Transitioning to a renewable energy future

A White Paper For Governments

ISES
International Solar Energy Society

EXECUTIVE SUMMARY

White Paper

The White Paper is intended to provide a rationale for effective governmental renewable energy policies worldwide, as well as sufficient information to promote effective governmental policies.

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 50% of world primary energy can come from renewable energy sources by 2050. The White Paper recognizes that there can be no guarantee this will happen, but lays out the foundations to show that it is possible and desirable.

This Executive Summary presents some of the main findings of the full Paper, which is available from the Society. Please visit:

http://whitepaper.ises.org

The White Paper advances arguments to show that the "renewable energy transition" must occur if economic and environmental chaos are to be avoided when fossil fuel use dwindles from increasing resource scarcity, or global environmental limits, or when the "conventional" energy resources become unreasonably priced well before those limits are reached.

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 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 suggests that the attractive economic, environmental, security and reliability benefits of the accelerated use of renewable energy resources will be sufficient to warrant policies that "pull" the changes necessary, avoiding the "push" of the otherwise negative consequences of inaction by governments.

Particular findings of the White Paper include:

"Energy policy should be a policy in support of those integrated, interconnected pieces that define the energy systems on which society depends… in the public interest, away from environmental and social destruction, and toward compatible and restorative relationship with the natural world. Energy policy must be predicated on sustainability, and opportunity for future generations, or it will fail, and bring economies and societies down with it. The renewable energy transition must start now, or it will be too late…[it] is not just a fantasy goal, but rather a real vision, which could be implemented by most nations, with reasonable technologies, in a reasonable time, and at reasonable costs."

"**Major** worldwide improvement in the energy efficiency of all technical activities and social services is necessary in order for renewable energy resources to become a meaningful fraction of world primary energy in the future… as future economies grow, energy productivity must improve at an even faster rate, so that total primary energy use will diminish over time. This will be achievable with attractive and positive economic returns."

"It is today public policy and political leadership, rather than either technology or economics, that are required to move forward with the widespread application of solar energy technologies and methodologies. The technologies and economics will all improve with time, but they are sufficiently advanced **at present** to allow for major penetrations of renewable energy into the mainstream energy and societal infrastructures. There are no resource limitations to this scenario."

"It is risk, and risk avoidance, that is the dramatic new driver of policy emerging into public discourse today. Power plants, transmission lines and substations, and gas and oil pipelines, are all attractive and accessible centralized targets for terrorists who wish to bring the working of a society to a quick and decisive halt. When governments look at all of the risks, the potential benefits to be enjoyed by energy efficient societies that rely increasingly on their own available and inexhaustible environmental energy resources, in locally and regionally distributed applications, become persuasive. Indeed, one can say with confidence that it will be those nations that will be the safest, most stable and secure, and economically strongest, by the middle of this century. The economic and policy risks of inaction in the aggressive adoption of energy efficiency and the renewable energy resources are far greater than any economic risks or impacts of such programs."

"After efficiency, the most accessible, least cost, and economically beneficial starting point for any national energy policy aimed at reducing the use of conventional energy resources and lowering the production of greenhouse gases is buildings. This includes upgrading existing buildings, and designing all new residential and commercial buildings for maximum energy efficiency and the optimal use of locally available environmental resources for light and comfort."

"Global wind power capacity exceeded 31,000 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 (estimated to be 1,260GW, producing 3,093TWh) 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 wind resource will remain undiminished, and the cost of wind-produced electrical energy will remain stable, over the coming decades of volatility in conventional fuel prices and availability. No wars will have to be fought over the renewable energy resources."

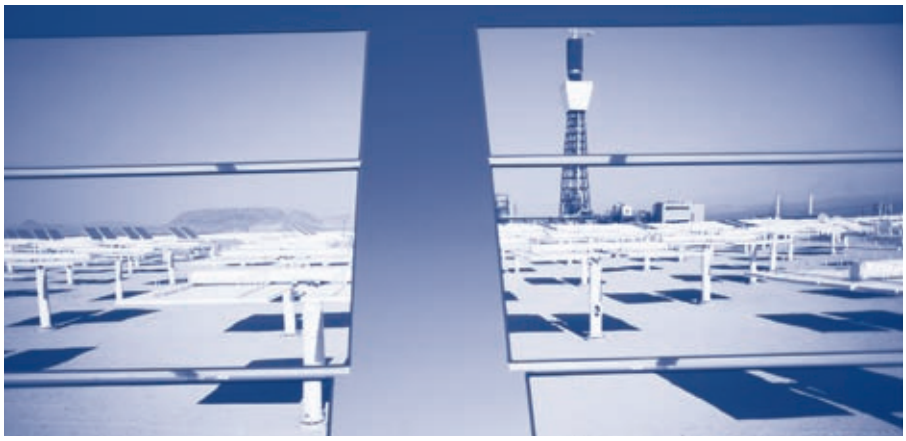
"Photovoltaic (PV) solar electric technology is growing worldwide at an amazing pace. The average rate of growth of the PV industry in the first three

years of this Millennium has been 36.6%. The value of sales in 2002 of about US$3.5 billion is projected to grow to more than US$27.5 billion in 2012. At least one forecaster sees very low cost achievements by the end of this decade, at which point he expects to see the world market reach 10,000MWp in annual shipments. 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. This should be a basic element of any security planning for cities and urban centers in the world."

"It is to the benefit of all economies to promote and accelerate solar water heating on a large scale. Even with government incentives, the overall economic benefits of solar water heating justify such programs. Serious long-range goals for the application of solar domestic water and space heating systems need to be established by all governments, totaling several hundred million square meters of new solar water heating systems worldwide by 2010."

"Concentrating Solar Power (CSP) is a valuable component of the renewable energy portfolios of countries with sufficient solar resources. A worldwide goal of 100,000MW of installed CSP technology by 2025 is an achievable goal with potentially great long-term benefits."

"All of those square meters of collectors and hectares of fields capturing solar energy, blades converting the power of the wind, and wells delivering the Earth's thermal energy, will displace precious and dwindling fossil fuels and losses of energy from the worldwide phase-out of nuclear power. Sparing the use of fossil fuels for higher economic benefits, or using them in fuel-saving "hybrid" relationship with the intermittent renewable energy resources (sun and wind), will contribute to leaner, stronger, safer societies and economies. And, in the process, carbon emissions into the atmosphere will be greatly reduced, but now as a result of economically attractive new activities, not as an expensive environmental penalty."



"Experience gained to date in countries and areas with significant shares of intermittent renewable energy resources in their energy mix shows that at least 20% of electrical energy requirements can be met by intermittent renewable energy resources within the frameworks and operations of existing utility grids. Regional and international transmission grids to allow for the import and export of renewable electricity across different climate regions will facilitate greater penetrations. But in the future energy storage mechanisms will also have to be developed and adopted. The most likely candidate will be hydrogen for converting electricity derived from renewable energy resources into a fuel, for its development will also be supported by its potential for transforming transportation systems worldwide."

"Global employment in the wind industry alone is estimated to have contributed directly and indirectly to the creation of 70,000 new jobs. It has also been estimated that [from 1990 to 2002] approximately 40,000 new jobs were created in renewable energy industries that contributed about 5% of German electricity (wind plus solar) in 2002. In contrast, the German nuclear industry, which supplies about 30% of Germany's energy, employs only 38,000 people, suggesting that renewable energy industries are **ten times** more efficient in producing jobs than the nuclear industry. The PV industry in the U.S. is equivalent at present from the standpoint of employment to major computer industries, such as Dell Computer, or Sun Micro-systems, and it could become as large as General Motors. So could the biomass power industry in the U.S., when it reaches a level of annual activity of about US$6 billion. "

"In the area of PV, much fundamental R&D remains to be done. Fundamental physics research could still lead to significant breakthroughs. There is much R&D still to be done to improve the solar thermal electric technologies, and building science has emerged as a major scientific and engineering discipline. An important component of any national renewable energy policy should be support for both fundamental and applied R&D, along with cooperation with other nations in R&D activities. R&D can lead to new industries, and R&D breakthroughs can produce new competitive advantages for nations, while contributing to the advancement of the field for all countries."

"Experience has shown that reliable, long term policies framed in a series of goals for the steadily growing penetration of renewable energy into a country's energy portfolio, are essential, provided that they are established in ways that promote the fair development of a diversity of renewable energy resources and technologies. This requires recognizing the differences in cost, benefits and market readiness of the various technologies. The best policy is a mix of stimuli, combining renewable portfolio standards with direct incentive and energy production payments, loan assistance, tax credits, and development of tradable market instruments".

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Produced by:
The International
Solar Energy Society
(ISES)
Wiesentalstr. 50
79115 Freiburg
Germany
hq@ises.org
http://www.ises.org/