Green Energy Coalition

David Suzuki Foundation

eneract

GREENPEACE

Sierra Club Canada

WWF

the PEMBINA institute
Sustainable Energy Solutions

OSEA

BEFORE THE ONTARIO ENERGY BOARD

IN THE MATTER OF sections 25.30 and 25.31 of the Electricity Act, 1998;

AND IN THE MATTER OF an application by the Ontario Power Authority for review and approval of the Integrated Power System Plan and proposed procurement processes.

Shifting to Renewable Generation: Planning Recommendations for Ontario

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Green Energy Coalition
(David Suzuki Foundation, Eneract, Greenpeace Canada, Sierra Club of Canada, World Wildlife Fund Canada)
Pembina Institute
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Shifting to Renewable Generation: Planning Recommendations for Ontario

Evidence of H. Scheer

0. Qualifications

- Since 1980 Member of the German Bundestag
- Since 1988 Honorary President of EUROSOLAR - The European Association for Renewable Energy.
- Since 2001 Founding General Chairman of the World Council for Renewable Energy (WCRE).
- Since 2004 Chairman of the International Parliamentary Forum on Renewable Energies
- Author, policy innovator and global leader in the field of renewable energy

My curriculum vitae appears as appendix 1 to this report.

1. Introduction

Ontario has made several good decisions such as shutting down the coal plants and, despite its flaws, initiating the renewable energy standard offer process (RESOP), but based on the information I have received, the OPA appears to be stumbling at this point.

The recently announced changes to RESOP have effectively stopped development for perhaps a year, and the predominant effect of the OPA's announcement is to limit RESOP rather than improve on it.[1] This episode is symptomatic of the fundamental flaws in the OPA's approach to planning and procurement.

[1] Ontario Power Authority, Presentation for Technical Session II, June 9, 2008. I understand that OPA has suspended RESOP applications, proposed rules that stop multiple projects greater than 10 MW on one transformer

The reality behind OPA's recent assertions that its delivery of renewable energy is ahead of the government's targets is a further case in point. It is my understanding that the government set targets for new renewable energy at 1350 MW by 2007 and 2700 MW by 2010[2]. It is also my understanding that less than 515 MW had been constructed by the end of 2007 consisting of 471 MW from RFPs[3] and just over 27 MW from RESOP.[4] If all of the remaining contracted RESOP Projects and future planned RFPs resulted in 100% realization, just over 2700 MW would be in place by 2010.[5] OPA's processes and goals are such that it will not exceed the minimums but risks failing to achieve them. It proposes keeping coal plants on line as insurance against the possibility of its own failure. Instead of targeting the minimum in the Directive, OPA should be pursuing all the renewable generation and CDM that is cost effective, be working to streamline approvals and eliminating any possible need for such coal 'insurance'.

These particular problems reflect larger failings in the planning approach. The development of the Ontario Power Authority's 20 year electricity plan, the Integrated Power System Plan, presents Ontario with an unprecedented opportunity to switch from an energy system based on polluting, risky, finite, and in the long run, expensive, fuels, to an energy system that relies on clean, safe, emission-free, abundantly available and cost decreasing, renewable energy sources. The OPA plan, if accepted, will miss this opportunity.

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station from any one developer, and has proposed to exclude RESOP projects from two-thirds of Ontario while providing access for larger non-renewable projects through other procurement methods. A notable example is the curtailing of wind projects on the shores of Lake Huron while granting Bruce Power access to the grid (with penalties to be paid if access is limited) for nuclear refurbishments.

[2] Ontario Liberal Policy Platform, 2003

[3] http://www.powerauthority.on.ca/Storage/70/6535_Progress_Report_on_Electricity_Supply_-First_Quarter_2008.pdf

[4] http://www.powerauthority.on.ca/sop/Storage/7087_RESOP_May_2008_report.pdf

[5] Derived from Ontario Power Authority Backgrounder on Changes to RESOP and Progress Report on Electricity Supply plus http://www.powerauthority.on.ca/sop/Storage/70/6543_RESOP_Background_May13_2008.pdf

In announcing Ontario's Climate Change Plan in June 2007, Premier McGuinty declared climate change to be "the defining issue of our generation"[6] and that as "the strongest province in one of the most blessed countries on the planet…. we have a responsibility to the future to do our share — and we are commissioned by history to lead."[7] He also highlighted how this environmental crisis is also an economic opportunity – a chance to develop the new green economy that we need to thrive in the 21st century. The electricity sector has been singled out as the largest source of reductions in Ontario's climate plan[8]. Despite these policy goals, OPA's plan largely ignores the potential of new, green energy systems in favour of a system dominated by large nuclear plants, backed up by heritage hydro facilities and new relatively inefficient centralized natural gas plants[9], with new renewables and conservation pegged at the minimum allowed by the government's directive. Ontario has an opportunity to create a systemic shift in energy supply representing a paradigm shift in technological, economic, social and political terms. A switch from fossil and nuclear to renewable energies can and will change everything. Yet, the OPA's adherence to an outdated centralized system reveals a lack of basic acceptance of the new technologies available and the sociology of energy.

In discussing the IPSP one should not simply carry out isolated cost comparisons but must compare energy systems as a whole. In OPA's plan, a centralized energy system, run by huge companies, is seen as a given, as set in stone. Yet this is a fallacy.

I would argue that each social system is bound up with the particular sources of energy which it uses. The choice of energy source fundamentally determines the political, economic and technological effort that is required for extraction, processing, transport and distribution,

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[6] Press release, available at http://www.premier.gov.on.ca/news/Product.asp?ProductID=1397

[7] Remarks By Dalton McGuinty, Premier Of Ontario at The Shared Air Summit (June 20, 2007), available at http://www.premier.gov.on.ca/news/Product.asp?ProductID=1414

[8] Ontario Greenhouse Gas Emissions Targets: A Technical Brief (Monday, June 18, 2007), available at www.gogreenontario.ca/plan.php

[9] Relative to CDM, dispersed renewables and CHP which are cleaner and avoid T & D and losses.

including the transformation technology that is needed. It can mean a switch from commercial to non-commercial primary energies; from a small number of large power stations and refineries to a large number of medium and small-scale power plants; from an internationalised to a regionalised infrastructure; and from energies which produce emissions to those that are emission-free. And, not least, from highly concentrated company and ownership structures to more diverse ones. It is here where the political crux of the energy problem can be found.

We have a worldwide electricity supply system that is based on 19th century technology and the use of fossil fuels that have no future. The energy system that prevails in the world today is coming to the end of the line, even though it currently accounts for over 90 percent of total supply – and even 100 percent in some countries. It is nearing its end for two irrefutable reasons: First, no one can deny that reserves are limited. Second, we can no longer afford to burn all the reserves known today because the Earth's ecosphere and atmosphere simply could not bear it. In fact, the ecological limits of the current energy system will be reached well before our fossil and uranium energy resources are exhausted. Ontario has a unique opportunity to minimize its demand from these reserves and to minimize its ecological footprint now and in the future. The architecture of the electricity system is a fundamental aspect of those considerations.

This goes beyond simply counting kilowatt hours and transmission line capacity. Rebuilding Ontario's energy system is inextricably tied to issues of sustainability, jobs, reliability, resilience and security. Ontario stands at the crossroads and will have to decide not only on the different size of the shares of electricity coming from either fossil, nuclear or renewable energy sources but on the design of its energy system as a whole.

Ontario has a unique opportunity to accelerate a shift to renewables. As owner of the primary transmission and distribution system, it has the discretion to require Hydro One to alter its approach to the design and operation of the grid, to make it distributed energy and renewable energy friendly. What is claimed to be technical limitations is no more than protection of the status quo and an organizational unwillingness to change and embrace a new future. I understand that part of the mandate of the Ontario Energy Board is to promulgate a Distribution System Code and a Transmission System Code that governs the obligations of the distributors and the transmission company to connect renewable generation and further, that the Board is obliged by the legislation to facilitate the implementation of the OPA's IPSP if approved. If the OPA's plan called for the unfettered right of renewable generators to connect to the grid the Board could thus ensure that it occurs. We did this in Germany by legislation. Ontario appears to have the opportunity to drive these changes through regulatory policy or government directive or legislation.

2. The Time is right for a shift in direction

2.1. Only Conservation and Renewables can meet the Environmental and Security Challenge.

It was always clear that oil would run out one day. But because people didn't know when, they put the problem to the back of their minds. The alarmist mood among state leaders today shows that they were living from day to day, whilst their countries' dependence on the resources which were becoming depleted grew greater and greater. Yet the question as to how long the reserves will last is only the third most important question.

The most important question arises from the following fact: the maximum ecological burden which world civilisation can cope with will be reached before the limit of availability of finite resources. The findings of the Intergovernmental Panel on Climate Change (IPCC) have shown this in great detail.[10]

The second most important question is: what does the rise of energy prices mean for the global economy and the individual national economies? The unbroken increase in energy prices is rooted in several factors. First, the era of uranium or oil which could easily be extracted ("easy

[10] Intergovernmental Panel on Climate Change: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)], Geneva 2007

oil") is definitively over, leading to an increasing tendency to resort to the potential of non-conventional fossil fuels[11]. Second, due to the development of China, for example, and the increase in world travel, world energy demand is increasing more rapidly than new technology can increase supply. Third, the necessary infrastructure is becoming increasingly costly, as the world's fossil system becomes ever more dependent on exploiting the very last remaining sources.

The political uncertainties constitute a third factor. In a world which is growing more and more unstable in cultural, economic and social terms, these uncertainties are likely to grow further. This means that the vulnerability of the outdated energy system to disruption is increasing; the main logistical challenge for this system lies in ensuring energy supply to the whole of the world by means of oil, gas and uranium from relatively few extraction points and countries, using long supply chains. This vulnerability to disruption means an increase in the political and military costs of energy security, i.e. in the task of protecting strategic energy supply lines and centres from terrorist attacks.

Thus, world energy supply is already in a precarious and desolate state today, far in advance of the actual depletion of resources. Conventional plans aimed at finding a way out of the energy trap often are illusory: the worldwide 'renaissance' of nuclear energy and the promotion of 'clean' coal power plants are based on the assumption that the world energy system would be intact if only it were not for the carbon-dioxide/climate problem. Calls are made for the extracting countries to be pressured into increasing their quotas and the international transport networks expanded, in the interests of energy security – even though this is in conflict with climate-protection and security goals.

A shift in the energy basis – a shift to renewable energies - ought to have been given absolute strategic priority long ago. In order to continue to avoid this conclusion, untenable excuses and

[11] I understand that high uranium prices have driven increased exploration in Ontario resulting in protests and jail sentences for native leaders who have sought to protect their lands and people.

apologies are given. It is claimed, for example, that renewable generation costs are not competitive with conventional sources of electricity, meaning that renewable energies constitute an unacceptable economic and social burden. This is the underlying fallacy in the IPSP – that renewable energies represent a premium cost compared to the existing sources. The evidence does not support this conclusion. Only if a narrow definition of costs is used could this be the case.

In addition, there are assertions that technology development would be too slow for an introduction of renewable energy technologies on a large scale, meaning that the focus must remain on conventional power plants for decades to come. I often encounter an undue pessimism about efficiency achievements among energy industry insiders and on the other hand an undue optimism about nuclear cost and performance. The same false assumptions, excuses and apologies can be encountered in the OPA's IPSP.

2.2. The opportunity for rapid implementation of Renewable Energies

Not long after I started taking a closer look at the situation in Ontario, I realised how Ontario's electricity generation needs will be growing rapidly in the near future due to the decision to close coal plants by 2014 and the fact that the large nuclear fleet is nearing its end of life. Ontario is thus in urgent need of alternatives – and they have to be implemented quickly. Ontario is in a fortunate position, if it takes bold action.

No form of energy supply can be activated more quickly than the decentralised facilities needed to exploit renewable energy. Once a windfarm site is prepared, a wind turbine can be installed in one week, whilst the installation of a large-scale power plant takes 5 to 15 years. Whoever asks about the amount of time needed to introduce renewable energy will have to compare this time requirement with the time spent on new conventional energy facilities. By way of illustration, between 2000 and 2004, in just five years, Germany experienced the creation of about 14,000 megawatts of electricity production capacity from renewable energy. Investors had as yet little practice in this new technology, and the power plant industry was not even equipped to handle this kind of growth. Let us imagine, by contrast, that the electricity conglomerates had decided in 2000 to build new large power plants and commenced with the initial preparations. It is unlikely that any would have come on line by 2004 and only gas plants could have come on line by 2008. By contrast, installing solar and wind power facilities took place in a matter of days, and for small water power plants it was only a matter of weeks. In every situation where providing new capacity is the issue, decentralized energy has a clear time advantage.

In Germany[12], electricity production from renewable energy sources amounted to 73,04 Billion KWh in 2006, in 2007 it rose to 86,71 Billion KWh. The power production that was added in 2007 alone amounted to the annual output of one nuclear power plant.

As a result of Germany's Renewable Energy Sources Act nearly 15 per cent of Germany's entire electricity supply is achieved using renewable energy. The annual growth in capacity promoted by the Renewable Energy Sources Act and its forerunners comes to about 3000 megawatts, of which wind power has the largest share. If one assumes that Germany experiences the same annual growth over the next few decades, capacity would increase to 48,000 megawatts in 2015, 78,000 in 2025, 108,000 in 2035, 148,000 in 2045 and 178,000 in 2054 (note, what we are describing here is an introductory tempo for which there already exists practical proof).

We must not let the inertia of the traditional management systems for transmission and distribution of electricity block the development of new green power. Rather than putting limits on renewable generation (as was the rationale for suspending the RESOP program) in order to fit within the system's current capacity, we need to find creative ways to increase the grid's capacity to transition Ontario's electricity system to the vision established by the Premier. In

[12] For numbers and figures concerning renewable energies in Germany, please consult:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Ed.): Development of Renewable Energies in Germany in 2007. 12 March 2008. Data of the German Federal Environment Ministry (BMU) on the development of renewable energies in Germany in 2007 (provisional figures) on the basis of information compiled by the Working Group on Renewable Energies – Statistics (AGEE-Stat), Berlin 2008
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Ed.): Renewable energy sources in figures – national and international development. Status: June 2007, Berlin 2007

the shorter term this may mean the incorporation of smart-grid technologies such as line regulators and even the simple requirement that additional transformers be kept in stock. In the mid-term this may require some grid upgrades and reliance on storage or interconnections to firm intermittent generation.

In the long-term, the solution lies in a different kind of energy system, a largely decentralized renewable system that today's plans and rules must anticipate and encourage.

The thesis that there is an enormously long time requirement for introducing new kinds of energy is a misapprehension that energy experts have derived from the history of conventional energy systems. This experience is based both on the long construction times required for large power plants and on the often more time-consuming process of completing the wide-ranging transportation and distribution structure needed to supply conventional energy. This experience, however, would be applicable to renewable energy only if the choices about its expansion were to be oriented solely around the traditional model and its trajectory of large-scale technology. Yet, with a few exceptions, this is precisely what renewable energy renders technologically unnecessary and economically meaningless. The fundamental technological-economic assumption behind the excessive time requirement, therefore, is also untenable. The real time problem for renewable energy is truly neither technological nor economic, but rather political and mental: the political problem takes the form of countless arbitrary administrative hurdles, and the mental problem lies in the need for a change of attitude.

3. Specific shortcomings of the IPSP

3.1. Undue pessimism about renewable generation costs and technology development

I was duly amazed when I read the following paragraph in Exhibit D-5-1[13] in which OPA sets out its approach to meeting the renewable resource goals of the Supply Mix Directive:

[13] D-5-1, pp 51-52

> "Rapidly evolving technologies present a challenge in planning. Anticipating future developments in technology may not be prudent, while ignoring such developments will lead to an overly conservative plan from a technology perspective. **The renewable resource development plan has intentionally not anticipated future developments,** which by their nature are uncertain. This approach recognizes that the associated risks will be mitigated by the fact there will be a different renewable resource plan with every successive IPSP. As a result, it will be possible to reflect the best available information in the successive Plans, for example, to make better technology choices and better cost and schedule estimates.
>
> Technological risk is also mitigated by the fact there will be a steady introduction of new renewable resources over the period of the IPSP, with new resources being able to utilize more advanced technology than those introduced in earlier years." (emphasis added)

I think that adhering to the above planning assumption is fundamentally wrong. It implies that planning is a passive exercise and does not shape the future. Ontario has the opportunity to create the future, not settle for time-worn predictions.

Renewable energy's still youthful generation technologies will continuously increase their level of efficiency, and new storage technologies will follow. Whereas traditional energy technologies tend to be nearing the end of their potential for technological development, so that we can only expect diminishing returns from their optimization, renewable energy technology is at the start of its development, so that each of its varieties harbours a huge potential for optimization.

I want to give one example from Germany. Repowering (where first generation wind turbines are replaced by more efficient ones of the newest generation) shows clearly how fast technology is developing in the sector of renewable energy. In 2007, 108 first generation turbines have been replaced by 45 new ones. Although the number of installations decreased during the process, the output of these turbines increased 2,5 fold: from 41 MW to 103 MW without at the same time increasing land consumption[14]. We read of breakthroughs in solar cell technology frequently. The Strategic Research Agenda for Photovoltaic Solar Energy Technology, prepared by Working Group 3 "Science, Technology and Applications" of the EU PV Technology Platform shows clearly how far this sector has advanced – and which leaps in technology development are still to be expected[15]. Nanosolar, a California based company backed by the innovators that created Google is but one example. It has developed a thin film technology that "prints" photovoltaic material on aluminum backing, a process the company says will reduce the manufacturing cost of the basic photovoltaic module by more than 80 percent.[16]

A crucial component of a renewable energy future will be by new energy storage technologies, such as electrostatic storage (super condensers), electro-mechanics (flywheels, compressed air), electrochemical (flow batteries), electrodynamics (supraconducting magnets) or thermal storage with the assistance of metal hydrides. Hybrid renewable energy systems with alternating complementary power plants (like wind power and biomass generators) will be a further significant option. These technologies will remove the alleged barriers of irregular wind and solar radiation patterns. Energetically self-sufficient residential subdivisions and buildings and industries supplied continuously by photovoltaic current or wind power alone will no longer be utopian[17]. Groundbreaking opportunities will thereby emerge for the dynamic exploitation of renewable energies in manifold energy-autonomous forms, in residential construction and by and for enterprises, residential developments, cities, regions and countries. Herein also lies the chance of achieving numerous technological innovations along with new

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[14] Figures of the German Wind Energy Association (Bundesverband Wind Energie – BWE) http://www.wind-energie.de/en/topics/repowering/

A visualized scenario for 2030: http://www.unendlich-viel-energie.de/uploads/media/Repoweringpotenzial.jpg

[15] http://www.eupvplatform.org/fileadmin/Documents/PVPT_SRA_Complete_070604.pdf

[16] http://www.nytimes.com/2007/12/18/technology/18solar.html

[17] http://www.eurosolar.de/en/index.php?option=com_content&task=view&id=271&Itemid=43

prospects for the industries. Since the only direct costs of renewable energy production are those of making available the technology needed, technology development is closely linked with renewable energy costs. When using renewable energy sources, fuel costs would no longer have to be paid. The only exception is bioenergy, because the agricultural and forestry work needed has to be paid for.

The costs of the equipment will sink as a result of mass production and ongoing technological fine-tuning. This, in turn, will lead to a gradual decrease in the costs of renewable energies[18], whilst the direct costs of conventional energy are perpetually rising.

In every cost comparison between renewable and conventional energy, the basic question has to be whether we are dealing with an isolated microeconomic or with a macroeconomic type of

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[18] In 2006 the German Renewable Energy Agency published figures on cost reduction of renewable energy technology since 1990 that were based on information from the industry: 68% cost reduction with solar, 60% with wind and 40% with solar heat – which amounts to an average cost reduction of roughly 50% since 1990. The industry aims at further reductions till 2020 of an additional 40%. Informationskampagne Erneuerbare Energien: Data and facts concerning renewable energy sources in Germany, Berlin 2006

The U.S. Department of Energy (DoE), in general not a particularly optimistic organisation in regards to renewable technologies, recently issued a report on the feasibility of 20% of US power needs being met by wind by 2030. It found that wind power could indeed provide 20% of US power needs by 2030, reducing greenhouse gas emissions by 825 megatonnes per year, for an incremental cost of as little as 0.6 cents/kWh; by way of contrast, the IPSP envisages only 7.5 TWh of wind power out of an expected demand of 170 TWh (i.e. 4%) by 2027. The US DoE estimates that the capital costs for wind turbines would decline by 10% and capacity factors increase by 15% over the next two decades. See *20% Wind by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply* (U.S. Department of Energy, May 2008)at : http://www.20percentwind.org/20percent_wind_energy_report_05-11-08_wk.pdf

RBC Capital Markets published a report entitled *Investing in Solar Now* in April 2007 stating that "Using bottom up capacity and utilization rates at each stage of the supply chain, we estimate the total industry average installed cost for PV solar will decline from ~$7.37/watt in 2007 to ~$4.40/watt in 2011, reaching organic competitiveness to grid electricity without incentives in 2012-2014 depending on the region." Available at: http://www.fullermoney.com/content/2007-05-03/SOLARENERGY070430RBC.pdf

According to *The McKinsey Quarterly* from June 2008 entitled "The Economics of Solar": "Within three to seven years, unsubsidized solar power could cost no more to end customers in many markets, such as California and Italy, than electricity generated by fossil fuels or by renewable alternatives to solar…. [using] demand and capacity forecasts [that] assume continued improvement in solar-cell designs and materials but neither a radical breakthrough nor the emergence of a dominant technology."

cost accounting (including ecological follow-up costs), and whether this is a short- or long-term calculation. The counter-argument that introducing renewable energy entails a major economic burden is only correct if microeconomic burdens are equated with macroeconomic ones and if nobody recognizes both short- and long-term burdens. Undoubtedly, the shift to renewable energy is a burden on the conventional energy business, a burden that is greater the quicker and the more broadly the transformation takes place. For many actors, especially in the primary energy sector, this prospect poses an existential threat. Even energy consumers might be in for some temporary burdens. But to avoid them means to hazard even greater burdens in the future, because ultimately no one is spared the wildfires of the global crises caused by energy. Seen from a macroeconomic perspective, by contrast, the shift to renewable energy presents an enormous opportunity.

Taking advantage of this opportunity, however, means recognizing new ways to proceed. Instead of simply extrapolating from the large-scale to the small-scale, one needs to see how the small-scale points to the big picture. The macroeconomic advantages of renewable energy reside:

• in its indigenous availability and thereby in the currency savings it affords along with the improvement in the balance of payments from cutting back on energy imports from other countries or from other regions of the same country;

• in the replacement of commercial fuels by free primary energy, that is, in the substitution of technology for fuel costs – and thereby in the creation of new jobs for installing power facilities. Unlike large power plant construction, which cannot be distributed broadly enough, production of decentralized power facilities is possible in almost every country, every region and even every community;

• in the avoidance of infrastructure costs and losses through regionalized energy production that is then used in the same region;

• in the promotion of crafts and agriculture that comes from solar construction and biomass utilization, which means permanent stabilization of small- and medium-sized businesses and thereby of regional economic structures;

• in the broad distribution of income because of the emergence of decentralized entrepreneurial forms;

• in the avoidance of ecological follow-up costs, *inter alia* by reducing health costs and costs for catastrophe prevention and compensation;

• in the avoidance of local and international security costs.

3.2. Undue pessimism about efficiency achievement

I will leave it to expert practitioners (see the evidence of VEIC) to discuss how higher levels of efficiency, fuel switching and demand response can be obtained in practice. Instead I want to take a step back and discuss the general efficiency advantage of renewable energy.

The thesis is that gains in efficiency and savings while continuing to use conventional energy are the most cost-effective and quickest path to lowering energy emissions and should therefore be given priority over mobilizing for renewable energy; however, this is a thesis conceived in isolation, and it construes a contradiction that does not even exist. Greater energy efficiency from motors, electronic devices or houses will function independently of whether one uses fossil/nuclear or renewable energy. The lower the actual demand, the easier it is to substitute renewable for conventional energy because the amount of energy that needs to be replaced in each case is smaller. Any such 'efficiency-based approach' may therefore accelerate the shift in energy from fossil/nuclear to renewable.

In my book *The Solar Economy* I described in extensive detail the inevitably long supply chains of fossil and nuclear energy use starting with the production of coal, petroleum, natural gas and uranium all the way through to their final use in motors and appliances, and I compared these with the supply chains for renewable energy.[19] The latter are fundamentally shorter simply because – aside from the use of energy crops – any expenditure to make primary energy available drops out of the picture. Such expenditure can, moreover, be shortened even further (extremely so) if the renewable energy converted in decentralized facilities is also used at the same site or in the same region. Therein lies the systematic advantage of renewable energy, which has not been noticed nearly enough. It has, not least of all, a decisive advantage when it comes to efficiency, and one that has only been exploited in a preliminary way. The kind of autonomous energy that can only be made available to everyone using renewable energy is no makeshift solution; it represents, instead, the general prospect for the future. It gives developing countries an opportunity to get ahead of the game instead of having to undertake a protracted, costly and inefficient effort at copying the energy supply structures handed down from the industrial societies. In industrial societies, the systemic advantage renewable energy has in efficiency terms will only be fully revealed over the medium or long term. This is because the infrastructure expense that was indispensable to produce and supply traditional energy emerged slowly over several decades, has largely been paid off, and only needs partial supplementation, renewal and maintenance. For this reason it is possible to have strategies using this infrastructure – which does not mean this needs to be the standard for every other new approach. All strategic designs for renewable energy need to keep an eye on what constitutes the greatest potential for increasing renewable energy's productivity, which is the opportunity to avoid, whenever possible, the inevitable and wasteful expense associated with making fossil and nuclear energy available. An energy supply system based on renewable energy has efficiency opportunities that are definitively closed off to a system working with nuclear and fossil energy. These opportunities ensue from the following reasons, briefly outlined here:

[19] Hermann Scheer (2002): The Solar Economy, London: Earthscan, pp 37

• Since each instance of 'final energy' use always happens at that decentralized site where people work and live, every decentralized way of providing energy, as a rule, has an efficiency advantage over any centralized solution.
• Efficiency is greater the less technical refurbishing or conversion is required. When fossil energy is used as fuel or heating energy, fewer conversions are required than is the case when fossil energy is turned into electricity, which then has to be distributed.

Therefore, proceeding from an input of primary energy, electricity supplied from fossil and nuclear energy in large power plants turns out to be the most inefficient way of making energy available. Particularly for electricity, clinging to traditional forms of energy is the greatest obstacle to efficiency in the future of any society or economy. By contrast, the opportunity to turn solar radiation and wind or flowing water and waves into electricity in a single conversion step is tantamount to the greatest revolution in energy efficiency imaginable. The fact that this requires separate electricity storage expenditures is neither an insurmountable impediment, nor does it eliminate renewable energy's systemic advantage.

Heightening efficiency is both a precondition and a consequence of all rational economic management. Efficiency criteria have to be guaranteed not only when comparing renewable with fossil and nuclear energy, but also when comparing fossil with nuclear energy or different types of fossil energy with each other – and, needless to say, also when comparing different possible uses of renewable energy. Hence, various plans that try to concentrate electricity production from renewable energy and bio-energy on specific regions – on regions where there is more sunshine (for Europe this means North Africa), where the wind gusts are stronger (for Europe this means the European or North African Atlantic coast or on the high seas), where the biomass harvest is larger (as in Brazil), or where more large dams might be built in order to transport energy from there, by way of lengthy transmission lines, to the sites of consumption where, if need be, they can be converted into other forms – such plans are certainly well-intentioned, but they have not been thought through to the end systematically enough. The economic factor of low production costs gets overvalued, and this leads all other factors to get neglected. These are unnecessary attempts at copying the past on the part of today's energy business.

Only with renewable energies will we be able to attain true energy efficiency. In the global chain of conventional energy from the mines and wells to the customers – sometimes over distances of more than 20,000 miles – there are huge energy losses. Only with short energy chains based on the use of indigenous renewable energies, these energy losses can be reduced radically. The central responsibility of those who are drafting long-term plans to supply cities, regions or whole states with power should therefore consist in making short energy chains – through the deployment of renewable energy sources – feasible.

3.3. Flaws in the procurement strategy, particularly for CDM and for distributed renewable and high efficiency gas generation

The OPA's preference for RFPs for procurement is simply wrongheaded. Experience in other jurisdictions demonstrates that RFPs delivered promises of MWs but not actual MWs. RFPs favour large projects and lose the benefits of small dispersed and local projects. The OPA's flirtation with feed-in tariffs, RESOP, has been tentative and recent changes have negated any positive impact on industry development, long term planning or procurement. It is my understanding that the original recommendations of the Ontario Sustainable Energy Association were only implemented in part, leaving out the critical 'advanced tariffs' elements necessary for success.[20] I would advise the OPA to return to the original recommendations and deliver a program that will succeed. I understand that OPA is also stumbling with respect to its CESOP standard offer for clean combined heat and power but I will leave it to others more

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[20] Ontario Sustainable Energy Association, ARTS Revision Report: Renewables Without Limits, November 2007. Advanced tariffs can tie payments to wind regimes, enabling projects that have lower average wind speeds while avoiding overpayment for windy areas.

expert than I am to comment on the specifics. With respect to conservation, I understand that OPA's programmatic approach to date has been to procure the least expensive peak conservation instead of pursuing as much peak and energy conservation as is possible and cost-effective. Such a 'cream skimming' approach was deemed inappropriate fifteen years ago. It drives the wrong behaviours and decision making approaches by individuals, institutions, commercial operations and industries. Again, I will leave it to experts in that field to offer specifics.

My focus is on renewable power. The advantages of renewable energy are so clear and so overwhelming that resistance to them needs diagnosis. There are many who still pay lip service and who say that the promotion of renewable energy should not be their job, but that of others. Based on my experiences everywhere in the last thirty years, my recommendations are: Don't leave the job to the market alone. A fair market requires equal market conditions, but these currently do not exist: Trillions in subsidies were – and still are – being spent on nuclear and fossil energies, directly and indirectly. The key to a sustainable energy future is renewable energy feed-in legislation or regulation, modelled on the German example[21].

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[21] Sir Nicolas Stern: The Economics of Climate Change. The Stern Review, Cambridge 2006, p. 366 http://www.hm-treasury.gov.uk./media/C/7/Chapter_16_Accelerating_Technological_Innovation.pdf
"The deployment mechanisms described in Box 16.6 can be characterised as price or quantity support, with some tradable approaches containing elements of both. The costs of these policies are generally passed directly on to consumers though some are financed from general taxation. When quantity deployment instruments are not tradable, the policymaker should consider whether there are sufficient incentives to strive for cost reductions and whether the supplier can profit from passing an excessive cost burden onto the consumer. If the level of a price deployment instrument is too low no deployment will occur, while if it is too high large volumes of deployment will occur with financial rewards for which are essentially government created rents. With tradable quantity instruments, the market is left to determine the price, usually with tradable certificates between firms. This does lead to price uncertainty. If the quantity is too high, bottlenecks may lead to a high cost. If the quantity is too low, there may not be sufficient economies of scale to reduce the cost.
Both sets of instruments have proved effective but existing experience favours price-based support mechanisms. Comparisons between deployment support through tradable quotas and feed-in tariff price support suggest that feed-in mechanisms achieve larger deployment at lower costs57. [Emphasis added.] Central to this is the assurance of long-term price guarantees. The German scheme, as described in Box 16.7 below, provides legally guaranteed revenue streams for up to twenty years if the technology remains functional. Whilst recognising the importance of planning regimes for both PV and wind, the levels of deployment are much greater in the German scheme and the prices are lower than comparable tradable support mechanisms (though greater deployment increases the total cost in terms of the premium paid by consumers). Contrary to criticisms of the feed-in tariff,

The goal of the German feed-in legislation, the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz – EEG) is to speed up the market launch of technologies for electricity production from wind power, solar radiation, biomass, geothermal power and hydropower, as well as mine gas. The core element of the legislation is the duty of grid operators to give priority to electricity from renewable energy sources, and to pay for it according to fixed tariffs. Through its three basic elements – guaranteed grid access, fixed fees, no capping - the German Renewable Energy Sources Act has led to investment autonomy through operators who are independent of the power supply industry. New players have stepped into the market who now no longer have to ask the established energy providers for permission to access the grid. Wherever this concept has been introduced, renewable energies have gained momentum.

The German feed-in-tariff law has been immensely successful[22]: The target of producing 12,5% of energy coming from renewable energy sources in 2010 was already met in 2007.[23] In 2008, the share of renewable energies of gross energy consumption amounted to 14,3%. Moreover:

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analysis suggests that competition is greater than in the UK Renewable Obligation Certificate scheme. These benefits are logical as the technologies are already prone to considerable price uncertainties and the price uncertainty of tradable deployment support mechanisms amplifies this. Uncertainty discourages investment and increases the cost of capital as the risks associated with the uncertain rewards require greater rewards."

[22] "The Renewable Energy Sources Act has proven - also by international comparison - to be the most successful instrument for the market introduction of technologies for renewables use.", in: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU): What Electricity from Renewable Energies costs, Berlin 2007

[23] "Since the Renewable Energy Sources Act entered into force in 2000, the share of renewables in primary energy consumption has more than doubled, from 2.6% in 2000 to around 5.8% in 2006; the same applies to the share of renewables in total final energy consumption, from 3.8% (2000) to around 8.0% (2006). The share of renewable energies in total gross electricity consumption has almost doubled, from 6.3% in 2000 to around 11.6% in 2006.", in: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU): Renewable Energy Sources Act (EEG) Progress Report 2007. Pursuant to Article 20 of the Act to be submitted to the German Bundestag by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in agreement with the Federal Ministry of Food, Agriculture and Consumer Protection and the Federal Ministry of Economics and Technology, Berlin 2007, p. 5

- In 2007 the number of people employed in the renewable energy sector - including foreign trade and upstream value added steps – increased to more than 250,000. Of these, 150,000 (60%) can be directly attributed to the EEG[24].

- German renewable power businesses are leading the world, and in 2006 had a global market share of 15%. Investments in electricity-generating equipment from Germany can increase from 9 billion euros (2005) to an estimated 20 billion euros in 2020.

- From a macroeconomic point of view, electricity generated from renewable sources is already paying off today[25].

- The EEG is the most effective instrument for reducing CO_2 emissions: By 2006, 45 million tonnes of CO_2 had already been saved[26]. And so the EEG has avoided external costs of around 3.4 billion euros which would have arisen if the electricity had been generated by fossil fuel power stations from coal, gas or oil.

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[24] Internal Paper, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) (2008): Was bringt das neue Erneuerbare-Energien-Gesetz (EEG)?, Berlin 2008

[25] "The Renewable Energy Sources Act continues to generate considerable impetus for innovation, domestic value added and employment. According to a recent analysis, domestic turnover from the installation and operation of renewable energy systems increased from € 18.1 billion in 2005 to around € 22.9 billion in 2006, with around € 14.2 billion of this being directly attributable to the Renewable Energy Sources Act. Exports will become increasingly important in future: in 2006, for example, the export share of the German wind energy sector was already above 70%, while that of the photovoltaics sector was around 30%. (…) Other effects of the Renewable Energy Sources Act (EEG) are significant savings due to avoided energy imports (hard coal and gas imports for electricity generation), and, with conventional power being substituted by electricity from renewables, avoidance of environmental damage from CO_2 emissions and hence its resulting external costs.", in: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU): Renewable Energy Sources Act (EEG) Progress Report 2007. Pursuant to Article 20 of the Act to be submitted to the German Bundestag by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in agreement with the Federal Ministry of Food, Agriculture and Consumer Protection and the Federal Ministry of Economics and Technology, Berlin 2007, p.5

See also: F. Sensfuß, M. Ragwitz and M. Genoese. The Merit-order effect: A detailed analysis of the price effect of renewable electricity generation on spot market prices in Germany. Energy Policy 2008
26 Press Release Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU): „Gabriel: An outstanding success story. Federal Environment Minister presents progress report on Renewable Energy Sources Act" http://www.erneuerbare-energien.de/inhalt/39678/20042/

No political programme of industry support has ever cost so little and achieved so much so quickly. The public accepts the additional costs, because they accept the goal being pursued. In the space of six years, plant costs have already dropped by 40 per cent due to production effects. This energy shift means that CO_2 emissions have been reduced by an additional 7 million tonnes per year. So the law has achieved significantly more as a climate-policy instrument than emissions trading in the framework of the Kyoto Protocol.

This successful development has only been possible because of the sophisticated design of the German EEG described above. Germany is about three times smaller than Ontario but has renewable capacity on its grid at a level comparable to all the nuclear, fossil fuel and renewable capacity in Ontario combined. Ontario is lucky to have huge potentials but the design of the Renewable Energy Standard Offer Programme unfortunately has proven to be suboptimal in reaping those natural benefits.

There are many imperfections in RESOP and the recent changes only make it more problematic. First the limits on project size are unnecessary -- any distribution system will have short term limits and these need to be addressed but should not be entrenched. In the meantime, such caps create a climate for gaming and limitations on community creativity. The one price fits all standard offer (except for solar) fails to recognize the different costs and benefits of the various renewable resources. When the price was set for with respect to biogas and anaerobic digesters, there were no plants in operation in Ontario. I understand that the low price has created a substantial barrier for the rural community and the most recent limit of 250 kW only serves to render potential projects uneconomic. If the limits placed on renewable energy create uneconomic conditions, the flawed assumption in the IPSP that renewables are too expensive becomes a self fulfilling prophecy.

3.4. Undue optimism about nuclear cost and performance

Again, others will be in a better position than I am to comment on the particulars of OPA's cost and performance forecasts for nuclear, but from a planning perspective I am struck by the contrast between OPA's optimistic nuclear projections and OPA's plan based on stagnant renewable technology development; less than fully aggressive plans for CDM, low forecasts for co-generation and less than aggressive measures to obtain and integrate renewable generation.

Above, I have already elaborated on cost and technology development of renewable energy technology. Here I want to name the explicit reasons that stand fundamentally against a 20-year electricity plan for Ontario that counts on large scale power supply from nuclear facilities:

- A sharp worldwide increase of nuclear energy based on today's technology will be impossible due to the scarcity of uranium resources;
- New nuclear technologies like fusion reactors will not be available for at least 50 years (if they will become available at all);
- Nuclear energy has already consumed one trillion dollars of subsidies world-wide and will continue to depend on financial support from national budgets;
- Accidents in the past and possibly more in the future, plus the nuclear waste that needs to be disposed of, contaminate our environment and threaten human life;
- The excess heat of nuclear power plants is poorly suited for combined heat and power generation because of their location and the high costs of district heating systems appropriate to central nuclear power stations;
- The danger of nuclear terrorism, not only by missile attacks on reactors, continues to grow with the intensification of "asymmetrical conflicts";
- Full-load operation of capital-intensive nuclear reactors that is indispensable for their profitability can only be guaranteed if governments further de-liberalise electricity markets and obstruct alternatives. The nuclear economy remains a (concealed) state economy that displaces innovation and progress on other fronts.

All this would have to be accepted given the finite nature of fossil fuel resources if the possible option of renewable energy did not exist with an energy supply potential for our planet that is 15,000 times as great as the annual consumption of nuclear and fossil energy. Scenarios depicting a full supply capability with available technologies have been compiled repeatedly by the Union of Concerned Scientists in the USA (1978), the International Institute for Applied System Analysis for Europe (1981) and the Enquete Commission of the German Bundestag (2002)[27]. While none of these analyses has ever been seriously refuted, all are ignored by conventional experts.

The deployment of nuclear energy is the result of gigantic mechanisms of subsidisation and privilege. Before 1973, OECD governments spent over $150 billion (adjusted to current costs) in researching and developing nuclear energy, and practically nothing for renewable energy. Between 1974 and 1992, $168 billion was spent on nuclear energy and only $22 billion on renewables. The European Union's extravagant nuclear promotion efforts are not even included in this calculation. French statistics are still being kept secret. The total state support amounts to at least a trillion dollars, with mammoth assistance provided to market creation and to incentives for non-OECD countries, above all the former Soviet block. Only $50 billion has been spent on renewable energy. Since 1957, the IAEA and Euratom have assisted governments in designing nuclear programs. By contrast, no government-sponsored international organizations exist today for renewable energy.

In 1954 Lewis Strauss, Head of the US Atomic Energy Commission, promised the world that “it is not too much to expect that our children will enjoy in their homes electrical energy too cheap to meter.” The reality has in fact been the reverse – nuclear energy is one of the most expensive forms of energy. The true cost has been hidden by extensive government subsidies,

[27] Please consult Hermann Scheer: Energy Autonomy. The economic, social and technological case for renewable energy, London 2007, p. 50 for a comprehensive overview of “100 per cent scenarios” for energy supply with renewable energy

limits on liability for accidents, and the failure to include the full costs attributable to the uncertainties for waste storage and nuclear power plant decommissioning in pricing structures. The costs of wind and solar, on the other hand, are rapidly falling as energy efficiency improves and economies of scale kick in.

Moreover, nuclear energy is not carbon neutral. It is true that the fission of uranium in a nuclear reactor to generate energy produces no carbon emissions. However, every other step required to produce nuclear energy releases carbon into the atmosphere. These include yellowcake mining, ore transport, ore crushing, uranium extraction, uranium enrichment, uranium oxide furnacing, uranium casing (with zirconium) and nuclear power plant construction. In the paper "Nuclear Power: the energy balance" J.W. Storm and P. Smith calculate that with high quality ores, the CO_2 produced by the full nuclear life cycle is about one half to one third of an equivalent sized gas-fired power station. For low quality ores (less than 0.02% of U_3O_8 per tonne of ore), the CO_2 produced by the full nuclear life cycle is equal to that produced by the equivalent gas-fired power station.[28] Even though Canadian uranium mines are relatively high grade, as world reserves are diminished more and more carbon-intensive mining will result. Thus a choice to utilize uranium rather than renewables and efficiency in Ontario will contribute to growing carbon emissions worldwide.

After the middle of the seventies, nuclear energy was largely burnt out, due more to enormously increased costs than to growing public resistance. The limitations on construction have become more severe. Uranium reserves estimated at a maximum 60 years refer to the number of plants currently in operation. With twice the number, the available time periods would inevitably be cut in half. The industry expansion calculated by nuclear promotion agencies like the IAEA could not be realized without an immediate transition to fast breeders for extending the uranium reserves. Yet, the history of the breeder reactors is a history of

[28] http://www.stormsmith.nl/

fiascos. Like the Russian reactor, the British reactor achieved an operating capacity of 15 percent before its shutdown in 1992. The French Super Phoenix (1200 Megawatts) attained 7 percent and cost 10 billion euros. The much smaller Japanese breeder (300 Megawatts) cost 5 billion euros and experiences regular operating problems. Making these reactors fit for operation, if that were to prove possible, would require incalculably greater add-on costs. This path of development would be prohibitive without continued or increased public expenditures.

In 2000, Germany decided to phase out nuclear. The last reactor is scheduled to be switched off in the early 2020s. Different scenarios, from the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, the Federal Environment Agency or EUROSOLAR demonstrate which necessary steps will have to be taken to replace the share of nuclear power with renewable energy, CHP, energy efficiency and management measures so that there will be no gap in electricity supply.[29]

What is possible in Germany will definitely be possible in Ontario. However, if the Ontario government follows the advice of OPA to both build up to 3500 MW of new nuclear and refurbish much or all of the existing nuclear fleet, the commitments made in the nuclear sector will – for a long period – crowd out the opportunity to increase the share of clean, cost-decreasing, infinite renewables.

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[29] Stefan Peter, Dr. Harry Lehmann, ISUSI, Das deutsche Ausbaupotential Erneuerbarer Energien im Stromsektor, Eurosolarstudie, Aachen, Dezember 2004
Dr. Joachim Nitsch, Leitstudie 2007, Ausbaustrategie Erneuerbare Energien, Aktualisierung und Neubewertung bis zu den Jahren 2020 und 2030 mit Ausblick bis 2050, Studie im Auftrag des BMU, Stuttgart, Februar 2007
http://www.umweltbundesamt.de/uba-info-presse/hintergrund/atomausstieg.pdf
http://www.unendlich-viel-energie.de/uploads/media/windkraftbio.jpg

Conclusion

The government's directive set out targets for conservation and renewable generation that were minimums while its limit on nuclear production was a cap. Yet the OPA has in effect treated the targets for both conservation and renewable energy as caps and has proceeded to lay the groundwork for an increase in nuclear capacity, ignoring its many shortcomings. As a result, the IPSP not only fails to recognize and encourage the faster, increasingly cost-effective, more secure and environmentally necessary future of renewable power, it also risks displacing the opportunity for such a shift for decades to come.

Summary biography – Dr. Hermann Scheer

Member of the German Parliament, since 1980;

President of EUROSOLAR - The European Association for Renewable Energy;

General Chairman of the World Council for Renewable Energy (WCRE);

Author, policy innovator and global leader in the field of renewable energy.

- Born 29th April 1944 in Wehrheim, Germany
- University studies in Heidelberg and Berlin (Economy, Social Science, Public Law) PhD at Free University Berlin, 1972
- Dr. h.c. at Technical University Varna, Bulgaria, 1997
- Recipient of the Alternative Nobel Prize in Stockholm, 1999, granted for his worldwide commitment to Renewable Energy
- Recipient of the World Solar Prize by the 2nd World Conference on Photovoltaic Solar Energy Conversion in Vienna, 1998
- Recipient of the World Prize on Bio-Energy by the 1st World Conference on Biomass in Seville, 2000
- Named Hero for the Green Century by TIME Magazine, 2002
- Recipient of the Global Leadership Award by the American Council on Renewable Energy (ACORE) in New York, 2004
- Recipient of the World Wind Energy Award by the World Wind Energy Conference in Bejing, 2004
- Dr. h.c. at the Universität Lüneburg, Germany, 2007
- Since 1988 President of the European Association for Renewable Energies EUROSOLAR
- Since 2001 General Chairman of the World Council for Renewable Energy (WCRE)
- Since 2004 Chairman of the International Parliamentary Network for Renewable Energy

Seminal books on the renewable energy transition:

- Sonnenstrategie (1993), 8th edition 1999, published also in English under the title “A Solar Manifesto”, Spanish, Italian, Portuguese, Czech, and Hungarian

- Solare Weltwirtschaft, 1999, 5th edition 2002, published also in English under the title “The Solar Economy”, French, Spanish, Portuguese, Chinese, Japanese, Russian, Italian, Danish, Arabian, Czech,
- Energieautonomie, 2005, published also in English under the title “Energy Autonomy”, French, Italian, Danish, Korean

Biographical statement

Born in 1944, Hermann Scheer graduated from high school in 1964. He attended the Officers School of the German Federal Army from 1964 to 1966, serving as lieutenant during 1966-67. Hermann studied economics, sociology, political science and public law between 1967 and 1972 at the University of Heidelberg and the Free University of Berlin. He received his PhD in Economic and Social Science in 1972. Dr Scheer was appointed Assistant Professor at the Technical University of Stuttgart in the Faculty of Economics, 1972-76. He worked as system analysts at the German Nuclear Research Center from 1976-1980.

Dr Scheer was first elected member of the German Parliament in 1980, re-elected in 1983, 1987, 1990, 1994, 1998, 2002 and 2005. He served as Chairman of the Arms Control and Disarmament Committee 1990-93. Since 1983 Hermann Scheer has been delegated by the German Parliament to the Parliamentary Assembly of the Council of Europe, and served as Chairman of the Committee on Agriculture between 1994 and 1997. He holds a Doctor honoris causa, bestowed by the Technical University of Varna (Bulgaria) and one from the University of Lüneburg (Germany).

Dr Scheer has chaired as well as initiated numerous international research and development conferences. Examples include the

- International Parliamentary Forum on Renewable Energy (2004)
- 1st, 2nd and 3rd World Renewable Energy Forum (2002 and 2004), and the
- European Conference Solar Energy in Architecture and Urban Planning (1993, 1996, 1998, 2000, 2008)
- World Wind Energy Conference in Berlin (2002) and Capetown (2003)
- European Photovoltaic Solar Energy Conversion Conference in Glasgow (2000)
- First International Conference on Financing Renewable Energies (1997)
- Earth Conference on Biomass for Agriculture and Industry (1995)

His work has been honoured with the

- inaugural SolarWorld Prize (1998),
- Right Livelihood Award (1999)
- inaugural World Prize on Bioenergy (2000),
- TIME Magazine recognised him in 2002 as one of five “Heroes for the Green Century.”
- World Wind Energy Award (2004)
- Solar World Einstein Award (2005)

Dr Scheer’s work is dedicated to a broad shift in the energy basis of modern civilization: from fossil and nuclear resources to renewable energies. He has demonstrated both necessity and feasibility of this transition in his five books: The Stored Sun (1987), The Solar Age (1989), Solar Strategy (1993), The Solar Economy (1999) and Energy Autonomy (2005). In addition, Dr Scheer has also authored more than one thousand articles.

The Solar Strategy (1993) has been published in eight languages; the English version is entitled "A Solar Manifesto". The Solar Economy (1999) is distributed in eleven languages; the English publication is “Solar Economy”. Energy Autonomy (2005) is published in six languages. These three volumes are acknowledged as the most widely read books on renewable energy worldwide, combining new technological, economical and cultural issued with policy recommendations, from the local to the global scale. They suggest that the transition to renewable forms of energy with the aid of modern technologies will lead to a “solar information society.” This shift creates the most important and promising structural change of civilisation since the beginning of the industrial age and leads to manifold benefits for societies: mitigating climate change, and overcoming national security issues, addressing the mounting water crisis, cleaning the cities, improving the health of the people, revitalizing the agricultural economy, creating new industrial jobs and fighting underdevelopment and deprivation in the developing world.

In 1988 Dr Scheer founded the non-profit European Renewable Energy Association EUROSOLAR, and in 2001 the non-profit World Council for Renewable Energy (WCRE), serving as President and. General Chairman, respectively, of the two non-governmental organizations on a honorary basis. Through these institutions Dr Scheer elaborated his original policy concepts for renewable energy disseminations, and initiated legal frameworks in Germany and the European Union. He has done so both in his capacity as a Member of Parliament, and by advising governments and parliamentarians in Europe, Africa, Asia and Latin America.

In these roles Hermann Scheer's most successful policy innovations have been accomplished:

- the fully implemented 100.000 photovoltaic solar energy roof programme, the world's first mass implementation program;

- the German Renewable Energy Act with 16.000 MW installed decentralized renewable energy capacity below 5 MW per installation (including 14.000 MW wind energy capacity, 40% of total world wind power installations); and

- full tax exemption for all biofuels, affording a lower price level for renewable fuels when compared to fossil fuels.

The revolutionary German National Renewable Energy Act (Erneuerbare-Energien-Gesetz, EEG) provides the major boost for the renewable energy technology industries sector, generating more than 150.000 new jobs and triggering annual renewable energy growth rates of 30 percent. Based on these exemplary results Brazil and China have recently adopted this policy as concept, adapting it to their own requirements.

Hermann Scheer has been advocating the establishment of an International Renewable Energy Agency (IRENA) for years. In his coalition agreement, dating from 2005, the German government has adopted the IRENA initiative as one of its policy projects. Since there was a large number of favourable responses from those countries that were consulted during 2007, the German Government, after hosting two conferences on the IRENA in Berlin, decided to host the founding conference for the IRENA beginning of next year.