BOOK REVIEW

ENERGY AUTONOMY: GETTING SERIOUS ABOUT RENEWABLE ENERGY, by Hermann Scheer, Earthscan 2007.

Reviewed by Darrell Blakeway*

Dr. Hermann Scheer, member of the German Bundestag since 1980, is a distinguished leader of the world renewable energy community, and a moving force in establishing Germany as the leader of renewable energy development through the most effective legislation anywhere in the world. His most recent book, *Energy Autonomy*, was published in German in 2005. The English translation was published in January 2007.[1] Scheer argues that environmental advocates must press for massive and rapid development of renewable energy, and to halt the further development of fossil and nuclear energy to avert environmental, political, and economic disaster. He is deeply critical of the opposition he perceives from conventional fossil and nuclear energy industries.

Scheer makes a compelling case for renewable energy, noting many encouraging developments in recent years. Nevertheless, he perceives very effective opposition to renewable energy, sometimes overt but often covert, and concludes that many of the strongest proponents for renewable energy have been enervated by the opposition.

Energy Autonomy opens with a remembrance of the euphoria that swept through the 4,000 participants in the Renewables 2004 Conference in Bonn, Germany. Scheer was instrumental in persuading Gerhard Schroeder, then Chancellor of Germany, to convene the Conference. Despite the enthusiasm and optimism of the conference participants, Scheer observes that growth rates in fossil energy usage still remain significantly higher than growth rates for renewable energy resources.

While interest in renewable energy is growing around the world, Scheer says that the actual efforts to implement a major and sustained development have been limited to a very few countries. The steps necessary to realize the fullest potential for renewable energy are not being taken, Scheer asserts, because of the faulty perception, even on the part of many renewable proponents, that substantial reliance on renewable energy is not feasible. Components of this misperception are these:

- Renewable energy's usable potential is too limited to substitute for nuclear and/or fossil energy. We must continue to make massive investments in conventional energy during a long transition period to renewable energy.

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1. HERMANN SCHEER, ENERGY AUTONOMY: THE ECONOMIC, SOCIAL, AND TECHNOLOGICAL CASE FOR RENEWABLE ENERGY (Earthscan 2007) [hereinafter SHEER].

- Renewable energy must be integrated into existing energy supply structures, and be compatible with those structures. Renewable energy usage must be limited to the capacity that existing energy structures (such as electric transmission and distribution) can accommodate without jeopardizing the reliability of those structures.
- Energy policy should not jeopardize the financing of new conventional energy facilities, or threaten recovery of investments in existing facilities.
- Introducing renewable energy on a scale that would rapidly displace the existing energy structure would cost far more than society can afford. A very gradual transition to renewable energy is the only financially prudent path.
- Policies to develop renewable energy depend on subsidies, which are inherently unfair and uneconomical.
- Conventional energy businesses are essential components of our economy and should be relied upon to guide the development of renewable energy.
- Unregulated (or minimally regulated) energy markets are the best guarantors of the lowest prices to consumers. Governments should not impose policies to promote renewable energy that result in higher prices.
- The problem of global climate change and the need for clean renewable energy as a response to that problem are global problems, and solutions should not be implemented unilaterally by individual governments.
- Steps to promote renewable energy and address world-threatening problems caused by the continued use of conventional energy must not be so large or so radical that they generate significant political or economic opposition.

Scheer rebuts each of these claims, and calls for the rapid, massive development of a renewable energy alternative to the existing conventional energy regime. He opposes gradual evolution and frames his support for renewable developments in revolutionary language. The message will be inspirational to many (including this reviewer), but his roadmap will be hotly disputed and may not be the only avenue to a renewable energy future.

I. SUN OR ATOM: THE FUNDAMENTAL CONFLICT OF THE 21ST CENTURY

With the knowledge that non-renewable sources of energy will eventually be exhausted, Scheer argues that the only question is whether we will succeed in making a radical change in energy platforms in time to spare the world irreversible ecological damage and accompanying political and economic catastrophe.

The prospect of an 'oil peak,' after which oil will become progressively more expensive due to an inability to continue increasing production enough to meet increasing demand has been anticipated since the beginning of the oil age. The question has never been whether the world would run out of oil, or

affordable oil, but when. Scheer sees this day rapidly approaching and argues that we must quickly transition away from using oil as fuel and devote it to higher valued uses such as chemical feedstock.

Scheer characterizes the fundamental conflict over energy policy in the twenty-first century as the competition between the sun and the atom. In the 1950s, nuclear fuel was thought to be the obvious successor to fossil fuel. The prospect of reprocessing spent nuclear fuel made it seem to be a fuel virtually without limits. In Scheer's mind, the commitment to a conventionally conceived energy future involves, first, the exhaustion of carbon-based resources (oil, coal, natural gas) and a dangerous transition to a nuclear power. He contrasts that vision with a commitment to a far more benign environment, if the power of the sun is harnessed in its various forms, including wind, tides, ocean waves, and biofuels, as the primary source of energy for as long as the sun continues to shine.

II. CRISES FOR CONVENTIONAL ENERGY

Speaking darkly of a conventional energy future, Scheer lists the associated "crises" as follows:

1. The threat of global climate change is increasingly evident. Paleoclimatology studies indicate that the world has previously experienced climate changes, and some have occurred quite abruptly. These previous climate changes were not caused by humans burning fossil fuels, but Scheer subscribes to the now prevailing view that the climate change underway now is almost certainly caused or exacerbated by the use of fossil fuels. A rapid and complete change to a non-polluting renewable energy regime may significantly mitigate the most adverse effects of global warming.
2. Reserves of oil and gas, especially the reserves that can be extracted relatively effortlessly and cost-effectively, will be depleted in just a few decades. The majority of those reserves are in countries that are politically hostile or unstable, or both. There is evidence that the presence of such increasingly scarce and valuable resources leads, almost inevitably, to authoritarian, corrupt, and often unstable political regimes. The increasing dependence of the rest of the world on the dwindling supply of oil and gas imposes military costs far beyond what consumers pay at the gas pump. The necessity of maintaining a continuous military presence in the countries and regions where such reserves are located also contributes to the reactionary rage that leads to acts of terrorism.
3. Underdeveloped countries whose populations suffer most from poverty must also pay the ever-increasing costs of importing fossil fuels to support their nascent industries and ongoing agricultural activity. The economic impacts of increasing prices of imported fuel weigh more heavily on such countries, and the poor people of such countries, than upon the more advanced countries and their populations.

4. The threat of the proliferation of nuclear weapons and the prospect that such weapons will become available to 'rogue' nations or terrorist organizations are the most serious threats to world security and peace. And yet, a key feature of the Nuclear Non-Proliferation Treaty is that any country without nuclear weapons that promises not to develop or acquire such weapons is guaranteed technological and financial support to develop nuclear energy. Scheer asserts that whoever possesses the essential components of the nuclear fuel cycle, that is, reactors and the opportunity to enrich uranium and reprocess nuclear fuel, is just a few quick steps away from possessing nuclear weapons. (Witness the current concern over Iran's development of nuclear power). Thus, proliferation of nuclear energy gravely increases the risk of proliferation of nuclear weapons.
5. Both fossil-fueled and nuclear power plants use prodigious amounts of water, far more than is widely known by the general public, and thus contribute greatly to a growing crisis over the lack of adequate water supply in many parts of the world.
6. The use of fossil-fueled energy for farming and the increasing use of petroleum-based fertilizers are leading to a crisis in the agricultural economy of many countries and regions. The need for cash crops and the intensive farming techniques necessary to produce increasing amounts of such crops is often driven by the need for money to pay for the fossil fuels necessary for agriculture, residential and workplace heating, and other industrial activities, especially in underdeveloped countries. This perpetuates a vicious cycle of poverty.
7. A growing health crisis is also caused and will be exacerbated by increasing reliance on fossil fuels and nuclear energy. Coal mining is one of the most dangerous occupations to health and safety, as is the mining of uranium. Exposure to radiation by workers in nuclear processing or power plants, and the risk of exposure due to accidental radiation discharges are significant. Emissions of sulfur and nitrous oxides, and particulate matter, from coal-fired plants are also proven health hazards, and are costly to abate with scrubbers.

III. UNLIMITED RENEWABLE ENERGY

Scheer's view of a renewable energy future is far brighter. His vision is this:

- The amount of electricity used worldwide in 2001 could be provided by 2.5 million wind power facilities producing an average of 6 million kilowatt hours a year at medium-range wind speeds.
- The same amount of electricity could be produced using photovoltaic panels alone, assuming production of seventy-five kilowatt hours per year per square meter of solar panel area (a reasonable possibility in Northern Europe), with 210,000 square

kilometers of solar panels, which could be accomplished by covering roofs and southern-exposed walls of existing buildings.

- 155,000 square meters of solar thermal power plants situated in desert areas of the highest degree of insolation (solar radiation) could produce the amount of electricity needed world-wide.
- 15,000 square meters of solar collectors producing 2.25 kilowatt hours of solar heat per square meter could provide enough energy to meet the world's need for heating in 2001.
- The world's demand for energy from fossil fuels could be met by bio-fuels alone with 4.19 million square kilometers of forest, field, and farmland acreage devoted to growing such fuels, about 8 percent of such acreage in the world. There is also the potential for bio-fuels being grown and harvested from ten million square kilometers of semi-arid lands not now used for agriculture.

In addition to these examples, Scheer notes that there is significant potential for renewable energy from hydroelectric facilities, already in wide use, as well as additional potential from small hydro facilities that do not impede the free flow of streams and rivers (with all of the positive environmental benefits that such free flows entail). There is also potential for a substantial amount of electric energy from tidal flows and ocean waves and geothermal sites.

Scheer does not suggest that energy be derived exclusively from any one renewable energy source, but cites these statistics to challenge the common assertion that there is insufficient energy potential from renewable energy. Scheer's point is that reliance on a few large central station generators, producing prodigious amounts of electricity is not the only viable model. Thousands of smaller units can achieve the same result. For now, costs per output may be greater for many forms of renewable energy than conventional energy, but the costs of renewable energy are likely to decrease continuously as production capacity ramps up. On the other hand, costs of conventional energy are projected to increase continuously as demand for fossil fuels increase faster than diminishing supplies.

Scheer believes that tapping the power of renewable energy combined with increases of efficiency in energy usage can meet the ever increasing energy needs of the world, without continuing to rely on conventional energy. Scheer believes that the ingenuity and creativity of physicists, chemists, and engineers is equal to the challenge of providing a comprehensive energy supply using renewable energy alone.

IV. OBSTACLES TO RENEWABLE DEVELOPMENT

If the advantages of rapidly developing and implementing renewable energy resources to supplant conventional energy are so compelling, why hasn't this project advanced further? The hurdles are not, at core, technical and economic barriers, says Scheer. We must first free ourselves from the common assumption that there is an insufficient technological potential for renewable energy, and implement the policies necessary to realize that potential. And we must

understand the costs (political and economic) of the long supply chains of most conventional energy structures.

Scheer's previous book, *The Solar Economy*,[2] contains detailed descriptions of the contrast between the long 'supply chains' that conventional energy requires and the short supply chains that most renewable energy resources use. This difference makes renewable energy potentially much more efficient and economical. Oil is often produced in one country, piped to ports and loaded onto tanker ships, shipped to distant ports, then off-loaded into refineries, where it is distilled into various products which are then piped or trucked long distances to local distributors and filling stations. Retail consumers then take delivery and consume the energy in their automobiles or home furnaces. This supply chain for delivery of the energy from well-head to furnaces and internal combustion engines is often thousands of miles, perhaps half-way around the globe. In contrast, renewable energy in some form or another is available almost anywhere in the world, and can be captured and used locally. The supply chain involves obtaining the raw materials necessary to manufacture the solar photovoltaic panels or the wind turbines, manufacturing the facilities, and delivering the finished products to the site of use.

The necessity of the long and complicated supply chains for conventional energy requires transnational corporations of enormous size and power, and leads to a dependency by consumers and governments. Renewable energy, by contrast, can be 'harvested' and used locally, and with appropriate hybrid systems or storage systems, can operate largely independently of the conventional energy systems. Thus, renewable energy lends itself to a system of 'distributed generation' for which reliance on extensive national transmission grid systems and support from large central station power plants becomes less necessary, and ultimately dispensable. This potential of renewable energy systems that are independent of existing energy systems is another example of what Scheer calls "energy autonomy," the title of his book.

V. RELIANCE ON THE CONVENTIONAL ENERGY INFRASTRUCTURE

Scheer urges that renewable energy facilities be installed as close as possible to the customers who will use the energy. He argues that any loss from 'harvesting' solar and wind energy in sub-optimal locations may be more than offset by the avoided costs of transmission infrastructure, and the value of greater autonomy from existing conventional energy companies.

One of the major arguments of conventional energy companies against renewable energy is that wind and solar facilities provide energy only intermittently, and must be 'backed up' with conventional power generators. Scheer says that there are in fact many more possibilities for storing electricity than are usually acknowledged, including batteries, compressed air, pumped storage hydroelectric facilities, and others. But, more research and development of electric storage technologies is needed to allow renewable energy to stand alone, without relying on conventional generation resources to back them up.

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2. HERMANN SCHEER, THE SOLAR ECONOMY: RENEWABLE ENERGY FOR A SUSTAINABLE GLOBAL FUTURE (Earthscan 2002).

As things now stand, one third of the world's population does not have access to electricity. Scheer believes they can be provided electricity more quickly and cheaply by development of hybrid renewable energy systems (e.g., wind backed up by solar, and vice versa) and electricity storage technologies that can provide reliable electric service to villages that are not connected to a national or local grid system.

VI. COMPETITION BETWEEN CONVENTIONAL AND RENEWABLE ENERGY

This possibility of renewable energy being developed autonomously is very important, Scheer believes, because there is a natural competition between conventional energy and renewable energy; and conventional energy businesses enjoy tremendous political and economic influence. Individual CEOs of conventional energy companies may be personally very sympathetic to the need for renewable energy, and companies such as BP and Shell may invest in renewable energy subsidiaries as a kind of 'hedge' against the day when fossil fuels will no longer be available at affordable prices. But the boards of directors and executives of conventional energy companies must act to protect the interests of their shareholders. And their shareholders' interest is protected by making sure that the investments made in conventional energy facilities are recovered through depreciation expense, and a return on their investment, over the forty or fifty year useful life of such facilities.

In Scheer's view, there will never be a time when the investments in conventional energy facilities are fully depreciated and recovered by investors. If renewable energy facilities are developed as rapidly as Scheer believes is necessary, shareholders of the supplanted conventional energy facilities will inevitably bear the cost of their stranded investments. Scheer argues that this realization motivates conventional energy companies to delay the development of renewable energy as long as possible, or promote its development very slowly over a long period of time.

Scheer says that renewable energy advocates must recognize that for their efforts to succeed, investments in conventional energy must be severely curtailed. Despite their rhetoric supportive of renewable energy development, he argues that utility executives will not forego conventional investments, such as plans to build LNG import and regasification facilities, new coal-fired generators, new nuclear plants, and new transmission infrastructure—all to continue the existing methods of providing energy as the only feasible alternative until someday in the unforeseeable future.

Scheer says that anybody who pleads on behalf of promoting renewable energy and also thinks it is possible to replace non-renewable energy completely is simply not taken seriously and branded as naïve or ideological (and Scheer is surely speaking of his personal experience here). The more limited their commitment, the more renewable energy advocates are tolerated and regarded as 'reasonable.' Renewable energy advocates who accept the preeminence of conventional energy development must act with great reserve, and find it embarrassing to demand major, rapid steps towards replacing non-renewable energy.

Scheer also says there is an 'obsession' with achieving a perfectly efficient market that produces the lowest price to consumers, which often ignores the values of environmental protection and energy security and reliability.

Conventional energy resources can provide abundant energy at prices below the cost of most renewable energy resources. But that should not end the discussion about whether policies are needed to foster renewable energy development. Conventional energy has received subsidies in so many various shapes and forms for so long, Scheer argues, they are virtually invisible, or accepted as the natural order of things. Scheer believes it is necessary to foster the rapid development of renewable energy to the point it can supplant conventional energy as soon as possible. The fact that it costs more, at least in the short term, and possibly in the long term, should not deter public policy makers.

VII. ENERGY AUTONOMY: THE BREAKTHROUGH TO RENEWABLE ENERGY

Scheer says that the breakthrough to a renewable energy future cannot happen until enough people break out of the 'prison' of 'one-dimensional' thinking about conventional energy. What is required, he believes, is a new structure of energy usage, which can only come into being alongside the current structure—and which replaces the latter, step by step, until it finally makes the old system superfluous.

Scheer believes that conventional energy will not ultimately finance a new regime that puts it out of business. Only when investment decisions for renewable energy are made independently of the conventional energy business will there be serious economic competition from renewable energy that can facilitate disengagement from the existing energy institutions.

Decentralizing the source of energy will also create the possibility of decentralizing many other components of our economy, and perhaps diminishing some of the harmful effects that many perceive in the developing 'globalization' of the economy. International organizations can play a very constructive role in bringing about the new renewable energy regime. Scheer argues for creation of a new International Renewable Energy Agency and thinks that it can be created and funded by a consortium of existing UN organizations. The World Bank and other international development banks must expand their energy credit portfolios and concentrate on renewable energy. It may be necessary to establish an International Bank for Renewable Energy and Energy Efficiency, similar to the proposal of Michael Eckhart, president of the American Council on Renewable Energy (ACORE) for a 'Solar Bank' program. The main function of such a bank would be to provide micro-credits in a way similar to the Grameen Shakti in Bangladesh, a subsidiary of the Grameen Bank.

VIII. PROMOTING RENEWABLE ENERGY WITH POLICIES THAT WORK

Scheer reviews the various public policies that have been employed around the world to stimulate the development of renewable energy, and compares their advantages and disadvantages. He says that Germany's Renewable Energy Sources Act (EEG), with its feed-in tariff, is by far the most effective, better than Renewable Portfolio Standards and tax credit incentives. (Scheer was the major sponsor of the EEG in the Bundestag). The electric utilities of Germany are obligated to interconnect and purchase energy in any volume offered from any supplier of renewable energy, and they are required to pay premium prices for that electricity for a period of twenty years. The premium prices are established

at different rates for different forms of renewable energy sources, and the guaranteed minimums decline over a schedule of years. The effectiveness of such feed-in tariffs depends on how high the premiums are, and, obviously, it is possible to set the premiums higher than necessary to stimulate the amount of development wanted or needed. Germany is committed to stimulate substantial amounts of such development as quickly as possible, so the premiums under its feed-in tariff are higher than in several other European countries with such policies.

The electric utilities do not bear the cost of these stimulative premiums, but pass the costs through, as they do all other costs of purchased power, to their ratepayers. Obviously, there is much room for debate about the value of raising the price of electricity to all of Germany's ratepayers to pay for this development program, but apparently the costs are not so high that they have suppressed the strong popular support in Germany for developing renewable energy extensively and rapidly.

As a result of the stimulus of this act, about 10% of Germany's entire electricity supply is provided with renewable energy, and 7% comes from 'new' forms of renewable energy, i.e., not from hydroelectric facilities. The 7% from new renewable energy sources represents about 19,000 megawatts of power plant capacity. The annual growth in capacity is about 3000 megawatts, of which wind power has the largest share. This rapid growth has been possible because development and implementation of new renewable energy resources takes much less time than planning, securing regulatory approvals, and building most large conventional energy power plants. Rapid installation of renewable energy is also possible in developing countries where stand-alone facilities are installed without taking the time to build costly transmission infrastructure.

Scheer succeeded in enacting the most effective policies for promoting renewable energy anywhere in the world. But he says he must continually fight against efforts to repeal or severely weaken this legislation. The political battle over renewable energy in Germany provides some insight into what the political battle will be like world-wide. In Germany, if the electric companies do not succeed soon in stopping the expansion of renewable energy at the level of political action, they will be forced to shelve their own plans for building new coal and nuclear plants. The outcome in Germany will decide what strategies will be pursued by both sides all around the world.

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Inspirational though he is, Scheer is clearly state-oriented in his thinking about solutions, certainly to the U.S. ear. He appears to have little appreciation of the potential for entrepreneurship to be a major driver of the transition to the renewable energy future he so fervently desires, and the economic and political clout that such developers may eventually wield. Furthermore, he gives short shrift to the need to fostering energy efficiency with the same dedication and commitment as renewable energy, as if both were not essential to managing the transition to a fossil free and nuclear free era. Finally, he gives too little attention to the need for integrating renewable energy and energy efficiency technologies into the surrounding landscapes and architectural styles and the diverse cultural and religious traditions of non-Western peoples. Such consideration for cultural context is often a critical element of spreading the

benefits of renewable energy to the poorest segments of the world's peoples, and necessary to avoid the disruptive effects of new technologies and the backlash of cultural and economic imperialism—some of the worst side effects of 'globalization.'

In many ways, Scheer's account of how conventional energy corporations thwart the rapid development of renewable energy and energy efficiency has been overtaken by events in the three years since he wrote this book. The unabated increases in oil prices, and other energy and commodity prices, and the increasing public awareness and concern about the looming threat of global warming, have swept away much of the apathy and entrenched opposition to renewable energy. In February of 2007, the Edison Electric Institute (EEI), the trade association of privately owned electric utilities, adopted Global Climate Change Principles, recognizing a growing imperative to reduce emissions of greenhouse gases.[3] The EEI declared its commitment (among other things) to aggressive and sustained efforts to accelerate development and deployment of renewable energy and energy efficiency technologies. Moreover, individual electric utility CEOs are exercising significant leadership within the industry on renewable energy and energy efficiency, for example, John Bryson of Edison International (Southern California Edison).

Scheer's political career as a populist in the German Bundestag exposed him to the harder political edge of lobbyist for conventional energy companies, but seems to have blinded him to the necessity of engaging such companies in the paradigm shift that will occur as conventional fuels become increasingly unaffordable or dangerous, or both. Entrepreneurs of all kinds are rushing to meet the need for renewable energy. Indeed, fostering small entrepreneurs to establish renewable energy and energy efficiency businesses in developing countries is the best way to integrate these technologies into the cultural fabric of those countries, a pre-condition for supplanting their reliance on firewood, kerosene, and diesel fuel, with all their environmental, health, and economic detriments.

Scheer makes excellent points about the efficiencies of using renewable energy available locally, and avoiding the costs and political liabilities of dependency on long supply chains. But relying solely on local or regional energy resources may not always be the best path to secure a clean and reliable energy future. The truth is we are embarked on a long transition in the world's energy regimes, and integration with existing fossil fuel and nuclear resources, and transmission grids where they exist, during the early stages of that transition will be the best path in many circumstances.

Scheer's class struggle rhetoric may be inappropriate in the current environment, where there appears to be significant potential for business and governmental leaders to collaborate in response to an increasingly common view of the need for renewable energy and energy efficiency. Fostering such collaboration will take political leadership of a high caliber and quality, but hope for such leadership springs eternal, especially during the season of the United States' presidential elections.

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3. EDISON ELEC. INST., EEI GLOBAL CLIMATE CHANGE PRINCIPLES (2007), http://www.eei.org/industry_issues/environment/climate/070208_climate_principles.pdf.

Autonomy from energy dependence on Russia, Iran, Venezuela, and Saudi Arabia might enhance our security and power, and diminish theirs. But confident and inspired political leadership could empower the United States and its oil-importing allies to engage these countries in a new spirit of principled diplomacy and negotiation. Arrangements can be made that will benefit the oil and natural-gas producing and consuming blocks of the world, and the poorest of the world's peoples, without advantaging one block at the expense of the other.

Interestingly, Scheer takes some of his inspiration for the struggle to promote renewable energy from Martin Luther King, Jr., and, like King, envisions a better future that seems to be within reach. Attentive and sympathetic readers may absorb some of Scheer's determination and confidence, and be stirred by his imagination. They may find themselves believing in the possibility of a new social and political atmosphere in which the United States will assert its sorely missed leadership in promoting the rapid development and world-wide deployment of renewable energy and energy efficiency. And, with that, leaps of progress may become possible that no one had previously anticipated.