsible for helping the world make the critical transition to a sustainable energy future. They subsequently issued an invitation to all interested countries to attend the Founding Conference for IRENA to be held in November 2008 in Berlin which will adopt IRENA's statutes, agree on an initial working program, outlining IRENA's first activities and establishing interim structures to allow for a prompt commencement of the work.

To move forward, a Working Program Group and a Statutes and Finance Working Group have been established which will meet in Berlin from June 30 to July 1st with preparatory documents going out to all participants, and results forwarded to other interested countries in July with requests for comments by August. In September results will be sent to all countries interested in becoming members of IRENA prior to its Founding Conference to be held in November 2008.[4] Help is on the way and civil society will be calling on their governments to support this worthy effort to save our planet from environmental catastrophe.[5] Since Irene is the Greek word for peace, this new initiative is particularly well named, adding resonance to the peaceful benefits of sustainable energy, the reliance upon which will preclude further global strife and conflict over resources.

SUSTAINABLE ENERGY

Today some 2.4 billion people still have no access to modern energy services and one quarter of the world's population lives without electricity.[6] Sustainable sources of energy will have a substantial impact on poverty alleviation in developing countries, offering access to readily available, cost-free energy sources while integrating growing energy needs and sustainable development goals. Sustainable energy coupled with energy efficiency offers solutions to the critical challenges of our time – climate change, energy security, nuclear proliferation risks and economic development.

Solar Power

Every thirty minutes, enough of the sun's energy reaches the earth's surface to meet global energy demand for an entire year.[7] The sun is a fireball of free energy that can be harnessed for hot water and temperature control using solar collectors. In addition, solar energy can be used to provide electricity utilizing photovoltaic (PV) technology, which generates electricity from sunlight without producing green house gases. The Worldwatch Institute reports that already," rooftop solar collectors provide hot water to nearly 40 million households worldwide." [8] Solar PV is versatile, and can produce stand-alone electricity or connect to existing electricity grids. The solar energy available in a 100-square-mile area of Nevada could supply the United States with all its electricity needs.[9]

Wind Power

Wind has the potential to satisfy the world's electricity needs 40 times over, and could meet all global energy demand five times over.[10] One US study concluded that, "good wind areas, which cover 6% of the contiguous U.S. land area, have the potential to supply more than one and a half times the current electricity consumption of the United States." [11] Globally, the wind energy market grew a staggering 40.5% in 2005.[12] In Europe, wind installed capacity has already exceeded the European Commission's goals of 40GW before the end of the decade.[13] Germany is the European leader, with more than 18GW of installed wind capacity.[14] In Navarra, Spain, half of the electricity consumption is met by wind power and in Denmark wind represents 20% of the electricity production.[15] India is now the world's fourth-largest producer of wind energy.[16] In China, wind energy grew at a 60% rate in 2005.[17]

Geothermal Power

Geothermal energy is produced when magma rising from the Earth's core heats nearby water, creating high-temperature water and vapor which is converted to electricity by pumping steam out of the ground and through a turbine, to power a generator. Geothermal energy is also used directly to heat and cool buildings and in agriculture.[18] Geothermal energy stored in the top six miles of the Earth's crust contains an estimated 50,000 times the energy of the world's known oil and gas resources.[19] Geothermal energy can meet 100% of all electricity needs in 39 developing countries and could serve the needs of 865 million people around the world.[20] Even in regions without heavy geothermal activity, the regular heating of the ground by the sun can be harnessed to heat and cool homes.[21]

Tidal Energy and Smaller-Scale Hydropower

Both tidal, wave and smaller-scale hydroelectric projects are a significant improvement over traditional, 'big dam' hydroelectric power and large ocean-based tidal barrages which are environmentally destructive[22]. Tide-powered marine turbines are preferred. Northern Ireland is expected to generate 1,200 kW of electricity from marine turbines and it is estimated that tidal streams could meet 5-7% of the U.K.'s electricity needs. For inland regions, small-scale riverbank projects can produce electricity for agriculture or other uses[23]. Wave power and tidal energy has been estimated to be able to produce 20% of Britain's electricity. [24] The U.S. Department of Energy's National Renewable Energy Laboratory estimates the potential of global wave power to be 2 to 3 million MW, with wave energy density averages of 65 MW per mile of coastline in favorable places.[25]

INTERMITTENCY: A CONCERN OF THE PAST

When the sun doesn't shine and the wind doesn't blow, we can interconnect renewable energy sources or store the energy as hydrogen.[26] Distributed solar PV can also produce electricity on-site, making it "harder to disrupt, more stable, and less brittle than full reliance on centrally generated power." [27] Geothermal energy is unaffected by weather patterns and tidal patterns can be predicted centuries into the future. Hydrogen fuel, made by electrolysis, can be stored as liquid or compressed gas and either be combusted like conventional fuel or used in fuel cells to produce electricity. The only byproducts of the fuel cell recombination are heat and water vapor, pure enough to drink! Importantly, electrolysis can be performed using the power of the sun, the wind, the tides, geothermal, creating a perfect circle of sustainable energy while providing back up fuel to store for periods of intermittency.[28]

Significantly, the power outage rate of fossil-fuel power plants is about 8%, compared to wind turbines at only 2%.[29] Fossil fuel supply lines are also vulnerable to political instability as in Nigeria, where internal turmoil decreased oil production by

20%.[30] But temporary energy shortages are a minor concern compared to the fact that the world's oil production will "peak" in the very near future, and global supply will be unable to keep up with demand.[31] Without a rapid transition away from petroleum dependence, a sustained global energy crisis could trigger bloody resource wars over access to remaining fossil fuel reserves. Uranium resources are also limited and may be depleted as soon as fifty years from now.[32] However, there has yet to be a weather forecast predicting the imminent disappearance of the sun, wind, or tides.

HYDROGEN: THE KEY TO SUSTAINABLE TRANSPORTATION

By 2030, according to a US Department of Energy report, "wind- and solar-based hydrogen systems …can produce enough hydrogen to virtually eliminate petroleum energy use and greenhouse gas emissions from the light-duty transportation sector." [33] In Spain, hydrogen production for transportation is now considered an alternative to costly grid reinforcements, as a way of exploiting the [region's] vast wind resources. Producing hydrogen fuel for an American light-duty fuel cell vehicle (FCV) fleet would consume about the same amount of water that is currently used to produce conventional gasoline.[34] Any water used to produce hydrogen will be returned to that cycle in the form of fuel cell water vapor emissions. Current transportation methods are responsible for 27% of America's greenhouse gas emissions[35] and 14% of emissions worldwide.[36] Manufacturers are consistently improving the distances that FCV's can go without refueling, and some prototypes can travel as far as 300 miles before refueling.[37]

Icelandic New Energy – a public-private partnership for the advancement of a hydrogen economy in Iceland – says Iceland could become "the first fossil-free hydrogen society in the world," [38] shifting completely to hydrogen produced by geothermal and hydropower energy sources by 2050.[39] Hydrogen fuel cell buses in Reykjavík[40] are now a part of a program, in nine cities across Europe.[41] Hydrogen busses are also used in Australia, Japan, and as part of China's " Green Olympics" program for the 2008 Summer Games in Beijing.[42] Icelandic New Energy, started the H-Ship project in 2004, testing the viability of fuel cells in ships. Japan expects to have a hybrid fuel cell train in operation by the end of 2007.[43] Hydrogen is a viable fuel for air travel and NASA has been using it to power its space shuttles, using the steam as drinking water for the crew.

BIOFUEL, COAL, AND NUCLEAR ENERGY: UNSUSTAINABLE DEAD ENDS

Sustainable energy is also a better alternative to industrial biofuel, "clean" coal, and nuclear energy. Resources invested in these technologies divert valuable and finite resources that can be applied in the development and promotion of sustainable energies.

Industrial Biofuel – Factory Farming for Energy

Biofuels are being falsely promoted by industrial agriculture as a replacement for gasoline with less carbon impact. U.S. refiners anticipate doubling their use of corn-based ethanol to eight billion gallons a year by 2012.[44] The European Union hopes to meet 20% of its fuel needs for road transportation using biomass.[45] Unconstrained industrial biofuel production is already producing dire consequences. The limited availability of the world's arable land results in biofuel feedstock taking priority over food crops.[46] There is heavy use of pesticides as well as petroleum-based fertilizers. The runoff from these additives contributes to the expansion of 'dead zones' – aquatic areas so polluted with nitrates and industrial waste they cannot support life. Significant expansion of biofuel feedstock production will cause widespread deforestation in regions such as South East Asia. The Malaysian government intends to develop 3 million hectares of new oil palm plantations by 2011,[47] even though oil palm production is responsible for an estimated 87% of the deforestation in Malaysia from 1985 to 2000.[48] In addition to decreasing biodiversity, deforestation limits the planet's ability to absorb CO_2 from the atmosphere, undermining one of the main justifications for using biofuels in the first place.[49]

Coal – Carbon Will Always Pollute

The coal industry argues that coal can be made environmentally friendly by sequestering carbon: capturing and storing coal's carbon emissions before they enter the atmosphere, in large underground reservoirs or reservoirs under the ocean which would require storage for hundreds or thousands of years before any carbon could be released.[50] Even coal's supporters concede this may produce leaks in storage containers leading to water displacement, groundwater contamination, or even human asphyxiation.[51] The additional energy required for carbon sequestration could also accelerate coal consumption, hampering the reduction of carbon emissions through long-term sustainable solutions.

Coal mining and burning causes havoc to land, groundwater, local ecosystems and human health. In West Virginia, coal producers are blowing up hilltops to access coal seams, dumping the leftover rock and dirt into nearby valleys. With mountain top removal, hundreds of feet of dirt, plants, and rock above the coal seam are blasted off and dumped over the side of the mountain, smothering streams, polluting the air, and eroding the soils. One study calculated that mountain top removal in the Appalachian coalfields resulted in 724 miles of streams buried and thousands of acres of destroyed forests.[52] Coal-fired electric power plants are the largest source of human-caused mercury air emissions in the U.S., accounting for about 40% of mercury emissions in the country.[53] Neurological abnormalities from mercury exposure include deficiencies in memory, attention, language, movement and cerebral palsy.[54] One study found that 8% of women had mercury blood levels exceeding the level deemed safe for unborn children.[55]

Nuclear – Never Far from a Disaster

The nuclear industry is now flacking for nuclear power, asserting its potential to lower greenhouse gas emissions. It even maintains that nuclear energy produces electricity, "*without polluting the environment*." [56] However, every step of the nuclear fuel cycle – mining, milling, production, transportation and disposal of waste – relies on fossil fuels and produces greenhouse gas emissions. A complete life-cycle analysis shows that generating electricity from nuclear power emits 20-40% of the carbon dioxide per kilowatt hour (kWh) of a gas-fired system when the whole system is taken into account.[57]

Nuclear power is the slowest and costliest way to reduce CO_2 emissions, as financing nuclear power diverts scarce resources from investments in renewable energy and energy efficiency. The enormous costs of nuclear power per unit of carbon emissions reduced would actually worsen our ability to abate climate change as we would be buying less carbon-free energy per dollar spent on nuclear power compared to the emissions we would save by investing those dollars in solar, wind or energy efficiency.[58] A Massachusetts Institute of Technology study on the future of nuclear power indicates that 1500 new nuclear reactors would have to be constructed worldwide by mid-century for nuclear power to have a modest impact on the reduction of greenhouse gasses.[59] Further, nuclear power's impact in mitigating climate change and reducing oil dependence is limited to the production of electricity.

Nuclear power plants in the United States alone have produced more than 80,000 tons of highly radioactive waste for which there is no suitable storage location.[60] This waste will remain lethal to human health and the environment for more than 250,000 years, and its continued production poses an unacceptable burden on present and future generations. Numerous nuclear power plants have been leaking radioactive toxins into groundwater and soil.[61] Radiation causes cancer, various immune deficiencies, infant mortality and chromosomal mutations. While the US Nuclear Regulatory Commission (NRC) sanctions the radioactive content of "routine releases," the National Academy of Sciences concluded that there is no "safe" level of radiation exposure." [62]

The nuclear power industry has demonstrated that it cannot compete in a liberalized electricity market. Despite the tens of billions of taxpayer dollars the nuclear industry it received since 1948, the industry still cannot operate without massive subsidies, tax breaks and incentives. In the U.S., the 2005 Energy Bill allocated over $13 billion in direct and indirect subsidies for the nuclear industry.[63] The U.S. nuclear industry is estimated to have received more than $115 billion in direct subsidies from 1947 through 1999. Government subsidies for wind and solar energy for the same period totaled only $5.49 billion.[64]

Nuclear power construction cost estimates have been notoriously inaccurate in the past. By factors of two or more. DOE data reveals that the total estimated cost of 75 of today's existing nuclear units was $45 billion (in 1990 dollars)[65] and the actual costs turned out to be $145 billion. The estimated cost of $1,500 – $2,000 per KW for the new generation of nuclear plants is extremely optimistic and unlikely to be achieved as evidenced by the prices of recently built nuclear power plants in Japan, which were much higher, ranging between $1,796 and $2,827 per KW (2003 US dollars).[66]

Nuclear storage facilities and power plants are vulnerable to accidents or attacks, and to hazards from transporting nuclear waste by truck, train or ship. The Chernobyl disaster may ultimately cause 270,000 cases of cancer, of which 93,000 could be fatal.[67] There is also concern regarding terrorist or wartime attacks for which there is little defense, as 'mock attacks' carried out by the NRC against nuclear power plants from 2000-2001 were successful in nearly half of the tests performed.[68] A terrorist or military attack resulting in a core meltdown would carry a disastrous human toll, with estimates of upwards of 15,000 acute radiation deaths and up to one million deaths from cancer.[69] And in a much less hypothetical example, the Indian Point nuclear reactors, located some 30 miles from New York City, were listed as suggested targets in documents found from Al-Qaeda after the World Trade Center attacks.

In addition, the nuclear fuel cycle involves numerous byproducts and processes that can also be utilized for weapons purposes, literally making every nuclear power plant a potential nuclear bomb factory.[70] Indeed, civilian nuclear programs in Israel, India, and Pakistan, enabled each of those countries to covertly develop nuclear weapons as a result of their " peaceful" nuclear energy programs. International Atomic Energy Agency (IAEA) Director Mohammed El-Baradei paints an even grimmer picture, saying, "We just cannot continue business as usual…we are really talking about 30, 40 countries sitting on the fence with a nuclear weapons capability that could be converted into a nuclear weapon in a matter of months."[71] Currently, Iran's assertion of its right under the Nuclear Non-Proliferation Treaty to uranium enrichment is raising international concerns as the same technologies used for the production of nuclear power can be used to produce nuclear weapons. The proposal to create a Global Nuclear Energy Partnership to reprocess used nuclear fuel and create an international network of nuclear fuel and technology transfer would further increase current proliferation risks. Reprocessing nuclear spent fuel would be a dangerous shift in global nonproliferation policy and would increase the likelihood that fissile material could be stolen to build a nuclear bomb.

Sustainable Energy: Good Choice for the Economy

Dollar for dollar, the economic rewards from sustainable energy investments continue to outpace those from conventional energy sources. Sustainable energy sources provide more jobs "per MW of power installed, per unit of energy produced, and per dollar investment than the fossil fuel-based energy sector."[72] The sustainable energy sector is experiencing virtually unprecedented financial success. Currently a $2.5 billion industry, solar PV is projected to grow an average of almost 20% a year through 2020.[73] Wind energy is also booming, with a record-setting $3 billion worth of new equipment installed in the U.S. alone last year.[74] Some forecasts anticipate that solar and wind energy will each constitute a $40 billion to $50 billion industry by 2014.[75] Already a $1.5 billion industry in its own right, geothermal energy may grow by up to 15% annually in some sectors, and the DOE predicts that foreign governments will spend as much as $40 billion from 2003 to 2023 to build geothermal energy plants.[76]

The Union of Concerned Scientists estimates that 355,000 new jobs in American manufacturing, construction, operation, maintenance, and other industries can be created if the United States obtained 20% of its energy from sustainable sources by 2020.[77] Solar power alone is expected to provide more than 150,000 U.S. jobs by 2020.[78] The Breakthrough Technologies Institute estimates that the hydrogen fuel cell industry could create up to 189,000 jobs in direct and indirect employment by 2021.[79] Germany now employs 170,000 people in its sustainable energy sector, and substantial future growth is anticipated.[80] On a global scale, over 1.7 million people are already directly employed in sustainable energy manufacturing, technology, and maintenance, with indirect employment believed to be several times higher.[81]

Sound Policies to Fast-Track Sustainable Energy

Sustainable energy still faces the challenge of becoming more cost competitive with conventional sources. The "*Catch 22* element at work," according to Peter Fraenkel of Marine Current Turbines Ltd., is that marine and other sustainable energy sources become affordable "once they are perfected and then deployed on a large scale…but while costs and risks are high there is no incentive for large-scale deployment." [82] Thus, governments must get "ahead of the curve" by enacting policies that more accurately reflect the true costs and benefits of both conventional and sustainable energy sources.

One effective mechanism is net metering, which offers small-scale energy producers a significant savings by allowing them to sell their surplus energy back to the grid. Technology procurement, tradable certificate programs, increased funding of sustainable energy production, development of codes and standards, and simplification of the permitting process can remove the roadblocks that currently impede faster development of sustainable energies. Promoting a more efficient use of energy is one of the cheapest and fastest ways to move towards a sustainable energy future. According to the US Department of Energy, improving building energy efficiency by 30% could reduce consumer costs in the U.S. by $38 billion over a 15-year period.[83]

Obstacles to a Sustainable Energy Economy

Subsidies and Incentives

Market distortions - such as subsidies and the failure to account for the true societal cost of conventional energy - have unjustly benefited the nuclear, fossil, and biomass industries for decades. Worldwide, conventional energy sources received approximately $250 billion in 2003 in government subsidies,[84] for example, while combined U.S. and European government support for renewable energy totaled just $10 billion the following year.[85] The World Bank allotted just 9% of its energy financing in 2005 to sustainable projects.[86] According to the United Nations Development Program, the unfair advantages afforded to unsustainable energy, "discourage new entrants into the market and undermine the pursuit of energy efficiency." [87]

Subsidies, incentives, and other forms of assistance are the economic lifeblood of the nuclear industry. Nuclear power receives 61% of the European Union's energy-related research and development funding even though it contributes only 13% of the region's energy.[88] In addition, the unacceptably high cost of insurance, waste removal and storage, and decommissioning would make nuclear energy completely untenable in a truly equalized marketplace. The US nuclear industry has been shielded from this reality by measures such as the Price-Anderson Act of 1957, which protects it from full liability in the case of an accident and shifts the burden of the financial obligation, after $10 billion, to the taxpayer.[89] In the event of a core meltdown, however, the economic damage could total *trillions* of dollars.[90]

The fossil fuel industry has also thrived from disproportionate incentives such as a Clinton-era initiative, the Deep Water Royalty Relief Act, which will allow oil and gas companies to avoid royalty payments on over $65 billion worth of revenues for the next five years at a cost of $9.5 billion with losses to the treasury over 25 years at approximately $20 billion." [91] The U.S. 2005 Energy Bill also provided royalty relief, tax breaks and other incentives for the oil, gas, coal and nuclear industries, which have been estimated at $27 billion.[92] The oil industry has responded in kind, having spent almost $190 million in U.S. campaign contributions since 1989.[93] Fossil fuels receive indirect subsidies as well, often in the form of military support to maintain secure oil supply lines. The US spends more than $50 billion a year maintaining troop readiness to intervene in the Persian Gulf *during peacetime*.[94] That sum alone does not account for the enormous costs of war often driven by a need to secure energy resources.

Unaccounted Costs: Externalities

Unsustainable energy sources are misleadingly under-priced because their market values do not account for the toll they take on human health and the environment. These costs are paid by society at large and include environmental costs associated with ecological disasters, air pollution, and climate change, and health, social and productivity costs – characterized as "externalities" by economists. The calculation of external costs is not a simple task. However, "not to incorporate externalities in prices is to implicitly assign a value of zero, a number that is demonstrably wrong."[95]

Even without quantifying the risks from radioactive waste or weapons proliferation, for example, nuclear energy produces up to $2.7 billion a year in external costs in the EU-15 countries alone.[96] A recent study calculated that 75,000 American lives could be extended each year with a decrease in the soot and particulates that pollute our cities' air.[97] The rewards could be even greater for cities such as Bombay, India, where just breathing the air has been compared to smoking more than two packs of cigarettes a day.[98] In 1999, the real cost of gasoline was estimated to lie between $5.60 and $15.14 per gallon, when the price at the pump was barely more than a dollar per gallon.[99]

Though the immense advantages of sustainable energy are difficult to quantify, monetizing the costs and benefits of sustainable and unsustainable energies is indispensable to understanding their comparative prices. A study in the journal *Nature*, for example, puts the total value of the world's ecosystem services at an average of $36 trillion a year.[100] Another study concluded that if externalities were included in petroleum-based electricity prices, their cost would double, immediately making sustainable energy more cost-competitive.[101] The European Wind Energy Association estimates that when external costs are accounted for, electricity produced using gas and coal carries a total social cost up to twice that of wind.[102] Despite the difficulty of calculating the costs, it is clear that understanding the penalty society pays for unsustainable energies is an essential part of the rapid transition away from reliance on those sources.

Conclusion: Democracy and Stability At Home and Abroad

Little action is needed to convince the world's citizens of sustainable energy's power and promise. In a 2000 survey, 76% of respondents from 27 countries agreed with the statement that human beings should "coexist with nature" rather than "master nature." [103] Europeans believe that sustainable energy more than any other energy source will be affordable, efficient, and environmentally sound in the next fifty years.[104] Americans agree, with more than 85% supporting greater funding for sustainable energy research and development and only a third in favor of reducing foreign oil dependence through drilling in the Alaska National Wildlife Refuge (36%), building more coal-burning electric plants (33%), or constructing new nuclear power plants (36%).[105]

Relying on sustainable energy would promote democratic values and the international aspirations embodied in the United Nations. Most conventional energy sources are centrally controlled, produced, and distributed, leaving many consumers with few choices regarding where their energy comes from or how it is produced. Sustainable energy can be decentralized to allow end-users greater freedom in deciding how their energy will be both produced and consumed. Governments can foster this dynamic by encouraging greater local control over energy-related decisions. In Denmark, for example, two-thirds of wind turbines are cooperatively owned. This has given local communities a direct stake in the projects' success and increased their overall support.[106] Similarly, small-scale hydropower projects in Sri Lanka are often managed by Electricity Consumer Companies, where locals decisions are made on issues ranging from setting tariffs, to end-uses, to resolving disputes between consumers.[107]

In addition to regional and national initiatives, the switch to sustainable energy must receive genuine support at the international level. Currently, there is no global institution to promote and implement a transition to a sustainable energy economy. For nearly fifty years, the International Atomic Energy Agency has promoted nuclear energy, while the International Energy Agency, established in 1974 during the OPEC oil crisis, is mandated to secure adequate supplies of fossil fuels. The welcome announcement of plans to establish an International Renewable Energy Agency would address the critical need for a global commitment for a world-wide transformation to a 21st century safe, nuclear and carbon-free energy future. [108]

September 2000 bore witness to a rare moment of global unity when every member of the United Nations pledged to meet a set of eight Millennium Development Goals by the year 2015. Three of those goals bear repeating here:

- Eradicate extreme hunger and poverty;
- Ensure environmental sustainability;
- Develop a global partnership for development.

The Millennium Goals are a demonstration of the possible, and they place a moral obligation in the hands of every citizen to demand environmentally responsible practices from their leaders and themselves. Politicians, businesspeople, diplomats, academics, workers, and activists, all share a common bond and a common responsibility to help realize these goals by supporting a rapid transition to plentiful sustainable energy. The barriers to this transition are not technological, but political. The failure to make this transformation would occur not from a lack of solutions, but from a subversion of democracy.

[1] *New York Times*, April 30, 2008, at A16
[2] Inter Press Service, "Biofuels a Lose-Lose Strategy, Critics Say" by Stephen Leahy, January 26, 2008
[3] http://www.sourcewatch.org/index.php?title=Patrick_Moore_on_Nuclear_Power
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