Transitioning to a Renewable Energy Future

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ISES is one of the world's largest scientific and technical non-governmental organisations in the field of Renewable Energy. It is recognized by the United Nations as a consulting, non-governmental organisation (NGO) and is a member of the United Nations Economic & Social Committee (ECOSOC).

Founded in 1954 as an international, non-profit organisation, the International Solar Energy Society was formed with the goal of promoting the use of solar and renewable energy world-wide. It has some 30,000 members in more than 110 countries. They are interested in all aspects of the environmentally friendly use of energy, especially Renewable Energy. ISES sees itself as a forum for everyone who deals with this topic.

The goal of ISES is to support sustainable development world-wide with the intelligent, appropriate use of Renewable Energy technology. The Society promotes the research, development, and use of technologies dependent either directly or indirectly on the sun that reduce the damaging effects of energy use. In this context, ISES has focused on three basic fields for the future: cities/urban areas, rural areas, and social responsibility. In the process, ISES also aims to raise awareness both among the public and decision-makers in politics and the industry of newest developments and findings in the research and application of solar energy. This awareness is aimed at furthering the growing understanding of and willingness to use solar energy in everyday life. ISES has internalised the concept of "thinking globally and acting locally" as an intrinsic part of the Society's structure.

Since the Rio Conference in 1992, ISES has launched a multitude of projects and initiatives in conjunction with economic, political and research leaders to support the increased use of Renewable Energy and to help industry to realise them.

The members of ISES form the foundation upon which the ideals, goals and activities of the society are built. A rich source of knowledge, experience and ideas, it is commitment and participation that set the ISES membership apart. Drawn from all over the world, our members form a global community, unified through common goals. Their service requirements drive the services and products the Society offers.

Communication between researchers, industrialists and politicians is actively supported by ISES through activities such as journals, magazines, meetings, conferences, congresses and a website. With the help of partners, ISES has established a communication system called WIRE (World-wide Information System on Renewable Energy, http://wire.ises.org/) to allow the creation of a global 'one stop shop' for renewable energy information with links to all other important renewable energy sites.

The ISES journal (Solar Energy Journal) and conferences allow excellent technical exchange to occur between renewable energy engineers, architects and physicists. ISES also welcomes non-specialists to participate in ISES congresses and conferences, as well as to exchange viewpoints in the magazine (Refocus) and meetings. ISES is rapidly and proactively increasing its project programme to ‚seed' renewable energy technology world-wide. It co-operates with many other international organisations.

Transitioning to a Renewable Energy Future

At the Science Forum in Bonn, ISES used the opportunity to introduce the salient points of its new white paper of the same title.

The White Paper provides a rationale for effective governmental renewable energy policies worldwide, as well as sufficient information to

accelerate effective governmental policies. It is the thesis of this White Paper that a worldwide effort to generate the renewable energy transition must emerge at the top of national and international political agendas, starting now.

In the history of human energy use, the White Paper records that sustainable resources were the sole world supply, even in nascent industrial development well into the 1800s, and that the world will necessarily again have to turn to sustainable resources before the present century is over. The fossil fuel period is therefore an "era", not an age, and highly limited in time in comparison with the evolution, past and future, of civilizations and societies. Accordingly, it is critical for governments to view what remains of the fossil fuel era as a transition.

The White Paper reveals that policies now in existence, and economic experience gained by many countries to date, should be sufficient stimulation for governments to adopt aggressive long-term actions that can accelerate the widespread applications of renewable energy, and to get on a firm path toward a worldwide "renewable energy transition", so that 20% of world electric energy production can come from renewable energy sources by 2020, and 50% of world primary energy production by 2050. There can be no guarantee for this to happen, but the White Paper presents compelling arguments that show it is possible, desirable, and even mandatory.

The window of time during which convenient and affordable fossil energy resources are available to build the new technologies and devices and to power a sustained and orderly final great world energy transition is short – an economic timeline that is far shorter than the time of physical availability of the "conventional" energy resources. The White Paper argues that the attractive economic, environmental, security and reliability benefits of the accelerated use of renewable energy resources should be sufficient to warrant policies that "pull" the changes necessary, avoiding the "push" of the otherwise negative consequences of governmental inaction. There is still time left for this.

The White Paper presents three major conditions that are driving public policy toward a renewable energy transition: 1) newly emerging and better understood environmental constraints; 2) the need to reduce the myriads of risks from easy terrorist targets and from breakdowns in technologies on which societies depend; and 3) the attractiveness of the economic and environmental opportunities that will open during the renewable energy transition.

The renewable energy transition will accelerate as governments discover how much better the renewable energy policies and applications are for economies than the present time- and resource-limited policies and outmoded and unreliable centralized systems for power production and distribution.

Today, it is public policy and political leadership, rather than either technology or economics, that are required to move forward with the widespread application of the renewable energy technologies and methodologies. The technologies and economics will all improve with time, but the White Paper shows that they are sufficiently advanced at present to allow for major penetrations of renewable energy into the mainstream energy and societal infrastructures. Firm goals for penetrations of renewable energy into primary energy and electrical energy production can be set by governments with confidence for the next 20 years and beyond, without resource limitations.

Specifically, with regard to the renewable energy technologies, the White Paper shows the following:

Bioenergy:
About 11% of world primary energy use at present is derived from bioenergy, the only carbon-neutral combustible carbon resource, but that is only 18% of today's estimated bioenergy potential. Estimates for world bioenergy potential in 2050 average about 450 EJ, which is more than the present total world primary energy demand. Fuel "costs" for the conventional resources become instead rural economic benefits with bioenergy, producing hundreds of thousands of new jobs and new industries.

Geothermal Energy:
Geothermal energy has been used to provide heat for human comfort for thousands of years, and to produce electricity for the past 90 years. While geothermal energy is limited to those areas with access to this resource, the size of the resource is huge. Geothermal energy can be a major renewable energy resource for at least 58 countries: thirty-nine countries could be 100% geothermal powered, with four more at 50%, five more at 20%, and eight more at 10%. Geothermal energy, along with bioenergy, can serve as stabilizing "baseload" resources in networks with the intermittent renewable energy resources.

Wind Power:
Global installed wind power capacity exceeded 32,000 MW by the end of 2002, and has been growing at a 32% rate per year. Utility-scale wind turbines are now in 45 countries. The price of wind-produced electricity is now competitive with new coal-fired power plants, and should continue to reduce to where it will soon be the least expensive of all of the new electricity-producing resources. A goal of 12% of the world's electricity demand from wind by 2020 appears to be within reach. So is a goal of 20% of Europe's electricity demand by 2020. This development pace is consistent with the historical pace of development of hydroelectric and nuclear energy. The 20% penetration goal for the intermittent renewable energy resources is achievable within present utility operations, without requiring energy storage.

Solar Energy:
The energy from the sun can be used directly to heat or light buildings, and to heat water, in both developed and developing nations. The sun's radiant energy can also directly provide very hot water or steam for industrial processes, heat fluids through concentration to temperatures sufficient to produce electricity in thermal-electric generators or to run heat engines directly, and produce electricity through the photovoltaic effect.

It can be used directly to enhance public safety, to bring light and the refrigeration of food and medicine to the 1.8 billion people of the world without electricity, and to provide communications to all regions of the world. It can be used to produce fresh water from the seas, to pump water and power irrigation systems, and to detoxify contaminated waters, addressing perhaps the world's most critical needs for clean water. It can even be used to cook food with solar box cookers, replacing the constant wood foraging that denudes eco-systems and contaminates the air in the dwellings of the poor. Buildings: in the industrial nations, from 35% to 40% of total national primary use of energy is consumed in buildings, a figure which approaches 50% when taking into account the energy costs of building materials and the infrastructure to serve buildings. Letting the sun shine into buildings in the winter to heat them, and letting diffused daylight enter the building to displace electric lighting, are both the most efficient and least costly forms of the direct use of solar energy.

Data are mounting that demonstrate conclusively enhancements of human performance in day-lit buildings, with direct economic and educational benefits that greatly multiply the energy-efficiency "paybacks". The integrated design of "climate-responsive" buildings through "whole building" design methods enables major cost-savings in actual construction, normally yielding 30% to 50% improvement in energy efficiency of new buildings at an average of less than 2% added construction cost, and sometimes at no extra cost.

Serious long-range goals for the application of solar domestic water and space heating systems need to be established by all governments, totalling several hundred million square meters of new solar water heating systems world-wide by 2010. A worldwide goal of 100,000 MW of installed concentrating solar power (CSP) technology by 2025 is also an achievable goal with potentially great long-term benefits.

Photovoltaic (PV) solar electric technology is growing worldwide at an amazing pace, more than doubling every two years. The value of sales in 2002 of about US$ 3.5 billion is projected to grow to more than US$ 27.5 billion by 2012. PV in developed and developing nations alike can enhance local employment, strengthen local economies, improve local environments,

increase system and infrastructure reliability, and provide for greater security. Building-integrated PV systems (BIPV) with modest amounts of storage can provide for continuity of essential governmental and emergency operations, and can help to maintain the safety and integrity of the urban infrastructure in times of crisis. PV applications should be an element of any security planning for cities and urban centres in the world.

Policy:
The White Paper stresses the importance of governmental policies that can enhance the overall economic productivity of the expenditures for energy, and the great multiplier in the creation of jobs from expenditures for the renewable energy resources rather than for the conventional energy sources. Utilities are not in the job producing business, but governments are, supporting the need for governments to control energy policies and energy resource decisions.

National policies to accelerate the development of the renewable energy resources are outlined, emphasizing that mutually supporting policies are necessary to generate a long-term balanced portfolio of the renewable energy resources. Beginning with important city examples, the discussion moves to national policies, such as setting renewable energy standards with firm percentage goals to be met by definite dates. The specific example of the successful German "feed-in" laws is used to illustrate many of these points.

Market-based incentives are described in the White Paper, to compare with legislated goals and standards, and discussed in terms of effectiveness. It is shown that various voluntary measures, such as paying surcharges for "green power", can provide important supplements to funding for renewable energy, but that they cannot be sufficient to generate reliable, long-term growth in the renewable energy industries, nor to secure investor confidence. Reliable and consistent governmental policies and support must be the backbone for the accelerated growth of the industries.

It is also shown in this White Paper that the energy market is not "free", that historical incentives for the conventional energy resources continue even today to bias markets by burying many of the real societal costs of their use. It is noted that the very methodologies used for estimating "levelized" costs for energy resources are flawed, and that they are not consistent with the more realistic economic methodologies used by modern industries. Taking into account future fuel supply risk and price volatility in net present valuations of energy resource alternatives paints a very different picture, one in which the renewable energy resources are revealed to be competitive or near-competitive at the present time.

The White Paper concludes with the presentation of two comprehensive national energy policies to demonstrate the method of integration of various individual strategies and incentives into single, long-range policies with great potential returns, including

- National multi-year goals for assured and increasing markets for renewable energy systems, such as „Renewable Energy Standards" (also called, in the U.S., „Renewable Portfolio Standards", or RPS), or the EU Renewables Directive, especially when formulated to support balanced development of a diversity of renewable energy technologies;
- Production incentives, such as "feed-in" laws, production tax credits (PTC), and net metering;
- Financing mechanisms, such as bonds, low-interest loans, tax credits and accelerated depreciation, and green power sales;
- System wide surcharges, or system benefits charges (SBC), to support financial incentive payments and loans, R&D and public interest programs;
- Credit trading mechanisms, such as Renewable Energy Credits (RECs) or carbon reduction credits, to enhance the value of renewable energy, to increase the market access to those energy sources, and to value the environmental benefits of renewables; specific governmental renewable energy "quotas" for city and state renewable energy procurements;

- Removal of procedural, institutional and economic barriers for renewable energy, and facilitation of the integration of renewable energy resources into grids and societal infrastructure;
- Consistent regulatory treatment, uniform codes and standards, and simplified and standardized interconnection agreements;
- Economic balancing mechanisms, such as pollution or carbon taxes (which can then be diverted as "zero sum" incentives to the non-polluting and non-carbon technologies);
- "Levelling the playing field" by redressing the continuing inequities in public subsidies of energy technologies and R&D, in which the fossil fuels and nuclear power continue to receive the largest share of support.

Solar Energy from Then to Now and Beyond

Solar energy is not an "alternative energy". It is the original and continuing primary energy source. All life and all civilizations have always been powered by solar energy. Expanding the technical applications of solar energy and its other renewable energy cousins to carry civilizations forward is simply a logical extension of its historic role, but also the inescapable key to achieving sustainability for human societies.

The White Paper is available from http://whitepaper.ises.org/

More Information about the "Energy Rich Japan" Project (Reports, Simulation, Animation): www.energyrichjapan.info