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Policies for the Promotion of New and Renewable Sources of Energy

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Abstract

New and renewable sources of energy have been considered as an alternative to conventional sources for thirty years and during the last ten years their potential contribution to global pollution abatement has been widely acknowledged. Nevertheless, their participation in the world primary energy matrix is still quite modest (less than 2%). Today, several barriers inhibit the enhanced utilization of new and renewable energy sources, such as economic and financial, institutional and legislative, environmental as well as socio-political barriers. In order to overcome this large variety of barriers, it is necessary to create a portfolio of policies to foster the use of new and renewable energy sources. This article presents several categories of policies providing examples of adopted and planned policy tools and actions to promote alternative sources of energy.



INTRODUCTION

Today, almost all commercial energy used in the world is derived from fossil fuels. Coal, oil and natural gas represent around 90% of the energy supply, while hydro and nuclear electricity only represent about 5%. The new and renewable sources (modern biomass, solar, wind, geothermal, and small hydro) contribute a little over 2%, and from this total, 1.7% are due to modern and sustainable uses of biomass (Figure 1).

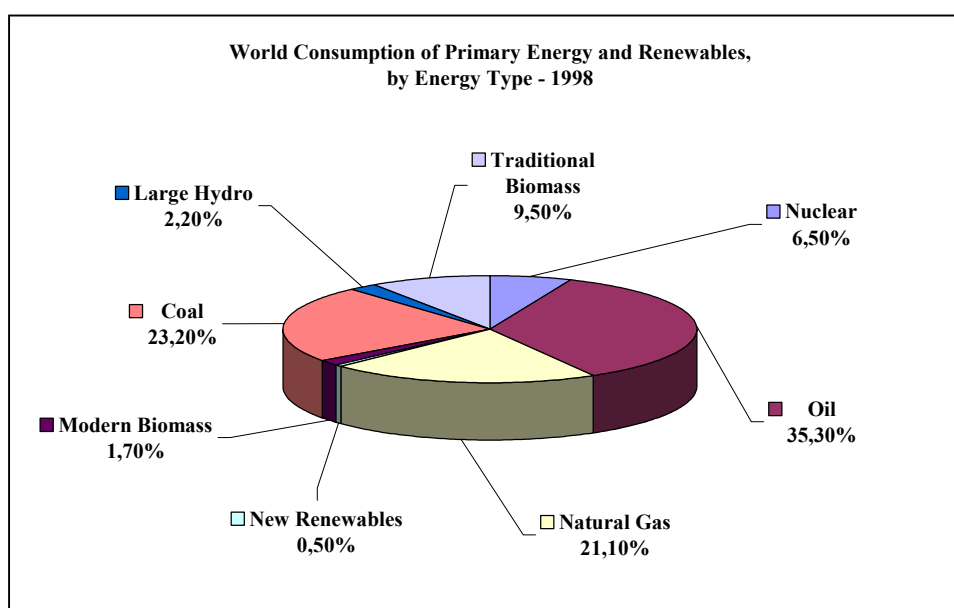


Figure 1: World consumption of primary energy and renewables (1998)

It is worthwhile to remember that new and renewable sources became to be considered as potential contributors to the energy matrix almost 30 years ago during the oil crisis of 1973 and 1979. After these 30 years their contribution seems impressive in absolute terms (Table 1), but in relative terms the increase was modest (0% to 2%).

Technology	All countries	Developing countries
Wind power	18,000	1,700
Small hydropower	43,000	25,000
Biomass power	32,000	17,000
Geothermal power	8,500	3,900
Solar thermal power	600	0
Total renewable power capacity	102,000	48,000
Large hydropower	680,000	260,000
Total world electric power capacity	3,400,000	1,500,000

SOURCE: Martinot et al, 2002

BARRIERS

An increased utilization of new and renewable energy sources is prevented by several barriers:

- **Economic and financial barriers.** A major constraint for many biomass schemes is the relatively high cost per unit of output, which is a consequence of the small-scale nature of most biomass energy-based projects, the high capital and initial investment requirements, the high costs of raw material as well as the low cost of competitive fuel. Biomass schemes have to compete with scarce resources and it is a major difficulty to find adequate funding. It is documented that many biomass schemes, although technically and economically well prepared, often overlook financial implications. All these factors have in the past discouraged potential financial bankers and investors to engage in the financing of biomass energy projects.
- **Institutional and legislative barriers:** Integrating new energy sources into the existing energy systems has always required a long time. Until quite recently almost all major energy suppliers were state monopolies or large private corporations, which have made it very difficult for small independent energy producers to enter the market. This situation is changing rapidly where the energy sector is open to competition. The regulatory and legal framework, whether at national, regional or local levels, can often be a barrier, as in most cases legislation deals with conventional (fossil or nuclear based) energy sources and is often lacking reference to other sources. This vacuum creates confusion and delays, when it comes to planning permissions. Thus, legislative support is important to ensure that small independent producers have access to the national grid or to provincial or local transmission lines.
- **Environmental barriers:** Biomass energy schemes have environmental costs and benefits that need to be quantified and compared with non-biomass options. Public perception of biomass schemes is important and their views on possible disruption to habitats, ecosystems, conservation areas as well as visual impacts, have to be taken into consideration. This has been notoriously lacking in many cases.

- **Socio-political barriers:** Social acceptance and participation are important elements for the success of modern biomass energy schemes. Thereby, it is important to understand political implications and to establish close contacts with decision-makers in order to realize political support for biomass energy schemes. Experiences from Austria, Brazil, Denmark and Sweden show that these elements must all be fulfilled for successful implementation of modern biomass energy schemes. However, similar policies are still lacking in many countries worldwide.

Considering this large number of barriers it is clear that an increased implementation of new and renewable energy sources requires appropriate policies. Some policy tools are designed to improve technology, others to face the lack of economic competitiveness and several are designed to change human habits and promote market transformation. The latter changes are difficult to achieve, especially when there are market forces induced by the present economic power of fossil fuels user's and producers. The presented portfolio of policy tools will provide decision-makers with the opportunity to select the most appropriate options for their countries.

POLICIES AND POLICY TOOLS

There is no "single way" for overcoming the barriers to a more sustainable energy future. A variety of policy initiatives is needed to increase the availability and deployment of energy efficiency and renewable energy technologies. These policies can be grouped into the following 12 categories (Geller, 2002):

1. Research, Development and Demonstration (RD&D) Policies

In the field of RD&D it is necessary to enact policies which expand government-funded research, development and demonstration on clean energy technologies in order to reduce their cost and improve their performance. Additionally, RD&D activities on behavioral and implementation-related issues as well as collaboration between research institutes and the private sector have to be increased in order to combine RD&D with market development efforts. Examples for RD&D policy tools are:

- **USA:** The *Biomass Research and Development Initiative* is a multi-agency effort to coordinate and accelerate all USA Federal bio-based products and bioenergy research and development, as outlined in the Biomass Research and Development Act of 2000.
- **Brazil - *Utilities Compulsory Investment in Energy Efficiency and R&D:*** Starting in 1998, the federal regulatory agency for the electric sector in Brazil (ANEEL) began requiring utilities in Brazil to invest at least one percent of their revenues in energy efficiency programs.

2. Financing Policies

Supportive financing policies have to provide financial services to increase the adoption of renewable energies. Financing at low interest should reward superior performance (e.g. pay for renewable energy production). Thereby, financing at low interest rates should diminish or phase out as markets for renewable energies expand. The following examples for financing policy tools have been identified:

- USA: The *Commodity Credit Corporation (CCC) Bioenergy Program* provides partial compensation to producers of bio-ethanol and bio-diesel for the purchase of commodities to expand existing production.
- Bangladesh - *GEF Seed Funding for Solar Home Systems*: In 1998 the Global Environment Facility (GEF) provided funding to an organisation in Bangladesh, Grameen Shakti, which enabled them to offer improved credit terms, i.e. an increased payment period for solar home systems from one to three years.

3. Financial Incentives

Just as in the case of financing policies, newly enabled financial incentives have to aim at increasing the adoption of renewable energies by rewarding superior performance (e.g. pay for renewable energy production):

- Asia - *Greening the Energy Sector Portfolio of Multilateral Banks*: The Asia Alternative Energy Programme (ASTAE) was established by the World Bank in 1992 with the goal to enhance sustainable energy use in Asia by 'greening' World Bank lending to the power sector in this region.

4. Pricing Policies

In the field of energy pricing it is essential to eliminate subsidies for fossil fuels and enact taxes based on environmental and social costs. Additionally, tax revenues have to be implemented to support energy efficiency and renewable energy initiatives in order maximize the energy, environmental and economic benefits. Examples for pricing policies include:

- USA – *Ethanol Small Producer Tax Credit*
- UK – *Climate Change Levy Exemption*

5. Voluntary Agreements

Voluntary agreements between governments and the private sector may prove to be a favorable option in situations where regulations or market obligations cannot be enacted or enforced. These voluntary agreements should be complemented with financial incentives, technical assistance and the threat of taxes or regulations in case the private sector does not meet its commitments. An example for voluntary agreements exists in the Netherlands (figure 2):

- The Netherlands – *Tax Incentives for Green Investment*: The Green Fund System (GFS) was introduced in the Netherlands in 1992, as a co-operative activity between the government and the financial sector. It combines a tax incentive, a framework for designation of green projects and active involvement of the financial sector. The basic principle behind the system is that the general public receives tax advantages for investments in 'Green Funds'.



Figure 2: 'Green Power' promoted by the Dutch utility Essent.

6. Regulations

Enacting regulations or market obligations are a valuable tool to stimulate widespread adoption of energy efficiency improvements or renewable energy sources. Thereby, it is necessary, that these regulations or obligations are technically and economically feasible and up-dated periodically during enforcement. Additionally, emissions caps and trading schemes have to be introduced, encouraging and providing credits for emission reductions achieved through end-use efficiency improvements and renewable energy technologies. Suggestions for enabling regulations include the following:

- *Tax Treatment and Duties for Imported Bio-fuels*
- *Minimum Efficiency Standards for New Thermal Power Plants*
- *Minimum Fuel Economy or CO2 Emission Standards for New Passenger Vehicles*

7. Information Dissemination and Training

In order to increase awareness and improve know-how with respect to renewable energy options, information dissemination and training activities are of great importance. Where possible these efforts should be combined with incentives, voluntary agreements or regulations in order to increase their impact. The following global initiative provides information dissemination and training tools:

- *RETScreen (A Tool for Market Coherence)* is a global decision support and capacity building tool for assessing potential renewable energy projects developed by the Energy Diversification Research Laboratory of Canada (figure 3). The tool evaluates the energy production, life cycle costs and greenhouse gas emission reductions for renewable energy projects at any geographic location around the world.



Figure 3: Dissemination and training tool RETScreen.

8. Procurement Policies

Bulk procurement is a suitable measure to assist commercialization and the establishment of initial markets for innovative clean energy technologies. Governments should purchase energy-efficient products, renewable energy devices or “green power” for their own use as well as sponsor and help to organize bulk purchases by a wide range of public and private entities.

9. Market Reform Policies

Market reform policies have the prime aim to transform markets. These policies have to be integrated into market transformation strategies addressing the range of barriers that are present under certain local framework conditions. Thereby, market reform policies have to be strong enough to remove or overcome these barriers and they should evolve over time as some barriers are removed and others come to the forefront. A successful example for market reform actions is the Brazilian PROALCOOL program, introduced in 1975 with the purpose to diversify the sources of liquid fuels in Brazil. In order to guarantee commercial opportunities for bio-ethanol, the government created a fund with resources collected from taxes on conventional gasoline. Today, bio-ethanol is a fully competitive commodity on the Brazilian transport fuel market (see figure 4).



Figure 4: Fuel station in Brazil selling bio-ethanol and conventional gasoline

10. Market Obligations

The adoption of market obligations are a very strong tool to stimulate widespread utilization of renewable energy sources. It is necessary, that these obligations (as well as the regulations mentioned in section 6) are technically and economically feasible and up-dated periodically during enforcement. The following examples for adopted or planned market obligations have been identified:

- European Union: In September 2001, the EU adopted the *Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market*. According to this Directive, EU member states shall have their own national indicative targets (of renewables) at 12% share of gross national energy consumption by 2010 and 22.1% share of electricity generation by 2020.
- The *Brazilian Energy Initiative* brought to the WSSD in Johannesburg proposed to increase in the region the use of renewable energy to 10% of the total by 2010 (Goldemberg, 2002).
- USA: Establishment of a national *Renewable Portfolio Standard* that will require 20% of power generated in the United States by the year 2020 to be derived from non-hydro renewable energy sources. This ensures a market for renewable power, critical to the development and use of renewable energy (Ames and Wermer, 2001).
- USA: Establishment of a national *Renewable Fuels Standard (RFS)* that would require an increasing percentage of transportation fuel sold in the United States to be renewable biofuels, such as bio-ethanol and bio-diesel.
- Italy – *Green Electricity*: In 1999, Italy introduced a quota system that obliges each power supplier from 2002 on, to feed electricity from renewable energy sources (2% of the non renewable electricity generated or imported in the previous year) into the Electrical National System. Suppliers can meet this obligation by building their own RE-plants or by buying certificates. This “Compulsory Renewable System” (CRS) follows defined rules regarding certificate issuing and trading (figure 5).

- Germany: The *German Renewable Energy Law* was passed in 2000 in order to establish a framework for doubling the market share of renewable energy sources by 2010. The law sets specific maximum payback prices for each individual renewable energy technology, based on their annually decreasing real cost. The aim of the tariffs is to initiate a self-sustaining market for renewables and create a critical mass through a large-scale market introduction programme, whilst not imposing any additional burden on the taxpayer.
- Morocco has set up a *Rural Electrification Programme* with the aim of increasing rural electrification from 20% in 1995 to 80% by 2006.



Figure 5: First label for Green Energy in Italy (100% Energia Verde).

11. Capacity Building

In order to ensure worldwide implementation of new and renewable energy sources, profound capacity building in all countries is of utmost importance. Businesses that will manufacture, market, install and provide service to clean energy technologies have to be trained and supported continuously.

12. Planning Techniques

In order to guide investments to options that minimize overall societal costs (including environmental costs), both integrated energy resource planning and integrated transportation and land use planning have to be carried out. Energy and transportation plans should contain concrete goals, actions for achieving the goals as well as monitoring and evaluation procedures.

CONCLUSIONS

As has been pointed out by the Intergovernmental Panel on Climate Change - IPCC (Moomaw et al, 2001), there is no shortage of technologies to abate Greenhouse Gas Emissions in the short term (2010-2020). Some of the technologies are already cost-effective and others will be if carbon emissions are associated with costs of about US\$100/tC. Nevertheless, market potential for these technologies is presently small and will probably continue to grow slowly. Thereby, this actual market potential is well below the economic market potential, which is even lower than the socio-economic market potential. The IPCC document concludes that lack of policies is the major obstacle for pushing up market potential to the level of the economic and socio-economic potential.

In this article we have attempted to classify policies in different categories and to provide examples of practical adopted or planned policy tools (actions) to implement such policies. Examples were extracted from literature and the list is far from complete, since we investigate a limited number of actions proposed in a limited number of countries (for more information, see Moreira, 2003). Nevertheless, the purpose of this document is to give insight to policy makers about several possible policy tools that can be proposed to foster policies to enhance the use and production of renewable sources of energy.

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