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ANES

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PLENARY SESSION

International Seminar on Bioenergy and Sustainable Rural Development
- 5th LAMNET Project Workshop – Mexico 2003

POLICIES FOR 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. In the last ten years concern with global pollution has been considered as one more positive factor in favor of their use. Even so, their participation in the world primary energy matrix is still quite modest (less than 2.5%). Such small participation is quite often justified by lack of commercial competitiveness requiring further technological improvement to overcome such barrier. However, several studies have shown that, presently, there are technologies for the use of new and renewable sources that make them economically competitive with conventional sources. Even in this circumstance, new and renewables occupy a market share much below their economic potential. Barriers created by socio and behavioral attitudes exist and they add to the technological and economic ones. Also, when economic barriers are present it is necessary to provide incentives since through large-scale use, frequently, it is possible to reduce costs. With so many barriers to overcome it is imperative to create a portfolio of policies to foster the use of new and renewable energy sources. This paper discusses several categories of policies providing examples of policy tools (actions) already implemented or being proposed in some countries to promote alternative sources of energy. Some of the policy tools are designed to improve technology, others to face lack of economic competitiveness with conventional sources, but several are designed to change human habits and promote market transformation. These changes are difficult to perform and can be even harder to implement when there are market forces induced by the present economic power of fossil fuels users and producers. A large portfolio of policy tools is presented and it is expected that decision-makers interested in a larger market share for new and renewable sources will be able to select the most appropriate ones for their countries.

I. INTRODUCTION

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 represent 5% of the commercial energy supply. The new and renewable sources (modern biomass, solar, wind, geothermal, and small hydro) represent a little over 2%, and from this total 1.7% are due to modern and sustainable uses of biomass (see Figure 1).

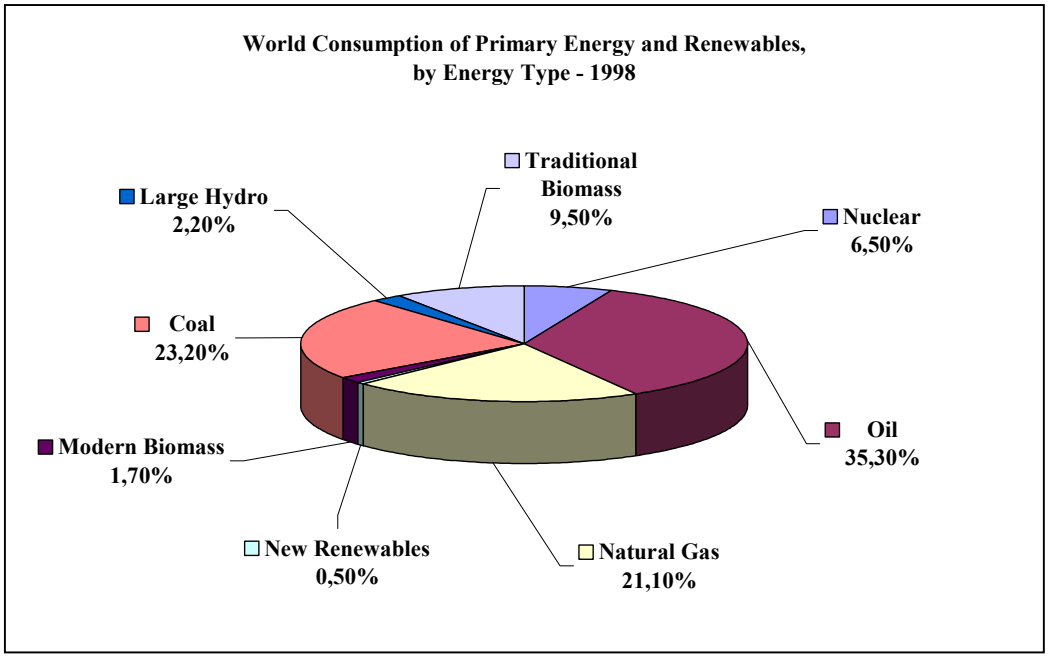

Figure 1: World Consumption of Primary Energy and Renewables

It is worthwhile to remember that new and renewable sources became to be considered as potential contributors to the energy matrix at almost 30 years ago with the oil crisis of 1973 and 1979. During these 30 years their contribution, in absolute value, looks impressive (see Table 1 and Table 2), but on relative basis, increased modestly from zero to 2%. Several barriers prevent their expansion.

Table 1 – Renewable Electricity Grid-Based Generation Capacity Installed as of 2000 (Megawatts)

Technology	All countries	Developing countries
Wind power	18,000	1,700
Small hydropower	36,000	19,000
Biomass power	38,000	30,000
Geothermal power	8,500	3,900
Solar thermal power	350	0
Total renewable power capacity	100,000	55,000
Large hydropower	680,000	260,000
Total world electric power capacity	3,400,000	1,500,000

SOURCE: Martinot et al, 2002

Table 2 Renewable Energy Markets in Developing Countries	
Application	**Indicators of Existing Major Markets**
1. Rural residential and community lighting, TV, radio, and telecomm	11 million households receive lighting from biogas 950,000 households with solar home systems (out of 300-500 million households not connected to electric grid) 170,000 household-scale wind-power generators 25,000 PV-powered cellular and satellite phones (serving a rural community)
2. Rural small industry, agriculture, and other productive uses	10,000 PV or wind-powered water pumps (out of 10 million off-grid water pumps total, mostly diesel powered) 100 PV-powered drinking water purifiers/pumps 40 MWp PV for off-grid industrial and telecommunications needs
3. Village-scale mini-grids	5,000 small hydro mini-grids (relative to 100,000 diesel-powered mini-grids) 200 solar or wind hybrid village mini-grids (with diesel)
4. Rural residential and commercial cooking	250 million more-efficient biomass stoves (out of [#] households that use biomass for cooking) 7000 solar cookers 20000 households cook with biogas fuel
5. Residential/ commercial heating	110,000 homes with solar hot water systems 8700 MWth geothermal direct heat production
6. Grid-based bulk power markets	55,000 MW installed capacity producing 200,000 GWh/year (mostly biomass and small hydro)[1]
7. Transport fuels	15 billion liters/year ethanol vehicle fuel produced from biomass 180 million people live in countries mandating mixing of ethanol with gasoline

[1] Some of this capacity serves small village mini-grids rather than central power grids

- **Economic/financial barrier**. A major constraint for many biomass schemes is the relatively high cost per unit of output, because of the small-scale nature of most biomass energy-based projects, high capital and initial investment, high costs of raw material, low cost of competitive fuel, etc. Biomass schemes have to compete with scarce resources and it is a major difficulty to find adequate funding, but even more, that the financial community understands what is being proposed. It is well documented that many biomass schemes, although technically well prepared and costed, often overlook the financial implications. All these factors have combined in discouraging potential financial bankers and investors in biomass energy projects.

- **Institutional and legislative:** Bureaucratic obstacles can be a major problem, because the generally poor understanding such bureaucrats have about biomass, in particular those in the conventional energy institutions, owing to the different nature in which they operate. Integrating new energy sources into the existing energy systems has always required a long time span. 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 behind with regard to other sources. This vacuum creates confusion, delays, etc., when it comes to planning permission. Thus, it is important that there is legislative support to ensure that small independent producers have access to the national grid, or integration with other provincial or local lines, etc.

- **Environmental:** All biomass energy schemes have environmental costs and benefits that need to be quantified and compared with non-biomass ones. Public perception of biomass schemes is important and their views on possible disruption to habitats, ecosystems, conservation areas, visual effects, etc., must be taken into consideration. This has been notoriously lacking in many cases.

- **Socio-political:** Social acceptability and participation are important elements for the success of any modern biomass energy scheme. It is also important that biomass energy schemes do receive political support, to understand the policy implications and to have access to decision-makers, so that they understand the problems, what is being proposed and that issues of competence are well understood. The experience from Austria, Brazil, Sweden, and Denmark, for example, shows that these elements must combine for successful implementation. However, similar policies are still lacking in many countries (World Energy Commission 2000 Report).

Considering such large number of barriers it is clear that expansion of new and renewable sources of energy requires appropriated policies to succeed. The high cost for their production is a serious issue that can be mitigated through significant investments in R&D and “learning by doing”. But even when technology and cost are not any more barriers, renewable sources of energy still face other kind of barriers. In a recent study 68 countries (G-8, 2001) identified some of the market forces stimulating and restraining the growth of New and Renewable (see Column 1 and 3, Table 3). It is worthwhile to observe the large number of policies suggested by the 68 countries study to influence such forces (Column 2, Table 3). In this paper we will provide several examples of policies tools that are being applied or are suggested in the literature to overcome these barriers, while also helping to overcome economic and socio-political barriers.

Table 3: Market Forces			
Forces stimulating RE	***G8 vehicles to influence forces***		Forces restraining RE
→			←
Aspirations to eradicate poverty	National RE plans	Co-operation with DC's through ODA**/IFIs***	Lack of awareness of RE options/ benefits in DC's, IFI's & lack of co-ordination
Aspirations to improve local/global environment		Climate change & other environment policies: taxation, incentives and fiscal measures, carbon trading CDM,	Vested interests and subsidies for conventional energy, ignorance
Aspirations to diversify for energy security		RE portfolio	Vested interests in conventional energy, ignorance
Energy market liberalization		Green certificates; Distributed generation policy; Renewable portfolio standards	Decrease ODA/IFI support for energy projects
Cost reductions for RE technology	R&D policies, public-private-partnership		Lack of awareness / trust / familiarity with RE technology, other barriers to RE project development; apparent cost competition
Increased FDI* / trade promotion Increased role of private sector	ECA****, public-private-partnership, tax and other incentives, risk mitigation, global corporate initiative		Vested interests in conventional energy and export credit support Decreased role of government
Global integration of markets	Coherent action, policy co-ordination, information exchange, ECA reform		Market immaturity

* FDI = Foreign Direct Investment
** ODA = Overseas Development Assistance
*** IFI = International Financing Institution
**** ECA = Enhancing Commercial Agency

There is no "silver bullet" for overcoming the barriers to a more sustainable energy future. Many policy initiatives are 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):

- research, development, and demonstration
- financing
- financial incentives
- pricing
- voluntary agreements
- regulations
- information dissemination and training
- procurement
- market reforms
- market obligations
- capacity building
- planning techniques

II. POLICIES and POLICY TOOLS

1. Research, development, and demonstration

Expand government-funded research, development and demonstration (RD&D) on clean energy technologies in order to reduce their cost and improve their performance. Also, expand RD&D on behavioral and implementation-related issues. Foster collaboration between research institutes and the private sector, and combine RD&D with market development efforts.

Examples of policy tools

1.1 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 and Executive Order 13134.

Recommendations:

- Fully fund the Biomass Research and Development initiative at its authorized level of $49 million a year, as authorized in the Biomass Research and Development Act.

- Extend the initiative from 2005 to 2010, conducting a review in 2005 to determine which areas of research have proved the most promising.

- Give priority funding in awarding competitive research grants to projects for the commercialization of cellulosic ethanol and the development of energy crops (Ames and Wermer, 2001).

1.2 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. But only one quarter of the one percent must be spent on efforts that help consumers to use electricity more efficiently. In 2000, the requirement was changed with half of the one percent devoted to an R&D fund, but the minimum amount for consumer-oriented efficiency programs was maintained (Jannuzzi 2001).

1.3 Japan – Importance of R&D to stimulate the learning effect

In June 1998, with PV generation costs three times as high as conventional electricity, Japan set a target of 5000 MWp of newly installed PV capacity by 2010, and established an R&D Programme, - Development of Technology for Practical Application of PV Power Generation Systems- to drive down PV costs thereby helping to insure that the target will be met.

To date the R&D programme has been very successful, with approximately 200 MW of PV installed in the first 18 months. Over ten thousand residential systems have been installed annually as a result of the subsidies. The programme has achieved economies of scale and as a result, significant price reductions: it reduced costs of installed residential PV systems from US$30 in 1993 to US$8 per peak watt in 1998 (G-8, 2001).

2. Financing

Provide financial services to increase the adoption of renewable energy measures. Financing at low interest should reward superior performance; e.g., pay for renewable energy production. Also, financing at low interest should diminish or phase out as markets for renewable energy measures expand.

Examples of policy tools:

2.1 Rural Business-Cooperative Service – RBS in United States provides financial and technical assistance to establish and sustain agricultural cooperatives.

Recommendations:

- The mission of RBS should explicitly state that farmer-owned cooperatives are a crucial component of renewable energy development.

- Provide grants and loan guarantees to establish cooperatives or expand existing cooperatives to undertake wind, biopower, biofuel, and bioproduct development projects. Give priority funding to proposals that aim to produce several marketable products in the same integrated facility, such as a biorefinery (Ames and Wermer, 2001).

2.2 Commodity Credit Corporation Bioenergy Program – CCC is the financing organization for USDA's commodity programs and several conservation programs. The Bioenergy Program provides partial compensation to producers of ethanol and biodiesel for the purchase of commodities to expand existing production (cellulosic energy crops are considered eligible commodities)(Ames and Wermer, 2001).

2.3 Transmission – Facilitate financing for Rural Electrification Cooperatives (RECs) to improve the carrying capacity, reduce line loss and increase the overall efficiency of their existing transmission/distribution networks. In many places, a major barrier to the large-scale development of rural renewable energy resources (especially wind and biomass) is the lack of transmission capacity. Development of rural renewable energy resources is critical to U.S. energy supply, greenhouse gas mitigation, air and water protection and increased farm income and rural economic development. Therefore, it is critical that lack of transmission capacity in the grids owned by RECs not be the downfall of renewable energy development.

Recommendation:

- Provide loan guarantees or other appropriate financing assistance for on-farm renewable energy systems, including wind turbines, solar panels and anaerobic digestion systems (Ames and Wermer, 2001).

2.4 Bangladesh- seeds funding for solar home systems

In 1998 the Global Environment Facility (GEF) provided funding to an organization in Bangladesh, Grameen Shakti, which enabled them to offer improved credit terms, increasing the payment period for solar home systems from one to three years. This had a significant effect on demand. Between 1997 and 1999, Grameen Shakti sold 1500 systems Solar Home Systems and installed 2000 to 2500 systems in the year 2000. Grameen Shakti found that after a "critical mass" of installations, for example 100 systems, the process of building customer confidence and demand became less time consuming, as people bought systems on the recommendations of other customers. Grameen Shakti believes that after three to four years of this profitable growth they will be able to obtain financing from commercial banks. This project has shown that the use of GEF financing to support a "high risk" project, unable to obtain commercial financing on its own, can result in significant growth and provide the means by which an organization can obtain commercial financing (G-8, 2001).

3. Financial Incentives

Provide financial incentives to increase the adoption of renewable energy measures. Financial incentives should reward superior performance; e.g., pay for renewable energy production. Also, incentives should diminish or phase out as markets for energy efficiency and renewable energy measures expand and their costs drop.

Examples of policy tools:

3.1 In USA the idea is to provide "private use" relief for tax-exempt bonds of state and locally owned electric utilities and eliminates tax impediments faced by rural electric cooperatives that inhibit full participation in emerging competitive markets.

- Allow enhanced accelerated depreciation for property used in the transmission or generation of electricity.

- Encourage Federal Electricity Regulatory Commission of USA (FERC) to ensure adequate investment returns that will attract the necessary capital investment in the electric transmission system (Ames and Wermer, 2001).

3.2 Conservation Reserve Program - CRP is the largest of the Farm Bill conservation programs for United States, with a current enrollment cap of 36.4 million acres (equivalent in size to the state of Iowa). Its mission is to preserve land vital for soil conservation, water quality protection, and wildlife habitat. It is recommendable to add renewable energy production to those goals.

Recommendations:

- Permit the growing of biomass crops, and the harvesting of biomass, for the production of biopower, biofuels, and biobased products, on CRP lands with an appropriate reduction in rental payments. The rental reduction should not be so high as to cancel any incentive for a farmer to undertake a biomass project.

- Allow wind turbines to be sited on CRP lands, where ecologically and economically appropriate.

- Give a higher priority in awarding Environmental Quality Incentives Program (EQIP) contracts to producers who propose to convert animal waste operations over to anaerobic digestion systems for the capture and burning of biogas to produce heat and electricity (Ames and Wermer, 2001).

3.3 Greening the Energy Sector Portfolio of Multilateral Banks: the case of ASTAE

The Asia Alternative Energy Programme (ASTAE) was established by the World Bank in 1992. The goal of ASTAE was to mainstream sustainable energy in Asia by 'greening' World Bank lending to the power sector in this region. The programme has been so successful that the target of increasing the share of alternative energy in its Asian power sector loan portfolio to 10 percent has now been met and exceeded. In the financial year of 1999 the share was as high as 46.3%. As of June 2000, 38 projects were either in the pipeline, approved or completed and it is projected that the implementation of these projects will avoid around 1GW of conventional capacity (G-8, 2001).

4. Pricing

Reform energy prices. Eliminate subsidies for fossil fuels and enact taxes based on their environmental and social costs. Use some of the tax revenue to support energy efficiency and renewable energy initiatives in order to maximize the energy, environmental, and economic benefits.

Examples of policy tools:

4.1 Ethanol Small Producer Tax Credit – In the United States it is recommendable to expand this credit to include farmer-owned cooperatives. We also recommend allowing all producers with annual production capacity up to 60 million gallons to qualify (currently the limit is 30 million gallons) (Ames and Wermer, 2001).

4.2 "Green technologies are on the verge of becoming one of the next waves in the knowledge economy revolution. I believe the role of Government is to accelerate the development and take up of these new technologies until self-sustaining markets take over. The Government's programme for incentivate renewables will create a new market worth over £500 million through the Renewables Obligation, Climate Change Levy exemptions and the Non Fossil Fuel Obligation. We have already announced £100 million to support offshore wind and energy crops. Today I can announce a further £100 million .... This new money will help us to promote solar PV, give a boost to offshore wind, kick start energy crops, and bring on stream other new generation technologies. This investment in renewable energy technology is a major down-payment in our future, and will help open up huge commercial opportunities for Britain." (Blair, 2001).

5. Voluntary Agreement

Adopt voluntary agreements between governments and the private sector in situations where regulations or market obligations cannot be enacted or enforced. Complement voluntary agreements with financial incentives, technical assistance where needed, and the threat of taxes or regulations should the private sector not meet their commitments

Example of policy tool:

5.1 The Netherlands tax incentives for green investments

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 the 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'. The Green Funds provide soft loans with low interest rates to green projects. Initially, only projects in the Netherlands were eligible for funding, but in 1995 the scope was extended to projects in developing countries and economies in transition.

The enthusiasm of the public has contributed to the success of the Green Funds system. The Green Fund System has successfully set up a self supporting market development programme for green projects, which is based on existing financing infrastructures and encourages the active support of the financial sector and general public (G-8, 2001).

6. Regulation

Enact regulations or market obligations to stimulate widespread adoption of energy efficiency improvements or renewable energy sources. Make sure these regulations or obligations are technically and economically feasible, enforce them, and update them periodically. Also, structure emissions cap and trading schemes so that they encourage and provide credit for emissions reductions from end-use efficiency improvements and renewable energy technologies.

Example of policy tool

6.1 Harnessing the bagasse resource would require a fully operational legislative environment for Independent Power Production (IPP) in USA. Legislation allowing for IPP exists; thus concrete steps toward implementing the long-term expectation amongst policymakers of private ownership of everything but the grid have been taken. However, the policy framework for operationalizing independent power production is not entirely in place.

Rural Utilities Service – RUS provides grants, loans, and technical assistance to rural electric and water utilities in USA. The following recommendations will likely entail amending the Rural Electrification Act of 1936.

Recommendations:

- **Net Metering:** Rural Electric Cooperatives (RECs) should provide net metering services to their customers (potential small residential generators) to encourage the production and use of renewable energy sources for on-farm use by their members. In essence, net metering allows the electric meter to run backwards as electricity produced by the customer is fed back into the system. In this way, customers already connected to the coops distribution lines can feed into the coops system any excess power they may generate. Thereby customers pay for the net amount of power they consume. Customers should receive a fair price on power they contribute to the system. Over 40 states have already passed various versions of net metering legislation, and bills have been introduced in the House and Senate regarding net metering. Because RECs serve so much of rural America, this is an important way in which RECs can benefit their members and improve the reliability and capacity of their systems.

- **Standardized Interconnection:** Rural Electric Co-ops should provide interconnection to their distribution systems at a fair and non-discriminatory price for their member/customers who want to generate power from renewable energy sources for their own farm. Use but also be able to sell excess power back to the coop. Such renewable resources would include solar, wind, and anaerobic digestion systems. Some states have enacted their own legislation, and bills have been introduced in the Senate (e.g., S. 933), but if farmers are going to be allowed/encouraged to develop their on farm renewable energy resources, then it is important that RECs provide this service to their members. Too many times utilities (of all kinds) have thwarted development of on site renewable energy by not allowing interconnection or by charging exorbitant fees (Ames and Wermer, 2001).

6.2 Tax treatment and duties for imported biofuels

This issue is being discussed in many fora (Faaij et al, 2002). Very few of the new and renewable energy sources have the potential to be traded in significant amount. Wind, solar, small hydro sources are potential sources of electricity and such form of energy is essentially consumed in the producing site or nearby. Biomass, which can be used as a source of biofuel, heat, electricity or a combination of them, has some potential to be consumed in different regions than the one it is produced. In particular, biofuels are, probably, the most feasible form of biomass that can be transported over large distances and still be economically competitive with conventional liquid fuels. Tropical countries with abundance of rainfall have a significant advantage as producers of biofuels (Moreira, 2002) and are potential exporters.

Unfortunately, many developed countries with much less opportunities to produce them due their temperate climate impose trade barriers to protect their farmers. In a global economy such attitude is becoming susceptible to criticism. One possible way for the removal of trade barriers is to require fair use of commercial practices promoted by the World Trade Organisation. Through enforcement of policies designed by WTO it should be possible to open developed country's market to biofuel produced in tropical countries.

6.3 Adopt Minimum Efficiency Standards for New Thermal Power Plants

Brazil has sought for some time to increase electricity supplies from thermal power plants, but Brazil lacks high-quality coal reserves and development of natural gas was quite limited until recently. The increased supply of natural gas has sparked great interest in the construction of natural gas-fired power plants. Utilities or private developers proposed many projects in recent years.

The great majority of the gas-fired power plants proposed or under construction is simple-cycle plants, meaning efficiencies of 30-35 percent rather than 50-60 percent achieved by state-of-the-art combined-cycle plants. Private investors prefer simple-cycle plants because of the lower investment costs, shorter construction time, and greater flexibility to respond to varying load conditions. In the future, some of these plants may be converted to combined-cycle operation.

Minimum efficiency standards could be adopted for all new gas-fired power plants that enter into operation in Brazil. Also, plants built as simple cycle gas turbines could be required to add steam turbines and operate as combined cycle plants if they are used more than a nominal amount. This policy would require all gas-fired power plants used over 500 hours per year to meet or exceed an efficiency level of 55 percent. This requirement also would narrow the difference in capital cost between electricity only and CHP plants, thereby helping to stimulate investment in CHP systems (Szklo and Geller, 2003).

6.4 Adopt Minimum Fuel Economy or CO_2 Emissions Standards for New Passenger Vehicles

There are no fuel efficiency standards for new cars or light trucks in Brazil. Vehicle manufacturers receive some tax incentives for producing vehicles with engines one liter or smaller in volumetric capacity. But the fuel efficiency of Brazilian cars and light trucks is still relatively low. In 1998, the average fuel economy of all passenger cars in circulation in Brazil was about 23.5 mpg or 10 kilometers per liter (km/l), while the average fuel economy of all new passenger cars sold that year in the country was about 26 mpg (11 km/l) (Azuaga 2000).

Passenger vehicles sold in Brazil are relatively inefficient because of the outdated technology employed in one-liter Brazilian engines. Most of these engines are derived from 1.6 liter-engines used to equip older models. But vehicle production by the multinational auto manufacturers is rapidly growing in Brazil. As production expands, it would be reasonable to insist that new vehicles include a variety of fuel-efficient technologies.

This policy calls for adopting passenger vehicle fuel efficiency standards in Brazil. These standards could be expressed in terms of either an increase in fuel economy (the approach followed in the United States) or a reduction in CO_2 emissions per kilometer traveled (as is the case in Europe). The advantage of a CO_2 emission standard in Brazil is that auto manufacturers could opt either to raise fuel efficiency or produce and sell more ethanol (and other cleaner fuelled) vehicles. If a CO_2 emission standard were adopted, manufacturers most likely would comply through some combination of efficiency improvement and fuel shifting (Szklo and Geller, 2003).

7. Information dissemination, and training

Disseminate information and provide training to increase awareness and improve know-how with respect to renewable energy options. Combine these efforts where possible with incentives, voluntary agreements, or regulations in order to increase their impact.

Example of policy tool:

7.1 RETScreen: a tool for market coherence

RETScreen is a global decision support and capacity building tool for assessing potential renewable energy projects developed by the Energy Diversification Research Laboratory of Canada. 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.

The tool enables planners and decision-makers to routinely consider renewable energy technology projects at the critically important initial planning stage. The tool has been used widely to date for example for: preliminary feasibility studies, project lender due-diligence, market studies, policy analysis, information dissemination, training, sales of products and/or services, project development and management, product development and research and development (G-8, 2001).

8. Procurement

Use bulk procurement to help commercialize and establish 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 organize bulk purchases by a wide range of public and private entities.

Examples of policy tools:

8.1 Establish Federal Purchasing Programs - Executive Order 13134 and the Agricultural Risk Protection Act of 2000 set the goal of tripling the use of biofuels and biobased products in the United States by 2010. We recommend establishing a purchasing requirement for all federal government agencies and contractors that sets increasing percentages for purchase of biofuels and biobased products consistent with the above goals. We also recommend a Federal Renewable Portfolio Standard requiring agencies to purchase no less than 10 percent non-hydro renewable power by 2010, and 15 percent by 2015 (Ames and Wermer, 2001).

8.2 PROINFA – a Brazilian Federal Program foresee raising the share of renewable energy power generation by adding 3,300 MW installed capacity of wind, small hydro, and biomass based electricity generation, offering long-term contracts with special conditions through ELETROBRAS the holding of the public electricity utilities, lower transmission costs, and lower interest rates from the local development banks. While the program is very indicative of a positive approach of the federal government, the “special conditions” were only precisely defined by the end of December 2002, although there are already some concerns with the process designed for collection of funds that will support the programs. Several possible projects are in the pipeline; many of them have received approval of ANEEL, while others have construction licenses issued by state authorities. Nevertheless, the initial call for project qualification to the program will occur by the middle of 2003, if time schedule set by the law will not be postponed.

8.3 PV Market Transformation Initiative in India

The PV market in India was approximately 10 MWp/year in 1997. Government PV purchasing and subsidy programmes have played a significant role in supporting the development of an Indian PV industry. However the market is characterized by:

- an unacceptably high incidence of system failure in the field
- inadequate marketing, distribution, customer support and after-sales service attributable to private sector markets being suppressed by subsidy programmes.
- general lack of consumer awareness of PV technology and its benefits.
- dependence on end-user subsidy.
- underdeveloped availability of consumer finance which is crucial to make solar home systems affordable.

The PVMTI programme aims to build up financing, distribution and service capability. This will be achieved through the provision of finance for sustainable and replicable commercial PV business models, the financing of business plans with commercial loans at below-market terms or with partial guarantees or equity instruments, and the provision of technical assistance to PV businesses on planning, financing operations and technology (G-8, 2001).

9. Market Reforms

Aim to transform markets. Integrate policies into market transformation strategies, addressing the range of barriers that are present in a particular locale. Make the policies strong enough to remove or overcome these barriers. And allow them to evolve over time as some barriers are removed and others come to the forefront.

Examples of policy tools:

9.1 PROALCOOL Program in Brazil – This program was introduced in 1975 with the purpose to diversify the sources of liquid fuels. To guarantee commercial space for ethanol, which at that time had a price above US$0.60/liter, the government created a fund with resources collected from tax on conventional gasoline (Moreira and Goldemberg, 1999).

9.2 Fuel Diversity and Supply - No individual fuel is capable of providing the energy to meet all of our nation's electricity demands. Rather, a diversity of supply options is key to affordable and reliable electricity. Policymakers and regulators need to work together to reconcile conflicting energy, environmental, and other public policy goals in order to capitalize on our nation's abundant natural resources and address challenges that now limit the development and viability of numerous fuel sources (Ames and Wermer, 2001).

9.3 Equipment Testing for Biofuels - Many gasoline and diesel engine manufacturers will not certify their engines to run on higher blends of ethanol and biodiesel. USDA and the Environmental Protection Agency should provide research grants to test biofuels in higher concentrations in farm equipment, construction equipment, diesel generators, and other applications. USDA should work in collaboration with equipment manufacturers to certify their engines to run on biofuels, and promote their use to consumers (Ames and Wermer, 2001).

9.4 Establishment of Independent Power Suppliers in Brazil – The reform of the Electric Sector in Brazil unbundled the sector into generation, transmission, and distribution assets. This model introduces competition among generators, maintains a neutral common carrier managed by the ONS and allows free consumers and producers, including IPPs, ready access to the grid. Privatizing distribution companies first was viewed as a crucial step not only in selling off the gencos but also in making IPP projects viable. Since the distribution companies would be the buyers of the energy sold by the gencos and new IPP producers, the credit risk to new investors would be reduced if the distribution companies were already financially sound and under private ownership. This policy was very relevant for the significant increase in the number of sugarcane mills interested in sales of co-produced surplus electricity to the grid, as shown in Figure 2.

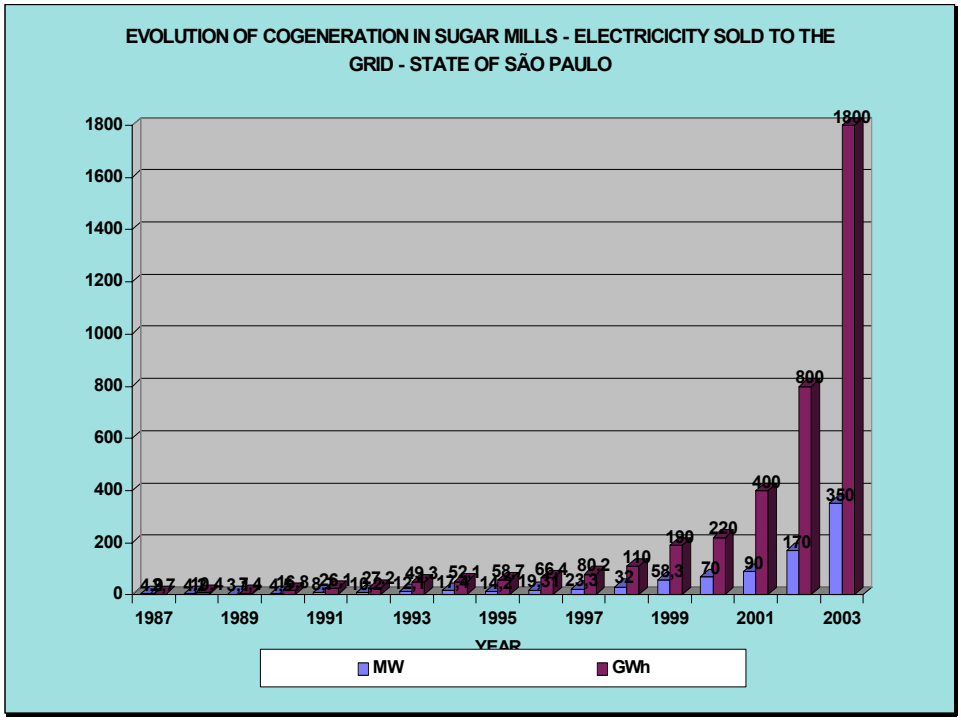

Figure 2: Evolution of Electricity generation in Sugar Mills

9.5 Sri Lanka: the importance of IPP regulation

In Sri Lanka, the World Bank/GEF Energy Services Delivery project was started in 1997 with the aim of promoting the provision of grid electricity by private-sector power developers. The project had the effect of opening up the market to third party mini-hydro developers. More than 21 MW of small hydro has been financed by independent-power-producers (IPPs) as a result of the project. Also regulatory frameworks for IPPs were developed, including standardized “non-negotiable” power-purchase tariffs and contracts (Power Purchase Agreements -PPAs). This project provided sufficient incentive for the national utility to adopt IPP frameworks and agree to PPAs, which together with demonstration of the technology through previous mini-hydro installations and new incentives for developers (such as import duty waivers and income tax concessions) succeeded in stimulating the market (G-8, 2001).

10. Market Obligation

Enact regulations or market obligations to stimulate widespread adoption of renewable energy sources. Make sure these regulations or obligations are technically and economically feasible, enforce them, and update them periodically. Also, structure emissions cap and trading schemes so that they encourage and provide credit for emissions reductions from end-use efficiency improvements and renewable energy technologies.

Examples of policy tools:

10.1 In September 2001, the European Union (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" (Goldemberg, 2002).

10.2 The Brazilian Energy Initiative - A meeting of the Ministers of Environment, from Latin American and Caribbean Countries, which met in São Paulo in May 2002 prior to PrepCom IV, adopted as a resolution the Brazilian proposal drafted as:

- "Increase in the region the use of renewable energy to 10% as a share of total by 2010" (Draft of the Final Report of the 7th Meeting of the Intersessional Committee of the Forum of Ministers of Environment of Latin America and the Caribbean)

The Brazilian proposal allows trading of "new renewable energy" certificates among countries.

Other proposals were presented in Bali:

- "Diversify energy supply by developing cleaner, more efficient and innovative fossil fuel technologies, and promote the increase of the share of non- hydro renewable energy sources to at least 5% of total primary energy supply by 2010"(Switzerland).

- "Diversify energy supply by developing cleaner, more efficient and innovative fossil fuel technologies, and promote the increase of the share of new renewable energy sources by at least 2% with the objective of increasing the global share to at least 15% of total primary energy supply by 2010. To achieve this all countries should adopt and implement ambitious national goals. For industrialized countries, these goals should aim at an increase of the share of renewable energy sources on total primary energy supply by, at as least, 2 percentage points by 2010 relative to 2000". (European Union)

They were all consolidated in a bracketed text PrepCom IV in Bali and included in the Chairman's Report (June 2002), which means it will be the object of further negotiations before or/at WSSD in Johannesburg.

[[Diversify energy supply by developing cleaner, more efficient and innovative fossil fuel technologies, and promote the] increase of the share of [non-hydro]/[new] renewable energy sources [by at least 2%]/[with the objective of increasing the global share to at least 15% of total primary energy supply by 2010.] [To achieve this all countries should adopt and implement ambitious national goals.][For industrialized countries, these goals should aim at an increase in the share of renewable energy sources of total primary energy supply by at least 2 percentage points of total energy supply by 2010 relative to 2000.]/[to at least 5% of total primary energy supply][by 2010].] at the goal level by 2010. To achieve this, all countries should adopt and implement specific national goals;]]

Recent discussions between Brazil and Sweden led to the following formulation for a target: increase the share of modern renewable energy in the world's energy supply by 10% by 2012 (Goldemberg, 2002).

10.3 Renewable Portfolio Standard - Establish a national Renewable Portfolio Standard that will require 20 percent 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 across the country and on America's farms (Ames and Wermer, 2001).

10.4 Texas Portfolio Standards

Under the Renewables Portfolio Standard (RPS) in Texas retail electricity suppliers have a requirement to include a specified percentage of renewables in their generation portfolio. The policy is backed up by annual renewable energy generation targets. Texas has set targets increasing to 2,880MW of renewables to be installed by 2009; this includes the addition of 2000MW from new renewable generating projects. Wind energy is currently dominating the new installed capacity of renewables with supply costs of around 3 cents/kWh (which includes a 1.7-cent/kWh federal production tax credit).

Projections show that the first year target of 400MW of new capacity to be installed during 2002 and 2003 will be exceeded significantly. The key factors considered to be contributing to the success of the policy are clear renewable energy targets, clear renewable resource eligibility requirements, stringent non compliance penalties, a Tradable Renewable Energy Certificate system that encourages flexibility and minimizes costs, and a dedicated regulatory commission that fully involved numerous stakeholders during the detailed design of the policy.

A major lesson from Texas is that, while the RPS is new and relatively untested as a policy tool, it has the potential to cost-effectively support the establishment of a robust renewable energy market (G-8, 2001).

10.5 Renewable Fuels Standard - Establish 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 ethanol and biodiesel. The RFS should contain a credit trading system to allow refiners, blenders, and retailers to buy and sell credits from each other to meet their content goals. The RFS should also contain an incentive to expand the production of cellulosic ethanol (Ames and Wermer, 2001).

10.6 Proposal to Foster Use of Sugarcane Residues - A combination of policies could facilitate higher efficiency bagasse cogeneration in Brazil as well as encourage use of leaves and tops for energy production, where appropriate. Some of these policies are similar to those needed to stimulate CHP with natural gas:

1) Require utilities to purchase excess power from sugar mills at avoided generation, transmission, and distribution costs via long-term contracts;
2) Require utilities to interconnect CHP systems to the power grid without excessive delay or unreasonable technical requirements;
3) Continue to develop and demonstrate more efficient technologies such as bagasse gasification and combined cycle power generation in sugar mills (Szklo and Geller, 2003).

10.7 Green electricity in Italy - 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.

The Italian government considers separate trading of green certificates and electricity to be one of the best options to promote renewable sources inside the European common market. The Italian government strongly advocates a common market, where all participants share similar rules and where green certificates are not merely a proof of origin, but a title per se, which can be sold separately (G-8, 2001).

10.8 German Renewable Energy Law

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. A key lesson learned is that a law, which takes into account learning curves for renewable energy technologies through decreasing feed-in tariffs, is appropriate, particularly in a deregulated market. It has led to the largest installed wind energy capacity in the world (G-8, 2001).

10.9 Morocco: Rural Electrification Programme

Morocco has set up a rural electrification programme with the aim of increasing rural electrification from 20% in 1995 to 80% by 2006. The electricity utility ONE has assessed the areas where grid connection is the best option through the use of economic criteria. A cost per household for the grid connection of each village is calculated. The households which exceed the economic limit for grid connection are then identified as potential candidates for off-grid electrification. In these rural locations it is more economic to install solar home systems than to provide a connection to the grid (G-8, 2001).

11. Capacity Building

Build capacity to implement effective energy efficiency and renewable energy policies and programs in all countries. Also, train and support the businesses that will manufacture, market, install, and service clean energy technologies.

Examples of policy tools:

11.1 Agricultural Research Service - ARS is USDA's primary scientific research agency. The **Bioenergy and Energy Alternatives program** does research in the areas of ethanol, biodiesel, energy alternatives for rural practices, and energy crops.

Recommendations:

- Increase funding within the **Bioenergy and Energy Alternatives program** for the development of biofuels and energy crops.
- Expand the mission of the **Cooperative State Research, Education, and Extension Service (CSREES)** to promote the development of renewable energy resources on America's farmland.
- Provide funding to CSREES to provide education and technical assistance to farmers and farmer-owned co-ops for the development and marketing of renewable energy resources, including biomass, wind, solar, and geothermal. The CSREES should also conduct outreach to the general public on the societal benefits of developing these resources.
- Stipulate that the CSREES should work in close collaboration with the Regional Biomass Programs, sponsored by the Department of Energy. Together, the organizations should provide assistance to farmers for growing, handling, and processing energy crops and waste streams for the production of biopower, biofuels, and biobased products. Where possible, the two organizations should share resources, staff, and expertise (Ames and Wermer, 2001).

11.2 Guidelines for national renewable energy plans in developing countries (NREL/TCAPP, 2001).

Developed countries should facilitate preparation and implementation of renewable energy development plans, especially where such plans and planning activities:

- Drive the budgeting and policy decisions in developing countries so that the plan recommendations translate into real commitments for action at national and local levels.
- Integrate renewable energy strategies and initiatives with national and local economic, poverty alleviation, health, environmental, and other development programs
- Engage the business and finance community in structuring and implementing initiatives to ensure that they build sustainable markets and accelerate renewable energy investment
- Provide a vehicle for co-ordinating and focusing bilateral and multilateral donor support for renewable energy programs in developing countries
- Engage and build support from all key stakeholders in the country, including national and local government agencies, community groups, technical institutions, businesses and finance organizations, and other key stakeholders.

12. Planning Techniques

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

Examples of policy tools:

12.1 Local use in developing countries vs. export. Exporting country has the choice of exporting biofuels or CO2 credits. A sensitivity analysis would be needed to show at which levels of CO2 prices and biofuels prices which option would be best. Fossil reference systems can make a difference (coal vs. oil vs. gas) (Schalamadinger, 2002)

12.2 From the view of industrialized countries technology export opportunities should be considered (e.g., processing and end use of biofuels). Security of fuel supply issues to be considered (Schalamadinger, 2002).

12.3 Biofuels import could alleviate concerns of wood industries regarding biomass energy use (competitive use of their resource). Could be important to get wood industries involved. Effects of biofuels trade on future power plant / refinery siting in Europe should be considered (Schalamadinger, 2002).

12.4 National Plan in China

China Renewable Energy Plan – The Government of China has developed 5 year plans to accelerate renewable energy development through market based policy instruments. In addition the Government will introduce a range of fiscal measures, such as VAT and income tax reduction, interest rate subsidies and government subsidies, to pay for part of the additional financial costs of new renewable energy capacity (G-8, 2001).

Currently the government is considering:

- To create a Mandated Market Share for renewable energy in the form of a legal requirement that a specified share of electricity comes from renewable energy.
- To introduce an instrument, such as trading, to share the incremental cost and benefits among the regions in China

III CONCLUSIONS

As has been pointed out by IPCC (Moomaw et al, 2001) in the short term (2010 – 2020) there is no shortage of technologies to abate Greenhouse Gas Emissions. Some of the technologies are already cost-effective and others can be used if carbon emission has costs up to US$100/tC. Even so, market potential for them is presently small and probably will continue to grow slowly. The market potential is well below the economic market potential, which is 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 paper we try to classify policies in different categories and provide examples of practical policy tools (actions) already taken or being suggested to implement such policies. Examples were extracted from the literature and the list is far from complete, since we investigate a limited number of actions proposed in a limited number of countries. Nevertheless, the purpose of this document is to give insight to police makers about several possible policy tools that can be proposed to foster policies to promote the use and production of renewable sources of energy.

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