The prospects for energy efficiency, R&D and climate change issues in a competitive energy sector environment in Brazil

Gilberto De Martino Jannuzzi, Universidade de Campinas – UNICAMP

1. SYNOPSIS

Brazil is one of the few countries that is securing funds for investments in energy efficiency and energy R&D. There are, however, central issues that need to be addressed to ensure assessment of priorities, transparency and participation.

2. ABSTRACT

The energy sector restructuring and deregulation that has taken place almost globally has created additional difficulties to governments willing to implement climate change policies, energy efficiency, and other public benefits associated with the energy industry. New approaches are required in order to finance and implement policies that bring about the desired societal benefits related to energy services. In Brazil substantial funds start to be collected from oil & gas concessions and privatised electric utilities revenues with the main purpose of investing in energy efficiency, research and development, environmental protection and energy sector capacity building. The creation of a funding mechanism is necessary but not sufficient to ensure the allocation of resources in activities that will bring about the desired benefits. In the case of Brazil, a great share of resources will be spent in R&D activities and the Ministry of Science and Technology will have a pivotal role in managing the newly created energy funds. In this paper we discuss the potential, current difficulties and limitations of these recent initiatives, we also suggest a greater link between climate change and public interest R&D to support the future development of energy efficiency and clean energy technology.

3. INTRODUCTION

The advancement of privatisation and the trend to insert measures to attract private capital to finance the expansion of energy services has risen several concerns about the provision of long term benefits such as those related to climate change issues. In fact, de-regulation and the promotion of a broad range of public benefits associated with the power sector, such as rural electrification, energy efficiency, environmental protection, low income programmes, research and development and others, have also been the focus of attention of several energy analysts, legislators and policy makers (Bruce *et al*. 1995, Levine *et al* 1994, Swisher 1994). The indications are that as more competition is introduced into this sector and the government role is diminished, it is likely that the provision of these societal benefits will only be guaranteed if adequate mechanisms to encourage or compel non-government investment in public goods provision are established. In some cases this might not be sufficient and it will be required a direct intervention of the public sector in the provision of energy related public goods. In developing countries this seems to be the case of low income energy programmes, rural electrification, public interest R&D, capacity building and regional development issues, amongst others.

Power sector re-structuring has also meant a re-definition of the role of the public sector in energy services. It has required the establishment f specific energy policies, guidelines to the private sector, regulation and mechanisms to finance such activities listed above. Public agencies need to acquire a better understanding of which services will be available as the result of market forces, and those which will not. Most countries seem to be in the early stages of a learning curve.

The assessment of the impacts of restructuring on the provision of public benefits and the effectiveness of the protection mechanisms implemented are currently under way in many countries. The results show a diversity of policy and financial instruments, priorities, and different degrees of success. In some countries the sectoral reforms can help the promotion of DSM, as reported by Lopes *et al.* (2000) in a study analysing European Union member states. Bergmasth *et al.* (2000) also shows the regained interest of Swedish utilities in DSM initiatives as energy services to customers after the introduction of competition. Maldonado *et al.* (2000) reports the absence of energy efficiency activities in the liberalised Chilean electricity market, compared with the much richer experience of Brazil and Mexico, countries with public sponsored conservation agencies.

The US has been one of the few countries that has included in their restructuring and/regulatory order a strategy that addresses some sort of "public benefits" requirements. Most countries, however, are dealing with the implementation of funding mechanisms and long term strategies for the energy sector at later stages of the reform process (Hagler 1998). One example of funding mechanism, is the concept of "public benefits funding" as the primary mechanism for supporting utility-related societal benefits, and usually collected directly from consumers. This instrument has been put into practice and has progressed in many states in the US where de-regulation is being implemented (Kushler 2000).

Brazil is pursuing a more centralised institutional arrangement for implementing activities in the area of energy efficiency and R&D. The funding mechanism currently in practice is not collected directly through customers energy bills, but rather from utilities revenues and channelled to a common fund. For the first time in Brazil, significant and stable resources are being secured for energy efficiency and specially for research and development programmes (about 75% of the funds collected are destined to energy R&D only).

Since 1998 the country has dedicated efforts to continue the development of energy efficiency and R&D within the private utility sector. However, there are still issues of governance, transparency, accountability and public participation that need to be addressed. These elements will determine how the responsible agents elect priorities, evaluate proposals and monitor procedures.

In Brazil, one outcome of the new institutional setting is the emergence of the Ministry of Science and Technology as a pivotal player in future investments in energy related research and development. This Ministry is also responsible for co-ordinating the national initiatives on climate change policies which could potentially help the development and facilitate the commercialisation of energy efficient and clean technologies.

The objective of this paper is to review the recent trends in energy-related public policy initiatives that have impacts in climate change issues in Brazil. The measures taken by the public sector to guarantee a stream of investments in efficiency and R&D are sufficient to accomplish desired societal benefits and introduce innovation in the private energy sector? We are interested in analysing the role of long term energy policies that can be established in the country considering the funding mechanism that are being implemented. At the end we present our conclusions and raise some new issues that need to be addressed in order to more effectively avoid mismatches between long term investments in energy efficiency, research and development and climate change issues.

We first review briefly the country's experience in regulating funds for utilities' energy efficiency programmes and R&D activities since 1998 and then discuss some implications of the current procedures.

4. ENERGY SECTOR RE-STRUCTURING

Electricity sector restructuring started in 1995, with the Congress Bill[1] that allowed the privatisation of electric utilities and set general rules for concessions. Later in 1997, the monopoly regime enjoyed by the state oil company Petrobrás, started to be broken down with another Congress Bill[2], which also created the National Oil Regulatory Agency (ANP) in charge of overlooking the activities of the oil and gas industries . In another paper (Jannuzzi, 2000b) we presented the main characteristics of the new decision making process that has emerged from the reforms: two major developments resulting from legislative acts[3] during years 1996 and 1997 were the creation of the

Energy Policy National Council – CNPE and the two regulatory agencies: ANP and the National Electricity Regulatory Agency – ANEEL. CNPE is an inter-ministerial commission that advises the President on energy matters and is responsible for formulating the national guidelines for the sector, including a long term indicative planning. Although created by Law in 1997, it was only formally assembled in year 2000, when it held its first meetings.

It should be mentioned that the first utilities started to be privatised in 1995, without clear rules and regulatory framework, and only at the very end of year 1996 was created the National regulatory agency (ANEEL). ANEEL became operational only in 1997.

5. THE COUNTRY'S EXPERIENCE WITH REGULATED FUNDS: THE 1% OBLIGATION FOR ELECTRIC UTILITIES (1998-2000)

In 1998 ANEEL established a regulation requiring that the privatised utilities invested a total of 1% of their net annual operational revenues in energy efficiency (end-use and supply-side) and research and R&D programmes. The utility programmes had to be submitted to ANEEL for approval before their implementation. Table 1 shows the breakdown of the regulated investments for energy efficiency programmes (end-use and supply side) and R&D during the period 1989-2000 according to the regulation.

Table 1. Regulated investments in Energy Efficiency and Research & Development during 1998-2000 (Minimum levels of total annual revenues)

% of total annual revenues (net of taxes)		Areas of expenditures	
(a)	_1.00%	End-use efficiency, R&D, Supply-side efficiency	
		Details of suggested limits and investment priorities	
(b)	_0.25%	End-use efficiency	Up to a maximum of 0.125% to be invested in public lighting and marketing Minimum of 0.025% to be invested in each of the sectors: industrial, residential and public (Resolution 248/98). This requirement was later modified stating that a minimum of 0.075% had to be invested in all three sectors, but the concessionaire had to present at least one project for each sector (Resolution 261/99 and 271/00).
(c)	_0.1%	Research and Development	Suggested areas: energy planning, improvement of the quality of service, co-generation, alternative energy sources, new materials.
(d)	(a)-(b)-(c)	Supply-side efficiency	Load factor improvements (minimum of 30% to be invested in regions South, Southeast and Centre WestW, minimum of 10% in regions North and Northeast, Resolution 248/98. These percentages were later modified to 15% and 5% respectively by Resolutions 261/99 and 271/00). Energy losses (technical and commercial)

Note: generating companies that do not own distribution networks have a minimum of 0.25% to be invested in R&D, the remaining is invested in supply-side efficiency programmes. **Source:** Resolutions ANEEL no. 248/98, 261/99 and 271/00.

Table 2 presents the amount of funds invested in utility programmes (end-use and supply-side efficiency and R&D) during 1998-2000. Although the values invested in energy efficiency by utilities are much higher than the historical annual amounts invested by PROCEL (the National Electricity Conservation Agency), a closer analysis of the types of programmes reveals that most of them have very limited direct societal benefits. Nearly 70% of total investments in energy efficiency were directed to supply-side programmes. One of the main efficiency programmes undertaken by utilities had the objective of installing meters in customers. The expenditures in these programmes alone, which in fact reduce utilities commercial losses, represented almost 18% of total invested in energy efficiency programmes during 1999 (Jannuzzi 2000a). Other supply-side efficiency programmes implemented by utilities included

improvements and upgrades of distribution lines and reduction of electricity losses in grid systems. Also during this period, several end-use efficiency programmes implemented in utilities premises, such as lighting retrofits, building audits and retrofits, were considered as end-use energy efficiency programmes by ANEEL. Most of R&D programmes proposed by utilities and approved by ANEEL so far aimed at solving problems related to technical losses, software development to control utilities' operational and maintenance costs. It is possible to state that during the first years of ANEEL's 1% Resolutions, most programmes proposed by utilities were highly advantageous for them, and were focussed on reducing their short term commercial or technical losses, avoid new installed capacity investments and promote their marketing efforts. Eventually these cost reductions benefits could be captured later by customers during tariff revision process, and this remains to be seen.

It is true that under the present price-cap regulation utilities face strong disincentives to promote programmes that have the potential to reduce their sales[4]. Therefore efficiency programmes proposed by utilities are naturally conceived under this type of limitation. This constraint needs to be addressed appropriately by the regulatory agency.

The directives given by the public sector in the first years of the 1% resolution through ANEEL, did not specify targets areas/programmes, benchmarks or performance indicators. ANEEL verification methods are based on the control of utilities expenditures on programmes and not on the amount of saved energy[5]. A more explicit indication of the types of desired programmes and targets could facilitate the proposition of utility programmes with more direct societal benefits or programmes that could contribute to governmental targets related to regional social development, or the improvement of overall electricity system reliability indicators. Although there were recommendations given by ANEEL for energy efficiency and R&D programmes (see Table 1), they were not effective to avoid a concentration of investments in supply-side efficiency (Table 2) and short term R&D. Indeed, many of these initiatives ideally should not require any specific regulation and procedures from the public sector to have them in place considering that utilities are operating now in a competitive environment (Jannuzzi 2000c).

Kozloff *et al*. (1999) investigated further, and suggested better strategies for the regulatory agency ANEEL that can maximise societal benefits accruing from utility efficiency and R&D programmes. One of the recommendations from this study was the suppression of the requirements to invest in supply-side energy efficiency projects and that only end-use efficiency programmes should be funded and supervised by the public regulatory agency[6]. Other suggested initiatives include ways to promote co-operation amongst utilities, market transformation strategies and programmes to improve system reliability. These efforts can produce beneficial impacts at regional or national levels, but tend to be disregarded from the individual private utility perspective. Also, it was suggested strategies to address current utilities' regulatory disincentives to promote end-use efficiency, ways to attract further funding from other partners to co-finance the programmes that use the regulated fund, and the need to improve ANEEL's programme evaluation and monitoring methods.

Table 2. Annual investments made by privatised Utilities under ANEEL Resolutions (millions of current EUR)

	End-Use Efficiency	Supply Side Efficiency	R&D	Total
1998/99	33.3	70.7	6.4	EUR 110.4
1999/00	46.8 *	74.2 *	12.7 **	EUR 133.7

Notes: (*) as of Dec./29/2000. Exchange rate: US$ 1.00 = R$ 1.92. **, R$ 1.00 = EUR 0.53.

(**) Estimated by the author.

Sources: ANEEL

As observed in Jannuzzi (2000a,c) and Kozloff *et al.* (1999), ANEEL's 1% regulation provided a window of opportunities for investments in energy efficiency and energy R&D, but presented distortions and did not capture the effective operation of competitive utilities, nor transferred the benefits effectively to consumers. Profit seeking utilities would not require any legislation to direct investments to reduce commercial losses which consumed a privileged portion of the one percent regulation during the period analysed. A recognition of this fact is the edition of the new Law 9.991/00 that eliminates the requirements for investments in supply-side efficiency projects and allocates the 1% funds only to end-use efficiency and R&D projects (see following chapter).

The lack of a more explicit guidance from the CNPE on matters related to the provision of energy public goods and national energy policy, explains partly ANEEL's performance and the limitations of the applications of resolutions regarding the maximisation of benefits to consumers or society, as suggested here.

6. ENERGY SECTORAL FUNDS: THE NEW APPROACH OF REGULATED INVESTMENTS IN ENERGY EFFICIENCY AND R&D

The "sectoral funds" are being established for each sector under privatisation and deregulation (transportation, water, electricity, oil, telecommunication, minerals extraction, etc). They are basically mechanisms that capture a percentage of the revenues from privatised companies or, alternatively, charge compensations for the use of natural resources from the private concessionaires (through shares of royalties payments).

These funds are centralised in accounts under responsibility of the Ministry of Science and Technology - MCT under the National Fund of Science and Technology Development - FNDCT. Each account is managed by specific committee of 10 members chaired by a MCT representative.

Table 3 shows the main characteristics of the oil and electricity funds. The oil fund (CTPETRO) collects a percentage of the royalties[7] accruing from oil and gas extraction and is destined to finance R&D activities. The oil fund has established a 5 year investment plan and elected 13 R&D areas as priorities. These areas cover the production chain of oil and gas, from exploration to distribution. Oil and gas engineering and refining, fuel quality, environmental mitigation and conservation are heavily represented amongst these areas.

The electricity fund created in year 2000 is based on utilities' (generators, IPPs, transmission companies, distribution) revenues. It has a more complex allocation: 50% will be managed by a committee (CTENERG) headed by MCT and the other half will be used for utility-funded programmes (end-use efficiency and R&D) under ANEEL's supervision, following basically the procedures already established under the 1% mechanism described earlier. The funds managed by CTENERG are mainly destined for R&D projects, but can also include energy efficiency projects. However, it is not yet clear the scope of the efficiency programmes that can be financed by CTENERG and how they will differ from the ones proposed by utilities and submitted to ANEEL.

One important characteristic of these funds is that only research institutions can have direct access to the resources. This might create difficulties and in fact widen the gap between scientific and technology knowledge and the incorporation of innovation in the market. There is also the need to promote a larger participation of equipment manufacturers (both for energy production and use) so that improved technology is available. At the present stage, for instance, only the energy supply industry research interests (this seems to be case of the oil fund) appears to be represented.

Table 3. Main characteristics of the Oil (CTPETRO) and Electricity (CTENERG and ANEEL) Funds

	Oil Fund	Electricity Fund
Legal instruments	Law no. 9.478 (6 August 1997), Decrees no. 2.851/98 and 3.318/99	Law no. 9.991 (24 July 1999)
Funding sources for R&D	Royalties from oil and gas exploitation. The recipients of funds are local Research Institutions and Universities.	Percentage (varying from 0.75 to 1%) of the net annual revenues from electricity utilities (generation, transmission and distribution companies) and Independent Power Producers. The recipients of funds from CTENERG are local research institutions and universities.
Funding for energy efficiency	No specific provision or requirement.	Up to year 2005 distributing utilities must invest 0.5% of their annual revenues in end-use efficiency projects, afterwards the percentage drops to 0.25%. These programmes are submitted to ANEEL for approval.
Administration	Fund managed by a commission headed by	50% Funds managed by a commission

	Oil Fund	Electricity Fund
	MCT (CTPETRO). The commission selects programmes and conducts evaluations.	(CTENERG) and the other half is under ANEEL's responsibility. Both agencies are responsible for approving and evaluating programmes.
Guidelines	CTPETRO has established an Investment Plan for 1999-2003 and stated 13 target areas for investment in R&D for the oil and gas industry. The selected areas include oil exploration and extraction in deep water, oil engineering, environmental monitoring and conservation, energy conservation, planning methods and information systems. These areas should cover problems related to oil & gas exploration, production, transport, refining and distribution.	A multi-year investment plan and the establishment of priorities are under discussion. Law 9.991 states that distributing utilities must invest 0.75% of their annual revenues in R&D projects and 0.25% in end-use energy efficiency programmes (from 2005 onwards). Transmission, generation utilities and IPPs are obliged to invest 1% of their revenues in R&D. As of March/2001 no details were available regarding priority areas or types of programmes that will be funded by CTENERG. ANEEL provides general guidelines and recommends areas for utilities programmes.
Regional allocation	40% of funds invested by research institutions located in the North and Northeast regions.	30% of funds invested by research institutions located in the North, Northeast and Centre-West regions.

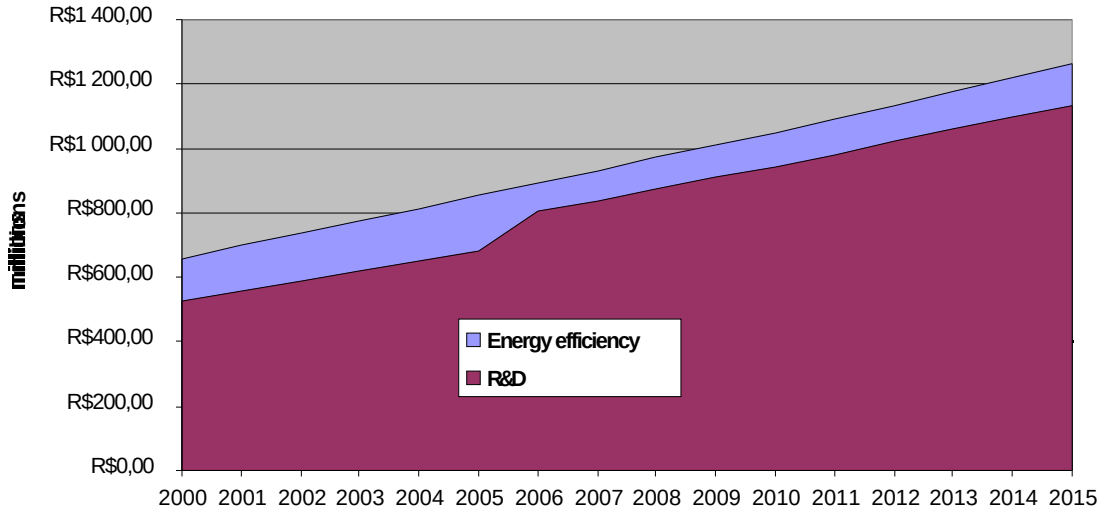
Sources: Law 9.991/00 and 9.478/97

As result the amount of resources that will become available for electricity-related R&D and end-use efficiency is significant. Figure 1 shows the estimated annual amount of investments that will be available for energy efficiency and R&D through the Electricity Fund. Table 4 presents the estimated values for the oil fund up to year 2003. The country has never experienced such amounts for resources dedicated mainly to energy-related R&D purposes nor for end-use electricity efficiency.

Presumably the rationale for much larger share of funds directed to R&D is the correction of market failures in the production of scientific and technological knowledge by private companies in Brazil (there is no significant tradition of private sector investments in R&D in the country) in general and by electric utilities in particular, owned mostly by foreign investors that may not be interested in developing in-house capacity. Procedures are now required to establish[8] priorities (for electricity R&D) and mechanisms that ensure the successful incorporation of innovation in the market place.

Figure 1. Estimated annual investment stream for electricity-related end-use efficiency and R&D projects (2000-2010) (in constant reais, year 2000)

Notes: This graph considers a situation where all generating, transmission and distribution utilities are privatised (currently about 80% electricity



is sold by private distribution utilities, 30% is privately generated and transmission is still state owned). Presently the collection of funds applies only to the privatised companies. Exchange rate: R$ 1= EUR 0.53.

Table 4 : The oil fund: total investments in R&D 1999-2003

1999: total of EUR 19.6 millions were invested 2000: total of EUR 53 millions. EUR 13.3 millions were invested in projects related to the improvement, quality control and monitoring of fuels; EUR 29.1 millions in oil engineering, environmental protection, natural gas research; EUR 10.6 million in infra-structure of Universities in the North and Northeast regions to undertake research in oil & gas area. 2001: EUR 68.9 million. 1999-2003: it is expected that a total of EUR 477 millions will be available for investments.

Sources: Ministry of Science and Technology (MCT 2001[a])

7. CONCLUSIONS: THE IMPORTANCE OF R&D AND ITS ROLE IN ENERGY EFFICIENCY AND CLIMATE CHANGE. WILL THIS WORK?

The perceived risks of under-provision of knowledge-based innovative effort on the part of profit-seeking, and largely foreign owned utilities, has created the opportunity to introduce mechanisms and institutions in Brazil, that can collect funds and provide guidelines for investments in areas that can reduce the contribution of the energy sector towards the climate change problem. The country also has taken a step forward and created two major national instances[9] responsible for establishing national policies for climate change and energy alongside with funding mechanism called “sectoral funds”. These initiatives can potentially ensure the provision of desired energy-related public benefits in a more competitive and private energy sector.

However, there is still the need to establish clear national public policies that can guide the regulatory agencies and the private sector. Also, the performance and management of the funds (oil and electricity) rests to be tested. So far, the evidence from the experience with the ANEEL 1% regulated fund (1998-2000) suggests that these mechanisms are necessary but they have not been sufficient to guarantee investments in areas that will affect in the long run the provision of desired societal benefits. The analysis of the initial years of regulated activities of utilities' programmes in energy efficiency and R&D shows the absence of projects with high social rates of return, long term exploratory projects and investments in research infrastructure.

A more explicit and committed participation of the mentioned inter-ministerial commissions mentioned with clear statements of national energy and climate change policies seem an obvious and necessary condition.

Several issues need still to be addressed by these commissions and agents responsible for the funds, in particular the Ministry of Science and Technology and the Ministry of Mines and Energy, and include:

1. Develop criteria for allocation of investments which is consistent with national development objectives;
2. Determine the cost-effective potential for introduction of efficiency and renewables, and which areas need specific intervention for market transformation;
3. Develop new ways for transforming end-use markets so that they can absorb cost-effectively the results achieved from the R&D investments;
4. Determine the optimal roles of public and private sector in managing R&D priorities and managing R&D portfolios;
5. Find ways to leverage public with private funds to finance the development and commercialisation of clean and efficient energy technologies;
6. Promote co-operation between energy industry, its suppliers, appliance manufacturers and research institutions;
7. Ensure that there is a continuing capacity building, investments in research infrastructure and incorporation of energy technology innovation in the public and private sectors.

The Ministry of Science and Technology has acquired a much more significant role than it had in the past with respect to the investments in research and development of energy-related and climate change issues. It has become a new challenge to co-ordinate such diverse interest agenda and interactions with the oil and electricity industry.

The country has initiated a process that provides stable stream of funds that can in the long run have positive impacts in the development of a more sustainable energy system. This seems to be a new ground of work for energy analysts to investigate. At this point it is necessary that the country quickly manages to establish a transparent agenda that can be constantly evaluated by the society. If this fails there is the risk of having these funds destined for immediate political purposes.

8. REFERENCES

Agência Nacional de Energia Elétrica - ANEEL. 1998. Resolução 242. E*stabelece critérios para aplicação de recursos em ações de combate ao desperdício de energia elétrica e pesquisa e desenvolvimento tecnológico do setor elétrico brasileiro*. Brasília:24/Julho.

Agência Nacional de Energia Elétrica – ANEEL. 1999. "Relatório Síntese dos Programas de Combate ao Desperdício de Energia Elétrica." Ciclo 1999/2000. Brasília.

Agência Nacional de Energia Elétrica - ANEEL. 2000. Resolução 271. *Estabelece critérios para aplicação de recursos em ações de combate ao desperdício de energia elétrica e pesquisa e desenvolvimento tecnológico do setor elétrico brasileiro*. Brasília:19/Julho.

Bruce, T., E. Hirst, & D. Bauer. 1995. "Public-Policy Responsibilities in a Restructured Electricity Industry." *Report*, Oak Ridge National Laboratory, ORNL/CON-420.

Conselho Nacional do Desenvolvimento Científico e Tecnológico - CNPq. 2000. Edital CTPETRO/CNPq - no. 01/2000. *Apoio a projetos de pesquisa científica e desenvolvimento tecnológico para o setor de petróleo e gás natural*. Brasília: CNPq.

Hagler Bailly Services, Inc. 1998. "Case Studies of the Effects of Power Sector Reform on Energy Efficiency.," Washington DC, Report prepared for the U.S. Agency for International Development, Office of Energy, Environment, and Technology. Report no. 98-03.

Jannuzzi & G. M. 2000. "Public Goods and Restructuring of the Brazilian Power Sector: Energy Efficiency, R&D and Low Income Programmes." Proceedings: *2000 Summer Study on Energy Efficiency Buildings "Efficiency and Sustainability."* Asilomar, California, ACEEE. 5.131-5.140.

Jannuzzi, G. M. 2000. "Energy Efficiency and Restructuring of the Brazilian Power Sector." *Energy for Sustainable Development*, IV (2):15-20. Bangalore, India.

Kozloff, K., R. H. Cowart, G. M. Jannuzzi, & O. Mielnik. 1999. "Recomendações para uma estratégia regulatória nacional de combate ao desperdício de eletricidade no brasil".

Kushler, M. G. 2000. "What's Up with Public Benefits? A Review and Initial Assessment of Public Benefits Policies and Programmes in Restructured States." Proceedings: *2000 Summer Study on Energy Efficiency Buildings "Efficiency and Sustainability."* Asilomar, California, ACEEE. 5.163-5.174.

Levine, M.D., E. Hirst, J. Koomey, J. Mcmahon, & A. Sanstad. 1994. "Energy Efficiency, Market Failures and Government Policy.," Berkeley, Lawrence Berkeley National Laboratory. LBL-35376.

Lopes, C., L. Nilsson, S. K. Thomas, & A. Verbruggen. 2000. "Linking Reforms and Energy Efficiency to Explore the Possibilities for IRP and DSM in the Liberalized Internal European Electricity Market." Proceedings: *2000 Summer Study on Energy Efficiency Buildings "Efficiency and Sustainability."* Asilomar, California, ACEEE. Pp. 5.176-5.186.

Maldonado, P., R. Friedman, & G. M. Jannuzzi. 2000. "Energy Efficiency in Public or Privatized Power Systems: Contrasts of the Brazilian, Chilean, and Mexican Experiences." Proceedings: *2000 Summer Study on Energy Efficiency Buildings "Efficiency and Sustainability."* Asilomar, California, ACEEE. 5.187-5.198.

Ministério de Ciência e Tecnologia - MCT. 2000. "Petróleo - CTPETRO." *MCT - Temas em C&T - Fundos Setoriais*. Portuguese. Http://www.mct.gov.br, last modified Jan/2000.

Ministério de Ciência e Tecnologia - MCT. 2000. *Fundos Setoriais de Desenvolvimento Científico e Tecnológico: Uma Estratégia de Desenvolvimento Nacional*, Brasília, MCT. 46pp.

Ministério de Ciência e Tecnologia. 1998. Decreto no. 2.705. *Plano Nacional de Ciência e Tecnologia do Setor Petróleo e Gás Natural (CTPETRO)*. Brasília.

Ministério de Ciência e Tecnologia. 1998. Decreto no. 2.851. *Plano Nacional de Ciência e Tecnologia do Setor Petróleo e Gás Natural (CTPETRO)*. Brasília.

Ministério de Ciência e Tecnologia. 1999. Decreto no. 3.318. *Plano Nacional de Ciência e Tecnologia do Setor Petróleo e Gás Natural (CTPETRO)*. Brasília.

Presidência da República. 2000. Decreto no. 3.520, *Dispõe sobre a estrutura e funcionamento do conselho Nacional de Política Energética e dá outras providências*. Http://www.planalto.gov.br/CCIVIL/decreto.D3520.htm. Brasília:21/06/2000.

9. END NOTES

[1] Law 9.887/95.

[2] Law 9.478/97.

[3] Laws 9.478/97 and 9.427/96.

[4] Current regulation allows utilities to include expenditure in energy efficiency projects in their tariffs to customers (it is not clear, however, if these expenditures are net of the investments from the 1% sources). This provision does not seem to attract enough interest from utilities so far.

[5] More recently, ANEEL's Resolution 271/2000 introduced the requirement that utilities should also present an evaluation plan together with the energy-efficiency project. This resolution also allowed utilities to present multi-year projects.

[6] This recommendation appears later in year 2000 with the creation of the electricity sectoral fund, which makes compulsory the utility investments only in end-use efficiency and R&D programmes.

[7] Royalties are financial compensation that concessionaires of oil and gas resources pay to the State. They amount to 10% of the total monthly oil and gas revenues, but may be reduced to a minimum of 5% according to the degree of risk and uncertainty of the resource (Law 9478/97).

[8] The Ministry of Science and Technology has initiated in February/2001a prospective study in consultation with energy experts and industry to determine the most promising and needed areas for funding R&D activities.

[9] The Inter-ministerial Commission on Climate Change (under the co-ordination of the Ministry of Science and Technology) and the National Council on Energy Policy (under the co-ordination of the Ministry of Mines and Energy).